NFPA® 31

Standard for the Installation of Oil-Burning Equipment

2024 Edition

NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

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Note that these indicators are a guide. Rearrangement of sections may not be captured in the markup, but users can view complete revision details in the First and Second Draft Reports located in the archived revision information section of each code at www.nfpa.org/docinfo. Any subsequent changes from the NFPA Technical Meeting, Tentative Interim Amendments, and Errata are also located there.

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NFPA® 31

Standard for the

Installation of Oil-Burning Equipment

2024 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 December 1, 2023, with an effective date of December 21, 2023, and supersedes all previous editions.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See "Codes & Standards" at www.nfpa.org for more information.

This edition of NFPA 31 was approved as an American National Standard on December 21, 2023.

Origin and Development of NFPA 31

Oil-burning equipment standards date back to 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 NFPA, and a completely revised standard was 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. Between 1948 and 2020, 24 revised editions of NFPA 31 were published.

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 of Appendix E.

The 2006 edition incorporated several amendments all coupled with the revision in 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 appliances function in accordance with the manufacturer instructions, and to ensure adequate separation between stored materials and oil-burning appliances, chimneys, chimney connectors, and flues.

In the 2020 edition, the definitions for *heating fuel* and *used oil* were revised, and the list of acceptable fuels in Chapter 4 was modified based on updated ASTM reference standards. Annex material was also added to explain the changes regarding acceptable fuels. The specifications for acceptable piping and fitting materials in Section 8.2 were also revised based on updates to the reference test standards.

For the 2024 edition, the valve definitions have been revised and a new definition for *fusible link valves* has been added. The requirements for fusible link valves have also been expanded and clarified. In addition, a requirement for chimney connectors to always be mechanically fastened to oil-fired and other heating appliances has been added. Tank foundation requirements describing acceptable foundations for indoor and outdoor tanks have been added as well. Finally, several UL standards for vent caps and Type L venting systems have been added to the listed references.

Technical Committee on Liquid Fuel Burning Equipment

Roland A. Riegel, *Chair*
UL LLC, NY [RT]

James Aycock, Field Controls LLC, NC [M]

John E. Batey, Energy Research Center, Inc., CT [M]
Rep. Oilheat Manufacturers Association

David A. Bessette, National Association of Oil and Energy Service Professionals, MA [IM]

Robert V. Boltz, Vincent R. Boltz, Inc., PA [IM]

Bob Carpenter, Viega, LLC, CO [M]

Aaron J. Clark, Lipton Energy Inc., MA [IM]

Brian Coyne, Mitco Manufacturing, NY [M]

Marvin Evans, CSA Group, Canada [RT]

Christopher D. Faucher, The Peterson School, MA [SE]

Leo Herrmann, Leo Herrmann Fireplace Inc., PA [SE]

Dale D. Hersey, State of Maine, ME [E]

Rocco J. Lacertosa, New York State Energy Coalition, Inc./New York Oil Heating Association, NY [IM]

Yves Legault, Granby Industries LP, Canada [M]

John F. Levey, Oilheat Associates, Inc., NY [C]
Rep. National Oilheat Research Alliance

Thomas J. Ludwig, Travelers Insurance Company, CT [I]

Matthew Menotti, Intertek, NY [RT]

John J. Pilger, Chief Chimney Services, Inc., NY [IM]
Rep. Chimney Safety Institute of America (CSIA)

Andrew Sozio, AKS Mechanical Services, Inc., PA [IM]

Thomas J. Tubman, American Energy Coalition, NY [IM]

Alternates

Eric Bourassa, Granby Industries LP, Canada [M]
(Alt. to Yves Legault)

Robert G. Hedden, Oilheat Associates, VT [M]
(Alt. to John E. Batey)

Robert O'Brien, National Oilheat Research Alliance (NORA), NY [C]
(Alt. to John F. Levey)

Mark Skierkiewicz, UL, LLC, IL [RT]
(Alt. to Roland A. Riegel)

David M Wagner, New York Oil Heating Association, NY [IM]
(Alt. to Rocco J. Lacertosa)

Michael Marando, NFPA Staff Liaison

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.

Contents

NFPA 31

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Installation of Oil-Burning Equipment

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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.

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

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2022 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection,* 2022 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 2024 edition.

NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages,* 2024 edition.

NFPA 54, *National Fuel Gas Code,* 2024 edition.

NFPA 70®, National Electrical Code®, 2023 edition.

NFPA 80, *Standard for Fire Doors and Other Opening Protectives,* 2022 edition.

NFPA 85, *Boiler and Combustion Systems Hazards Code,* 2023 edition.

NFPA 86, *Standard for Ovens and Furnaces,* 2023 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems,* 2024 edition.

NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems,* 2024 edition.

NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel–Burning Appliances,* 2024 edition.

2.3 Other Publications.

2.3.1 API Publications. American Petroleum Institute, 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001.

API Standard 650, *Welded Steel Tanks for Oil Storage*, 13th edition, 2020.

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*, 2018.

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*, 2020.

ASTM A106/A106M, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*, 2019.

ASTM A254/A254M, *Standard Specification for Copper-Brazed Steel Tubing*, 2012 (Reapproved 2019).

ASTM A269/A269M, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*, 2015 (Reapproved 2019).

ASTM A312/A312M, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes*, 2021.

ASTM B43, *Standard Specification for Seamless Red Brass Pipe, Standard Sizes*, 2020.

ASTM B75/B75M, *Standard Specification for Seamless Copper Tube*, 2020.

ASTM B88, *Standard Specification for Seamless Copper Water Tube*, 2020.

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*, 2020.

ASTM D396, *Standard Specification for Fuel Oils*, 2021.

ASTM D3699, *Standard Specification for Kerosine*, 2019.

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*, 2020a.

ASTM D6823, *Standard Specification for Commercial Boiler Fuels with Used Lubricating Oils*, 2008 (Reapproved 2013).

ASTM D7666, *Standard Specification for Triglyceride Burner Fuel*, 2012 (Reapproved 2019).

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

NORA Recommended Practice for Home Heating Oil Tank Flood Resistance, 2015.

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

UL 30, *Metal Safety Cans*, 2019.

UL 58, *Steel Underground Tanks for Flammable and Combustible Liquids*, 2018.

UL 80, *Steel Tanks for Oil-Burner Fuels and Other Combustible Liquids*, 2007, revised 2019.

UL 103, *Factory-Built Chimneys for Residential Type and Building Heating Appliances*, 2010, revised 2021.

UL 142, *Steel Aboveground Tanks for Flammable and Combustible Liquids*, 2019, revised 2021.

UL 142A, *Special Purpose Aboveground Tanks for Specific Flammable or Combustible Liquids*, 2018, revised 2021.

UL/ULC 180, *Combustible Liquid Tank Accessories*, 2019, revised 2023.

UL 295, *Commercial-Industrial Gas Burners*, 2017, revised 2019.

UL 296, *Oil Burners*, 2017, revised 2020.

UL 296A, *Waste Oil-Burning Air-Heating Appliances*, 2018.

UL 443, *Steel Auxiliary Tanks for Oil Burner Fuel*, 2006, revised 2018.

UL 641, *Type L Low-Temperature Venting Systems*, 2010, revised 2018.

UL 842, *Valves for Flammable and Combustible Liquids*, 2020.

UL 842B, *Valves for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil*, 2022.

UL 971, *Nonmetallic Underground Piping for Flammable Liquids*, 2021.

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

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

UL 1316, *Fibre Reinforced Underground Tanks for Flammable and Combustible Liquids*, 2018, revised 2019.

UL 1746, *External Corrosion Protection Systems for Steel Underground Storage Tanks*, 2007, revised 2014.

UL 2039, *Flexible Connector Piping for Fuels*, 2016.

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

UL 2085, *Protected Aboveground Tanks for Flammable and Combustible Liquids*, 1997, revised 2010.

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

UL 2258, *Aboveground Nonmetallic Tanks for Fuel Oil and Other Combustible Liquids*, 2018, revised 2019.

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, 2020.

2.4 References for Extracts in Mandatory Sections.

NFPA 54, *National Fuel Gas Code,* 2024 edition.

NFPA 70®, National Electrical Code®, 2023 edition.

NFPA 86, *Standard for Ovens and Furnaces,* 2023 edition.

NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel–Burning Appliances,* 2024 edition.

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

Chapter 3 Definitions

Δ 3.1 General.

***N* 3.1.1** The definitions contained in this chapter shall apply to the terms used in this standard.

***N* 3.1.2** 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.

***N* 3.1.3** *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 phrases "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,** 2023]

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 ft^3 (2.8 m^3) 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 ft^3 (2.8 m^3) 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 ft^3 (2.8 m^3) 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 ft^3 (2.8 m^3), excluding burner equipment; a floor mounted or suspended type unit heater larger than 100 ft^3 (2.8 m^3) 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 ft^3 (2.8 m^3) 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,** 2024]

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,** 2024]

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, nonenclosed use at specified minimum clearances to combustibles, and assembled in accordance with the terms of the listing to form the completed chimney. [**211,** 2024]

Δ **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, *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,** 2024]

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,** 2024]

Δ **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 NFPA 211.

3.3.11 Chimney Connector. The pipe that connects a fuel-burning appliance to a chimney. [**211,** 2024]

3.3.12 Chimney Flue. The passage in a chimney for conveying the flue gases to the outside atmosphere. [**211,** 2024]

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 ft^3 per 1000 Btu/hr (4.8 m^3 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,** 2024]

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.

Δ **3.3.28 Flue Collar.** That portion of an appliance designed for attachment of a chimney or vent connector or a draft hood. [**211,** 2024]

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,** 2024]

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,** 2024]

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,** 2024]

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,** 2024]

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,** 2024]

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,** 2024]

3.3.29.3 ***Central Warm-Air, Gravity-Type Furnace.*** A central furnace depending primarily on circulation of air by gravity. [**211,** 2024]

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,** 2024]

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. The fan is used only to overcome the internal resistance to airflow. [**211,** 2024]

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,** 2024]

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. A fuel-burning floor furnace is designed to take air for combustion from outside the space being heated and is provided with means for observing the flame and lighting the appliance from such space. [**211,** 2024]

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,** 2024]

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

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,** 2023]

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,** 2024]

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. Room heaters that have openings in an outer jacket to allow some direct radiation from the heat exchanger are classified as a radiant type. [**211,** 2024]

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,** 2024]

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,** 2024]

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 ft^3 per 1000 Btu/hr (4.8 m^3 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.

Δ **3.3.63.1** ***Burner Control Valve.*** An automatically or manually operated valve for controlling the fuel supply to a burner.

3.3.63.2 ***Burner Metering (Regulating) Valve.*** A fuel control valve for regulating burner input.

N **3.3.63.3*** ***Fusible Link Valve.*** Valves intended for use in fuel supply lines that close when the temperature in the vicinity of the valve exceeds the fusing temperature of the fusible element.

3.3.63.4 ***Manual Fuel Shutoff Valve.*** A manually operated valve in a fuel line for the purpose of turning on or completely shutting off the fuel at any point in the burner supply line.

Δ **3.3.63.5** ***Safety Valve.*** An automatic fuel control valve of the "on" and "off" type (without any bypass to the burner) that is actuated by a safety control or 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,** 2024]

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,** 2024]

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, *Standard Specification for Industrial Burner Fuels from Used Lubricating 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.

Δ **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, *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 cm^2/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 cm^2/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 cm^2/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 cm^2/kW), based on the total input rating of all appliances in the space.

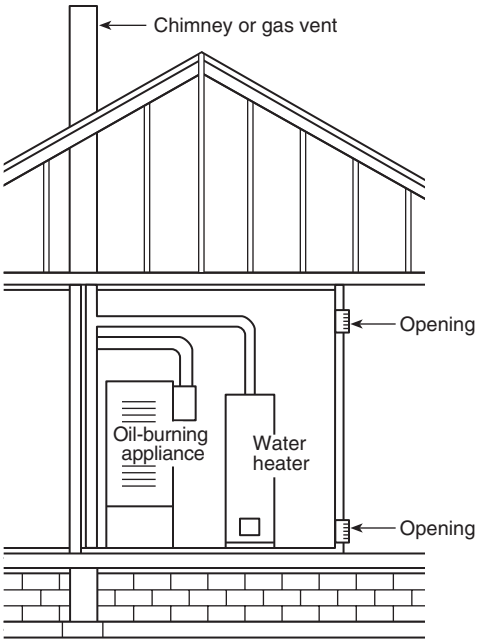


FIGURE 5.4.1.1 Appliances Located in Confined Spaces — All Air Taken from Inside the Building.

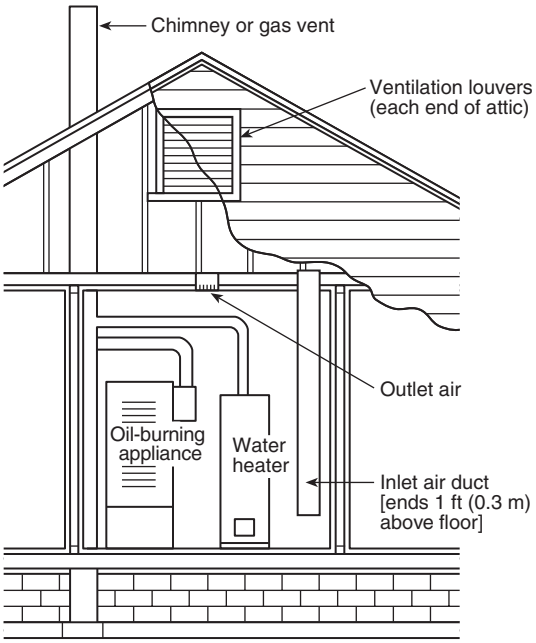


FIGURE 5.4.2.2(b) Appliances Located in Confined Spaces — All Air from Outdoors Through Ventilated Attic.

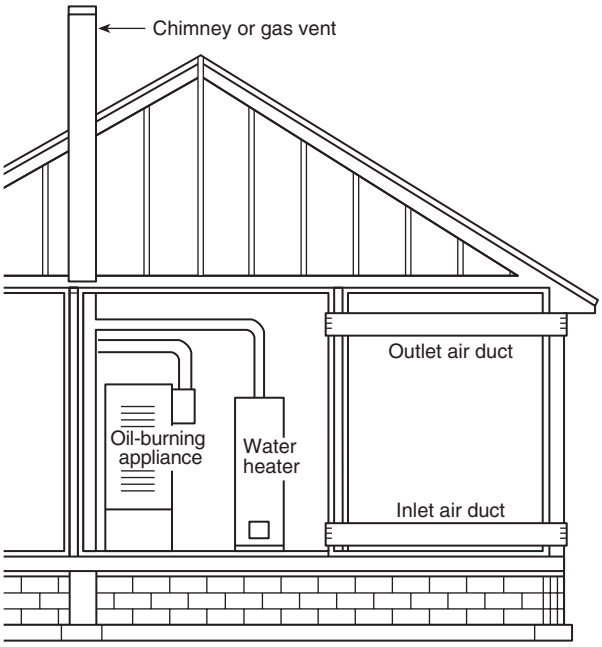


FIGURE 5.4.2.2(a) Appliances Located in Confined Spaces — All Air from Outdoors.

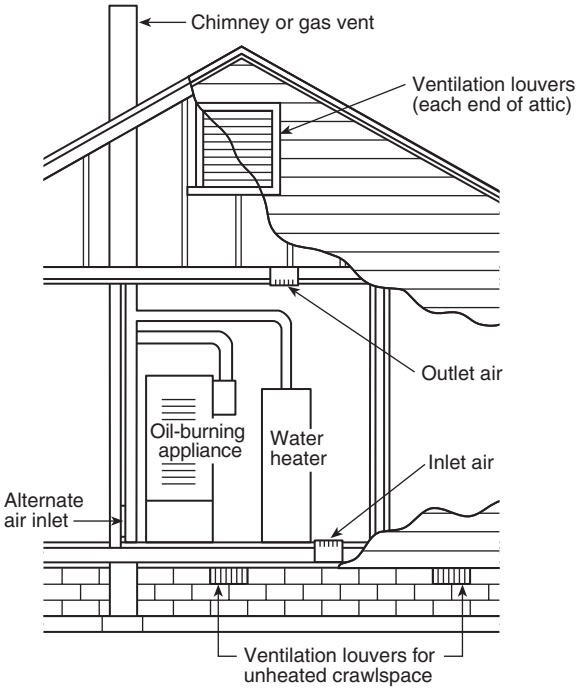


FIGURE 5.4.2.2(c) Appliances Located in Confined Spaces — All Air from Outdoors, with Inlet Air from Ventilated Crawl Space and Outlet Air to Ventilated Attic.

5.4.3 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.

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 cm^2/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 ft^3 per 1000 Btu/hr (2.4 m^3/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 cm^2/kW), based on the total input rating of the burner or burners, but in no case less than 35 in.^{2} (0.425 m^2).

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 ¼ 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.

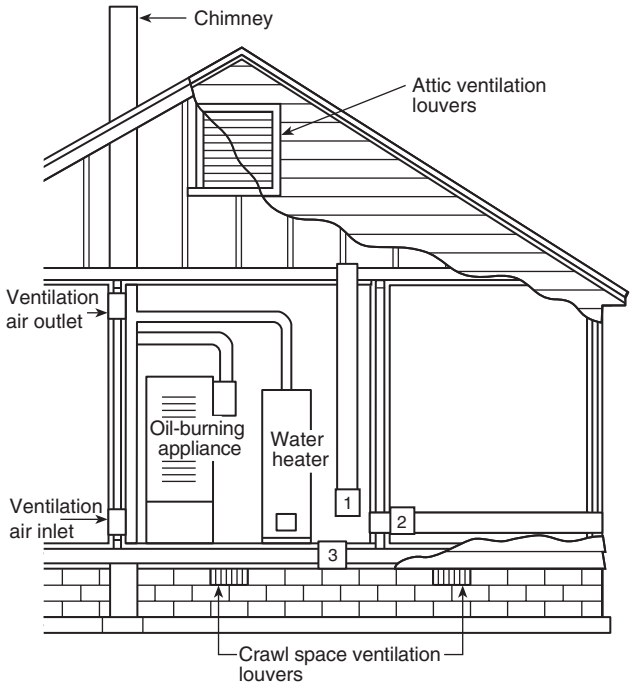


FIGURE 5.4.3.1 Appliances Located in Confined Spaces, with Ventilation Air from Inside Building and Combustion Air from Outside, Ventilated Attic, or Ventilated Crawl Space.

