OIL BURNING EQUIPMENT 1964

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National Fire Protection Association
International

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This and other NFPA codes, standards, and recommended practices are published in the **National Fire Codes,** a compilation of NFPA's official technical material. Write the Association for full information.

Official NFPA Definitions

Adopted Jan. 23, 1964. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

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Standard for the Installation of
Oil Burning Equipment

NFPA No. 31 — 1964

1964 Edition of No. 31

The 1964 edition of this Standard supersedes the 1963 and all previous editions and was adopted by the National Fire Protection Association at the 1964 Annual Meeting held May 18-22 in Dallas, Texas, upon the recommendation of the Sectional Committee on Liquid Fuel Burning Equipment with the approval of the entire Flammable Liquids Committee.

The major change contained within this edition is a complete revision of the chapter on Tank Storage. This was necessary to meet similar requirements in the Flammable and Combustible Liquids Code, NFPA No. 30, which was revised in 1963. A major addition to this standard is the inclusion of revised provisions for a municipal ordinance. These provisions previously had been published as a separate NFPA publication numbered 31LA. Other proposed amendments are for clarification or are editorial in nature.

Origin and Development of No. 31

Oil burning equipment standards date from 1902 when they were issued by the National Board of Fire Underwriters. Subsequently, the project was turned over to the NFPA and a completely revised edition was first presented to the Association in 1913. The responsibility for this Standard is now that of the Sectional Committee on Liquid Fuel Burning Equipment. During the last two decades there have been nine editions of this Standard issued in the years 1948, 1951, 1953, 1955, 1956, 1957, 1959, 1961 and 1963. The 1963 Edition was adopted on July 26, 1963 as an American Standard and designated Z95.1 following procedures established by the American Standards Association (UDC No. 662.94: 697.49.005).

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Interpretations Procedure of the Committee on Flammable Liquids

Requests for interpretations shall be submitted to the Committee on Flammable Liquids through the NFPA office. Five identical copies (or more if so specified) including drawings, if any, shall be provided. Each shall be directed to a single subject with identification of the particular paragraph or paragraphs in question, and, if an actual field situation is involved, shall identify all parties at interest.

Committee officers may rephrase questions if desired or refuse to consider requests for interpretations which they find not in proper form.

No committee shall be under any obligation to process requests for interpretations at any specified time, nor to issue interpretations except at its own convenience.

Requests for interpretations should be addressed to the National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. 02110.

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Standard for the Installation of

Oil Burning Equipment

NFPA No. 31 — 1964

CHAPTER 1. GENERAL PROVISIONS.

100. Definition of Terms.

1001. For the purpose of this installation standard, the following terms shall be interpreted in accordance with the following definitions.

Air Heater — An indirect-fired appliance intended to supply heated air for space heating and other purposes but not intended for permanent installation. This definition does not include central heating appliances, kerosene stoves, oil stoves or unit heaters as defined herein.

Antiflooding Device — A primary safety control which causes the flow of fuel to be shut off upon a rise in fuel level or upon receiving excess fuel, and which operates before the hazardous discharge of fuel can occur.

Appliance, Industrial High Heat — An appliance operating at a temperature above 1500° F. such as a billet and bloom furnace, brass furnace, brick kiln, earthenware kiln, glass furnace, porcelain baking or a glazing kiln.

Appliance, Industrial Medium Heat — An appliance operating at a temperature of about 600° F. to not more than 1500° F. such as an annealing furnace, galvanizing furnace, or a steam boiler of over ten boiler horsepower capacity operating at over 50 pounds per square inch gauge pressure. An appliance otherwise classed as a high-heat appliance may be considered as a medium-heat appliance if not larger than 100 cubic feet in size.

Appliance, Low Heat — An appliance operating at a temperature below 600° F. such as a central heating appliance, a heating or cooking appliance, a bakery oven, candy furnace, coffee roasting oven, core oven, lead melting furnace, a steam boiler operating at not over 50 pounds per square inch gauge pressure, or a steam boiler of not over ten boiler horsepower capacity regardless of operating pressure. An appliance otherwise classed as a medium-heat appliance may be considered as a low-heat appliance if not larger than 100 cubic feet in size.

Approved — Acceptable to the authority having jurisdiction.

Boiler — An appliance intended to supply hot water or steam for heating, processing or power purposes.

Boiler, High Pressure — A boiler furnishing steam at pressures in excess of 15 pounds per square inch gauge.

Boiler, Hot-Water and Low-Pressure Steam — A boiler furnishing hot water at pressures not more than 30 pounds per square inch gauge or steam at pressures not more than 15 pounds per square inch gauge.

Burner, Automatically Lighted — A burner where fuel to the main burner is normally turned on and ignited automatically.

Burner, Manually Lighted — A burner where fuel to the main burner is turned on only by hand and ignited under supervision.

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

Burner, Natural Draft Type — A burner which depends primarily upon the natural draft created in the flue to induce the air required for combustion into the burner.

Central Heating Appliance — A stationary indirect-fired flue connected appliance comprising one of the following classes as defined herein: boiler, central furnace, floor furnace or recessed heater.

Chimney — A vertical shaft enclosing one or more flues for conveying flue gases to the outside atmosphere.

a. FACTORY-BUILT CHIMNEY: A listed chimney.

b. MASONRY CHIMNEY: A chimney of solid masonry units, bricks, stones, listed masonry units or reinforced concrete, lined with suitable flue liners.

c. METAL CHIMNEY: A field-constructed chimney of metal.

Chimney Connector — The conduit connecting the heating appliance with the vertical flue.

Chimney Flue — The flue gas conveying passageway in a chimney.

Clearance — The distance between the appliance, chimney, chimney connector or plenum and the nearest surface of combustible material as defined herein.

Combustible Material — As pertaining to materials adjacent to or in contact with heat-producing appliances, chimney connectors, steam and hot water pipes, and warm air ducts, shall mean materials made of or surfaced with wood, compressed paper, plant fibres, or other material that will ignite and burn. Such material shall be considered as combustible even though flameproofed, fire retardant treated, or plastered.

Constant-Level Valve — A device for maintaining within a reservoir a constant level of fuel for delivery to the burner.

Control, Limit — An automatic control responsive to changes in liquid level, pressure or temperature; for limiting the operation of the controlled equipment.

Control, Primary Safety — The automatic safety control intended to prevent abnormal discharge of oil at the burner in case of ignition failure or flame failure. Barometric oil feed is not considered a primary safety control.

Control, Safety — An automatic control (including relays, switches, and other auxiliary equipment used in conjunction therewith to form a safety control system) which is intended to prevent unsafe operation of the controlled equipment.

Control, Safety Combustion — A primary safety control responsive directly to flame properties, sensing the presence of flame and causing fuel to be shut off in event of flame failure.

Conversion Range Oil Burner — An oil burner designed to burn kerosene, range oil or similar fuel. This burner is intended primarily for installation only in a stove or range, a portion or all of which originally was designed for the utilization of solid fuel and which is flue-connected.

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

Damper — A valve or plate for regulating draft.

NOTE: A damper is generally considered as being located on the downstream side of the combustion chamber usually in the chimney connector or in a flue passage of the appliance.

Direct Fired Heater — A unit in which combustion products or flue gases are mixed with the medium (i.e., air) being heated. For example, a salamander.

Draft Regulator — A device which functions to maintain a desired draft in the oil-fired appliance by automatically reducing the chimney draft to the desired value.

Fire Wall — A wall constructed of solid masonry units, or of hollow masonry units faced on each side with brick, or reinforced concrete. They are used to subdivide a building or separate buildings to restrict the spread of fire. The wall starts at the foundation and extends continuously, through all stories to and above the roof, except where the roof is of fire-resistive or semi-fire-resistive construction and the wall is carried up tightly against the underside of the roof slab.

Flue Collar — That portion of an appliance designed for attachment of the chimney connector.

Fuel Oil — Kerosene or any hydrocarbon oil as specified by U.S. Department of Commerce Commercial Standard CS12 or A.S.T.M. D396, or the Canadian Government Specification Board, 3-GP-28, and having a flash point not less than 100° F.

Furnace, Attic — A forced-air type central furnace designed specifically for installation in an attic or in a space with low headroom normally unoccupied.

Furnace, Central Warm Air — A self-contained appliance designed to supply heated air through ducts to spaces remote from or adjacent to the appliance location.

a. GRAVITY TYPE CENTRAL FURNACE: A central furnace depending primarily on circulation of air by gravity.

b. GRAVITY TYPE CENTRAL 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 air flow.

c. GRAVITY TYPE CENTRAL FURNACE WITH BOOSTER FAN: A central furnace equipped with a booster fan which does not materially restrict free circulation of air by gravity flow when such a fan is not in operation.

d. FORCED-AIR TYPE CENTRAL FURNACE: A central furnace equipped with a fan which provides the primary means for circulation of air.

1. HORIZONTAL TYPE CENTRAL FURNACE: A furnace designed with air flow through the furnace essentially in a horizontal path.

2. UPFLOW TYPE CENTRAL FURNACE: A furnace designed with air flow essentially in a vertical path, discharging air at or near the top of the furnace.

3. DOWNFLOW TYPE CENTRAL FURNACE: A furnace designed with air flow essentially in a vertical path, discharging air at or near the bottom of the furnace.

Furnace, Duct — A central furnace designed for insertion or installation in a duct of an air distribution system to supply warm air for heating and which depends for air circulation on a blower not furnished as part of the furnace.

Furnace, Floor — A self-contained indirect-fired unit furnace designed to be supported from the floor of the space being heated, taking air for combustion outside this space, and with means for observing flame and lighting the appliance from such space.

Furnace, Stationary-Type Industrial — 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.

Gallon — A U. S. gallon with approximate or accepted Imperial gallon equivalent given in parenthesis.

Heat Reclaimer (*Chimney Connector Type*) — A heat exchanger intended to be installed in the chimney connector between a heating appliance and the chimney to transfer heat from the flue gases through metal to air or water.