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, except for appliances equipped with mechanical draft burners.

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.

N **6.5.15** Connectors shall be fastened to appliances using sheet metal screws, rivets, banding, strapping, or other approved means. [**211:**9.7.10]

6.5.16 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.

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

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

6.5.19 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.

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

6.5.21 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.

Δ **6.5.22** If two or more openings are provided into one chimney flue, the following stipulations shall apply:

(1) They shall be at different levels.
(2) The smaller connector shall enter at the highest level consistent with available head room or clearance to combustible material.

[**211:**9.8.4]

6.5.23 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.

6.5.23.1 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.

6.5.24 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.

6.5.25 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.

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

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

Δ **6.5.28** Gas appliances and appliances burning liquid fuel shall be permitted to be connected to one chimney flue through separate openings or to be connected through a single opening, provided they are joined by a suitable fitting located as close as practicable to the chimney and provided both of the following apply:

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

[**211:**9.8.3]

6.5.29 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

6.5.30 The minimum thickness for steel pipe connectors shall meet the requirements of Table 6.5.30.

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.

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.

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 manufac-

Table 6.5.30 Minimum Thickness for Steel Pipe Connectors

Thickness	
Pipe Diameter (in.)	**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.

turer, 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 listed and labeled in accordance with UL 641, *Type L Low-Temperature Venting Systems*, and 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.

7.2.5.3 Interstitial spaces of secondary containment tanks shall be provided with venting 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.

7.2.5.4 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, *Steel Underground Tanks for Flammable and Combustible Liquids*
(3) UL 80, *Steel Tanks for Oil-Burner Fuels and Other Combustible Liquids*
(4) UL 142, *Steel Aboveground Tanks for Flammable or Combustible Liquids*
(5) UL 142A, *Special Purpose Aboveground Tanks for Specific Flammable or Combustible Liquids*
(6) UL 443, *Steel Auxiliary Tanks for Oil Burner Fuel*
(7) UL 1316, *Fibre Reinforced Underground Tanks for Flammable and Combustible Liquids*
(8) UL 1746, *External Corrosion Protection Systems for Steel Underground Storage Tanks*
(9) UL 2080, *Fire Resistant Tanks for Flammable and Combustible Liquids*
(10) UL 2085, *Protected Aboveground Tanks for Flammable and Combustible Liquids*
(11) UL 2245, *Below-Grade Vaults for Flammable Liquid Storage Tanks*
(12) UL 2258, *Aboveground Nonmetallic Tanks for Fuel Oil and Other Combustible Liquids*

7.2.7.2 Tanks intended for use inside buildings and with a capacity between 10 gal (38 L) and 1320 gal (5000 L) shall be constructed in accordance with 7.2.7.1(3), 7.2.7.1(4), 7.2.7.1(6), 7.2.7.1(9), 7.2.7.1(10), or 7.2.7.1(12).

7.2.7.3 Tanks intended for use inside buildings and with a capacity greater than 1320 gal (5000 L) shall be constructed in accordance with 7.2.7.1(4), 7.2.7.1(9), or 7.2.7.1(10).

7.2.7.4 Tanks intended for use outside aboveground with a capacity no greater than 1320 gal (5000 L) shall be constructed in accordance with 7.2.7.1(3), 7.2.7.1(4), 7.2.7.1(9), 7.2.7.1(10), or 7.2.7.1(12).

7.2.7.5 Tanks intended for use outside aboveground with a capacity greater than 1320 gal (5000 L) shall be constructed in accordance with 7.2.7.1(1), 7.2.7.1(4), 7.2.7.1(9), or 7.2.7.1(10).

7.2.7.6* Tanks intended for use underground shall be constructed in accordance with 7.2.7.1(2), 7.2.7.1(7), or 7.2.7.1(8). Tanks constructed in accordance with 7.2.7.1(2) shall be protected in accordance with either of the following:

(1) An approved cathodic protection system that is engineered, installed, and maintained in accordance with recognized standards
(2) Approved or listed external corrosion-resistant systems or materials integral with the tank

7.2.7.7* If a tank is installed in a vault outside the building, either above or below grade, the vault shall be constructed in accordance with 7.2.7.1(11).

7.2.8 Areas Subject to Flood or Earthquake. Where a tank is located in an area that is designated as subject to flood or earthquake, the following additional requirements shall apply to the tank, its connections, and its foundation and supports, as appropriate.

7.2.8.1 Where in a designated flood zone, the requirements of NFPA 30, *NORA Recommended Practice for Home Heating Oil Tank Flood Resistance*, or local requirements shall be met.

7.2.8.2 When in a designated seismic zone, the local requirements for earthquake resistance shall be met.

7.3 Tank Foundations.

7.3.1 Tanks and their supports shall rest on foundations made of solid concrete.

N **7.3.1.1** Installation of unenclosed UL 80 or UL 142 supply tanks not exceeding 330 gal (1250 L) inside buildings without finished cement floors shall be in accordance with the following:

(1) The tank is supported by four 4 in. x 8 in. x 16 in. (100 mm x 200 mm x 400 mm) solid concrete blocks or a reinforced concrete pad.
(2) The concrete pad is at least 3 in. (75 mm) thick and the pad's width and length extend to the full width and length of the tank.
(3) When a tank is equipped with integral leg brackets, the steel pipe legs do not exceed 12 in. (300 mm) in height with floor flanges at the base of the legs.
(4) The clearance under the tank is a minimum of 4 in. (100 mm) from any surface.
(5) No shims are utilized.

N **7.3.1.2** Horizontal UL 80 or UL 142 supply tanks not exceeding 330 gal (1250 L) located outside shall be in accordance with the following:

(1) The tank is supported by four 4 in. x 8 in. x 16 in. (100 mm x 200 mm x 400 mm) solid concrete blocks or a reinforced concrete pad consisting of one piece that is at least 3 in. (75 mm) thick and that is not smaller than the tank's length and width.
(2) The four blocks or the concrete pad rest on a firm subgrade consisting of a bed of compacted, well-draining gravel [6 in. (150 mm) minimum], crushed stone [6 in. (150 mm) minimum], or some other approved subgrade.
(3) When a tank is equipped with integral leg brackets, the steel pipe legs do not exceed 12 in. (300 mm) in height with floor flanges at the base of the legs.
(4) The clearance under the tank is a minimum of 4 in. (100 mm) from any surface.
(5) No shims are utilized.

N **7.3.1.3** UL 80 or UL 142 vertical supply tanks not exceeding 330 gal (1250 L) located outside shall be in accordance with the following:

(1) The tank is supported by a reinforced concrete pad at least 3 in. (75 mm) thick.
(2) The concrete pad width and length is not smaller than the tank's width and length.
(3) The concrete pad consists of only one piece.
(4) The concrete pad rests on a bed of compacted, well-draining gravel [6 in. (150 mm) minimum], crushed stone [6 in. (150 mm) minimum], or some other approved subgrade.
(5) When a tank is equipped with integral leg brackets, the steel pipe legs shall not exceed a height of 12 in. (300 mm) with floor flanges at the base of the leg.
(6) The clearance under the tank is a minimum of 4 in. (100 mm) from any surface.
(7) No shims are utilized.

N **7.3.2** Oil supply tanks other than UL 80 and UL 142 tanks shall be installed in accordance with the manufacturer's instructions.

Δ **7.3.3** The tank's foundation shall be designed to minimize uneven settling and corrosion in any part of the tank resting on the foundation.

Δ **7.3.4** The tank supports shall be integral to the tank or be of concrete, solid masonry, or steel.

N **7.3.4.1** For outside aboveground tanks, the tank supports shall be firmly anchored to the foundation.

N **7.4 Tank Supports.**

Δ **7.4.1** Steel supports for any outside aboveground tank whose capacity exceeds 660 gal (2500 L) shall be considered protected if they meet one of the following methods and are approved by the authority having jurisdiction:

(1) They are protected by materials having a fire resistance rating of not less than 2 hours.
(2) They are not otherwise protected but are less than 12 in. (300 mm) high at their lowest point.
(3) They are protected by a water spray system that meets the requirements of NFPA 15 or NFPA 13.

Δ **7.4.2** Every tank shall be supported in such a manner to prevent the excessive concentration of loads on the supporting portion of the shell.

N **7.4.3** The tank legs of an unenclosed supply tank located inside a building with a finished cement floor shall not exceed 12 in. (300 mm) in height with floor flanges at the base of the steel legs.

N **7.4.4** UL 80 and UL 142 oil supply tanks with pipe legs or other supports greater than 12 in. (300 mm) shall be installed in accordance with the manufacturer's instructions.

7.4.5 In areas subject to earthquakes, tank supports and connections shall be designed to resist damage as a result of such shocks.

7.5 Installation of Underground Tanks.

7.5.1 This section shall apply to tanks installed underground with backfill and to tanks buried beneath buildings.

7.5.2 Excavations for underground tanks shall be made in accordance with applicable building codes to avoid undermining the foundations of existing structures.

7.5.3 Underground tanks and tanks buried beneath buildings shall be located with respect to existing building foundations and supports so that the loads carried by the latter cannot be transmitted to the tank.

7.5.4 The distance from any part of an underground tank to the nearest wall of any basement or pit or to any property line shall not be less than 1 ft (0.3 m).

7.5.5* Underground tanks shall be installed in accordance with manufacturers' instructions and in accordance with applicable requirements of Chapter 23 of NFPA 30.

7.5.6 Underground tanks shall be equipped with vent opening(s) or automatically operated vent(s) for each tank compartment and interstitial space, which shall be arranged to discharge to the open air outside of buildings.

7.5.7* Underground tanks that are taken out of service shall be removed or permanently closed in accordance with the applicable requirements of NFPA 30.

7.6 Installation of Tanks Inside Buildings.

7.6.1 This section shall apply to tanks installed inside buildings, either enclosed or unenclosed, as herein described.

Δ **7.6.2** A safety can of less than 6.5 gal (26 L) capacity shall be permitted to be used for temporary fuel storage. It shall comply with UL 30, *Metal Safety Cans*, or UL 1313, *Nonmetallic Safety Cans for Petroleum Products*, and shall be specifically approved only for temporary use.

Δ **7.6.3** A supply tank of 60 gal (227 L) or less capacity shall be constructed in accordance with UL 142A, *Special Purpose Aboveground Tanks for Specific Flammable or Combustible Liquids*, and shall be specifically approved for permanent or temporary purposes.

7.6.4 A supply tank that exceeds 60 gal (227 L) capacity shall be installed on the lowest floor (story, cellar, or basement) of a building, except as provided for in 7.6.5.

7.6.5 A maximum of 660 gal (2500 L) of storage tank capacity shall be permitted to be installed on a higher floor, provided the following conditions are met:

(1) The higher floor does not have any floor or open space directly below it.
(2) The higher floor is provided with a liquidtight sill, containment device, or equivalent means having the ability to hold a minimum of 15 percent of the aggregate tank capacity to prevent spilled heating fuel from entering an adjacent, lower area.

7.6.6 A tank of less than 10 gal (38 L) capacity shall not be placed within 2 ft (0.6 m) from any ignition source, either in or external to the appliance being served, nor shall it be placed in a manner such that the temperature of the fuel in the tank exceeds the temperature of its surroundings by 25°F (14°C) or more.

7.6.7 A tank of capacity between 10 gal and 1320 gal (38 L and 5000 L) shall not be placed within 5 ft (1.5 m) horizontally from any open flame or fuel burning appliance unless separated from the source of heat by a barrier having a 1-hour fire resistance rating extending horizontally at least 1 ft (0.3 m) past the liquid fuel–burning appliance or the tank, whichever is greater, and extending vertically from floor to ceiling.

7.6.8 A tank of a capacity between 10 gal and 330 gal (38 L and 1250 L) that is provided with an opening in the bottom for use as a fuel supply connection to an appliance or as a drain shall be arranged as follows:

(1) The tank shall be pitched toward the opening with a slope of not less than ¼ in./ft (20 mm/m).
(2) Each supply line shall be provided with a readily accessible, fusible link valve installed as close as practical to the tank. *(See also 8.7.3).*
(3) If the fuel filter or strainer is installed at the tank, it shall be within 6 in. (150 mm) of the fusible link valve required by 7.6.8(2).
(4) A properly sized and rated fuel filter or strainer shall be installed in the fuel supply line to the appliance downstream and within 6 in. (150 mm) of the fusible link valve required by 7.6.8(2).
(5) Where three or more tanks are installed as part of a fuel storage system, each appliance supply line shall be provided with its own readily accessible fusible link valve.

7.6.9 Each tank or tank system shall be equipped with separate fill and vent openings.

7.6.10 Each tank shall be equipped with a gauging device. *(See 8.10.2.)*

7.6.10.1 Where tanks are cross-connected, as shown in Figure 8.9.1, Figure 8.9.2, and Figure 8.9.3, gauges shall only be installed in the vented tank(s).

7.6.11 Any unused opening in a tank shall be closed by a vaportight threaded plug or cap.

7.6.12 A tank or tank system shall be permitted to supply more than one liquid fuel–burning appliance.

7.6.13 Where a tank or tank system is not located in a dedicated room or enclosure, the maximum capacity in the building shall not exceed 1320 gal (5000 L) for a nonengineered system or 1375 gal (5200 L) for an engineered system, unless the installation meets the criteria in 7.6.13.1 or 7.6.13.2.

7.6.13.1 Fuel tanks of any size shall be permitted within a mechanical room, provided the room is designed using recognized engineering practices with suitable fire detection, fire suppression, and containment means to prevent the spread of fire beyond the room of origin.

7.6.13.2 Where a tank or tank system is not located in a dedicated room or enclosure, but is separated from other tank(s) by construction having a fire resistance rating of at least 2 hours, the maximum capacity in each separate area shall not exceed the quantities specified in 7.6.13. The maximum total capacity in the building shall not be limited.

7.6.13.3 Where a tank or tank system is located in a dedicated room or enclosure that is separated from the rest of the building by construction having a fire resistance rating of at least 1 hour, the maximum total capacity in the room shall not exceed 1320 gal (5000 L) for a nonengineered system or 1375 gal (5200 L) for an engineered system.

7.6.13.4 Where a tank or tank system is located in a dedicated room or enclosure that is separated from the rest of the building by construction having a fire resistance rating of at least 3 hours, the maximum total capacity in the room shall be permitted to exceed 1320 gal (5000 L) for a nonengineered system or 1375 gal (5200 L) for an engineered system.

7.6.13.5 Dedicated rooms or enclosures shall meet all applicable requirements of Section 7.7.

7.6.13.6 Tanks shall not obstruct quick and safe access to any utility service meters, electrical panelboards, or shutoff valves.

7.7 Requirements for Dedicated Tank Rooms and Tank Enclosures.

7.7.1 Each tank room or tank enclosure shall have a doorway with a noncombustible liquidtight sill or ramp at least 6 in. (150 mm) high and a self-closing, listed fire door that meets the requirements of NFPA 80.

7.7.1.1 If the sill or ramp is more than 6 in. (150 mm) high, the walls of the room or enclosure shall be built to withstand the static head that would be expected in event of a fuel spill, up to the height corresponding to the expected spill depth.

7.7.2 Fire doors for rooms or enclosures of 2-hour fire-resistant construction shall have a fire protection rating of 1½ hours.

7.7.3 Fire doors for rooms or enclosures of 3-hour fire-resistant construction shall have a fire protection rating of at least 3 hours.

7.7.4 Each tank room or tank enclosure shall be provided with means to ventilate the room or enclosure prior to its being entered for inspection or repair.

7.7.5 A tank installed in a room or area having a fire resistance rating of 2 hours or less shall be of such size and shape that it can be installed in and removed from the room or area and from the building as a unit (i.e., in one piece).

7.8 Auxiliary Tanks.

7.8.1 Auxiliary tanks shall not exceed 60 gal (227 L) capacity and shall be used only for connection in the supply line between the main tank and the appliance.

7.8.2 Auxiliary tanks shall comply with 7.2.7.1(6).

7.8.3 Auxiliary tanks shall be filled by pump transfer through continuous piping from the supply tank.

7.8.4 Auxiliary tanks shall be located at a level above the top of the supply tank from which they are filled.

7.9 Installation of Outside Aboveground Tanks.

7.9.1 This section shall apply to tanks that are installed aboveground outside of buildings. This section shall not apply to a centralized oil distribution system.

7.9.2 A tank or tanks whose capacity does not exceed 660 gal (2500 L) shall be permitted to be installed outside of and adjacent to a building, provided they are separated from the nearest line of adjoining property by the following minimum distance:

(1) 5 ft (1.5 m) for tanks not exceeding 275 gal (1040 L) capacity
(2) 10 ft (3 m) for tanks greater than 275 gal (1040 L) capacity, but not exceeding 660 gal (2500 L) capacity

7.9.3 A tank or tanks whose capacity exceeds 660 gal (2500 L) shall be installed in accordance with all applicable requirements of Chapter 22 of NFPA 30.

7.9.4* Outside aboveground tanks and their appurtenances and supports shall be protected from external corrosion by a coating suitable for exterior use.

7.9.5 Tanks that are intended for temporary supply to an appliance shall comply with 7.2.7.1(6).

7.9.6 Outside aboveground tanks shall also comply with 7.6.8 through 7.6.12 and with 7.6.13.6.

7.9.7 When a steel single-wall aboveground tank is fitted with a side outlet or is installed in a top draw configuration, and is located outside, it shall be installed within a secondary containment large enough to contain 110 percent of the tank's content.

7.10 Tank Heating Systems.

7.10.1 Where tanks are provided with heating systems to maintain fuel at the required temperature for proper atomization, the heating systems shall meet the requirements of 7.10.2 through 7.10.4, as applicable.