Heating and Cooking Appliance — An oil-fired appliance not intended for central heating. These appliances include kerosene stoves, oil stoves, portable kerosene heaters, and conversion range oil burners.

Indirect-Fired Appliance — An appliance in which combustion products (flue gases) are not mixed in the appliance with the medium (e.g., air) being heated.

Installation — The complete setting-in-place, ready for operation of an oil burning equipment together with its accessories and equipment.

Kerosene Stove — A non-flue-connected, self-contained, self-supporting kerosene-burning range, room heater, or water heater equipped with an integral tank not exceeding two gallons capacity.

Labeled — The word "labeled" used in connection with equipment throughout this standard refers to equipment bearing the inspection label of a nationally recognized testing agency.

Listed — The word "listed" used throughout this standard in connection with equipment, refers to devices and materials that have been investigated by and meet the listing requirements of a nationally recognized testing agency. Such equipment shall be identifiable by means of a label or other distinguishing marking specified in the current list published by the testing agency.

Oil Burner — A device for burning oil in heating appliances such as boilers, furnaces, water heaters, ranges and the like. A burner of this type may be furnished with or without a primary safety control; and it may be a pressure atomizing gun type, a horizontal or vertical rotary type, or a mechanical or natural draft vaporizing type.

Oil Burning Equipment — An oil burner of any type together with its tank, piping, wiring, controls and related devices and shall include all oil burners, oil-fired units, and heating and cooking appliances but exclude those exempted by Section 1101.

Oil-Fired Unit — A heating appliance equipped with one or more oil burners and all the necessary safety controls, elec-

trical equipment and related equipment manufactured for assembly as a complete unit. This definition does not include kerosene stoves or oil stoves.

Oil Stove — A flue-connected, self-contained, self-supporting oil-burning range or room heater. It may be equipped with an integral tank not exceeding ten gallons capacity or may be designed for connection to a separate oil-supply tank.

Portable Kerosene Heater — A non-flue-connected, self-contained, self-supporting heater, with integral reservoir, designed

Pump, Automatic Oil — A pump, not an integral part of a burner, stove or unit, which automatically pumps oil from the supply tank and delivers the oil by gravity under a constant head to an oil-burning appliance. The pump is designed to stop pumping automatically in case of total breakage of the oil supply line between the pump and the appliance.

Pump, Oil Transfer — An oil pump, automatically or manually operated, which transfers oil through continuous piping from a supply tank to an oil-burning appliance or to an auxiliary tank and which is not designed to stop pumping automatically in case of total breakage of the oil supply or return lines.

Range — A stove intended primarily for cooking.

Readily Accessible — Capable of being reached easily and quickly for operation, maintenance and inspection.

Recessed Wall Furnace — A self-contained, indirect-fired appliance complete with grills or equivalent, designed for incorporation in or permanent attachment to a wall or partition, and furnishing heated air directly into the space to be heated through openings or boots in the casing as supplied by the manufacturer as integral parts of the appliance. This definition does not include air heaters, central furnaces, floor furnaces or unit heaters as defined herein.

Room Heater — A self-contained, free-standing, heating appliance intended for installation in the space being heated and not intended for duct connection.

Room Heater, Circulating — A room heater with an outer exchanger and the outer jacket. Room heaters that have sub-

stantial openings in the outer jackets to permit radiation from the heat exchanger shall be classed as radiant type.

Room Heater, Radiant — A room heater designed to transfer heat primarily by direct radiation.

Sump — The receptacle employed with a vacuum tank.

Tank, Auxiliary — An auxiliary supply tank, having a capacity of not over 60 gallons (50 Imp. gallons), listed for installation in the supply piping between a burner and its main fuel supply tank. It may be included as an integral part of an automatic pump, or a transfer pump, or may be a separate tank.

Tank, Gravity — A supply tank from which the oil is delivered directly to the burner by gravity.

Tank, Integral — A tank which is furnished by the manufacturer as an integral part of an oil-fired appliance.

Tank, Storage — A separate tank which is not connected to the oil-burning appliance.

Tank, Supply — A separate tank connected directly or by a pump to the oil-burning appliance.

Tank, Vacuum or Barometric — A tank not exceeding five gallons capacity, which maintains a definite level of oil in a sump or similar receptacle by barometric feed. Fuel is delivered from the sump to the burner by gravity.

Unit Heater — A self-contained, automatically controlled heating appliance, which may or may not include an integral fan for circulating air, which may be of the floor-mounted or suspended type, intended for the heating of nonresidential space in which it is installed. A unit heater may be fuel-fired or may utilize steam, hot water or electricity.

Valve, Manual Oil Shut-Off — A manually operated valve in an oil line for the purpose of turning on or completely shutting off the oil supply to the burner.

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

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

(b) Safety Valve — An automatic oil control valve of the "on" and "off" type (without any by-pass to the burner) that is actuated by a safety control or by an emergency device.

Venting System, Type L — A vent system consisting of listed factory-made piping and fittings for use with fuel-burning appliances listed as exhausting low-temperature flue gases and approved for use with Type L venting systems.

Wall Furnace — See Recessed Wall Furnace.

Water Heater — An appliance for supplying hot water for domestic or commercial purposes other than for space heating.

110. Application and Scope.

1101. This standard applies to stationary and portable oil-burning equipment except internal combustion engines, oil lamps, and portable devices such as blow torches, melting pots, and weed burners.

1102. This standard is intended to prescribe reasonable minimum requirements for safety to life and property from fire in the installation of oil burners and the equipment used in connection with them, including tanks, piping, pumps, control devices and accessories. Careful attention to the maintenance and proper operation of the equipment is necessary for the continued safe operation of oil burners.

1103. Where the circumstances or conditions of any particular installation are unusual and such as to render the strict application of this standard impractical, the authority having jurisdiction may permit such modifications as will provide a substantially equivalent degree of safety and be consistent with good engineering practice.

120. Use of Approved Equipment.

1201. Oil-burning equipment shall be approved. Approved shall mean acceptable to the authority having jurisdiction as to design, equipment, installation or intended use

as required by this standard. Devices listed for a specific purpose by a nationally recognized testing agency may be considered as meeting the requirements of this standard.

130. General.

1301. Before installing or remodeling any oil burning equipment for commercial or industrial applications, plans or sketches showing 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.

1302. The installation shall be made in accordance with the instructions of the manufacturer, by qualified mechanics experienced in making such installations.

1303. The installation shall be such as to provide reasonable accessibility for cleaning heating surfaces, removing burners, replacing motors, controls, air filters, draft regulators and other working parts and for adjusting, cleaning and lubricating parts requiring such attention.

1304. Oil-burning appliances shall be installed only in locations where combustible dusts and flammable gases or vapors are not normally present.

1305. After installation of the oil-burning equipment, operation tests shall be conducted to make certain that the burner is operating in a safe and acceptable manner and that all safety devices function properly.

1306. Contractors installing industrial oil burning systems shall furnish diagrams showing the main oil lines and controlling valves, one of which shall be posted at the oil burning equipment and another at some point which will be accessible in case of emergency.

140. Air for Combustion and Ventilation.

1401. GENERAL. Appliances shall be installed in a location in which the facilities for ventilation permit satisfactory combustion of oil, proper venting and the maintenance of ambient temperature at safe limits under normal conditions of use. Appliances shall be located in such a manner as not to interfere with proper circulation of air within the confined space. When buildings are so tight that normal infiltration does not meet air require-

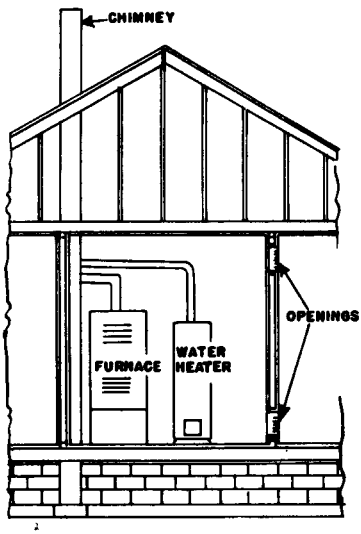
ments, outside air shall be introduced. Ducts used to convey air from the outdoors shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall be not less than 3 inches.

1402. For residence type installations and similar usages, the requirements of 1401 normally may be obtained by application of one of the methods covered in 1403 and 1404.

(a) For installation of commercial and industrial equipment see 1407.

1403. APPLIANCES LOCATED IN UNCONFINED SPACES.

(a) In unconfined spaces in buildings of conventional frame, brick or stone construction, infiltration normally is adequate to provide air for combusion and ventilation.



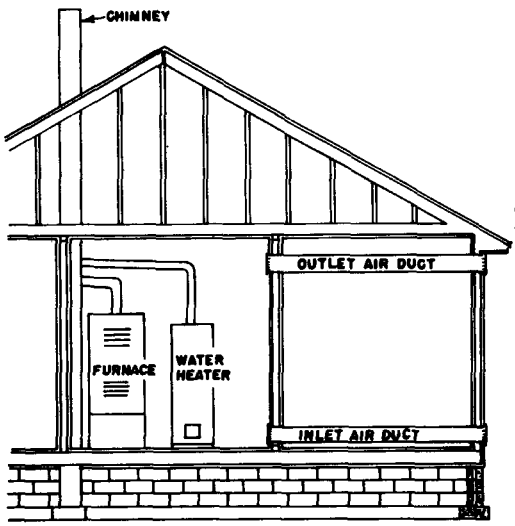
Note: Each opening shall have a free area of not less than one square inch per 1,000 Btu per hour (140 square inches per gallon per hour) of the total input rating of all appliances in the enclosure.

Fig. 1-A. Appliances Located in Confined Spaces All Air from Inside the Building. See 1404 (a).

(b) If the unconfined space is within a building having insufficient air because of tight construction, the air for combustion and ventilation shall be obtained from outdoors or from spaces freely communicating with the outdoors. Under these conditions a permanent opening or openings having a total free area of not less than one square inch per 5,000 Btu per hour (28 square inches per gallon per hour) of total input rating of all appliances shall be provided.

1404. APPLIANCES LOCATED IN CONFINED SPACES.

(a) All Air From Inside Building: The confined space shall be provided with two permanent openings, one near the top of the enclosure and one near the bottom. Each opening shall have a free area of not less than one square inch per 1,000 Btu per hour (140 square inches per gallon per hour) of the total input rating of all appliances in the enclosure, freely communicating with interior areas having in turn adequate infiltration from the outside. See Figure 1-A.



Note: Each air duct opening shall have a free area of not less than one square inch per 2,000 Btu per hour (70 square inches per gallon per hour) of the total input rating of all appliances in the enclosure.*

*If the appliance room is located against an outside wall and the air openings communicate directly with the outdoors, each opening shall have a free area of not less than one square inch per 4,000 Btu per hour (35 square inches per gallon per hour) of the total input rating of all appliances in the enclosure.

Fig. 1-B. Appliances Located in Confined Spaces All Air from Outdoors. See 1404 (b).

Note: The inlet and outlet air openings shall each have a free area of not less than one square inch per 4,000 Btu per hour (35 square inches per gallon per hour) of the total input rating of all appliances in the enclosure.

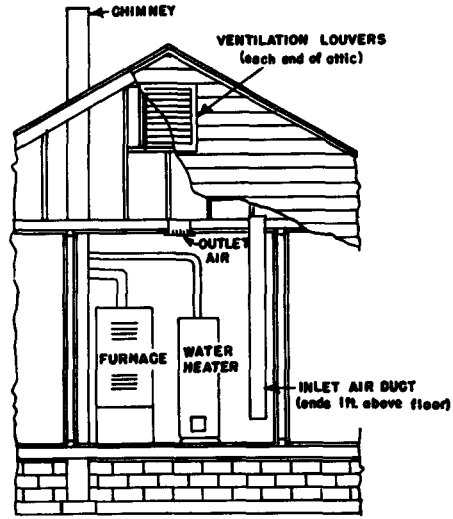
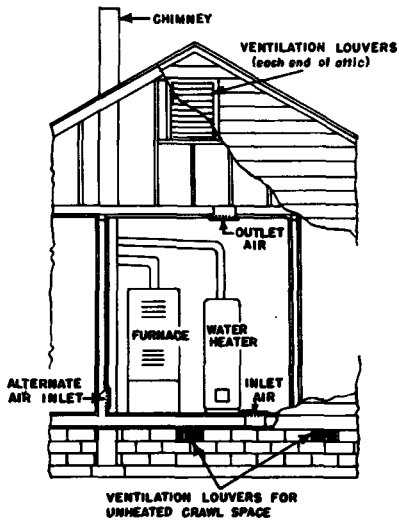


Fig. 1-C. Appliances Located in Confined Spaces All Air from Outdoors Through Ventilated Attic. See 1404 (b).



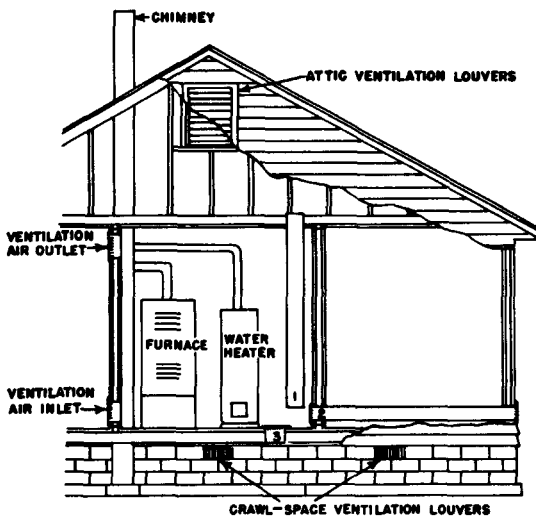
Note: The inlet and outlet air openings shall each have a free area of not less than one square inch per 4,000 Btu per hour (35 square inches per gallon per hour) of the total input rating of all appliances in the enclosure.

Fig. 1-D. Appliances Located in Confined Spaces All Air from Outdoors — Inlet Air from Ventilated Crawl Space and Outlet Air to Ventilated Attic. See 1404 (b).

(b) All Air From Outdoors:

(1) The confined space shall be provided with two permanent openings, one in or near the top of the enclosure and one in or near the bottom. The openings shall communicate directly, or by means of ducts, with outdoors or to such spaces (crawl or attic), that freely communicate with outdoors. See Figures 1-B, 1-C and 1-D.

(2) When directly communicating with outdoors or by means of vertical ducts, each opening shall have a free area of not less than one square inch per 4,000 Btu per hour (35 square inches per gallon per hour) of total input rating of all appliances in the enclosure. If horizontal ducts are used, each opening shall have a free area of not less than one square inch per 2,000 Btu per hour (70 square inches per gallon per hour) of total input of all appliances in the enclosure.



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

Attic ventilation louvers are required at each end of attic with alternate air inlet No. 1.

Nos. 1, 2, and 3 mark alternate locations for air from outdoors. Free area shall be not less than 1 square inch per 5,000 Btu per hour (28 square inches per gallon per hour) of the total input rating of all appliances in the enclosure.

Crawl-space ventilation louvers for unheated crawl space are required with alternate air inlet No. 3.

Each ventilation air opening from inside the building shall have a free area of not less than 1 square inch per 1,000 Btu per hour (140 square inches per gallon per hour) of the total input rating of all appliances in the enclosure.

Fig. 1-E. Appliances Located in Confined Spaces. Ventilation Air from Inside Building — Combustion Air from Outside, Ventilated Attic or Ventilated Crawl Space. See 1404 (c).

(c) Ventilation Air From Inside Building — Combustion Air From Outdoors:

The enclosure shall be provided with two openings for ventilation, located and sized as described in 1404 (a). In addition, there shall be one opening directly communicating with outdoors or to such spaces (crawl or attic) that freely communicate with outdoors. This opening shall have a free area of not less than one square inch per 5,000 Btu per hour (28 square inches per gallon per hour) of total input of all appliances in the enclosure.

1405. Louvers and Grilles.

In calculating free area in 1403, 1404 and 1407, consideration shall be given to the blocking effect of louvers, grilles or screens protecting openings. Screens used shall not be smaller than ¼ inch mesh and shall be readily accessible for cleaning. If the free area through a design of louver or grille is known, it should be used in calculating the size opening required to provide the free area specified. If the design and free area is not known, it may be assumed that wood louvers will have 20-25 per cent free area and metal louvers and grilles will have 60-75 per cent free area.

1406. Special Conditions.

Where an appliance is installed in a location in which the operation of exhaust fans, kitchen ventilation systems, clothes dryers, or fireplaces may create conditions of unsatisfactory combustion or venting, special provisions shall be made subject to the approval of the authority having jurisdiction.

1407. For commercial and industrial equipment, permanent facilities for supplying an ample amount of outside air shall be provided in accordance with the following:

(a) 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 one square inch per 14,000 Btu per hour (10 square inches per gallon per hour) of total input rating of the burner or burners and in no case less than 10 square inches.

(b) For furnace or boiler rooms not adjacent to outside walls the combustion air shall be supplied in a manner acceptable to the authority having jurisdiction.

1408. SPECIALLY ENGINEERED INSTALLATIONS.

The size of combustion air openings specified in 1403, 1404, and 1407 shall not necessarily govern when special engineering methods approved by the authority having jurisdiction assure an adequate supply of air for combustion and ventilation.

150. Disposal of Flue Gases.

1501. All oil-fired appliances other than:

(a) Direct-fired heaters,

(b) Listed kerosene stoves,

(c) Listed portable kerosene heaters

shall be chimney-connected except as provided in Section 170.

160. Chimneys and Chimney Connectors.

1601. CHIMNEYS.

(a) Masonry chimneys and metal chimneys (smokestacks) shall be built in accordance with accepted building code practice.*

(b) Factory-built chimneys shall be listed and shall be installed and used in accordance with their listings and the manufacturer's instructions.

(c) The flue-gas exit of a chimney shall be at least 3 feet above the highest point where it passes through the roof of a building and at least 2 feet higher than any portion of a building within 10 feet of such chimney. See Figure 2.

1602. CHIMNEY CONNECTORS.

(a) An appliance shall be placed so that the chimney connector will be as short as practicable. The horizontal length of a chimney connector for natural-draft burners shall not exceed 10 feet unless a draft booster is used. For appliances requiring a negative chimney draft, the chimney connector shall be not longer than 75 per cent of the portion of the chimney above the chimney-connector inlet.

*Reference may be made to NFPA Standard No. 211, published in National Fire Codes Vol. 4, to the National Building Code of the National Board of Fire Underwriters, 85 John St., New York, N. Y. 10038 or the National Building Code of Canada published by the National Research Council, Ottawa.

(b) No chimney connector shall pass through any floor or ceiling.

(c) No chimney connector of any medium or high-heat appliance shall pass through any combustible wall or partition. Chimney connectors of other appliances shall not pass through combustible walls or partitions unless they are guarded at the point of passage by (1) metal ventilated thimbles not less than 12 inches larger in diameter than the connector or (2) metal or burned fire-clay thimbles built in brickwork or other approved fireproofing materials extending not less than 8 inches beyond all sides of the thimble; or, in lieu of such protection, all combustible material in the wall or partition shall be cut away from the chimney connector a sufficient distance to provide the clearance required from such connector — any material used to close up such opening shall be noncombustible insulating material.

(d) The chimney connector shall extend through a chimney wall to the inner face or liner but not beyond, and shall be firmly cemented to masonry. A thimble may 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.