7.10.2* Where tanks are heated by steam coils, the maximum operating pressure of the steam coils shall not exceed a gauge pressure of 15 psi (gauge pressure of 105 kPa).

7.10.2.1 Where a pressure-reducing valve is used to limit the steam pressure to a gauge pressure of 15 psi (gauge pressure of 105 kPa) or less, the following shall apply:

(1) A relief valve set at not more than a gauge pressure of 5 psi (gauge pressure of 35 kPa) above the normal pressure in the coil shall be provided.
(2) Provision shall be made to limit the steam temperature to 250°F (121°C).

7.10.3 Where tanks are heated by hot water coils, the hot water shall be provided by indirect heaters and the maximum temperature of the water shall be limited to 250°F (121°C).

7.10.4 Where tanks are heated by electric heaters, the heaters shall be equipped with listed and approved thermostats designed to prevent the fuel from exceeding its minimum flash point.

7.11 Special Storage Arrangements. In particular installations, the provisions of Chapter 7 shall be permitted to be altered by the authority having jurisdiction after consideration of special features such as the following:

(1) Topographical conditions, barricades, walls, and proximity to buildings or adjoining property
(2) Height and character of construction and nature of occupancies of such buildings
(3) Capacity and construction of proposed fuel tanks
(4) Characteristics and properties of the combustible liquid fuels to be stored
(5) Degree of private fire protection to be provided
(6) Capability of the fire department to cope with combustible liquid fires

7.12 Tank Leakage Testing and Periodic Inspection.

7.12.1 Except as provided for in 7.12.1.1, all shop-built and field-erected tanks shall be leak tested before they are placed in service in accordance with one of the following, as applicable:

(1) For shop-built tanks, the manufacturers' instructions
(2) For field-erected tanks, Section 21.5 of NFPA 30

7.12.1.1 An ASME code stamp or a listing mark acceptable to the authority having jurisdiction shall be evidence of compliance with this test.

7.12.2 Following completion of a new installation, the tank and its piping shall be inspected for leakage during the initial fill by a qualified technician and, if a leak is found, the tank or piping shall be repaired and retested.

7.12.3 Each tank shall be periodically inspected by a qualified technician for evidence of leakage and shall be maintained liquidtight. Tanks found to be leaking shall be repaired or replaced.

7.13 Abandonment and Removal from Service of Tanks and Related Equipment. Except as provided for in 7.13.1, if a tank and its related piping are abandoned for whatever reason, the tank and all piping connected to it, including the outside fill and vent piping and any piping connected to the appliance, shall be emptied of all contents, cleaned, removed from the premises or property, and disposed of in accordance with applicable local, state, and federal rules and regulations.

7.13.1 If a liquid fuel–burning appliance is converted to an alternate fuel, but the tank is kept in place so that it can be returned to service at some future date, the following requirements shall be met before the alternate fuel is used:

(1) The entire contents of the tank shall be completely removed and the tank purged of all vapors.
(2) The fuel tank vent line shall remain intact and open.
(3) The outside fill pipe shall be removed and the tank opening shall be capped or plugged or the outside fill pipe shall be capped and filled with concrete, and all remaining piping, other than the vent line, shall be capped or sealed.

7.14 Fuel Storage Systems That Are Permanently Taken Out of Service.

7.14.1 If a fuel storage tank is permanently removed from service for whatever reason, the tank and all piping connected to it, including the outside fill and vent piping and any supply piping connected to the appliance, shall be:

(1) Emptied of all liquid contents and sludge
(2) Cleaned and rendered free of combustible vapors
(3) Removed from the premises or property
(4) Properly disposed of in accordance with all applicable local, state, and federal rules and regulations

7.14.2 The remover/installer of a tank taken out of service shall submit an affidavit of compliance to the authority having jurisdiction or to the tank owner stating that such fuel storage system was removed, in compliance with this section.

7.15 Permanent Abandonment of Underground Tanks. If an underground fuel storage tank is permanently removed from service, the requirements of 21.7.4.3.3 of NFPA 30 shall apply. *(See also Annex C of NFPA 30.)*

Chapter 8 Heating Fuel Piping Systems and Components

8.1 Scope. This chapter shall apply to piping systems and components used to provide filling and venting of tanks and transfer of heating fuel from tanks to heating fuel–burning appliances and equipment.

8.2 Acceptable Piping — Types and Materials.

Δ **8.2.1** Tank fill and vent piping shall be one of the types listed in 8.2.1.1 and 8.2.1.2, with male or female threaded ends that comply with a recognized thread specification, or press-connect ends listed to UL/ULC 180, *Combustible Liquid Tank Accessories*.

Δ **8.2.1.1** For aboveground fill and vent piping, only the following types and materials shall be permitted:

(1) Minimum Schedule 40 steel pipe that complies with either ANSI/ASME B36.10M, *Standard on Welded and Seamless Wrought Steel Pipe*; ASTM A53/A53M, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless;* or ASTM A106/A106M, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*
(2) Minimum Schedule 40 brass pipe that complies with ASTM B43, *Standard Specification for Seamless Red Brass Pipe, Standard Sizes*
(3) Minimum Schedule 40 stainless steel pipe that complies with ASTM A312/A312M, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes*
(4) Other piping that is part of an engineered fuel storage system that is listed to UL/ULC 180, *Combustible Liquid Tank Accessories*, installed in accordance with manufacturer's instructions, and approved by the authority having jurisdiction

Δ **8.2.1.2** For underground fill and vent piping, only the following types and materials shall be permitted:

(1) Listed nonmetallic piping that complies with UL 971, *Nonmetallic Underground Piping for Flammable Liquids*
(2) Listed metallic piping that complies with UL 971A, *Outline of Investigation for Metallic Underground Fuel Pipe*, or UL/ULC 180, *Combustible Liquid Tank Accessories*
(3) Steel pipe that meets 8.2.1.1(1)
(4) Brass pipe that meets 8.2.1.1(2)
(5) Stainless steel pipe that meets 8.2.1.1(3)

Δ **8.2.2** Fuel supply lines shall be one of the piping types listed in 8.2.2.1 or 8.2.2.2, with threaded ends that comply with a recognized thread specification, press-connect ends listed to UL/ULC 180, *Combustible Liquid Tank Accessories*, or tubing types intended for flared or engineered connections.

Δ **8.2.2.1** For aboveground fuel supply lines, only the following types and materials shall be permitted:

(1) Minimum Schedule 40 steel pipe that complies with ANSI/ASME B36.10M, *Standard on Welded and Seamless Wrought Steel Pipe*; ASTM A53/A53M, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless;* or ASTM A106/A106M, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*
(2) Minimum Schedule 40 brass pipe that complies with ASTM B43, *Standard Specification for Seamless Red Brass Pipe, Standard Sizes*
(3) Flexible metal pipe listed to UL 2039, *Flexible Connector Piping for Fuels*, and rated for aboveground use, where rigid connections are impractical
(4) Minimum 0.032 in. (0.081 cm) thick copper tubing that complies with ASTM B75/B75M, *Standard Specification for Seamless Copper Tube*; ASTM B88, *Standard Specification for Seamless Copper Water Tube;* or ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*
(5) Minimum 0.032 in. (0.081 cm) thick brass tubing that complies with ASTM B135/B135M, *Standard Specification for Seamless Brass Tube*
(6) Minimum 0.035 in. (0.089 cm) thick stainless steel tubing that complies with ASTM A254/A254M, *Standard Specification for Copper-Brazed Steel Tubing;* or ASTM A269/A269M, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*
(7) Aboveground fuel supply piping systems listed to UL/ULC 180, *Combustible Liquid Tank Accessories*

Δ **8.2.2.2** For underground fuel supply lines and for copper fuel supply lines that are in direct contact with concrete or soil, only the following types and materials shall be permitted:

(1) Listed nonmetallic piping that complies with UL 971, *Nonmetallic Underground Piping for Flammable Liquids*
(2) Listed corrosion-resistant metallic piping that complies with UL 971A, *Outline of Investigation for Metallic Underground Fuel Pipe*
(3) Flexible metal piping listed to UL 2039, *Flexible Connector Piping for Fuels*, and rated for underground use, where rigid connections are impractical
(4) Corrosion-resistant copper tubing in accordance with 8.2.2.1(4), corrosion-resistant brass tubing in accordance with 8.2.2.1(5), stainless steel tubing in accordance with 8.2.2.1(6), or tubing in accordance with 8.2.2.1(7)

8.2.2.2.1 Except where within 12 in. (300 mm) of a tank or appliance, tubing of copper, brass, or stainless steel, as identified in 8.2.2.2, shall be either provided with a listed corrosion-resistant coating or shall be installed through a corrosion-resistant conduit.

8.3 Acceptable Fittings — Types and Materials.

Δ **8.3.1** Pipe fittings shall be malleable iron, steel, stainless steel, or brass with male or female thread types that comply with a recognized thread specification or be press-connect-type fittings listed to UL/ULC 180, *Combustible Liquid Tank Accessories*. Threads shall be of the type, size, and direction that match with the pipe end threads with which they connect and shall be made liquidtight with suitable pipe joint or sealing compounds. Press-connect fittings shall be installed in accordance with the manufacturer's specifications with a tool recommended by the manufacturer.

Δ **8.3.2** Tubing fittings shall be of types suitable for metal-to-metal flare, press-connect fittings listed to UL/ULC 180, *Combustible Liquid Tank Accessories*, or engineered connections for the metals and thicknesses of the tubing with which they connect. They shall be of the type and size that match with the tube end, flare, engineered fitting, or press-connect end of

tubing with which they connect. They shall be connected in accordance with the manufacturer's instructions.

8.3.3 Other fittings and connection types shall be permitted if they are part of an engineered system that is listed for use with heating fuel and installed in accordance with the manufacturer's instructions.

8.3.4 Cast iron fittings shall not be used.

8.4 Piping System Design.

8.4.1 Piping systems shall be:

(1) Liquidtight
(2) Substantially supported
(3) Protected against physical damage

8.4.2 Proper allowance shall be made for expansion, contraction, jarring, and vibration of piping systems.

Δ **8.4.3** Piping systems made of combustible materials shall not be used inside of buildings or aboveground outside of buildings unless listed with at least a 30-minute fire rating, in accordance with UL/ULC 180, *Combustible Liquid Tank Accessories*.

8.4.4 Piping systems for underground tanks shall be provided with double swing joints or flexible connectors or shall be otherwise arranged to permit the tanks to settle without impairing the tightness of the piping system.

8.4.5 All connections to an underground tank shall be made through the top of the tank, except as provided for in 9.2.10.

8.4.6 Fuel shall not be transferred through piping to an appliance by pressurization of the tank.

8.4.7 Each tank or tank system shall be equipped with separate fill and vent pipes, both of which shall terminate aboveground outside the building.

Δ **8.4.8** Gauges for indicating the oil level in tank(s) shall be listed in accordance with UL/ULC 180, *Combustible Liquid Tank Accessories*, and shall be installed in accordance with manufacturers' instructions.

8.5 Tank Fill Piping.

8.5.1 The fill pipe connected to the tank shall be large enough and so located as to permit ready filling in a manner that minimizes spills. The fill pipe shall also be:

(1) At least 1¼ in. (30 mm) nominal pipe size
(2) Pitched toward the tank
(3) Protected from physical damage
(4) Without sags or traps where liquid can collect

8.5.2 For tanks that directly supply a fuel-burning appliance and are intended to be filled by hose from a delivery vehicle, the fill pipe shall terminate as follows:

(1) Outside the building at a point at least 2 ft (0.6 m) from any building opening
(2) In a manner that prevents spills when the filling hose is disconnected

8.5.3 For tanks that directly supply a used oil–burning appliance and are intended to be filled either by hose from a delivery vehicle or by hand at the point of use, the fill pipe shall be permitted to terminate as follows:

(1) In accordance with NFPA 30A
(2) With a funnel provided with a quarter-turn shutoff valve between the funnel and the tank

8.5.4 The end of the fill pipe shall be equipped with a tight metal cover designed to resist entry of water and shall be identified as a heating fuel fill opening.

8.6 Tank Vent Piping.

8.6.1 Vent piping connected to a tank shall be large enough and so located as to permit adequate normal fill and emergency venting. The vent pipe shall also be:

(1) Sized for the tank capacity in accordance with Table 7.2.5.1
(2) Pitched toward the tank
(3) Protected from physical damage
(4) Without sags or traps where liquid can collect
(5) Without obstructions other than an audible alarm at the tank opening

8.6.2 All vent pipes shall terminate outside of buildings at a point not less than 2 ft (0.6 m) from any building opening.

8.6.2.1 Vent pipes shall terminate high enough above the ground to avoid being obstructed by snow and ice.

8.6.2.2 Vent pipes shall terminate not more than 12 ft (3.6 m) from the fill pipe and at a point visible from the fill point.

8.6.3 The outer end of the vent pipe shall terminate in a corrosion-resistant weatherproof vent cap.

Δ **8.6.4** Vent caps shall be listed in accordance with UL/ULC 180, *Combustible Liquid Tank Accessories*.

Δ **8.7 Fuel Supply and Return Piping.**

Δ **8.7.1** The fuel supply piping between the supply tank and the appliance shall be:

(1) At least nominal ⅜ in. (10 mm) pipe or tubing
(2) Large enough to meet the fuel consumption rate of the appliance
(3) Provided with a manual shutoff valve or a fusible link valve at the outlet for an aboveground tank
(4) Provided with a fusible link valve at the outlet of an indoor tank or inside a building where a fuel line enters a building

8.7.2* The fuel supply piping from the supply tank shall be connected to the top of the tank, except in the following cases:

(1) Tanks of 330 gal (1250 L) or less
(2) Tanks with cross-connections

Δ **8.7.3** A readily accessible fusible link valve shall be installed in the following locations:

(1) As close as practical to the burner(s) supply connection
(2) Immediately upstream of the filter and inside the building if the piping passes through the foundation

Δ **8.7.4** The pressure at the fuel supply inlet to an appliance shall not exceed a gauge pressure of 3 psi (21 kPa) unless the appliance is approved for a higher inlet pressure.

8.7.5 Threaded pipe or valve ends installed in a tank bottom opening for gravity feed shall not penetrate above the bottom of the tank shell.

8.7.5.1 Use of stem pieces or other modifications to valves shall not circumvent the requirement of 8.7.5 to prevent water in the tank from draining out the bottom opening.

Δ **8.7.6** Unions or fittings that require gaskets or packings used in fuel lines shall be listed to UL/ULC 180, *Combustible Liquid Tank Accessories*.

Δ **8.7.7 Fuel Return Piping.** A return line from a burner or a pump back to a supply tank shall have no valves or obstructions except for a hard-seat or ball valve that is left in the open position, with the handle removed, and enter the top of the same tank.

8.8 Auxiliary Tank Piping.

8.8.1 An auxiliary tank shall be provided with an overflow pipe draining to the supply tank and extending into the top of the supply tank, unless the auxiliary tank is specifically listed for use without an overflow pipe.

8.8.2 An overflow pipe from an auxiliary tank shall have no valves or obstructions.

8.9 Piping for Cross-Connected Tanks.

8.9.1 Cross-connection of two tanks of not more than 660 gal (2500 L) aggregate capacity to the same fuel-burning appliance(s) shall be permitted if piped in accordance with Figure 8.9.1.

8.9.2 Cross-connection of three tanks of not more than 990 gal (3750 L) aggregate capacity to the same fuel-burning appliance(s) shall be permitted if piped in accordance with Figure 8.9.2.

8.9.3 Cross-connection of four tanks of not more than 1320 gal (5000 L) aggregate capacity to the same fuel-burning appliance(s) shall be permitted if piped in accordance with Figure 8.9.3.

8.9.4 Cross-connection of multiple tanks to the same burner or to the same group of burners using single fill and vent pipes shall be permitted in accordance with 8.9.1, 8.9.2, or 8.9.3, provided the tanks are rigidly secured to a common slab or foundation.

8.9.5 All fill and vent pipes shall drain toward the tank.

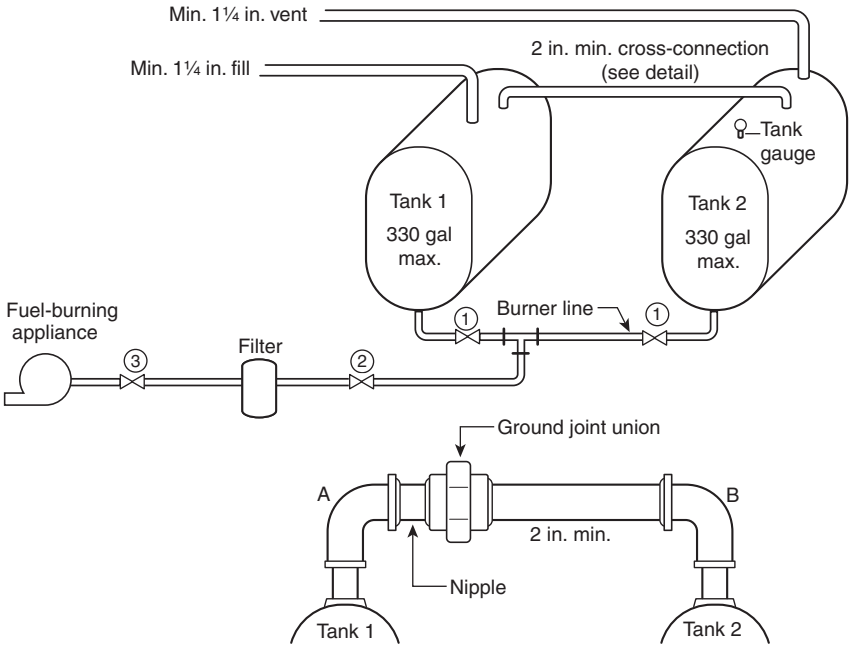
8.9.6 Vent pipes from more than one tank shall be permitted to be manifolded and connected into one outlet pipe.

8.9.6.1 The outlet pipe shall be at least one pipe size larger than the largest individual vent pipe connected thereto.

8.9.6.2 In no case shall the point of connection between two or more vent pipes be lower than the top of the fill pipe opening.