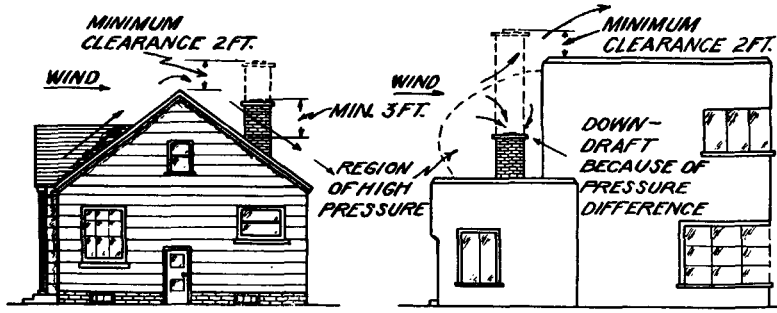


Figure 2. Typical Chimney Conditions Apt to Result in Back Drafts.

(e) The chimney connector for its entire length shall be not smaller than the flue collar of the appliance unless otherwise recommended by the appliance or chimney manufacturer. The

chimney connector throughout its entire length shall be readily accessible for inspection, cleaning and replacement.

(f) The chimney connector shall be of steel or refractory masonry and shall be maintained in good condition.

(g) The chimney connector shall maintain a pitch or rise of at least ¼ inch to the foot (horizontal length of pipe) from the appliance to the chimney.

(h) The chimney connector shall be installed so as to avoid sharp turns or other construction features which would create excessive resistance to the flow of flue gases. No device which will obstruct the free flow of flue gases shall be installed in a chimney connector or chimney. This shall not be construed to prohibit the use of devices specifically listed for installation in a chimney connector such as heat reclaimers, automatic dampers and safety controls.

(i) The chimney connector shall be securely supported and joints fastened with sheet metal screws or rivets.

1603. DRAFT.

(a) A chimney shall be capable of producing a draft not less than that for which the appliance connected thereto is listed and as recommended by the manufacturer of the appliance. To conform to this requirement, a draft booster may be used to increase low draft. When a draft booster is used, provision shall be made to shut off the fuel supply to the main burner in the event of failure of the draft booster.

NOTE: A natural-draft burner should be connected to an individual chimney or chimney flue used for no other appliance.

(b) Chimney-downdraft conditions cause faulty operation, thereby creating a hazard and, where this condition exists, corrective steps shall be taken.

1604. DRAFT REGULATORS.

(a) A draft regulator shall be provided for each oil-fired appliance required to be connected to a chimney unless the appliance is listed for use without one.

(b) A draft regulator, when used, shall be installed in the same room or enclosure as the appliance and in such a manner

that no difference in pressure between the air in the vicinity external to the regulator and the combustion air supply will be permitted.

(c) A manually operated damper shall not be placed in the chimney connector from an oil-fired appliance.

(d) Automatically operated dampers shall be of approved type designed to maintain a safe damper opening at all times and arranged to prevent starting of the burner unless the damper is opened to a safe position.

170. Type L Venting Systems.

1701. Listed Type L venting systems may be employed with appliances listed as suitable for use with Type L venting systems.

1702. Type L venting systems shall be installed and used in accordance with their listings and the manufacturer's instructions.

1703. Only one appliance shall be connected to any one Type L venting system.

1704. The flue-gas exit of a Type L venting system shall be at least 2 feet above the highest point where it passes through the roof of a building.

180. Electrical Wiring and Equipment.

1801. Electrical wiring and equipment used in connection with oil-burning equipment shall be installed in accordance with the National Electrical Code, NFPA No. 70* (the Canadian Electrical Code applies in Canada).

190. Fuel Oil.

1901. The grade of fuel oil used in a burner shall be that for which the burner is approved and as stipulated by the manufacturer. Crankcase oil or any oil containing gasoline shall not be used.

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*NFPA Standard No. 70 published by the National Fire Protection Association, 60 Batterymarch St., Boston, Mass. 02110 in National Fire Codes, Vol. 5 and in separate form; also available from the National Board of Fire Underwriters, 85 John St., New York, N. Y. 10038 (NBFU No. 70).

NOTE: The label of Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada stipulates for each burner the grade of fuel oil for which the burner is listed.

1902. Where heavy oils are used, provision shall be made for maintaining the oil at the proper atomizing temperature. Automatically operated burners requiring the preheating of oil shall be arranged so that no oil can be delivered for combustion until the oil is at a suitable atomizing temperature.

1903. No steam coil operating at a pressure greater than 15 pounds per square inch gauge shall be installed in an oil tank. When a pressure reducing valve is used to limit the steam pressure to 15 psi or less, a relief valve set at not more than 5 psi above the normal pressure in the coil shall be provided.

NOTE: Coils supplied by an indirect heater or which are connected so that the condensate or water is not returned to the boiler are preferred.

CHAPTER 2. TANK STORAGE.

20. Design and Construction of Tanks.

2010. Materials.

2011. Tanks shall be built of steel except as provided in 2012 through 2015.

2012. Tanks for underground service may be built of material other than steel.

2013. Tanks built of materials other than steel shall be designed to specifications embodying principles recognized as good engineering design for the material used and shall be approved by the authority having jurisdiction.

2014. Unlined concrete tanks may be used for aboveground or underground service for fuel oils having a gravity of 40 degrees API or heavier. Concrete tanks shall be built in accordance with sound engineering practice.

2015. Tanks may have combustible or noncombustible linings.

2020. Fabrication.

2021. Tanks may be of any shape or type consistent with sound engineering design.

2022. Metal tanks shall be welded, riveted and caulked, brazed, or bolted, or constructed by use of a combination of these methods. Filler metal used in brazing shall be nonferrous metal or an alloy having a melting point above 1000° F and below that of the metal joined.

2023. Tanks shall be used under substantially atmospheric pressure and shall be built in accordance with approved standards of design. Atmospheric tanks may be built in accordance with:

(a) Underwriters' Laboratories, Inc. Subjects No. 142, Standard for Aboveground Tanks for Flammable Liquids, Second Edition, October 1953; No. 58, Standard for Underground Tanks for Flammable Liquids, Fifth Edition, December 1961; or No. 80, Standard for Inside Tanks for Oil-Burner Fuel, Fifth Edition, September 1963.

Underwriters' Laboratories of Canada Subjects No. C 142 (a), Standard for Aboveground Tanks for Flammable Liquids, Second Edition, August 1955; No. C 58, Standard for Underground Tanks for Flammable Liquids, Third Edition, January 1962; or No. C 80, Standard for Inside Tanks for Oil-Burner Fuel, Second Edition, September 1956.

(b) American Petroleum Institute Standards No. 12A, Specification for Oil Storage Tanks with Riveted Shells, Seventh Edition, September 1951 or No. 650, Welded Steel Tanks for Oil Storage, First Edition, December 1961, and Supplement February 1963.

2024. Steel tanks designed for underground service not exceeding 2500 gallons capacity may be used aboveground.

2025. Atmospheric tanks built according to Underwriters' Laboratories, Inc., or Underwriters' Laboratories of Canada standards in 2023 (a) may be used for operating pressures not exceeding 1 psig. Atmospheric aboveground tanks shall be limited to 2.5 psig under emergency venting conditions.

2026. When the vertical length of the fill or vent pipes is such that when filled with liquid the static head imposed upon the bottom of the tank exceeds 10 psig, the tank shall be designed for the maximum static head which will be imposed.

2027. Pressure tanks, if required to conform to 2026, shall be built in accordance with the principles of the Code for Unfired Pressure Vessels, Section VIII of the ASME Boiler and Pressure Vessel Code, 1962 edition. If such tanks are larger than 550 gallons (500 Imp. gallons) or are to be buried underground, all openings in such tanks shall be located above the highest normal liquid level.

21. Installation of Underground Tanks.

2101. Only a tank complying with the construction provisions of Standard No. 58 or No. C 58 of 2023 (a) or as provided in 2027, shall be buried underground.

2102. Excavation for underground tanks shall be made with due care to avoid undermining of foundations of existing structures. Underground tanks or tanks under buildings shall be so located with respect to existing building foundations and supports that the loads carried by the latter cannot be

transmitted to the tank. The distance from any part of a tank storing fuel oil to the nearest wall of any basement, pit or property line shall be not less than one foot.

2103. An underground tank shall be set on a firm foundation and surrounded with at least 6 inches of noncorrosive inert materials such as clean sand, earth or gravel well tamped in place. The tank shall be placed in the hole with care since dropping or rolling the tank into the hole can break a weld, puncture or damage the tank metal or scrape off the protective coating of coated tanks. A tank shall be covered with a minimum of 2 feet of earth, or shall be covered with not less than 1 foot of earth on top of which shall be placed a slab of reinforced concrete not less than 4 inches thick. When underground tanks are, or are likely to be, subjected to traffic, they shall be protected against damage from vehicles passing over them by at least 3 feet of earth cover, or 18 inches of well-tamped earth, plus 6 inches of reinforced concrete or 8 inches of asphaltic concrete. When asphaltic or reinforced concrete paving is used as part of the protection, it shall extend at least 1 foot horizontally beyond the outline of the tank in all directions.

2104. Corrosion protection for the tank and its associated buried piping shall be provided by one or more of the following methods: (1) use of protective coatings or wrappings, (2) cathodic protection, or (3) corrosion resistant materials of construction.

2105. Underground tanks shall be equipped with an open vent or an automatically operated vent, arranged to discharge to the open air. Vent openings and vent pipes shall be of ample size to prevent abnormal pressure in the tank during filling but not smaller than the pipe size specified in Table 1.

2106. All connections to an underground tank shall be made through the top of the tank.

2107. An underground tank shall be provided with means for gauging. (See 350.)

Table 1

Capacity of Tank, U. S. Gallons	Approx. Imperial Gallons	Diameter of Vent, Iron Pipe Size
500 or less	500 or less	1¼ inches
501 to 3,000	501 to 2,500	1½ inches
3,001 to 10,000	2,501 to 8,300	2 inches
10,001 to 20,000	8,301 to 16,600	2½ inches
20,001 to 35,000	16,601 to 29,000	3 inches

NOTE: Where tanks are filled by the use of a pump through tight connections, special consideration should be given to the size of the vent pipe to insure that it is adequate to prevent the development of abnormal pressure in the tank during filling. This may be accomplished by providing a vent pipe not less in size than the discharge of the pump.

22. Installation of Unenclosed Supply Tank Inside Building.

2201. An unenclosed supply tank inside of a building shall conform to the following provisions:

(a) A supply tank not larger than ten gallons shall be specifically approved for the purpose.

(b) An approved safety can may be used as a storage tank.

(c) A supply tank larger than ten gallons but not larger than 550 gallons (500 Imp. gallons) shall meet the construction provisions of Standard No. 80 or No. C 80 of 2023 (a), or as provided in 2027.

(d) A supply tank shall be of such size and shape that it can be installed in and removed from the building as a unit.

2202. The size and location of unenclosed tanks inside of any building or any one portion of a building separated from other portions by a fire wall shall be in accordance with the following:

(a) Not more than six supply tanks having an individual capacity of ten gallons or less or not more than six safety cans may be located in any one or more stories.

(b) A supply or storage tank located above the lowest story, cellar or basement shall not exceed 60 gallons (50 Imp. gallons) capacity and the total capacity of tanks so located shall not exceed 60 gallons (50 Imp. gallons).

(c) A supply tank shall be not larger than 550 gallons (500 Imp. gallons). Not more than one 550 gallon (500 Imp. gallon) tank or two tanks of aggregate capacity of 550 gallons (500 Imp. gallons) or less shall be connected to one oil burning appliance and the aggregate capacity of such tanks installed in the lowest story, cellar or basement of a building shall not exceed 1,100 gallons (1,000 Imp. gallons), unless separation is provided for each 550 gallons (500 Imp. gallons) of tank capacity. Such separation shall consist of an unpierced masonry wall or partition extending from the lowest floor to the ceiling above the tank or tanks and shall have a fire resistance rating of not less than two hours.

2203. An unenclosed supply tank not larger than ten gallons shall be placed not less than two feet horizontally from any source of heat either in or external to the appliance being served but in any case shall be located so that the temperature of the oil in the tank will not exceed 25° F above room temperature.

2204. An unenclosed supply tank larger than ten gallons shall be placed not less than five feet horizontally from any fire or flame either in or external to the appliance being served by the tank.

2205. An unenclosed supply tank shall be securely supported by rigid noncombustible supports to prevent settling, sliding or lifting.

2206. When a supply tank larger than ten gallons capacity is provided with an opening in the bottom for use as a burner supply connection or as a drain, the tank shall be pitched toward the opening with a slope of not less than ¼ inch per foot of length.

2207. A shutoff valve shall be provided immediately adjacent to the burner supply connection at the bottom of a supply tank.

2208. A supply tank larger than ten gallons capacity shall be provided with an open vent pipe not smaller than the pipe size specified in Table 1 and a fill pipe, both terminating outside the building.

NOTE: Where tanks are filled by the use of a pump through tight connections special consideration should be given to the size

of the vent pipe to insure that it is adequate to prevent the development of abnormal pressure in the tank during filling. This may be accomplished by providing a vent pipe not less in size than the discharge of the pump.

2209. A supply tank provided with fill and vent pipes shall be equipped with a gauging device. (See Section 350.)

2210. Any unused opening in a tank equipped with fill and vent pipes shall be closed vapor tight by a pipe plug or cap screwed up tightly.

2211. Two supply tanks connected to the same burner as permitted by 2202 (c) may be cross-connected and provided with a single fill and a single vent pipe as described in Appendix A.

23. Installation of Enclosed Supply Tanks Inside Buildings.

2301. A supply tank larger than 550 gallons (500 Imp. gallons) capacity shall be enclosed when installed inside of a building.

2302. Tankage inside of a building in excess of that permitted in unenclosed tanks by 2202 (c) shall be enclosed.

2303. Only a tank meeting the construction provisions of Standards No. 58 or No. C 58 and No. 80 or No. C 80 of 2023 (a), or as provided in 2027 shall be installed enclosed inside of a building.

2304. The nominal gross capacity of enclosed tanks inside a building shall not exceed:

(a) 10,000 gallons (8,000 Imp. gallons) in buildings of other than fire-resistive construction.

(b) 15,000 gallons (12,000 Imp. gallons) in buildings of fire-resistive construction.

(c) 50,000 gallons (40,000 Imp. gallons) with an individual tank capacity not exceeding 25,000 gallons (20,000 Imp. gallons) in any building; provided that the tank or tanks are enclosed as specified in 2307, and in addition are located in a room cut off vertically and horizontally from other floors of the main building by construction having a fire resistance rating of two hours.

2305. The tank shall be supported at least four inches above the floor by masonry saddles at least 12 inches thick, spaced not more than eight feet on centers and extending the full width of the tank.

2306. All connections to an enclosed supply tank having a capacity of more than 550 gallons (500 Imp. gallons) shall be made through the top of the tank, and the transfer of oil shall be by pump only and through continuous piping to and from the consuming appliances.

2307. The walls of tank enclosures shall be constructed of solid masonry units or poured concrete construction having a fire-resistance rating of not less than three hours and bonded to the floor. The floor shall be of concrete or other fire-resistive construction. The top shall be of reinforced concrete at least five inches thick or equivalent fire-resistive construction, except that where the floor or roof construction above the enclosure is concrete or other fire-resistive construction, the walls may be extended to and bonded to the underside of the construction above in lieu of a separate top. At least 15 inches clearance shall be left around the tank for the purpose of inspection and repair.

2308. Each tank enclosure shall be provided with an opening closed by a self-closing Class A fire door and a noncombustible liquid-tight sill or ramp at least six inches high. If the sill or ramp is more than six inches high, the walls to a height corresponding to the level of oil that will be retained shall be built to withstand the lateral pressure due to the liquid head.

2309. Provision shall be made for adequate ventilation of such enclosures prior to entering for inspection or repair of tanks.

2310. An enclosed supply tank shall be equipped with an open vent or an automatically operated vent, terminating outside the building. Vent openings and vent pipes shall be of ample size to prevent abnormal pressure in the tank during filling but not smaller than the pipe size specified in Table 1.

2311. An enclosed supply tank shall be provided with a gauging device. (See Section 350.)

24. Installation of Outside Aboveground Tanks Not Larger Than 550 Gallons (500 Imp. Gallons).

2401. Tankage not in excess of that permitted by 2202 may be installed outside aboveground in a built-up area. The tanks may be adjacent to buildings but the distance to the line of adjoining property shall be in accordance with Table 2. Such tanks shall be suitably protected from the weather and from physical damage incident to outside use. The tanks shall not block normal means of egress.

2402. A tank not larger than 60 gallons (50 Imp. gallons) capacity may be an ICC-5 Shipping Container (drum) (BTC-5)* and so marked, a listed safety can, or a tank meeting the provisions of Standard No. 80 or No. C 80 of 2023 (a), or as provided in 2027.

2403. A tank other than an ICC-5 Shipping Container (BTC-5)* having a capacity of not more than 550 gallons (500 Imp. gallons) shall meet the provisions of Standard No. 80 or No. C 80 of 2023 (a), or as provided in 2027.

2404. A supply or storage tank located above the lowest story, cellar or basement shall not exceed 60 gallons (50 Imp. gallons) capacity and the total capacity of tanks so located shall not exceed 60 gallons (50 Imp. gallons).

2405. Not more than one 550 gallon (500 Imp. gallon) tank or two tanks of aggregate capacity of 550 gallons (500 Imp. gallons) or less shall be connected to one oil-burning appliance.

2406. Two supply tanks connected to the same burner as permitted by 2405 above may be cross-connected and provided with a single fill and a single vent as described in Appendix A but when so connected they shall be on a common slab and rigidly secured one to the other.

2407. Tanks having a capacity of 550 gallons (500 Imp. gallons) or less shall be securely supported by rigid noncombustible supports to prevent settling, sliding or lifting.

2408. The filling of a portable container from a storage tank larger than 60 gallons (50 Imp. gallons) shall be by means of a hand pump only.

2409. A shutoff valve shall be provided in the burner supply line immediately adjacent to the gravity feed connection of a supply tank.

* Board of Transport Commissioners, Ottawa.

2410. A tank not larger than 550 gallons (500 Imp. gallons) capacity shall be equipped with an open vent not smaller than the pipe size specified in Table 1.

2411. A tank shall be provided with a means to determine the liquid level. (See Section 350.)

2412. The fill opening shall be of such size and so located as to permit ready filling in a manner which will avoid spillage.

25. Installation of Outside Aboveground Tanks Larger Than 550 Gallons (500 Imp. Gallons).

2501. A tank having a capacity of more than 550 gallons (500 Imp. gallons) shall meet the construction provisions of Standard No. 142 or No. C 142 (a) of 2023 (a), or as provided in 2027, or shall comply with 2023 (b) except that a tank having a capacity less than 2,500 gallons (2,100 Imp. gallons) constructed according to Standard No. 58 or No. C 58 of 2023 (a) may be used.

2502. A tank having a capacity of more than 550 gallons (500 Imp. gallons) shall not be located in closely built-up areas.

2503. A tank shall be provided with a means to determine the liquid level. (See Section 350.)

2510. Location With Respect to Property Lines, Public Ways, or Nearest Important Building or Group of Buildings.

2511. Every aboveground tank for the storage of fuel oils and equipped with emergency venting which will not permit pressures to exceed 2.5 psig shall be located in accordance with Table 2.

2512. Every aboveground tank for the storage of fuel oils operating at pressures exceeding 2.5 psig or equipped with emergency venting which will permit pressures to exceed 2.5 psig shall be located in accordance with Table 3.

2513. Reference table for minimum distances used in Table 2 shall be as shown in Table 4.

2514. Where two tank properties of diverse ownership have a common boundary, the authority having jurisdiction may, with the written consent of the owners of the two properties, substitute the distances provided in 2521 through 2523 for the minimum distances set forth in 2510.