8.10 Pumps, Valves, Gauges, and Appurtenances.

8.10.1 Tanks, including each compartment of multicompartment tanks, in which a constant fuel level is not maintained by an automatic pump shall be equipped with a method of determining the fuel level.

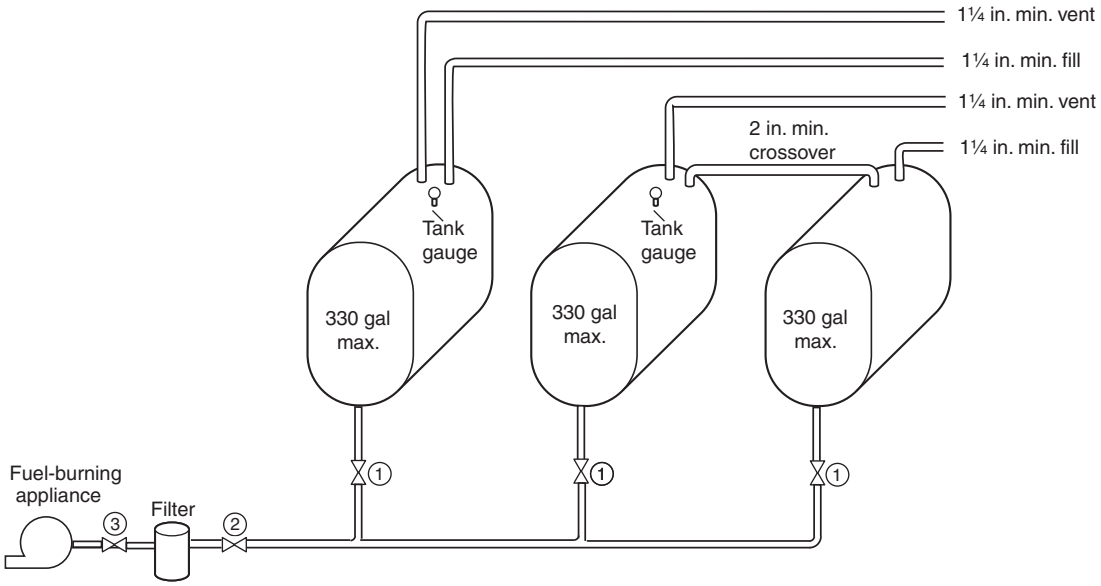


Detail of Cross-Connection Showing Components

Notes:
① Fusible link valve required by 8.7.1(4).
② Fusible link valve required by 8.10.6.1(1).
③ Fusible link valve required by 8.10.6.1(2).

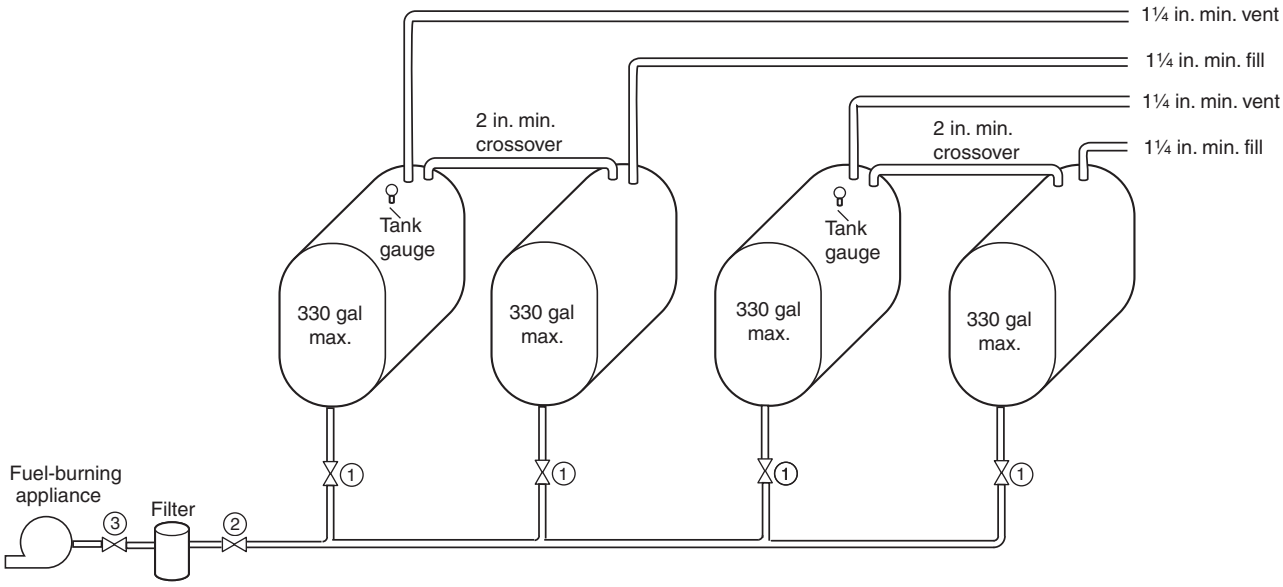
For SI units, 1 gal = 3.785 L, 1 in. = 25 mm.

Δ **FIGURE 8.9.1 Cross-Connection of Two Fuel Tanks of Not More Than 660 gal (2500 L) Aggregate Capacity.**



Notes:
(1) Fusible link valve required by 8.7.1(4).
(2) Fusible link valve required by 8.10.6.1(1).
(3) Fusible link valve required by 8.10.6.1(2).
For SI units, 1 gal = 3.785 L, 1 in. = 25 mm.

Δ FIGURE 8.9.2 Cross-Connection of Three Fuel Tanks of Not More Than 990 gal (3750 L) Aggregate Capacity.



Notes:
(1) Fusible link valve required by 8.7.1(4).
(2) Fusible link valve required by 8.10.6.1(1).
(3) Fusible link valve required by 8.10.6.1(2).
For SI units, 1 gal = 3.785 L, 1 in. = 25 mm.

Δ FIGURE 8.9.3 Cross-Connection of Four Fuel Tanks of Not More Than 1320 gal (5000 L) Aggregate Capacity.

Δ **8.10.2** Gauges for indicating the oil level in tank(s) shall be listed in accordance with UL/ULC 180, *Combustible Liquid Tank Accessories*. They shall be installed in accordance with manufacturers' instructions and so that fuel or vapor will not be discharged into the building.

8.10.3 Except as provided for in 8.10.3.1 and 8.10.3.2, supply tanks provided with fill and vent pipes shall be provided with a device to indicate either visually or audibly and within 12 ft (3.5 m) of the fill point, as specified by 8.6.2.2, when the fuel in the tank has reached a predetermined safe level.

8.10.3.1 Aboveground tanks that do not exceed 330 gal (1250 L) capacity shall rely on only an audible fill alarm to determine safe fill levels.

8.10.3.2 Underground tanks that can be filled using a portable fill pipe having an integral audible alarm that indicates a predetermined safe level shall not be required to meet the provisions of 8.10.3.

8.10.4 Supply tanks shall not be equipped with a glass gauge.

8.10.5 An automatic pump that is not an integral part of a burner shall be listed and shall be installed in full compliance with its listing.

Δ **8.10.6 Fusible Link Valve.**

Δ **8.10.6.1** A readily accessible fusible link valve that closes against the supply pressure shall be installed at each of the following points, except as provided in 8.10.6.2:

(1) As close as is practical but within 6 in. (150 mm) of the filter on the tank side of the filter
(2) As close as is practical but within 18 in. (450 mm) of the inlet connection to the burner
(3) Where flexible lines are used, upstream of flexible lines

Δ **8.10.6.2** Where the filter and inlet connection to a burner are within 18 in. (450 mm) of each other, only one fusible link valve shall be required to be installed on the tank side of the filter.

N **8.10.6.3** Fusible link valves used in piping systems shall be listed to UL 842, *Valves for Flammable and Combustible Liquids*, or UL 842B, *Valves for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil*.

8.10.7 Test wells shall be equipped with a tight-fitting metal cover.

8.11 Testing of Fuel Supply Piping.

8.11.1 Unless fuel supply piping and all fittings are visible for inspection, they shall be tested for leaks by either a pressure test method in accordance with 8.11.3 or a vacuum test method in accordance with 8.11.4 before being covered, enclosed, or placed into service.

8.11.2 Before oil supply lines are tested for leaks, any supply tank and any fuel-burning appliance shall be isolated from pressure, unless rated for the applicable test pressure or vacuum.

8.11.3 Pressure testing for leakage shall be conducted with air or an inert gas and shall be held for a time sufficient to conduct a complete visual inspection of all piping and fittings, but in no case for less than 10 minutes after stabilization.

8.11.3.1 A gauge pressure of at least 5.0 psi (35 kPa), but not more than 10 psi (70 kPa), shall be applied to all portions of the supply piping to be evaluated.

8.11.3.2 Leakage shall be detected by the appearance of bubbles after a soap-and-water solution or an equivalent leak detection fluid has been sprayed onto all joints.

8.11.4 Vacuum testing for leakage shall be conducted with a vacuum pump and vacuum gauge with 0.5 in. Hg (12 mm Hg) increments and accuracy of at least 2 percent. Vacuum shall be held for at least 30 minutes after stabilization with no loss.

8.11.4.1 A vacuum of at least 20 in. Hg (500 mm Hg) shall be applied to all portions of the supply piping to be evaluated.

8.11.4.2 Leakage shall be determined by any loss of vacuum after the test time.

8.11.5 Gauges used for leak testing shall be suitable for the test type, shall be in working order, and shall be calibrated. Gauges shall have a test range of not more than twice the test pressure and shall indicate in increments of not more than 1.0 psi (7 kPa) or 1.0 in. Hg (25 mm Hg).

Chapter 9 Oil Distribution Systems

9.1 Scope. This chapter shall apply to centralized oil distribution systems, as defined in 3.3.9, and to oil distribution systems for roof-mounted and ceiling-suspended oil-burning appliances.

9.2 Centralized Oil Distribution Systems.

9.2.1 A centralized oil distribution system shall meet the requirements of this section and all other applicable provisions of this standard.

9.2.2 The installation and maintenance of a centralized oil distribution system shall be supervised by a qualified person.

9.2.3 Plans showing the relative location of tanks, pumps, valves, piping, and structures to be supplied by the system shall be approved by and filed with the authority having jurisdiction.

9.2.4 Oil shall be permitted to be fed from the supply tank or tanks by gravity or by transfer pump.

9.2.5 All distribution piping outside of diked areas shall be underground.

9.2.6 The capacity of a single aboveground tank or the aggregate capacity of two or more aboveground tanks supplying a centralized oil distribution system shall not exceed 20,000 gal (75,700 L) nominal capacity.

9.2.7 Underground tanks installed in accordance with Section 7.5 shall be permitted to be of any capacity.

9.2.8 Tanks that supply a centralized oil distribution system shall meet all applicable requirements of Chapter 7.

9.2.9 Aboveground tanks shall be provided with spill control by means of diking meeting the requirements of NFPA 30.

9.2.10 The main distribution pipeline shall be permitted to be connected to a tank or tanks having an aggregate capacity not exceeding 20,000 gal (75,700 L) at a point below the liquid level.

9.2.10.1 Where this piping is so connected, a readily accessible internal or external shutoff valve shall be installed in the piping as close as practicable to the tank.

9.2.10.2 If external and aboveground, the shutoff valve and its tank connections shall be made of steel.

9.2.10.3 Connections between the tank(s) and the main pipeline shall be made with double swing joints or flexible connectors, or shall otherwise be arranged to permit the tank(s) to settle without damaging the system.

9.2.10.4 If located aboveground, the connections specified in 9.2.10.3 shall be located within the diked area.

9.2.11 A readily accessible and identified manual shutoff valve shall be installed either inside or outside of the structure in each branch supply pipeline that enters a building, mobile home, travel trailer, or other structure.

9.2.11.1 If inside, the valve shall be located directly adjacent to the point at which the supply line enters the structure.

9.2.11.2 If outside, the valve shall be protected from weather and damage.

9.2.12 A device shall be provided in the supply line at or ahead of the point where it enters the interior of the structure that will automatically shut off the oil supply, if the supply line between this device and the appliance is broken.

9.2.12.1 This device shall be located on the appliance side of the manual shutoff valve required in 9.2.11 and shall be solidly supported and protected from damage.

9.2.13 Means shall be provided to limit the oil pressure at the appliance inlet to a maximum gauge pressure of 3 psi (gauge pressure of 21 kPa).

9.2.13.1 If a pressure-reducing valve is used, it shall be a type approved for the service.

9.2.14 A device shall be provided that will automatically shut off the oil supply to the appliance if the oil pressure at the appliance inlet exceeds a gauge pressure of 8 psi (gauge pressure of 55 kPa). The device shall not be required under either of the following conditions:

(1) Where the distribution system is supplied from a gravity tank and the maximum hydrostatic head of oil in the tank is such that the oil pressure at the appliance inlet will not exceed a gauge pressure of 8 psi (gauge pressure of 55 kPa)
(2) Where a means is provided to automatically shut off the oil supply if the pressure-regulating device provided in accordance with 9.2.13 fails to regulate the pressure as required

9.2.15 Only appliances equipped with primary safety controls specifically listed for the appliance shall be connected to a centralized oil distribution system.

9.2.16 Accurate inventory records shall be maintained and reconciled on all storage tanks for indication of leakage from tanks or piping.

9.3 Oil Distribution Systems for Roof-Mounted or Ceiling-Suspended Oil-Fired Units.

9.3.1 An oil distribution system for roof-mounted or ceiling-suspended oil-burning appliances shall meet the requirements of this section and all other applicable provisions of this standard.

9.3.2 The installation and maintenance of the oil distribution system shall be supervised by a qualified person.

9.3.3 Plans showing the relative location of tanks, pumps, valves, piping, and their relationship to structures supplied by the systems shall be approved by and filed with the authority having jurisdiction.

9.3.4 Oil shall be permitted to be fed to the burner(s) directly from a storage tank or by means of a fuel distribution system that includes a transfer pump.

9.3.4.1 Where fed directly from a storage tank, the fuel supply system shall be designed so that the burner fuel unit operates with less than 10 in. Hg (34 kPa) vacuum at the inlet under normal operating conditions.

9.3.4.2 If the requirements of 9.3.4.1 cannot be met, a fuel supply system incorporating a transfer pump(s) shall be provided.

9.3.5 The fuel supply system shall meet the following requirements:

(1) All components (pumps, reservoirs, valves, regulators, relief valves, controls, and so forth) shall be listed for use with fuel oil.
(2) Control and relief provisions shall be provided to prevent pressurizing the main distribution pipelines to any point more than 50 percent above the normal working pressure.
(3) Dead-ended main distribution pipelines shall not be permitted unless provisions are made for air purging, and the purge points shall be closed by plugs or caps when not actually in use.
(4) Means shall be provided to limit the oil pressure at the burner inlet to a maximum gauge pressure of 3 psi (gauge pressure of 21 kPa).
(5) If a pressure-reducing valve is to be used, it shall be a type approved for the service.

9.3.6 The capacity of a single aboveground tank or the aggregate capacity of two or more aboveground tanks shall not exceed 20,000 gal (75,700 L) nominal capacity.

9.3.7 Underground tanks installed in accordance with Section 7.5 shall be permitted to be of any capacity.

9.3.8 Tanks, piping, pumps, and valves shall meet all applicable requirements of Chapters 7 and 8.

9.3.9 If required by design, individual supply tanks, including auxiliary tanks, connected to burners shall meet the requirements of 7.6.4, 7.8.4, and Section 8.8.

9.3.10 Valves and drip trays (roof-mounted units only) shall be provided to prevent oil spills during servicing.

9.3.11 A readily accessible and identified manual shutoff valve shall be installed in each branch supply pipeline that serves an individual burner and in the oil distribution line.

9.3.11.1 This valve shall be permitted to be either inside or outside of a protective enclosure.

9.3.11.2 If inside, the valve shall be located directly adjacent to the point at which the supply line enters the protective enclosure.

9.3.11.3 If outside, the valve shall be protected from weather and damage.

9.3.12 Only roof-mounted or ceiling-suspended appliances equipped with primary safety controls specifically listed for the appliance shall be connected to the distribution system.

9.3.13 A switch shall be provided in the electrical supply to the transfer pump.

9.3.13.1 The switch shall be permitted to be locked in the open position and shall be located at a convenient location so the fuel supply system can be shut down for maintenance.

9.3.13.2 Provisions shall be made so that shutdown of the fuel supply system interrupts the electrical supply to the appliances to which the fuel supply is connected. *(See also 10.5.9.)*

Chapter 10 Installation of Oil Burners and Oil-Burning Appliances

10.1 Scope. This chapter shall apply to installation of oil burners and oil-burning appliances and equipment.

10.2 Basic Requirements.

10.2.1 Installation of oil-burning boilers with inputs of 12,500,000 Btu/hr (3663 kW) and above shall meet the applicable requirements of NFPA 85.

10.2.2 Installation of oil-burning ovens and furnaces within the scope of NFPA 86 shall meet the applicable requirements of that standard.

10.2.3 Oil burners shall be permitted to be installed in boilers and furnaces.

10.2.4 Oil burners shall be permitted by the authority having jurisdiction for use in firing ovens, water heaters, ranges, special furnaces, and the like.

10.2.5 Where oil burners are installed in appliances originally designed for solid fuel, the ash door of the appliance shall be removed or bottom ventilation shall be provided to prevent the accumulation of vapors in the ash pit.

10.2.6 In installations in confined spaces, the clearances from the appliance to the walls and ceilings shall not be less than those specified in the listing, regardless of the type of construction.

10.2.7 Unless the appliance is approved by the manufacturer for use without a combustion chamber, the oil-burning appliance shall have a suitable combustion chamber furnished by the manufacturer or specified in the manufacturers' installation instructions.

10.2.8 Prior to installation of an oil burner, the furnace, boiler, or appliance into which it is installed shall be examined and shown to be in good condition. The combustion chamber and flue gas passages shall be examined and shown to be tight against leaks.

10.2.9 Storage of materials shall be separated from oil burning appliances and from chimneys, chimney connectors, and flues by a minimum distance of 5 ft (1.5 m).

10.3 Posting of Instructions. Complete instructions for the care and operation of the appliance, as furnished by the manufacturer, shall be conspicuously posted near the appliance.

10.4 Replacement of Appliances and Chimneys. (Reserved)

10.5 Operating Controls.

10.5.1* Oil burners shall be provided with some means for manually stopping the burner.

10.5.1.1 Such device or devices shall be placed in a readily accessible location.

10.5.1.2 For electrically powered appliances, the requirement of 10.5.1 shall be accomplished by an identified switch in the burner supply circuit, placed outside of and adjacent to the entrance to the room where the appliance is located.

10.5.1.3 For appliances that are not electrically powered, an identifiable valve in the oil supply line, operable from a location that can be reached without passing near the burner, shall be used.

10.5.2 An electrical service disconnect switch, arranged to stop and start the oil burner, shall be installed at the appliance and shall be located so that it is within easy reach of the service technician for control of the oil burner while observing the flame.

10.5.2.1 A single duplex electrical receptacle shall be permitted to be installed at the same location, wired in parallel with the electrical service disconnect.

10.5.3* Oil burners shall be equipped with a listed primary safety control of a type appropriate for the burner.

10.5.4* Each oil-burning appliance shall be provided with automatic limit controls that will prevent unsafe pressure or low water in a steam boiler, low water or over-temperature in a water boiler, or over-temperature in a furnace or heater.

10.5.5* Limiting controls and low-water shutoffs intended to prevent unsafe operation of heating equipment by opening an electrical circuit to the burner or oil shutoff device shall be so arranged as to effect the direct opening of that circuit, whether the switching mechanism is integral with the sensing element or remote from same.

10.5.6 A water heater shall be provided with a water pressure and temperature relief device.

10.5.7 Means shall be provided to prevent siphoning in any boiler or tank with a circulating water heater attached.

10.5.8 Electric motor–driven oil burners with integral oil pumps and electric motor–driven pump sets for use with burners not equipped with integral pumps shall be provided with a motor controller that incorporates no-voltage protection and is wired into the power supply to the motor.

10.5.9 In systems where either steam or air is used for atomizing the fuel oil or where air for combustion is supplied by a source that can be interrupted without shutting off the oil supply, the fuel oil supply and the steam or air supply shall be interlocked so that the fuel oil supply is shut off immediately upon failure of the steam or air supply.

10.5.10 Where automatically operated oil burners are used in installations equipped with forced- or induced-draft fans, or both, means shall be provided to shut off the oil supply immediately upon fan failure.

10.5.11 Oil burners not equipped to provide safe automatic restarting after shutdown shall require manual restarting after any control functions to extinguish the burner flame.

10.5.12 An acceptance test of the primary safety control shall be conducted on any appliance where more than one burner is fired in a single combustion chamber or where one burner is adapted to fire in two or more combustion chambers.

10.5.12.1 The test shall ensure that the primary safety control will function properly in the event of ignition failure or unsafe flame extinguishment at any of the burners.

10.6 Specific Requirements for Installation of Boilers, Furnaces, Floor-Mounted Unit Heaters, and Water Heaters.

10.6.1 Appliances shall be installed with clearances from combustible material not less than those indicated in Figure 10.6.1 and Table 10.6.1 or shall be permitted to be installed with lesser clearances in accordance with their listing.

10.6.1.1 In no case shall the clearances used interfere with providing combustion air or providing access to the appliance. *(See Chapters 4 and 5.)*

10.6.1.2 Chimney connectors shall be installed in accordance with Section 6.5.

Table 10.6.1 Clearances to Combustible Material[1]

Classification as to Type of Appliance	Clearances (in.)						
	A Above[2]	Duct[3]	B Front	C Chimney[4] Connector	D Rear	Ec Casing Sides[5]	Ep Furnace Plenum Sides[6]
Form I	2[9]	2	24	18	6	6	2 or 6[10]
Form IA	6	—	24	18	6	6	—
Form II[7]	6	2	24	18	6	6	2
Form III[8]	18	18	48	18	18	18	18
Form IV	48	—	96	36	36	36	—
Form V	6	—	24	18	18	18	—

For SI units, 1 in. = 25 mm.

Notes:

(1) For multiple-fueled appliances that can fire solid fuels, see NFPA 211 and NFPA 90B.

(2) This column indicates clearances above the top of the appliance casing or above the top of the furnace bonnet or plenum.

(3) This column indicates clearance from a horizontal run of warm-air duct within 3 ft (900 mm) of upflow, downflow, or horizontal type warm-air furnaces.

(4) See Section 6.5 for installation of chimney connectors.

(5) This column indicates clearances from the sides of the appliance casing.

(6) This column is applicable only to a warm-air furnace provided with an external plenum for connection to duct systems and indicates clearances from all sides of the outlet air plenum.

(7) The clearance from the bottom of a suspended (horizontal) furnace that is not otherwise classified as a low-heat industrial appliance shall not be less than 6 in. (150 mm).

(8) The clearance to combustible material from the bottom of a suspended (horizontal) furnace that is not classified as a low-heat industrial appliance under Form III, from a suspended-type unit heater that is classified under Form V, or from a unit heater that is classified as a low-heat industrial appliance under Form III shall not be less than 18 in. (450 mm).

(9) This clearance shall be permitted to be reduced to 1 in. (25 mm) for a listed, forced-air or gravity system equipped with a limit control that cannot be set higher than 200°F (93°C).

(10) Clearance is 2 in. (50 mm) for upflow warm-air furnaces and 6 in. (150 mm) for downflow warm-air furnaces.

Description of Classifications for Use with Table 10.6.1

Form I. Automatically fired upflow- or downflow-type warm-air furnaces, excluding horizontal types not larger than 100 ft^3 (2.8 m^3) in size (excluding blower compartments and burner equipment).

Form IA. Floor-mounted unit heaters, not larger than 100 ft^3 (2.8 m^3) in size, excluding blower or fan compartment and burner.

Form II. Horizontal-type warm-air furnaces; water wall-type boilers operating at not more than 250°F (121°C) for water boilers and at not more than gauge pressure of 15 psi (gauge pressure of 103 kPa) for steam boilers; water heaters not larger than 100 ft^3 (2.8 m^3) in size (excluding burner equipment and blower compartments of furnaces).

Form III. Low-heat industrial appliances; floor-mounted-type and suspended-type warm-air furnaces not classified under Forms I and II; steam boilers operating at not more than a gauge pressure of 50 psi (gauge pressure of 345 kPa) and not classified under Form II; water boilers operating at a water temperature not more than the temperature of saturated steam at not more than a gauge pressure of 50 psi and not classified under Form II; unit heaters not classified under Forms IA or V.

Form IV. Medium-heat industrial appliances; steam boilers operating at a gauge pressure of over 50 psi.

Form V. Suspended-type unit heaters not more than 100 ft^3 (2.8 m^3) in size (excluding fan compartment and burner equipment).

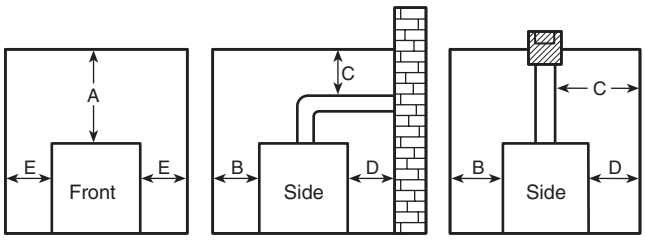


FIGURE 10.6.1 Clearances to Combustible Materials.

10.6.1.3 When multiple-fueled appliances using solid fuels are installed, the clearances and mounting requirements of NFPA 211 shall apply.

10.6.2 Appliances shall be permitted to be installed in rooms, but not in alcoves or closets, with lesser clearances to combustible material, provided the combustible material or appliance is protected as described in Table 10.6.2 and Figure 10.6.2(a), Figure 10.6.2(b), and Figure 10.6.2(c).

10.6.3 Floor-mounted appliances shall be placed in one the following ways:

(1) On floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material against the underside thereof
(2) On fire-resistive slabs or arches having no combustible material against the underside thereof
(3) In accordance with their listing, if listed specifically for installation on a floor constructed of combustible material

10.6.3.1 Such construction shall extend not less than 12 in. (0.3 m) beyond the appliance on all sides.

10.6.3.1.1* Appliances shall be permitted to be placed on combustible floors although not listed for such installation, provided the floor under the appliance is protected in accordance with the requirements of accepted building code practice.

10.6.3.1.2 An appliance listed for installation under Form I or II in Table 10.6.1 shall be permitted to be placed on a combustible floor that is protected with hollow masonry not less than 4 in. (100 mm) thick covered with sheet metal not less than 24 gauge, as shown in Figure 10.6.1. Such masonry shall be laid with ends unsealed and joints matched in such a way as to permit free circulation of air from side to side through the masonry. For such installations, the furnace shall be securely anchored to maintain the clearances required in Table 10.6.1.

10.6.4 The supply and return duct system of a central heating appliance shall be installed in accordance with NFPA 90A or NFPA 90B whichever is applicable.

10.6.5 A return system shall be arranged so that negative pressure from the circulating fan cannot affect the air supply for combustion or act to draw products of combustion from joints or openings in the appliance, chimney connectors, or chimney.

10.6.6 A down-flow furnace shall be installed so that there are no open passages in the floor through which flame or hot gases from a fire originating in the room below the floor can travel to the room above.

10.6.7 A down-flow furnace shall be automatically operated and equipped with an approved temperature limit control that will limit outlet air temperature to 200°F (93°C). The furnace shall be designed to prevent unsafe temperatures in the event of reverse flow.

10.7 Specific Requirements for Attic Furnaces. A furnace installed in an attic shall be listed for such installation and installed in accordance with its listing.

10.8 Specific Requirements for Duct Furnaces.

10.8.1 A duct furnace shall be installed with clearances of at least 6 in. (150 mm) to adjacent walls, ceilings, and floors of combustible material, unless listed for installation at lesser clearance and installed in accordance with its listing.

10.8.2 A duct furnace and its chimney connector shall be permitted to be installed in a room, but not in a confined space such as an alcove or closet, with reduced clearances to combustible material, provided the combustible material is protected as described in Table 10.6.2 and Figure 10.6.2(a), Figure 10.6.2(b), and Figure 10.6.2(c) and the requirements for combustion air and accessibility comply with Chapters 4 and 5.

10.8.3 A duct furnace flue pipe shall be installed to provide a clearance to combustible material of not less than 18 in. (450 mm).

10.8.4 A duct furnace shall be firmly supported.

10.8.5 Access panels shall be provided in the ducts on both the upstream and downstream sides of the furnace.

10.8.6 Controls shall be located outside the duct except for the sensing element of a control.

10.9 Specific Requirements for Floor Furnaces.

10.9.1 Floor furnaces shall not be installed in floors of combustible construction unless specifically listed for such installation and installed in accordance with their listing. *(See Figure 10.6.1.)*

10.9.2 The floor around the furnace shall be braced and headed with a framework of material not lighter than the floor joists.

10.9.3 Floor furnaces shall be supported independently of the floor grilles.

10.9.4 A floor furnace shall be placed not closer than 6 in. (150 mm) to the nearest wall and shall be so placed that a door, drapery, or similar object cannot be nearer than 12 in. (300 mm) to any portion of the register of the furnace.

10.9.5 Wall-register models shall be placed not closer than 6 in. (150 mm) to a corner.

10.9.6 The bottom of a floor furnace shall have at least 6 in. (150 mm) clearance from the ground.

10.9.6.1 Where the ground must be excavated to provide this clearance, the excavation shall extend at least 12 in. (300 mm) beyond the furnace on all sides and at least 18 in. (450 mm) on the control side.

10.9.6.2 Where the excavation exceeds 12 in. (300 mm) or where the ground contour or moisture condition is such that water seepage is likely, a watertight pan constructed of copper, galvanized iron, or other suitable corrosion-resistant material, properly anchored in place, or a waterproof concrete pit, shall be provided under the furnace. The sides of the pan or pit shall extend 4 in. (100 mm) above ground level.

Table 10.6.2 Reduction of Clearances with Specified Forms of Protection

		Allowable Clearance with Specified Protection (in.)									
		Where the required clearance with no protection from the appliance or chimney connector is:									
		36 in.		18 in.		12 in.		9 in.		6 in.	
	Type of Protection[1]	Above	Sides and Rear	Above	Sides and Rear	Above	Sides and Rear	Above	Sides and Rear	Above	Sides and Rear
(a)	3½ in. thick masonry wall without ventilated air space	—	24	—	12	—	9	—	6	—	5
(b)	½ in. insulation board over 1 in. glass fiber or mineral wool batts	24	18	12	9	9	6	6	5	4	3
(c)	0.024 in. (24-gauge) sheet metal over 1 in. glass fiber or mineral wool batts reinforced with wire on rear face with ventilated air space	18	12	9	6	6	4	5	3	3	3
(d)	3½ in. thick masonry wall with ventilated air space	—	12	—	6	—	6	—	6	—	6
(e)	0.024 in. (24-gauge) sheet metal with ventilated air space	18	12	9	6	6	4	5	3	3	2
(f)	½ in. thick insulation board with ventilated air space	18	12	9	6	6	4	5	3	3	3
(g)	0.024 in. (24-gauge) sheet metal with ventilated air space over 0.024 in. (24-gauge) sheet metal with ventilated air space	18	12	9	6	6	4	5	3	3	3
(h)	1 in. glass fiber or mineral wool batts sandwiched between 2 sheets 0.024 in. (24-gauge) sheet metal with ventilated air space	18	12	9	6	6	4	5	3	3	3

For SI units, 1 in. = 25 mm.

Notes:

(1) The type of protection specified is applied to and covers all surfaces of combustible material within the distance specified as the required clearance with no protection. *[See Figure 10.6.2(a), Figure 10.6.2(b), and Figure 10.6.2(c) for additional information.]*

(2) Reduction of clearances from combustible materials cannot interfere with combustion air, draft regulators, or accessibility for servicing.

(3) All clearances are measured from the outer surface of the combustible material to the nearest point on the surface of the appliance or connector, disregarding any intervening protection applied to the combustible material.

(4) Spacers and ties are of noncombustible material. No spacer or tie can be used directly opposite an appliance or connector.

(5) With all clearance reduction systems using ventilated air space, adequate provision for air circulation is to be provided as described. *[See Figure 10.6.2(a) and Figure 10.6.2(b).]*

(6) Provide at least 1 in. (25 mm) clearance between the reduction system and combustible walls and ceilings for reduction systems using ventilated air space.

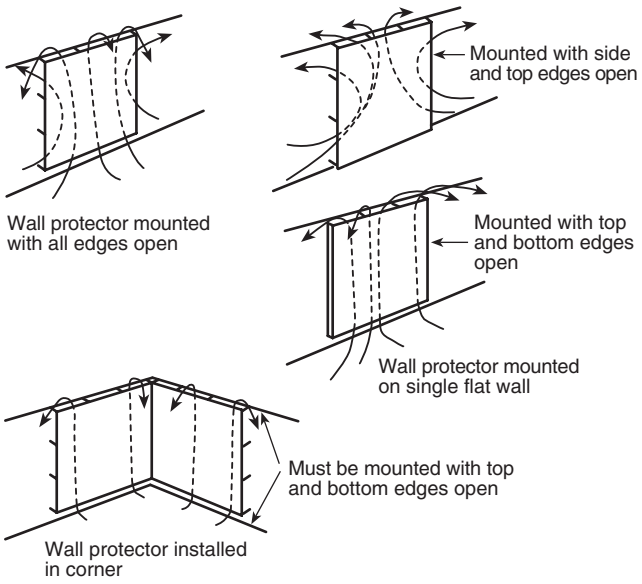
(7) If a wall protector is mounted on a single flat wall away from corners, adequate air circulation can be provided by leaving only the bottom and top edges, or only the side and top edges open, with at least a 1 in. (25 mm) air gap.

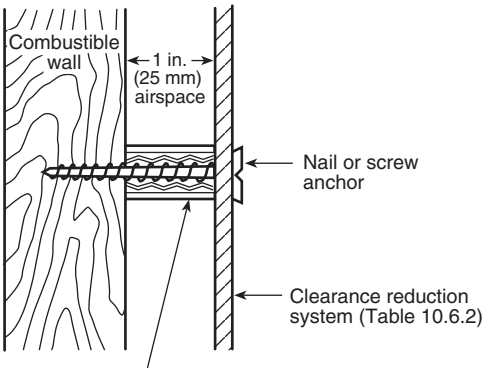
(8) Mineral wool batts (blanket or board) are to have a minimum density of 8 lb/ft^3 (128 kg/m^3) and a minimum melting point of 1500°F (816°C).

(9) Insulation material used as part of a clearance reduction system is to have a thermal conductivity of 1 (Btu/in.)/(ft^2/hr·°F) or less.

(10) Provide at least 1 in. (25 mm) between the appliance or connector and the protector. In no case is the clearance between the appliance or connector and the combustible material to be reduced below that allowed in the table.

(11) All clearances and thicknesses are minimum. Larger clearances and thicknesses are acceptable.





Note: 1 in. (25 mm) noncombustible spacer such as stacked washers, small-diameter pipe, tubing, or electrical conduit.

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

Do not use spacers directly behind appliance or connector.

Δ FIGURE 10.6.2(a) Wall Protector Clearance Reduction System.

10.9.7 Floor furnaces shall be made accessible.

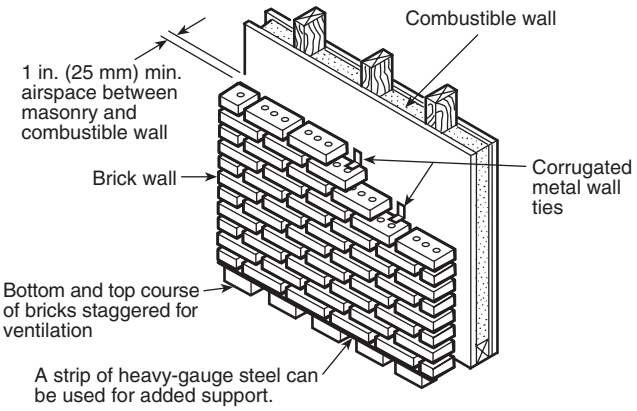
10.9.7.1 Openings in foundation walls and trap doors in floors shall not be smaller than 18 in. × 24 in. (450 mm × 600 mm) in dimension.