Table 2

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which May be Built Upon, Including the Opposite Side of a Public Way or to Nearest Important Building or Group of Buildings	Minimum Distance in Feet from Nearest Side of Any Public Way
Floating Roof	Protection for Exposures*	½ times diameter of tank but need not exceed 90 feet	⅛ times diameter of tank but need not exceed 30 feet
	None	Diameter of tank but need not exceed 175 feet	⅛ times diameter of tank but need not exceed 30 feet
Vertical with Weak Roof to Shell Seam	Approved foam or inerting system on the tank	½ times diameter of tank but need not exceed 90 feet and shall not be less than 5 feet	⅛ times diameter of tank but need not exceed 30 feet and shall not be less than 5 feet
	Protection for Exposures*	Diameter of tank but need not exceed 175 feet	⅓ times diameter of tank but need not exceed 60 feet
	None	2 times diameter of tank but need not exceed 350 feet	⅓ times diameter of tank but need not exceed 60 feet
Horizontal and Vertical, with Emergency Relief Venting to Limit Pressures to 2.5 psig	Approved inerting system on the tank or approved foam system on vertical tanks	½ times Table 4 but shall not be less than 5 feet	½ times Table 4 but shall not be less than 5 feet
	Protection for Exposures*	Table 4	Table 4
	None	2 times Table 4	Table 4

*Protection for exposures shall mean fire protection for structures on property adjacent to tanks. When acceptable to the authority having jurisdiction, such structures located (1) within the jurisdiction of any public fire department or (2) within or adjacent to plants having private fire brigades shall be considered as having adequate protection for exposures.

Table 3

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which May be Built Upon, Including the Opposite Side of a Public Way or to Nearest Important Building or Group of Buildings	Minimum Distance in Feet from Nearest Side of Any Public Way
Any Type	Protection for Exposures	1½ times Table 4 but shall not be less than 25 feet	1½ times Table 4 but shall not be less than 25 feet
	None	3 times Table 4 but shall not be less than 50 feet	1½ times Table 4 but shall not be less than 25 feet

*Special consideration may be given to tanks equipped with automatic depressuring systems.

2515. Where end failure of horizontal pressure tanks and vessels may expose property, the tank shall be placed with the longitudinal axis parallel to the nearest important exposure.

Table 4

Capacity of Tank		Minimum Distance in Feet from Property Line Which May be Built Upon, Including the Opposite Side of a Public Way or to Nearest Important Building or Group of Buildings	Minimum Distance in Feet from Nearest Side of Any Public Way
U. S. Gallons	Approx. Imperial Gallons		
275 or less	250 or less	5	5
276 to 750	251 to 625	10	5
751 to 12,000	626 to 10,000	15	5
12,001 to 30,000	10,001 to 25,000	20	5
30,001 to 50,000	25,001 to 40,000	30	10

NOTE: Refer to Table 5 of the Flammable and Combustible Liquids Code, NFPA No. 30, for tanks larger than 50,000 gallons.

2520. Spacing (Shell-to-Shell) Between Aboveground Tanks.

2521. The location of a tank with respect to any such other tank except tanks of 550 gallons (500 Imp. gallons) capacity or less shall be such that the distance between them shall be not less than three feet.

2522. The distance between adjacent tanks shall not be less than one-sixth the sum of their diameters except when the diameter of one tank is less than one-half the diameter of the adjacent tank, the distance between the two tanks shall not be less than one-half the diameter of the smaller tank.

2523. The minimum separation between a liquefied petroleum gas container and a fuel oil tank shall be 20 feet. Suitable means shall be taken to prevent the accumulation of fuel oil under adjacent liquefied petroleum gas containers such as by diversion curbs or grading. When fuel oil tanks are within a diked area, the liquefied petroleum gas containers shall be outside the diked area and at least 10 feet away from the center line of the wall of the diked area. The foregoing provisions shall not apply when liquefied petroleum gas containers of 125 gallons (105 Imp. gallons) or less capacity are installed adjacent to fuel oil supply tanks of 550 gallons (500 Imp. gallons) or less capacity.

2530. Normal Venting for Aboveground Tanks.

2531. Atmospheric tanks shall be adequately vented to prevent the development of vacuum of pressure sufficient to distort the roof of a cone roof tank or exceeding the design pressure in the case of other atmospheric tanks, as a result of filling or emptying, and atmospheric temperature changes.

2532. Normal vents shall be sized either in accordance with (1) the American Petroleum Institute Guide for Tank Venting, RP-2000; or (2) other accepted standard; or (3) shall be at least as large as the filling or withdrawal connection, whichever is larger but in no case less than 1¼ inch nominal inside diameter.

2540. Emergency Relief Venting for Fire Exposure for Aboveground Tanks.

2541. Every aboveground tank shall have some form of construction or device that will relieve excessive internal pressure caused by exposure fires.

2542. In a vertical tank the construction referred to in 2541 may take the form of a floating roof, lifter roof; a weak roof-to-shell seam, or other approved pressure relieving construction. The weak roof-to-shell seam shall be constructed to fail preferential to any other seam.

2543. Where emergency venting is not provided in accordance with 2542, the total capacity of both normal and emergency venting devices shall be not less than that derived from Table 5, except as provided in 2544 or 2545. (See Appendix A of NFPA No. 30, Flammable and Combustible Liquids Code.) The wetted area of the tank shall be calculated on the basis of 55 per cent of the total exposed area of a sphere or spheroid, 75 per cent of the total exposed area of a horizontal tank and the first 30 feet abovegrade of the exposed shell area of a vertical tank.

NOTE: See Appendix A of NFPA No. 30, Flammable and Combustible Liquids Code, for calculation to determine exposed areas of typical types of vessels.

2544. The total emergency relief venting capacity for any specific liquid may be determined by the following formula:

$$\text{Cubic feet of free air per hour} = V \frac{1337}{L \sqrt{M}}$$

V = cubic feet of free air per hour from Table 5.

L = latent heat of vaporization of specific liquid in BTU per lb.

M = molecular weight of specific liquids.

Table 5

Wetted Area Versus Cubic Feet Free Air per Hour (14.7 psia and 60° F.)

Sq. Ft.	CFH	Sq. Ft.	CFH	Sq. Ft.	CFH
20	21,100	200	211,000	1,000	524,000
30	31,600	250	239,000	1,200	557,000
40	42,100	300	265,000	1,400	587,000
50	52,700	350	288,000	1,600	614,000
60	63,200	400	312,000	1,800	639,000
70	73,700	500	354,000	2,000	662,000
80	84,200	600	392,000	2,400	704,000
90	94,800	700	428,000	2,800	742,000
100	105,000	800	462,000	and over	
120	126,000	900	493,000		
140	147,000	1,000	524,000		
160	168,000				
180	190,000				
200	211,000				

NOTE: Interpolate for intermediate values.

2545. The required air flow rate of 2543 or 2544 may be multiplied by the appropriate factor listed in the following schedule when protection is provided as indicated. Only one factor may be used for any one tank:

.5 for drainage in accordance with 2552 for tanks over 200 square feet of wetted area

.3 for approved water spray

.3 for approved insulation

.15 for approved water spray with approved insulation.

2550. Drainage, Dikes and Walls for Aboveground Tanks.

2551. DRAINAGE AND DIKED AREAS: The area surrounding a tank or a group of tanks shall be provided with drainage as in 2552, or shall be diked as provided in 2553, to prevent accidental discharge of liquid from endangering adjoining property or reaching waterways, except that in particular installations these provisions may be waived or altered at the discretion of the authority having jurisdiction when the tanks under consideration do not constitute a hazard to adjoining property.

2552. DRAINAGE: Where protection of adjoining property or waterways is by means of a natural or man-made drainage system, such systems shall comply with the following:

(a) A slope of not less than 1 per cent away from the tank toward the drainage system shall be provided.

(b) The drainage system shall terminate in vacant land or other area or in an impounding basin having a capacity not smaller than that of the largest tank served. This termination area and the route of the drainage system shall be so located that, if the fuel oils in the drainage system are ignited, the fire will not seriously expose tanks or adjoining property.

(c) The drainage system, including automatic drainage pumps, shall not discharge to adjoining property, natural water courses, public sewers, or public drains unless the discharge of fuel oils would not constitute a hazard, or the system is so designed that it will not permit fuel oil to be released.

2553. DIKED AREAS: Where protection of adjoining property or waterways is accomplished by retaining the liquid

around the tank by means of a diked area, such diked area shall comply with the following provisions:

(a) Except as provided in sub-paragraph (b), the volumetric capacity of the diked area shall not be less than the greatest amount of liquid that can be released from the largest tank within the diked area, assuming a full tank. The capacity of the diked area enclosing more than one tank shall be calculated by deducting the volume of the tanks other than the largest tank below the height of the dike.

(b) Walls of the diked area shall be of earth, steel, concrete or solid masonry designed to be liquid tight and to withstand a full hydrostatic head. Earthen walls 3 feet or more in height shall have a flat section at the top not less than 2 feet wide. The slope of an earthen wall shall be consistent with the angle of repose of the material of which the wall is constructed.

(c) The walls of the diked area shall be restricted to an average height of 6 feet above interior grade.

(d) Where provision is made for draining water from diked areas, drainage shall be provided at a uniform slope of not less than one per cent away from tanks toward a sump, drainbox or other safe means of disposal located at the greatest practical distance from the tank. Such drains shall normally be controlled in a manner so as to prevent fuel oils from entering natural water courses, public sewers, or public drains, if their presence would constitute a hazard. Control of drainage shall be accessible under fire conditions.

(e) No loose combustible material, empty or full drum or barrel, shall be permitted within the diked area.

2560. Stairs, Platforms and Walkways for Aboveground Tanks: Stairs, platforms and walkways shall be of metal, concrete or wood.

26. Supports, Foundations and Anchorage for All Tank Locations.

2610. Tank supports shall be installed on firm foundations. Tank supports shall be of concrete, masonry or protected steel. Single wood timber supports (not cribbing) laid horizontally may be used for outside aboveground tanks if not more than 12 inches high at their lowest point.