10.9.7.2 Underfloor passageways to the furnace shall not be smaller than 24 in. × 24 in. (600 mm × 600 mm).

10.9.8 Provision shall be made for proper air supply for combustion.

10.9.9 Listed floor furnaces shall be permitted to be installed in an upper floor of a building, provided the furnace assembly projects below into a utility room, closet, garage, or similar nonhabitable space.

10.9.9.1 In such installations, the floor furnace shall be completely enclosed (entirely separated from the nonhabitable space), with means for air intake and with access facilities for servicing on the control side.



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

Masonry clearance reduction system

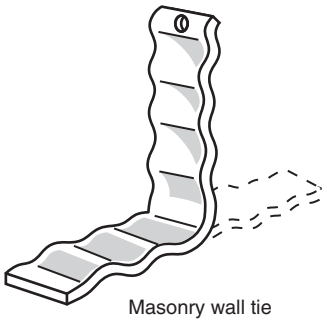
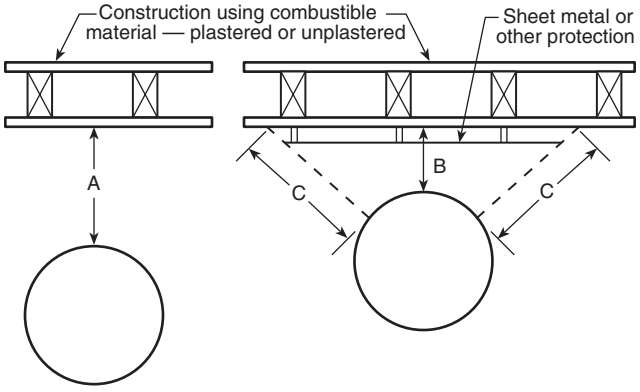


FIGURE 10.6.2(b) Masonry Clearance Reduction System.



"A" equals the required clearance with no protection, as specified in Table 10.6.1.

"B" equals the reduced clearance permitted. The protection applied to combustible materials is required to extend far enough in each direction to make "C" equal "A." Plastered constructions having combustible supports are classed as combustible regardless of the type of lath.

FIGURE 10.6.2(c) Extent of Protection Necessary to Reduce Clearances from Appliances or Chimney Connectors.

10.9.9.2 The minimum furnace clearances shall be 6 in. (150 mm) to all sides and bottom.

10.9.9.3 The enclosure shall be constructed of Portland cement plaster on metal lath or material of equal fire resistance.

10.9.10 A floor furnace shall not be installed in the floor of any aisle or passageway of an auditorium, public hall, or public assembly room or in an exitway from any such room or space.

10.9.11 A floor furnace chimney connector shall be installed with not less than 9 in. (225 mm) clearances to combustible material, unless the combustible material is protected as described in Table 10.6.2 and in Figure 10.6.2(a), Figure 10.6.2(b), and Figure 10.6.2(c).

10.10 Specific Requirements for Furnaces Used with Refrigeration Systems.

10.10.1 A furnace shall not be installed in conjunction with a refrigeration coil where circulation of cooled air is provided by the blower unless the blower has sufficient capacity to overcome the external static resistance imposed by the duct system, furnace, and cooling coil at the airflow required for heating or cooling, whichever is greater.

10.10.2 To avoid condensation within heating elements, furnaces used in conjunction with cooling equipment shall be installed in parallel with or on the upstream side of cooling coils unless the furnace has been specifically listed for downstream installation.

10.10.3 With a parallel flow arrangement, the dampers or other means used to control the flow of air shall be sufficiently tight to prevent any circulation of cooled air through the unit.

10.10.4 Where furnaces are to be located upstream from cooling units, the cooling units shall be designed or equipped so that excessive temperatures or pressures are not developed.

10.10.5 Furnaces shall be permitted to be installed downstream from evaporative coolers or air washers if the heating element is made of corrosion-resistant material.

10.10.5.1 Stainless steel, ceramic-coated steel, or an aluminum-coated steel in which the bond between the steel and the aluminum is an iron-aluminum alloy shall be considered corrosion-resistant.

10.10.5.2 Air washers operating with chilled water, which deliver air below the dew point of the ambient air at the appliance, shall be considered refrigeration systems.

10.11 Specific Requirements for Industrial Furnaces and Boilers — Stationary Type.

10.11.1 Stationary-type industrial furnaces and power boilers shall include low-heat, medium-heat, and high-heat appliances. *(See Chapter 3, Definitions, for examples of each type.)*

10.11.2 Low-Heat Appliances.

10.11.2.1 Low-heat appliances shall be installed with clearances not less than those specified by Form III in Table 10.6.1.

10.11.2.1.1 Low-heat appliances that are approved for installation with lesser clearances than specified in 10.11.2.1 shall be permitted to be installed in accordance with their listing.

10.11.2.1.2 Low-heat appliances shall be permitted to be installed with lesser clearances to combustible material, provided the combustible material is protected as specified in Table 10.6.2 and Figure 10.6.2(a), Figure 10.6.2(b), and Figure 10.6.2(c).

10.11.2.2 Floor-mounted low-heat appliances shall be installed in one of the following ways:

(1) On the ground
(2) On floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material against the underside thereof
(3) On fire-resistive slabs or arches having no combustible material against the underside thereof

10.11.2.2.1 The construction described in 10.11.2.2(2) and 10.11.2.2(3) shall extend not less than 12 in. (0.3 m) beyond the appliance on all sides.

10.11.2.2.2 Appliances that are listed specifically for installation on a floor constructed of combustible material shall be permitted to be placed in accordance with the conditions of their listing.

10.11.2.2.3 Low-heat appliances shall be permitted to be placed on combustible floors although not listed for such installation, provided the floor under the appliance is protected in accordance with the requirements of accepted building code practice.

10.11.3 Medium-Heat Appliances.

10.11.3.1 Medium-heat appliances shall be installed with clearances not less than those indicated by Form IV in Table 10.6.1.

10.11.3.2 Medium-heat appliances shall be installed in one of the following ways:

(1) On the ground
(2) On floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material against the underside thereof
(3) On fire-resistive slabs or arches having no combustible material against the underside thereof

10.11.3.2.1 The construction described in 10.11.3.2(2) and 10.11.3.2(3) shall extend not less than 3 ft (900 mm) beyond the appliance on all sides.

10.11.3.2.2 Medium-heat appliances shall be permitted to be placed on combustible floors although not listed for such installation, provided the floor under the appliance is protected in accordance with accepted building code practice.

10.11.3.3 Rooms containing medium-heat appliances shall be provided with ventilation to prevent accumulation of hot air over or near the appliance.

10.11.4 High-Heat Appliances.

10.11.4.1 High-heat appliances shall be installed with clearances to combustible material of not less than 10 ft (3 m) at the sides and rear, not less than 15 ft (4.5 m) above, and not less than 30 ft (9 m) at the front or side where hot products are removed.

10.11.4.2 Rooms containing high-heat appliances shall be provided with ventilation to prevent accumulation of hot air over or near the appliance.

10.11.4.3 High-heat appliances shall be placed in either of the following ways:

(1) On the ground
(2) On floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material against the underside thereof, with floors extending at least 10 ft (3 m) on all sides and at least 30 ft (9 m) at the front or side where hot products are removed

10.12 Specific Requirements for Miscellaneous Heaters (Air Heaters, Salamanders, and so forth).

10.12.1 A direct-fired heater or salamander shall not be used in an enclosed space or in proximity to combustible material.

10.12.2 A direct-fired heater or salamander shall be permitted to be used where salamanders fired by coal or coke are allowed.

10.12.3 An air heater shall be of a type designed to discharge air at a temperature not exceeding 250°F (121°C).

10.12.4 An air heater installed inside a building shall be provided with a chimney connector to conduct the flue gases to the outside.

10.12.5 Flexible ducts shall be made of material resistant to heat and flame and that can withstand prolonged exposure to temperatures as high as 250°F (121°C).

10.13 Specific Requirements for Recessed Wall Furnaces.

10.13.1 Listed recessed wall furnaces shall be permitted to be installed in walls of combustible construction.

10.13.2 The authority having jurisdiction shall be consulted for the proper installation methods to be followed.

10.13.3 Recessed wall furnaces shall be installed in accordance with the manufacturers' instructions.

10.13.4 Recessed wall furnaces shall be located so as not to cause a hazard to walls, floors, curtains, furniture, doors, and so forth.

10.13.5 The face of a warm-air register shall be at least 3 ft (0.9 m) from any wall or combustible surface that is directly opposite the register.

10.13.6 Panels, grilles, and access doors that must be removed for normal servicing operations shall not be attached to the building construction.

10.13.7 Adequate combustion and circulating air shall be provided.

10.14 Specific Requirements for Floor-Mounted Restaurant-Type Cooking Appliances.

10.14.1 Floor-mounted restaurant-type cooking appliances shall be installed with clearances to combustible material of not less than 18 in. (450 mm) at the sides and rear of the appliance and from the chimney connector thereof and not less than 4 ft (1.2 m) above the cooking top and at the front of the appliance.

10.14.2 Floor-mounted restaurant-type cooking appliances that are listed for installation with lesser clearances than specified in 10.14.1 shall be permitted to be installed in accordance with the conditions of their listing.

10.14.3 Floor-mounted restaurant-type cooking appliances shall be permitted to be installed in rooms, but not in confined spaces such as alcoves, with lesser clearance to woodwork or other combustible material, provided the combustible material is protected as specified by Table 10.6.2, Protection Types (c), (e), and (g).

10.14.4 Where a wall or cabinet of combustible material is located adjacent to the cooking top section of the appliance and is not shielded from the cooking top section by a high shelf, warming closet, or other such part of the appliance, the protection specified in 10.14.3 shall extend for a distance of at least 2 ft (0.6 m) above the surface of the cooking top.

10.14.4.1 Such wall or cabinet shall be protected even though the appliance is listed for "close-to-the-wall" installation.

10.14.5 Floor-mounted appliances shall be placed in either of the following ways:

(1) On floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material against the underside thereof
(2) On fire-resistive slabs or arches having no combustible material against the underside thereof, with such construction in all cases extending not less than 12 in. (300 mm) beyond the appliance on all sides

10.14.5.1 Floor-mounted appliances that are specifically listed for installation on a floor constructed of combustible material shall be permitted to be placed in accordance with the conditions of their listing.

10.14.5.2 Floor-mounted appliances shall be permitted to be placed on combustible floors although not listed for such installation, provided the floor under the appliance is protected in accordance with the requirements of accepted building code practice.

10.15 Specific Requirements for Suspended-Type Unit Heaters.

10.15.1 Suspended-type unit heaters shall be installed with clearances to combustible material not less than those specified by Table 10.6.1.

10.15.1.1 Suspended-type unit heaters that are listed for installation with lesser clearances shall be permitted to be installed in accordance with their listing.

10.15.1.2 Suspended-type unit heaters shall be permitted to be installed with lesser clearances to combustible material, provided the combustible material is protected as specified by Table 10.6.2 and Figure 10.6.2(a), Figure 10.6.2(b), and Figure 10.6.2(c).

10.15.2 Suspended-type heaters shall be safely and adequately supported.

10.15.3 Hangers or brackets supporting heaters shall be metal.

10.15.4 The location of any suspended unit heater or its ductwork shall be such that a negative pressure will not be created in the room where the unit heater is located.

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

10.16 Specific Requirements for Direct-Vent Appliances. (Reserved)

10.17 Specific Requirements for Appliances on Roofs.

10.17.1 Appliances installed on roofs shall be designed or enclosed to withstand expected climate conditions.

10.17.2 If the appliance is enclosed, the enclosure shall permit easy entry and movement, shall be of reasonable height, and shall have at least a 30 in. (750 mm) clearance between the entire service access panel of the equipment and the wall of the enclosure.

10.17.3 The roof where the appliance is to be installed shall be capable of supporting the additional load or shall be reinforced to support the additional load.

10.17.4 All access locks, screws, and bolts shall be of corrosion-resistant material.

10.17.5 Appliances shall be installed in accordance with their listings and with manufacturers' instructions.

10.17.6 Appliances shall be installed on a well-drained surface of the roof.

10.17.7 Except as provided for in 10.17.7.1, at least 6 ft (1.8 m) of clearance shall be maintained between any part of the appliance and the edge of the roof or similar hazard.

10.17.7.1 Rigidly fixed rails or guards at least 42 in. (1 m) high shall be permitted to be used as an alternate to the 6 ft (1.8 m) clearance. Parapets or other parts of the building structure that are at least 42 in. (1 m) high shall be permitted to be used in lieu of rails or guards.

10.17.8 Appliances requiring an external source of electrical power shall be provided with a readily accessible electrical disconnect that will completely de-energize the equipment.

10.17.8.1 This disconnect shall be installed within sight of the equipment.

10.17.8.2 A 120-volt ac grounding-type receptacle outlet shall be provided adjacent to the equipment.

10.17.8.3 This receptacle outlet shall be connected to the supply side of the electrical disconnect.

10.17.9 Where water stands on the roof at the equipment or in the passageways leading to the equipment or where the roof is of a water-sealed design, a suitable platform or walkway or both shall be provided above the water line and adjacent to the equipment and the control panels so that equipment can be safely serviced.

10.17.10 Appliances located on roofs or other elevated platforms shall be accessible.

10.18 Installation of Outdoor Appliances.

10.18.1 Appliances listed for outdoor installation shall be permitted to be installed without additional environmental protection in accordance with the terms of their listing and shall be accessible for servicing.

10.18.2 Appliances that are not listed for outdoor installation shall be permitted to be installed outdoors if approved for such installation.

10.18.2.1 In determining suitability for outdoor installation, the following factors shall be considered:

(1) Protection from physical damage
(2) Location of combustion air and other openings into the appliance
(3) Surface temperatures
(4) Weatherproofing
(5) Adequate and safe venting
(6) Clearances to adjacent combustibles

Chapter 11 Installation and Operation of Oil-Burning Stoves, Kerosene-Burning Room Heaters, and Kerosene-Burning Portable Heaters

11.1 Scope. This chapter shall apply to the installation and operation of oil-burning stoves, kerosene-burning room heaters, and kerosene-burning portable heaters.

11.2* Basic Requirements.

11.2.1 Appliances shall be kept clean and in good repair. The following requirements also shall apply:

(1) When necessary, repairs or replacement of parts shall be done by the manufacturer or the manufacturer's representative.
(2) Where repair or replacement of parts must be done by the user, it shall be strictly confined to procedures that have been fully covered by the manufacturer's printed instructions.

11.2.2 Instructions furnished by the manufacturer shall be preserved.

11.2.3 Special care shall be employed in the installation of oil-burning stoves, kerosene-burning room heaters, and kerosene-burning portable heaters in order to avoid direct contact with combustible material, including draperies and curtains, and to avoid accidental overturning.

11.2.4 Appliances shall be carefully leveled in accordance with manufacturers' installation instructions.

11.2.5 Where manufacturers' instructions specify that oil-burning stoves and kerosene-burning room heaters are to be fastened to the floor, these instructions shall be carefully followed.

11.2.6 In all cases, oil-burning stoves and kerosene-burning heaters that are supplied with fuel from separate supply tanks shall be securely attached to the floor or otherwise secured in position to avoid strains on piping.

11.2.7 The filling of removable tanks for oil-burning stoves and kerosene-burning portable heaters shall be done outside of buildings or at a special location where precautions can be taken to minimize fuel spills.

11.2.8 Flue Connections. Appliances that are intended for connection to a flue shall be connected to a suitable chimney or integral appliance venting system to ensure having sufficient draft at all times. *(See Section 6.6.)*

11.2.9 Fuel Supply Tanks.

11.2.9.1 Oil-burning stoves and kerosene-burning room heaters designed for gravity feed shall not be connected to separate supply tanks or lift pumps.

11.2.9.2 Oil-burning stoves and kerosene-burning room heaters specifically designed and listed for use with separate supply tanks shall be permitted to be connected for gravity feed from a supply tank or an automatic pump.

11.2.9.3 Tanks supplying oil-burning stoves and kerosene-burning room heaters by gravity feed shall be installed in such a way that the pressure at the fuel supply tank will not be greater than the pressure at a point 8 ft (2.4 m) above the appliance's fuel inlet connection and shall be installed in accordance with the applicable requirements in Chapter 7.

11.2.10 Automatic lift pumps shall be securely mounted and shall be equipped with an overflow line that returns to the supply tank. The oil piping shall comply with the applicable requirements in Chapter 8.

11.2.11 Clearances and Mounting.

11.2.11.1 Oil-burning stoves, kerosene-burning room heaters, and kerosene-burning portable heaters shall be installed to provide clearances to combustible material not less than those specified by Table 11.2.11.1.

11.2.11.2 Oil-burning stoves, kerosene-burning room heaters, and kerosene-burning portable heaters that are listed for installation with lesser clearances than specified in Table 11.2.11.1 shall be permitted to be installed in accordance with their listing.

11.2.11.3 Oil-burning stoves and kerosene-burning room heaters shall be permitted to be installed with lesser clearances to combustible material, provided the combustible material is protected as described in Table 10.6.2 and Figure 10.6.2(a), Figure 10.6.2(b), and Figure 10.6.2(c).

11.2.11.4 In no case shall the horizontal distance be less than 6 in. (150 mm) from an oil-burning stove to that portion of adjacent unprotected combustible walls or cabinets extending above the cooking top of the range portion of the oil-burning stove.

11.2.11.5 Oil-burning stoves shall have a clearance vertically above the top of not less than 30 in. (750 mm) to combustible material or cabinets.

11.2.11.5.1 Where the underside of combustible material or cabinets is protected by fire-resistive board at least 1.4 in. (6 mm) thick covered with sheet metal not lighter than 28 gauge, the distance shall be at least 24 in. (600 mm).