2620. Steel supports or exposed piling shall be protected by materials having a fire resistance rating of not less than two hours, except that steel saddles need not be protected if less than 12 inches high at their lowest point. At the discretion of the authority having jurisdiction, approved water spray protection or its equivalent may be used in lieu of fire-resistive materials to protect supports.

2630. Every tank shall be so supported as to prevent the excessive concentration of loads on the supporting portion of the shell.

2640. Tanks shall rest on the ground or on foundations made of concrete, masonry, piling or steel. Tank foundations shall be designed to minimize the possibility of uneven settling of the tank and to minimize corrosion in any part of the tank resting on the foundation.

NOTE: Appendix E of API Standard 650, Specification for Welded Steel Tanks for Oil Storage, and Appendix B of API Standard 620, Recommended Rules for the Design and Construction of Large, Welded, Low-Pressure Storage Tanks, provide information on tank foundations.

2650. Where a tank is located in an area that may be subjected to flooding, the applicable precautions outlined in NFPA No. 30, Protection of Tanks Containing Flammable or Combustible Liquids in Locations That May be Flooded, shall be observed.

2660. In areas subject to earthquakes, the tank supports and connections shall be designed to resist damage as a result of such shocks.

27. Testing.

2710. All tanks, whether shop-built or field-erected, shall be strength tested before they are placed in service in accordance with the applicable paragraphs of the Code or Standard under which they were built. The ASME Code stamp, API monogram, the label of the Underwriters' Laboratories, Inc., or the Underwriters' Laboratories of Canada on a tank shall be evidence of compliance with this strength test. Tanks not marked in accordance with the above Codes or Standards shall be strength tested before they are placed in service in accordance with good engineering principles and reference shall be made to the sections on testing in the Codes or Standards listed in 2023 or 2027.

2720. When the vertical length of the fill and vent pipes is such that when filled with liquid the static head imposed upon the bottom of the tank exceeds 10 psig, the tank and related piping shall be tested hydrostatically to a pressure equal to the static head thus imposed. In special cases where the height of the vent above the top of the tank is excessive, the hydrostatic test pressure shall be specified by the authority having jurisdiction.

2730. In addition to the strength test called for in 2810 and 2820, all tanks and connections shall be tested for tightness before being placed in use. In the case of field-erected tanks, the strength test may be considered to be the test for tank tightness. Underground tanks shall be tested for tightness before being covered or enclosed. Tanks shall be tested for tightness hydrostatically, or with inert gas or air pressure at not less than 3 psig and not more than 5 psig. (See 390 for testing piping.)

2740. All leaks or deformations shall be corrected in an acceptable manner before the tank is placed in service. Mechanical caulking is not permitted for correcting leaks in welded tanks except pinhole leaks in the roof.

28. Special Situations.

2810. In particular installations the provisions of this chapter may be altered at the discretion of the authority having jurisdiction after consideration of the special features such as topographical conditions, barricades, walls, nature of occupancies and proximity to buildings or adjoining property and height and character of construction of such buildings; capacity and construction of proposed tanks and character of liquids to be stored, degree of private fire protection to be provided and the adequacy of facilities of the fire department to cope with fuel oil fires.

CHAPTER 3. PIPING, PUMPS AND VALVES.

300. Piping Materials and Design.

3001. All piping shall be wrought iron, steel or brass pipe, or brass or copper tubing. Aluminum tubing shall not be used between the fuel oil tank and the burner unit. Wall thicknesses of wrought iron and steel pipe shall be in accordance with design methods outlined in Section 3 of the American Standard Code for Pressure Piping ASA B31.1-1955. Listed flexible metal hose may be used to reduce the effect of jarring and vibration or where rigid connections are impracticable and shall be installed in full compliance with its listing.

3002. Piping used in the installation of oil burners and appliances other than conversion range oil burners shall be not smaller than ⅜ inch iron pipe size or ⅜ OD tubing. Copper tubing shall have 0.035 inch nominal and 0.032 inch minimum wall thickness.

3003. Pipe shall be connected with standard fittings and tubing with fittings of listed type. Pipe connectors made of combustible materials or depending upon the frictional characteristics of combustible materials shall not be used inside of buildings or aboveground outside of buildings. If used below ground outside of buildings, connectors shall be of listed type and installed in accordance with their listing. All threaded joints and connections shall be made tight with suitable lubricant or pipe compound. Unions requiring gaskets or packings, right or left couplings, and sweat fittings employing solder having a melting point of less than 1000° F. shall not be used in oil lines. Cast iron fittings shall not be used.

3004. Piping shall be substantially supported and protected against physical damage and where necessary protected against corrosion. All buried piping shall be protected against corrosion. Drop pipes from shop piping mains to burners are subject to physical damage and it may be necessary to enclose them in heavier pipe or the equivalent means to safeguard against breakage.

3005. Proper allowance shall be made for expansion, contraction, jarring and vibration. Pipe lines, other than tubing, connected to underground tanks, except straight fill lines and test wells, shall be provided with double swing joints or flexible connectors arranged to permit the tanks to settle without impairing the tightness of the pipe connections.

310. Fill and Return Piping.

3101. A fill pipe shall terminate outside of a building at a point at least two feet from any building opening at the same or lower level. A fill pipe shall terminate in a manner designed to minimize spilling when the filling hose is disconnected. Fill opening shall be equipped with a tight metal cover designed to discourage tampering.

3102. A return line from a burner or pump to a supply tank shall enter the top of the tank.

3103. Cross connections, except between two supply tanks not exceeding 550 gallons (500 Imp. gallons) aggregate capacity, permitting gravity flow from one tank to another shall be prohibited.

3104. An auxiliary tank shall be filled by a pump transferring the oil through continuous piping from the supply tank.

3105. An auxiliary tank shall be located at a level above the top of the supply tank from which it is filled.

3106. An auxiliary tank shall be provided with an overflow pipe draining to the supply tank and extending into the top of the supply tank not more than one inch. This requirement does not apply to an auxiliary tank specifically listed for use without an overflow pipe.

3107. An overflow pipe from an auxiliary tank and a return line from a burner or pump shall have no valves or obstructions.

320. Supply Connections.

3201. All piping, except the burner supply line from a tank having a capacity not over 550 gallons (500 Imp. gallons) and the cross connection between two tanks having an aggregate capacity of 550 gallons or less, shall be connected into the top of a supply tank. When two tanks are cross connected, the tops of the tanks shall be on the same horizontal plane. See Figures 5 and 6 of Appendix A.

3202. The burner supply connection to a tank having a capacity of more than 550 gallons (500 Imp. gallons) or to two or more tanks having an aggregate capacity of more than 550 gallons (500 Imp. gallons) shall be connected into the top of each tank, except as permitted by 3206.

3203. A transfer pump or an automatic pump may be used to deliver oil from a supply tank to a burner or to an auxiliary tank. Except as permitted by 3206 and 380, a transfer pump shall be connected to a tank having a capacity not over 550 gallons (500 Imp. gallons) or to two tanks having an aggregate capacity of not over 550 gallons (500 Imp. gallons).

3204. The pressure at the oil supply inlet to an appliance shall be not greater than 3 psi.

3205. Where supply tanks are set below the level of the burner, the oil piping shall be so laid as to pitch toward the supply tank without traps.

3206. For commercial and industrial installations the oil supply from tanks of any capacity permitted by this Standard may be in accordance with the following:

(a) The burner supply line may be connected to an outside aboveground supply tank at a point below the liquid level but each such connection shall be provided with an internal or external shutoff valve located as close as practicable to the shell of the tank. External valves and their connections to the tank shall be of steel.

(b) A transfer pump may be used.

330. Vent Piping.

3301. Vent pipes shall be so laid as to drain toward one tank without sags or traps in which liquid can collect. They shall be located so that they will not be subjected to physical damage aboveground. Vent pipes from tanks may be connected into one outlet pipe. The outlet pipe shall at least be one pipe size larger than the largest individual vent pipe connected thereto. In no case shall the point of connection between two or more vent pipes be lower than the top of any fill pipe opening. The lower end of a vent pipe shall enter the tank through the top and shall extend into the tank not more than one inch.

3302. Vent pipes shall terminate outside of buildings at a point not less than two feet measured vertically or horizontally from any building opening. Outer ends of vent pipes shall terminate in a weather-proof vent cap or fitting or be provided with a weather-proof hood. All vent caps shall have a minimum free open area equal to the cross-sectional area of the vent pipe and shall not employ screens finer than

four mesh. Vent pipes shall terminate sufficiently above the ground to avoid being obstructed with snow and ice. Vent pipes from tanks containing heaters shall be extended to a location where oil vapors discharging from the vent will be readily diffused. If the static head with a vent pipe filled with oil exceeds 10 psi, the tank shall be designed for the maximum static head which will be imposed.

3303. Vent pipes shall not be cross connected with fill pipes, return lines from burners or overflow lines from auxiliary tanks.

340. Pressurized Tank Feed.

3401. Pressurized tank feed shall not be used.

350. Oil Gauging.

3501. All tanks in which a constant oil level is not maintained by an automatic pump shall be equipped with a method of determining the oil level.

3502. Test wells shall not be installed inside buildings. For outside service they shall be equipped with a tight metal cover designed to discourage tampering.

NOTE: The gauging of inside tanks by means of measuring sticks is a pronounced hazard and should not be permitted.

3503. Gauging devices such as liquid level indicators or signals shall be designed and installed so that oil or vapor will not be discharged into a building from the fuel supply system.

NOTE: An inside tank provided with fill and vent pipes should be provided with a device to indicate either visually or audibly at the fill point when the oil in the tank has reached a predetermined safe level.

3504. No tank used in connection with any oil burner shall be equipped with a glass gauge or any gauge which, when broken, will permit the escape of oil from the tank.