Table 11.2.11.1 Minimum Clearances for Heating and Cooking Appliances

Appliances	Minimum Clearance (in.)		
	Sides	Rear	Chimney Connector
Oil-burning stoves	24	9	18
Kerosene-burning room heaters	18	18	18
Kerosene-burning portable heaters of the radiant or convection type	36	36	Not applicable

For SI units, 1 in. = 25 mm, 1 ft = 0.3 m.

11.2.11.5.2 The protection shall extend 9 in. (225 mm) beyond the sides of the oil-burning stove.

11.2.11.6 Listed kerosene-burning portable heaters shall be permitted to be placed on combustible floors.

11.2.11.7 Oil-burning stoves and kerosene-burning room heaters shall be placed on noncombustible floors or on floors protected in accordance with accepted building code practice, unless listed for installation on combustible flooring.

11.3 Additional Requirements for Kerosene-Burning Portable Heaters.

11.3.1* Kerosene-burning portable heaters shall be listed.

11.3.2 Extreme caution shall be exercised in the placement and use of these devices since surface temperatures can be sufficient to cause contact burns and the device can constitute a source of ignition in the presence of flammable vapors.

Chapter 12 Used Oil–Burning Appliances

12.1 Scope. This chapter shall apply to appliances that burn used oil as a fuel.

12.2 Basic Requirements. Used oil–burning appliances shall meet the requirements of this chapter and all applicable requirements of Chapters 4 through 8 and Chapters 10 and 11 of this standard.

12.3 Use of Used Oil–Burning Appliances. Used oil–burning appliances shall not be used in a residential occupancy. Used oil–burning appliances shall be used only in commercial or industrial occupancies.

12.4 Listing Requirements.

Δ **12.4.1** Used oil–burning appliances shall be listed in accordance with UL 296A, *Waste Oil-Burning Air-Heating Appliances*.

12.4.2* The listing of the used oil–burning appliance shall apply to the used oil burner and the end-use appliance together as a single listed product.

12.4.3 A burner shall not be used for firing used oil unless the burner is covered together with the end-use appliance as a single listed product.

12.5 Installation Instructions.

12.5.1 The user shall preserve the installation and operation instructions provided with the used oil–burning appliance at the site where the appliance is operated.

12.5.2 The installation and operation instructions provided with the used oil–burning appliance shall include a statement to the effect that the used oil–burning appliance is to be installed by a qualified person.

12.6 Installation Clearances.

12.6.1 The installation of a used oil–burning appliance shall meet the appropriate clearances to combustible construction that are specified in Chapter 10.

12.6.2 Used oil–burning appliances shall be separated from flammable or combustible liquids in accordance with applicable requirements of NFPA 30A.

12.7 Burners for Used Oil–Burning Appliances.

12.7.1 Fuel Supply.

12.7.1.1 A readily accessible manual shutoff valve shall be provided downstream of the used oil supply tank.

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

12.7.1.2.1 The oil filter or strainer shall be downstream of the shutoff valve specified in 12.7.1.1 and upstream of the fuel pump of the used oil burner.

12.7.1.2.2 The oil filter or strainer shall be removable for inspection and cleaning.

12.7.2 Atomization Air Supply for Air-Atomized Burners.

12.7.2.1 The atomization air supply for an air-atomized burner shall be taken from a source that is reasonably constant in pressure and volume.

12.7.2.1.1 An atomization air supply that is covered as part of a listed used oil burner and used oil–fired appliance combination — for example, an air compressor — shall be deemed as meeting this requirement.

12.7.2.2 If shop air is used as the atomization air supply, the installation shall comply with the following:

(1) A manual shutoff valve shall be provided upstream of the atomization air supply connection to the used oil burner that will allow the used oil burner and used oil–burning appliance to be serviced without having to interrupt the shop air supply.
(2) When the shop air supply pressure is greater than the rated atomization air pressure for the used oil burner, the manual shutoff valve specified in 12.7.2.2(1) shall be followed by a suitable air pressure regulator that will allow atomization air to be supplied at the pressure(s) marked on the used oil burner or used oil–burning appliance.
(3) A suitably rated filter and condensate trap system shall be provided upstream of the atomization air supply connection to the used oil burner, but downstream of the manual valve specified in 12.7.2.2(1) or downstream of the atomization air pressure regulator, if provided.
(4) The air intake to the shop air source shall be reasonably free of carbon monoxide contamination.

12.8 Venting of Combustion (Flue) Gases. A used oil–burning appliance shall be vented in accordance with the manufacturers' instructions that are provided with the appliance. The requirements of 12.8.1 and 12.8.2 shall also apply and shall supersede the manufacturers' instructions.

12.8.1 The venting system for a used oil–burning appliance shall meet all applicable requirements of Chapter 6 of this standard.

12.8.2 A vent connector or vent manifold serving two or more used oil–burning appliances shall have an effective cross-sectional area that is not less than the combined cross-sectional area of the individual flue collars or individual connectors of all appliances served, unless the vent connector or vent manifold complies with 12.8.3.

12.8.3 A vent connector or vent manifold serving two or more used oil–burning appliances shall be permitted to have an effective cross-sectional area that is less than that specified in 12.8.2 if all of the following conditions are met:

(1) The configuration of the manifolded vent connectors are covered as part of the appliance listing.
(2) The transition piece that joins all of the vent connectors or vent manifolds is provided with the appliance.
(3) The manifolded vent is installed in accordance with the manufacturers' installation and operation instructions provided with the appliance and in accordance with the terms of its listing.

12.9 Used Oil Supply Tanks.

Δ **12.9.1** Supply tanks for aboveground indoor supply of used oil to a used oil–burning appliance shall be listed in accordance with UL 80, *Steel Tanks for Oil-Burner Fuels and Other Combustible Liquids;* UL 142, *Steel Aboveground Tanks for Flammable and Combustible Liquids;* or UL 142A, *Special Purpose Aboveground Tanks for Specific Flammable or Combustible Liquids.*

12.9.2 Secondary containment-type tanks meeting the requirements of 7.2.7.1 and listed for use with used oil shall be permitted to be used for aboveground, indoor supply.

Δ **12.9.3** Supply tanks for underground supply of used oil to a used oil–burning appliance shall be listed in accordance with UL 58, *Steel Underground Tanks for Flammable and Combustible Liquids*, or UL 1316, *Fibre Reinforced Underground Tanks for Flammable and Combustible Liquids*.

12.9.4 Supply tanks for supply of used oil to a used oil–burning appliance shall meet all other applicable requirements of Chapter 7 of this standard.

12.10 Piping, Pumps, and Valves.

12.10.1 Pumps, valves, and other ancillary equipment for transferring or storing used oil shall be listed and shall be suitable for use with the types of used oil intended to be fired.

12.10.2 Piping for transferring used oil to the used oil–burning appliance shall meet all applicable requirements of Chapter 8 of this standard.

12.11 Operating Requirements.

12.11.1 Only the types of used oil designated on the marking of the used oil burner or used oil–burning appliance shall be used.

12.11.2 Other types of used oil that are not designated on the marking of the burner or the appliance shall not be used and shall not be mixed with the types of used oil that are intended for use.

12.12 Vent Connector and Chimney Inspection. Prior to and after installation of the used oil–burning appliance, consideration shall be given to inspecting the vent connector and the chimney serving the appliance. *(See Annex E, Relining Masonry Chimneys.)*

12.13 U.S. Environmental Protection Agency Regulations. Regulations of the U.S. Environmental Protection Agency, as specified in 40 CFR 279.23, "On-Site Burning in Space Heaters," for the locality of the area where the used oil–burning appliance is operated shall be met. The following requirements shall also apply:

(1) The used oil–burning appliance shall burn only used oils that the owner or operator of the appliance generates on

the site where the appliance is operated, or used oils that are received from household do-it-yourself used oil generators.

(2)* The used oil–burning appliance shall not have a maximum input rate exceeding 500,000 Btu/hr (approximately 3.6 gal/hr) (527,500 kW).

(3) The combustion gases from the used oil–burning appliance shall be vented to the outdoors.

Chapter 13 Oil-and-Gas–Burning Appliances

13.1 Scope.

13.1.1 This chapter shall apply to appliances that are capable of burning either fuel oils or fuel gases as a main fuel source in an alternate manner, such as burners, furnaces, boilers, and so forth.

13.1.2 Oil-and-gas–burning appliances shall be used only in commercial 400,000 Btu/hr (117 kW) or industrial applications and installations.

13.2 Listing Requirements. An oil-and-gas–burning appliance and the burner of an oil-and-gas–burning appliance, either as part of the appliance or separately, shall be listed.

13.3 Installation, Operation, and Servicing Instructions.

13.3.1 Installation, operation, and servicing instructions for an oil-and-gas–burning appliance shall be preserved by the user.

13.3.2 The installation, operation, and servicing instructions furnished with an oil-and-gas–burning appliance shall include a statement to the effect that the oil-and-gas–burning appliance shall be installed and serviced by a qualified person.

13.3.3 A description of the method for changing the fuel supply to the appliance from oil to gas and vice versa shall be included in the installation, operation, and servicing instructions furnished with the appliance.

13.4 Clearances from Oil–Gas-Fired Appliance to Combustible Material.

13.4.1 Clearances from combustible materials shall be as specified in Chapter 10 of this standard and in NFPA 54 for the specific type of appliance.

13.4.2 Where there is a difference between the clearances required by Chapter 10 of this standard and those required by NFPA 54 for a particular appliance, the greater clearance shall apply.

13.5 Construction.

13.5.1 The burner of an oil-and-gas–burning appliance shall be arranged so that the main burner fuel not being fired will be shut off automatically when the main burner is not in its intended firing position for that fuel.

13.5.2 The burner of an oil-and-gas–burning appliance shall be arranged so that the fuel being fired is shut off before the other fuel is delivered to the ignition zone.

13.5.3 Prior to ignition of the main burner fuel from either a cold start or a fuel changeover, the burner ignition system shall provide a predetermined ignition cycle for the fuel to be fired.

Δ **13.5.3.1** The predetermined ignition cycle shall include the applicable pre-purge period, trial for ignition period, pilot flame establishing period, and main burner flame establishing period as specified in UL 296, *Oil Burners*, and UL 295, *Commercial-Industrial Gas Burners*.

13.5.4 The burner of an oil-and-gas appliance shall be arranged so that the maximum rated Btu/hr capacity of the burner does not exceed the maximum rated operating Btu/hr input of the appliance, regardless of the fuel being fired.

13.5.5 Changeover of the main burner fuel source shall be accomplished without manual adjustment of the appliance unless such adjustment is interlocked to provide safety shutdown of the appliance should misadjustment occur.

13.5.6 Fuel-handling components of an oil-and-gas burner and an oil-and-gas–burning appliance shall meet all applicable requirements of the standards under which they are manufactured.

13.5.7 Fuel-handling components of an oil-and-gas burner and an oil-and-gas–burning appliance shall be suitable for the intended application with respect to the type of fuel being handled and the exposed temperatures and pressures that the fuel-handling component will be subjected to in service.

13.6 Flue Connections.

13.6.1 The venting system of an oil-and-gas–burning appliance shall meet all applicable requirements of this standard and of NFPA 54.

13.6.2 Where requirements for venting differ between this standard and NFPA 54, the more stringent requirements shall apply.

13.7 Piping, Pumps, and Valves. Piping for fuel oil shall meet all applicable requirements of Chapter 8 of this standard. Piping for fuel gas shall meet all applicable requirements of NFPA 54.

13.8 Performance. An oil-and-gas burner and its appliance shall be capable of operation when firing each type of fuel for which the equipment is rated as marked on its respective nameplate.

13.9 Testing. Upon installation, an oil-and-gas burner and its appliance shall be tested for proper operation and combustion characteristics with each fuel, in accordance with its installation, operating, and servicing instructions and as required by the authority having jurisdiction.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1.5 Examples of portable devices not covered by this standard are blowtorches, melting pots, and weed burners.

Δ **A.3.2.1 Approved.** The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment, or materials, the "authority having jurisdiction" may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The "authority having jurisdiction" may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA standards in a broad manner because jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.8 Central Heating Appliance. A floor-mounted unit heater connected to a duct system is also classified as a central heating appliance.

A.3.3.25.1 Mechanical Draft. When the mechanical means is applied to *push* the flue gases through the chimney or vent system, the draft is *forced*. When the mechanical means is applied to *pull* the flue gases through the chimney or vent system, the draft is *induced*.

A.3.3.31 Heating and Cooking Appliance. These appliances include kerosene stoves, oil stoves, portable kerosene heaters, and conversion range oil burners.

A.3.3.38 Liquid Fuel. Fuel oil used for the typical liquid fuel–burning appliance has a flash point ranging from 100°F to 145°F (38°C to 63°C) and would be designated a Class II or Class IIIA combustible liquid, in accordance with NFPA 30.

A.3.3.42 Oil Burner. A burner of this type can be furnished with or without a primary safety control, and it can be a pressure-atomizing gun type, a horizontal or vertical rotary type, or a mechanical or natural draft vaporizing type.

A.3.3.43 Oil-Burning Appliance (Oil-Burning Unit). This definition does not include kerosene stoves or oil stoves.

A.3.3.45 Oil-Burning Stove. An oil-burning stove can be equipped with an integral oil tank or can be designed for connection to a separate oil supply tank.

A.3.3.57.1 Oil Burner Auxiliary Tank. An auxiliary tank can be included as an integral part of an automatic pump or a transfer pump, or it can be a separate tank.

A.3.3.60 Unconfined Space. Rooms connecting directly with the space in which the appliances are located by means of openings that have no doors or closures, unless fully louvered, are considered part of the unconfined space.

A.3.3.61 Unit Heater. A unit heater can be either direct-fired or indirect-fired using steam, hot water, or electricity.

N **A.3.3.63.3 Fusible Link Valve.** These valves are designed for an operating pressure of 18 psi (124 kPa) or less with the fusible element operating at 165°F (74°C) or less.

A.3.3.65 Venting System (Flue Gases). A venting system for exhausting flue gases usually is composed of a gas vent, Type L vent, or a chimney and vent or chimney connector(s), if used, assembled to form the open passageway.

A.3.3.66 Wall Furnace. Wall furnaces should not be provided with duct extensions beyond the vertical and horizontal limits of the casing proper, except that boots not exceeding 10 in. (250 mm) beyond the horizontal of the casing for extension through walls of nominal thickness are permitted. Where provided, such boots should be supplied by the manufacturer as an integral part of the appliance. This definition excludes floor furnaces, unit heaters, and central furnaces.

A.4.5.1 See Chapter 11 for additional requirements for oil-burning stoves, kerosene-burning room heaters, and kerosene-burning portable heaters. See Chapter 12 for additional requirements for used oil–burning appliances. See Chapter 13 for additional requirements for combination oil-and-gas–burning appliances.

Acceptable liquid fuels for use in oil-burning equipment are the liquid fuels for which the appliance is listed by an approved listing agency such as UL, based on testing to an accepted standard, or as approved and stipulated by the oil burner manufacturer. The fuels that are commonly used are No. 2 distillate fuel oil, ultra-low sulfur No. 2 distillate fuel oil, kerosene in residential oil burners, and other fuels listed in 4.5.1 for a range of burner applications. Not all fuels are approved for all applications. For example, 4.5.1 recently added ASTM D7666, *Standard Specification for Triglyceride Burner Fuel*, but this burner fuel might not be approved for, and cannot be burned in, residential oil-heating equipment. In addition, the biodiesel content for residential oil burners typically is limited by the burner manufacturer to 5 percent by volume in fuel oil, which is accepted by UL as equivalent to a heating oil without biodiesel content. Research is ongoing for use of B20 and higher biodiesel fuel blends in residential heating equipment, which require approval by the burner manufacturer. Equipment installers should refer to the installation instructions of the burner manufacturer regarding acceptable fuels to be used that are part of the burner's listing.

A.4.5.3 Where heavy oils are used, provisions should be made to maintain the oil within the recommended temperature range indicated in Table A.4.5.3, so that proper atomization is maintained.

Δ **A.4.5.3(4)** UL 296A, *Waste Oil-Burning Air-Heating Appliances*, specifies that a burner provided with preheating means for the fuel oil can be provided with an oil temperature interlock device to prevent delivery of the fuel oil to the firing portion of the burner until the fuel oil has reached a predetermined minimum temperature. On a burner that is not equipped with oil-preheating equipment, an oil temperature interlock device should not be provided on the burner and should be bypassed during any firing tests of the burner.

A.4.6.1 Typical locations are burner areas, fuel-handling areas, fuel storage areas, pits, sumps, and low spots where fuel leakage or vapors can accumulate. Chapter 5 of *NFPA 70* provides information for classifying such areas and defines requirements for electrical installations in areas so classified.

Crankcase oil and used oil properties can vary considerably, and light volatile materials can be released during storage or handling or upon heating. Because of this characteristic, appropriate and adequate provisions should be made to safely handle, store, and burn crankcase oil and used oil. It is desirable that flexibility be built into the facility to accommodate the expected range of properties. Failure to observe the necessary design, installation, and operating and maintenance procedures can result in fire, explosion, or personal injury.

Extensive treatment of this subject is beyond the scope of this standard. The authority having jurisdiction should be responsible for classifying areas where fuel is stored, handled, or burned, and for revising the classification if conditions are changed. Installation should conform to *NFPA 70*. Additional guidance can be obtained from NFPA 30 and NFPA 30A.

A.4.6.4 Required ventilation of areas where crankcase oil burning and used oil–burning appliances operate depends on the type of area where the equipment is located. For example, NFPA 30A requires 1 cfm/ft^2 (0.3 m^3/min/m^2) of floor area be provided based on the dispensing area for fuel-dispensing areas inside buildings. Additional guidance can be found in Chapter 5 of NFPA 30.

A.5.2.1.1 One method of testing is as follows:

(1) Close fireplace dampers and fireplace doors, close all exterior doors and windows in the building, and close all interior doors in the building.
(2) Turn on building air exhaust systems, including clothes dryers, range hoods, bathroom exhausts, and mechanical ventilation and forced-air heating or cooling system blowers and operate them at their highest speed setting. Do not operate a whole-house cooling exhaust fan.
(3) Operate the burner in the smallest oil heating appliance first, and then other appliances in order of increasing capacity. Measure and record the flue draft and over-fire draft of each appliance, and check for flue gas spillage.
(4) Check that the flue draft and over-fire draft are at a level that is required by the oil heating equipment manufacturer as specified in the installation and operating manuals for the appliance. Over-fire draft in oil appliances are usually negative 0.01 to negative 0.02 in. of water column.
(5) Return doors, windows, exhaust fans, fireplace dampers, and all fossil fuel–burning appliances to their previous conditions of use.

The oil heating equipment installer should take action as needed to correct excessive depressurization of the appliance combustion air zone and return the flue draft and over-fire draft to the requirements of the oil heat equipment manufacturer.

A.5.2.3 Remedial actions to correct excessive negative pressure in the combustion air zone might include the following:

(1) Air boots for oil burners to supply outdoor air directly to the burner
(2) Air-in-a-can to supply outdoor air into the boiler/furnace room
(3) Dedicated make-up air for kitchen exhausts
(4) Blocked vent safety shut-off devices
(5) Make-up air into furnace return ducts with barometric damper
(6) Warning labels on whole house fans

A.5.3.1 In buildings of conventional construction, normal infiltration is generally sufficient to provide the necessary air for proper combustion and ventilation.

A.5.7 Depressurization of houses by operating combustion equipment as well as by operation of exhaust fans, kitchen exhausts, whole-house fans, clothes dryers, fireplaces, and so forth, can adversely impact the operation and safety of oil-burning equipment. Houses vary widely with respect to depressurization, and newer, more tightly constructed houses are particularly susceptible. While Section 5.7 requires various methods for supplying combustion and draft dilution air, mechanical ventilation systems are now being produced that supply makeup air from outside. Where a mechanical combus-

Table A.4.5.3 Recommended Temperature Range for Proper Atomization of Heavy Oils

Fuel No.	Viscosity in SSU at 100°F	Low Temperature Limit (°F)	High Temperature Limit (°F)
4	45	35*	50
	50	35*	65
	60	45*	85
	75	62	105
	100	80	125
5	150	100	145
	200	112	160
	300	130	180
	400	140	190
	500	150	200
6	1,000	170	225
	2,000	190	245
	3,000	205	260
	4,000	212	270
	5,000	218	275
	10,000	240	290

*At these temperatures, proper operation of the appliance might not be attained because of unsatisfactory atomization of the fuel. For this reason, the fuel oil should be kept at the high end of the recommended temperature range.

tion air system is used to provide combustion and dilution, provisions should be made to prevent operation of the oil burner(s) where the combustion and dilution air system is not performing, so as to satisfy the safe operating requirements of the equipment.

A.6.3.1 A natural-draft burner, as defined herein, should be connected to an individual chimney or chimney flue used for no other appliance.

A.6.3.4 Some corrective steps that can be taken to reduce chimney downdraft include, but are not limited to, the following:

(1) Extension of the existing chimney
(2) Installation or replacement of the chimney cap
(3) Installation of a draft fan
(4) Determination that adequate combustion air is being provided
(5) Inspection of the chimney to determine if the passageway is blocked
(6) Relining the flue with a listed chimney lining system *(See Annex E.)*
(7) Installation of an insulated vent connector
(8) A check for depressurization of the building due to other exhaust fans, ventilation fans, and so forth and correction of any deficiencies

A.6.6.6 See Annex C for diagrams showing typical installations.

A.6.6.7 If the chimney or flue gas venting system shows signs of deterioration or is unlined and the oil-burning appliance is maintaining the proper draft as specified by the manufacturer, the appliance can be installed while awaiting the inspection and proper maintenance to be accomplished, as required by Chapter 13 of NFPA 211.

A.6.6.8 This might require repair, relining, or resizing of the chimney flue. See Annex E for additional information.

A.6.6.9 See Annex E for recommendations and venting tables for relined masonry chimneys.

A.6.7.3 Figure A.6.7.3 illustrates the application of the requirements of 6.7.3.

Δ **A.7.2.7.6** See UL 1316, *Fibre Reinforced Underground Tanks for Flammable and Combustible Liquids*; UL 1746, *External Corrosion Protection Systems for Steel Underground Storage Tanks*; and STI ACT-100, *Specification for External Corrosion Protection of FRP Composite Steel Underground Tanks, F894*.

A.7.2.7.7 The type of vault being referred to in this paragraph is *not* the same as that referred to in 7.6.13.3 or 7.6.13.4.

A.7.5.5 For additional information, see PEI RP-100, *Recommended Practices for Installation of Underground Liquid Storage Systems*.

A.7.5.7 See Annex C of NFPA 30.

A.7.9.4 Primer paints do not qualify as suitable corrosion protection. The asphaltum coating or rust-inhibiting material typically used on outside tanks does meet the intent of this requirement for external corrosion protection.

A.7.10.2 Tank heaters connected so that condensate or water is not returned to the boiler are preferred.

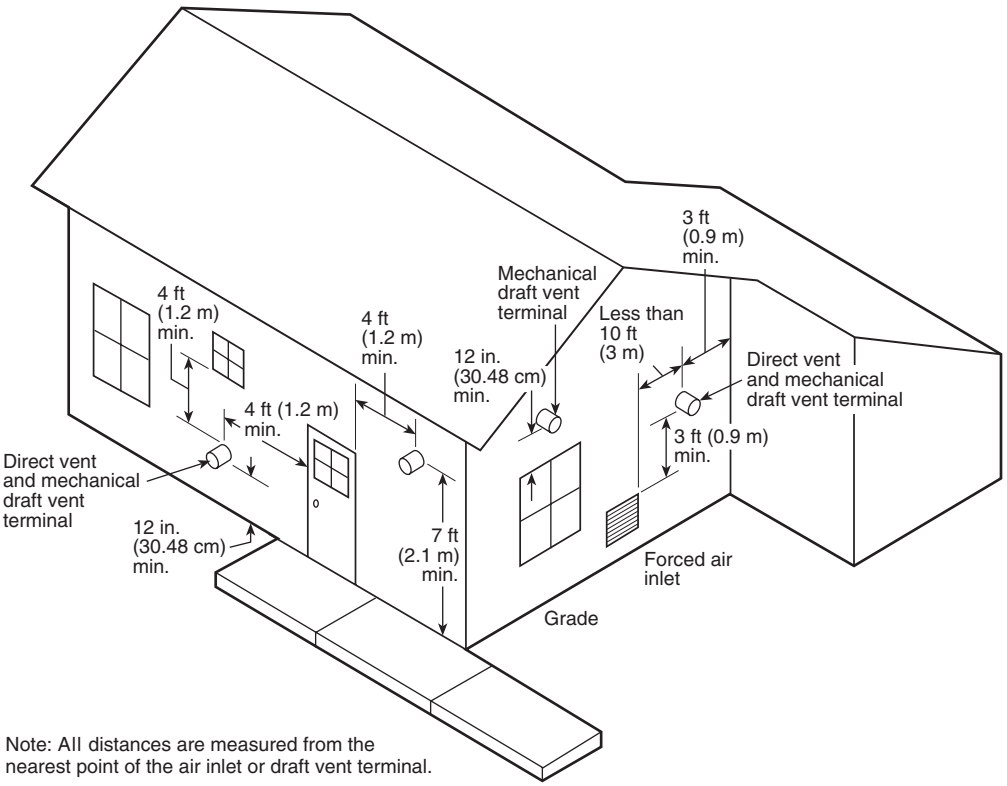


FIGURE A.6.7.3 Exit Terminals of Mechanical Draft and Direct Venting Systems.

A.8.7.2 Connecting fuel supply piping to the top of all supply tanks (top-draw connection) can increase the risk of water accumulation within the tank. If water is left in the tank, it could be at risk of premature failure due to internal corrosion. It is, therefore, recommended to properly maintain a top-draw tank by sloping the tank in accordance with 7.6.8(1) and 7.9.6 and adhering to the manufacturer's instructions for installation and maintenance. As a best practice for tank maintenance, the lowest point of the tank should be inspected for presence of water accumulation at least once per year and all water removed as soon as detected.

A.10.5.1 There should be an approved device installed above the unit to stop the flow of electrical current through the safety control circuit under conditions of excessive temperature in the room where the oil-burning unit is located. It should be of the type that requires replacement of the trip component to reactivate the unit when the device has tripped due to excessive temperature. Units that are installed outdoors and unenclosed are exempt from this recommendation.

Δ **A.10.5.3** See ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*, and UL 296, *Oil Burners*, for further information. Primary safety controls for burners can consist of a combustion-type electrical control or an antiflooding device. The proper control to be furnished with each burner is indicated in the listing by the testing agency.

A.10.5.4 The quantity and the specific operating characteristics for limit controls will vary, depending on the type of appliance and the requirements of the authority having jurisdiction. For information purposes only, the limit control requirements of applicable standards and from ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*, are presented in Table A.10.5.4. This information is provided only for limit controls that safeguard pressure and low water level in a steam boiler, that safeguard low water level and over-temperature in a water boiler, and that safeguard over-temperature in furnaces and heaters. Additional limit controls and operating controls (e.g., a fan control on a furnace) are usually required to safeguard other operational characteristics of the appliance. The user of this standard is advised to refer to the applicable standards and to the authority having jurisdiction for specific requirements and details.

A.10.5.5 The purpose of this requirement is to avoid interposing other controls in the limit control circuit, the failure of which can cause an unsafe condition that the limit control is intended to prevent.

A.10.6.3.1.1 This allows a permissible variation for placing the hollow masonry to accommodate a downflow furnace, as shown in Figure 10.6.1.

A.11.2 The safety of installation and use of appliances of this kind depends largely on the care of the installer and the care of the user in following manufacturers' operating and installation instructions.

Δ **A.11.3.1** See UL 647, *Unvented Kerosene-Fired Room Heaters and Portable Heaters*, for specific information.

Δ **A.12.4.2** UL 296A, *Waste Oil-Burning Air-Heating Appliances*, requires the burner to be factory installed on or provided with each appliance. The evaluation of products listed under UL 296A includes the suitability of the combination of the used-oil burner with the used oil–burning appliance and their operational characteristics relative to the construction of the combustion chamber of the appliance.

A.12.13(2) Since used oil can vary considerably in chemical and physical properties, its calorific value cannot be standardized. The conversion of 500,000 Btu/hr to 3.6 gal/hr is an approximation based on typical ASTM D396, *Standard Specification for Fuel Oils*, No. 2 fuel oil having a calorific value of approximately 140,000 Btu/gal.

Δ Table A.10.5.4 Limit Control Requirements from Various Standards

Appliance Type	Characteristic of Appliance to Protect	Limit Control Required		Standard Reference(s)
		Limit Control Description	General Operational Characteristics of Limit Control	
Boiler, high pressure steam	Low water level	Two low water level limit controls or two combination water feed controls and low water level limit controls. Both low water level limit controls should be electrically wired so that operation of either control causes fuel cutoff to the burner. One of the low water level limit controls should be set to function at a lower water level than the other low water level limit control. The upper low water level limit control can be of the automatic reset or manual reset type. The lower low water level limit control should be of the manual reset type and should require local manual intervention to reset. A miniature boiler* should be provided with one manual reset type low water level limit control or one combination water feed control and manual reset type low water level limit control. The low water level limit control should require local manual intervention to reset.	All low water level limit controls should cause fuel cutoff to the burner before the water level in the boiler falls below the lowest visible part of the gauge glass. Fuel cutoff to the burner and safety shut down can occur simultaneously with the low water level limit control functioning to shut down the burner, or it can incorporate a time delay to prevent short cycling. The time delay should not exceed the boiler manufacturers' recommended time or 90 seconds, whichever is less.	UL 726, *Oil-Fired Boiler Assemblies* ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*
	High steam pressure	One manual reset–type limit control, which requires local manual intervention to reset.	When adjusted to its maximum setting allowed by a fixed stop, the limit control should limit the steam pressure to not more than the maximum allowable working pressure of the boiler.	UL 726, *Oil-Fired Boiler Assemblies* ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*
		For a boiler installed in a residence as defined by the authority having jurisdiction, the high steam pressure limit control is not required to have local manual intervention to reset and can instead have automatic reset.		ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*

(continues)

Δ Table A.10.5.4 *Continued*

Appliance Type	Characteristic of Appliance to Protect	Limit Control Required		Standard Reference(s)
		Limit Control Description	**General Operational Characteristics of Limit Control**	
Boiler, low pressure steam	Low water level	Two low water level limit controls or two combination water feed controls and low water level limit controls. Both low water level limit controls should be electrically wired so that operation of either control causes fuel cutoff to the burner. One of the low water level limit controls should be set to function at a lower water level than the other low water level limit control. The upper low water level limit control can be of the automatic reset or manual reset type. The lower low water level limit control should be of the manual reset type and should require local manual intervention to reset. A miniature boiler* should be provided with one manual reset–type low water level limit control or one combination water feed control and manual reset type low water level limit control. The low water level limit control should require local manual intervention to reset.	All low water level limit controls should cause fuel cutoff to the burner before the water level in the boiler falls below the lowest visible part of the gauge glass. Fuel cutoff to the burner and safety shut down can occur simultaneously with the low water level limit control functioning to shut down the burner, or it can incorporate a time delay to prevent short cycling. The time delay should not exceed the boiler manufacturers' recommended time or 90 seconds, whichever is less.	UL 726, *Oil-Fired Boiler Assemblies* ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*
		For a gravity return boiler installed in a residence as defined by the authority having jurisdiction, only one low water limit control or one combination water feed control and low water level limit control is required. This low water level limit control should require local manual intervention to reset.		ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*
	High steam pressure	One manual reset–type limit control, which requires local manual intervention to reset.	When adjusted to its maximum setting allowed by a fixed stop, the limit control should limit the steam pressure to not more than a gauge pressure of 15 psi (103 kPa).	UL 726, *Oil-Fired Boiler Assemblies* ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*
		For a boiler installed in a residence as defined by the authority having jurisdiction, the high steam pressure limit control is not required to have local manual intervention to reset and can instead have automatic reset.		ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*

(continues)

Δ Table A.10.5.4 *Continued*

Appliance Type	Characteristic of Appliance to Protect	Limit Control Required		Standard Reference(s)
		Limit Control Description	**General Operational Characteristics of Limit Control**	
Boiler, water	Low water level	One manual reset–type low water level limit control or one combination water feed control and manual reset type low water level limit–control. The low water level limit control should require local manual intervention to reset. A tube or coil-type water boiler that requires forced water circulation can instead employ an automatic reset–type water flow sensing device instead of a manual reset–type low water limit control.	The low water level limit control should cause fuel cutoff to the burner before the water level in the boiler falls below the lowest permissible water level established by the boiler manufacturer. A tube- or coil-type water boiler requiring forced water circulation that employs an automatic reset–type water flow sensing device instead of a manual reset–type low water level limit control should prevent burner operation when the water flow rate is inadequate to protect the boiler against overheating. The automatic reset–type water flow sensing device should also shut down the burner and prevent restarting until an adequate water flow rate is established.	UL 726, *Oil-Fired Boiler Assemblies* ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*
		As permitted by the authority having jurisdiction, a low water level limit control or water flow sensing device is not required to be furnished on a water boiler that has a main flame hourly input of not more than 2.85 gal/hr (10.8 L/hr).		UL 726, *Oil-Fired Boiler Assemblies*
		A low water level limit control or water flow sensing device is not required to be furnished on a water boiler installed in residences as defined by the authority having jurisdiction.		ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*
	High water temperature	One manual reset–type limit control, which requires local manual intervention to reset.	When adjusted to its maximum setting allowed by a fixed stop, the limit control should limit the water temperature to not more than the maximum rated operating temperature of the boiler. For a low pressure water boiler, the maximum rated operating temperature should not exceed 250°F (121°C).	UL 726, *Oil-Fired Boiler Assemblies* ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*
		For a water boiler installed in a residence as defined by the authority having jurisdiction, the high temperature limit control does not need to have local manual intervention to reset and can instead have automatic reset.		ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*

(continues)

Δ **Table A.10.5.4** *Continued*

Appliance Type	Characteristic of Appliance to Protect	Limit Control Required		Standard Reference(s)
		Limit Control Description	**General Operational Characteristics of Limit Control**	
Water heater	High water temperature	One automatic reset–type temperature regulating control, and one automatic reset–type or manual reset–type limit control.	When adjusted to its maximum setting allowed by a fixed stop, the temperature-regulating control should limit the outlet water temperature to not more than 194°F (90°C). The temperature-regulating control is permitted to limit the water temperature to not more than 200°F (93°C) if the temperature-regulating control and the limit control have cutout temperature tolerances not greater than ±5.0°F (±2.8°C). When adjusted to its maximum setting allowed by a fixed stop, the limit control should limit the outlet water temperature to not more than 210°F (99°C).	UL 732, *Oil-Fired Storage Tank Water Heaters*
Furnace, central	Outlet air temperature	One automatic reset–type limit control. An additional auxiliary limit control, if provided, can be of the manual reset type.	When adjusted to its maximum setting allowed by a fixed stop, the limit control should prevent a central furnace from delivering air at a temperature in excess of the following: (1) 200°F (93°C) for a downflow or horizontal furnace intended for installation at the clearances specified in Form I or Form II as applicable in Table 10.6.1 (2) 250°F (121°C) for a downflow or horizontal furnace intended for installation at the clearances specified under Form III in Table 10.6.1 (3) 250°F (121°C) for a forced-air upflow furnace intended for installation at the clearances specified in Table 10.6.1 (4) 200°F (93°C) for any furnace intended for installation at less than the clearances specified in Table 10.6.1 (5) 200°F (93°C) for any furnace intended for closet or alcove installation at less than the clearances specified in Table 10.6.1	UL 296A, *Waste Oil-Burning Air-Heating Appliances* UL 727, *Oil-Fired Central Furnaces*
Furnace, floor	Outlet air temperature	An automatic reset–type limit control. An additional auxiliary limit control, if provided, can be of the manual reset type.	When adjusted to its maximum setting allowed by a fixed stop, the limit control should prevent a floor furnace from delivering air at a temperature in excess of 250°F (121°C).	UL 729, *Oil-Fired Floor Furnaces*

(continues)