360. Oil Pumps.

3601. An oil pump not a part of a listed burner shall be a positive displacement type which automatically shuts off the oil supply when stopped.

3602. An automatic pump not an integral part of a burner shall be a listed type installed in full compliance with its listing.

370. Valves.

3701. A readily accessible manual shutoff valve shall be installed at each point where required to properly control the flow of fuel in normal operation and where required to avoid oil spillage during servicing. The valve shall be installed to close against the supply.

NOTE: An automatically operated device designed to shut off the oil supply in case of fire in the immediate vicinity of the burner should be provided.

3702. Where a shutoff is installed in the discharge line of an oil pump not an integral part of a burner, a pressure relief valve shall be connected into the discharge line between the pump and the shutoff valve and arranged to return surplus oil to the supply tank or to bypass it around the pump, unless the pump includes an internal bypass.

3703. Any fuel oil line incorporating a heater shall be provided with a relief valve arranged to discharge to the return line when any valve, pump, or other device may prevent the release of excessive pressure because of the expansion of the oil when heated.

3704. Where oil is supplied to a burner requiring uniform flow by gravity feed and a constant level valve is not incorporated in the burner assembly or the oil is not supplied by an automatic pump, a constant level valve shall be installed in the supply line at the gravity tank or as close thereto as practicable, to insure uniform delivery of oil to the burner. The vent opening of such constant level valve shall be connected by piping or tubing to the outside of the building, unless the constant level valve is provided with an anti-flooding device. Vent piping or tubing of constant level valves shall not be connected to tanks or tank vents.

380. Centralized Oil Distribution Systems.

3801. For installations other than those covered by 3206, oil may be supplied by transfer pump from a central underground tank of any capacity permitted by this Standard through an underground piping system to one or more buildings, provided all the provisions of this Standard applicable to the system and all of the requirements in Paragraphs 3802 to 3809 inclusive are met.

3802. The installation and maintenance of the supply system shall be supervised by a qualified company acceptable to the authority having jurisdiction.

3803. Plans showing the relative location of appliances, tanks, pumps, valves, piping, and elevation of buildings and their lowest floors relating to the proposed installation shall be submitted to and approved by the authority having jurisdiction.

3804. Only appliances equipped with primary safety controls specifically listed for the appliance shall be connected to such a system.

3805. Appliances so supplied shall be located within the lowest story, cellar or basement of each building.

3806. A readily accessible manual shutoff valve shall be installed in the supply line directly adjacent to the point at which the supply line enters the building served. This valve may be either inside or outside of the building, but if outside, it shall be protected from weather and damage.

3807. An automatically operated device which will shut off the oil supply at or ahead of the point where it enters the building in case the supply line within the building is broken shall be installed on the appliance side of the manual shutoff valve required in 3806. This device shall be protected from damage, and it shall be secured to the building or equivalent solidity obtained by some other means.

3808. Means shall be provided to limit the oil pressure at the appliance inlet to a maximum of 3 psi.

3809. A manual reset, or equivalent means, shall be provided to automatically shut off the oil supply to the appliance if the oil pressure at the appliance inlet exceeds 8 psi.

390. Tests of Piping.

3901. After installation and before being covered, piping shall be tested for leaks. Piping shall be tested hydrostatically, or with equivalent air pressure, at not less than 1½ times the maximum working pressure but not less than five pounds per square inch at the highest point of the system. The

test shall be made so as not to impose a pressure of more than ten pounds per square inch on the tank. This test shall be maintained for at least 30 minutes or for sufficient time to complete visual inspection of all joints and connections. Instead of a pressure test, suction lines may be tested under a vacuum of not less than 20 inches of mercury maintained for at least 30 minutes.

3902. When the vertical length of the fill and vent pipes is such that when filled with liquid the static head imposed exceeds 10 psi, the piping shall be tested hydrostatically to a pressure equal to the static head thus imposed. (See 2026.)

CHAPTER 4.

INSTALLATION OF OIL BURNERS AND OIL-FIRED UNITS.

400. General Requirements.

4001. Oil burners may be installed in boilers and furnaces. They may also be permitted by authorities having jurisdiction for use in firing ovens, water heaters, ranges, special furnaces and the like.

4002. Where oil burners are installed in appliances originally designed for solid fuel, the ash door of the appliance shall be removed or bottom ventilation otherwise provided to prevent the accumulation of vapors in the ash pit, unless the ash pit is used as part of the combustion chamber.

4003. Oil-fired appliances shall be installed in rooms that are large compared with the size of the appliances, unless they are specifically listed for installation otherwise. In no case shall an oil-fired unit be installed with less clearance from combustible material than that for which it is listed.

4004. A suitable combustion chamber of firebrick, stainless steel, or other material as furnished by the manufacturer or specified in his installation instructions shall be employed.

4005. Prior to installation of an oil burner, the furnace, boiler or appliance shall be examined and shown to be in good condition and repair and that the combustion chamber and flue gas passages are tight against leaks.

410. Posting of Instructions.

4101. Complete instruction for the care and operation of the central heating appliances as furnished by the manufacturer shall be conspicuously posted near the equipment.

420. Controls.

4201. Oil burners other than oil stoves with integral tanks, shall be provided with some means for manually stopping the flow of oil to the burner. Such device or devices shall be placed in a convenient location at a safe distance from the burner. With

electrically driven equipment this may be accomplished by an identified switch in the burner supply circuit, placed near the entrance to the room where the burner is located. A valve in the oil supply line operable from a location reached without passing near the burner may also be used.

4202. Oil burners for which a competent attendant will not be constantly on duty in the room where the burner is located while the burner is in operation shall be equipped with a primary safety control of a type specifically listed for the burner with which it is used.

NOTE: Burners and oil-fired units so equipped are listed by Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada as Oil Burners with primary safety controls and Oil-Fired Units with primary safety controls respectively.

4203. Oil burners for which a competent attendant will be constantly on duty in the room where the burner is located, while the burner is in operation, are not required to be equipped with primary safety controls. When primary safety controls are installed in connection with oil burners of this type such automatic devices shall be of a type specifically listed for use with the burner to which they are attached.

NOTE: Oil burners of this type are listed by Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada as Industrial Oil Burners without primary safety controls.

4204. Primary safety controls for burners may consist of the combustion type electrical control or an anti-flooding device. The proper control to be furnished with each burner is indicated in the listing by the testing agency.

4205. Each appliance fired by oil burners and each oil-fired unit shall be provided with automatic limit controls which will prevent unsafe pressure or low water in a steam boiler or overheating within a hot-water boiler, furnace or heater.

NOTE: All "closed" hot water boilers should, in addition to temperature limit switch protection, be provided with at least one ASME Code rated relief valve. If the boiler BTU output, determined in accordance with the ASME Code, paragraph H-44 is greater than relief valve BTU rating, additional relief valves or rupture discs should be provided so that the combined BTU rating of all relief devices is equal to or greater than the boiler BTU output rating. In addition, protection against an emergency low water condition (such as may originate from prolonged water discharge from a re-

lief valve; water leakage from system; inoperative water feeder valve; or water line shut off) is recommended, as this is the only method to cause automatic cessation of burner firing in the event of low water.

4206. Limiting controls and low-water shutoffs intended to prevent unsafe operation of heating equipment by opening an electrical circuit to the burner or oil shut-off 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.

NOTE: The purpose of this requirement is to avoid interposing in the limit control circuit other controls the failure of which may be the cause of an unsafe condition which the limit control is intended to prevent. However, a limit control may interrupt the pilot circuit of a magnetic type motor controller which in turn directly opens the safety circuit when it is necessary to interrupt a single phase circuit carrying a load greater than the capacity of available limit controls or to interrupt a multiphase circuit.

4207. A water heater shall be provided with water pressure, temperature and vacuum relief devices. Means shall be provided to prevent siphoning in any boiler or tank to which any circulating water heater is attached.

NOTE: A cold water tube with a hole near the top is commonly accepted means to prevent siphoning.

4208. Electric motor-driven oil burners of the type described in 4203 with integral oil pumps and electric motor-driven pump sets for use with such burners not equipped with integral pumps, shall be provided with a motor controller incorporating no-voltage protection to be wired into the power supply to the motor.

NOTE: On failure of voltage, such controllers cause and maintain the interruption of the power from the main circuit. These controllers are included in Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada "Gas and Oil Equipment List" under the heading "Industrial Control Equipment".

4209. In systems where either steam or air is used for atomizing the oil or where air for combustion is supplied by a source which may be interrupted without shutting off the oil supply, the oil and atomizing or air supply shall be interlocked in a manner to immediately shut off the oil supply upon failure of the atomizing or air supply.

NOTE: Burners listed by Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada conform to this requirement.

4210. When automatically operated burners are used in installations equipped with forced or induced draft fans or both, means shall be provided to immediately shut off the oil supply upon fan failure.

NOTE: Oil-Fired Units listed by Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada are so equipped.

4211. Oil burners not equipped to provide safe automatic restarting after shut down shall require manual restarting after any control functions to extinguish the burner flame.

4212. An acceptance test shall be conducted where more than one burner is fired in a single combustion chamber or one burner is adapted to firing two or more combustion chambers, to make sure that the primary safety control will function properly in the event of ignition failure or unsafe flame extinguishment at one or more burners.

430. Requirements for Specific Appliances (Clearances, Mounting, Etc.).

4301. Boilers, Furnaces, Floor-Mounted Unit Heaters and Water Heaters.

(a) Oil-fired appliances shall be installed in rooms that are large compared with the size of the appliance except that an appliance specifically listed for installation in a confined space such as an alcove or closet may be so installed when the installation is in compliance with the listing. In alcove and closet installations, the clearances from the appliance to the walls and ceilings shall be not less than as specified in the listing, regardless of the type of construction.

(b) Appliances in rooms shall be installed with the clearances from combustible material not less than as indicated in Figure 3 and Table 6, except that appliances specifically listed for installation at lesser clearance may be installed in accordance with their listing. In no case shall the clearance be such as to interfere with the requirements for combustion air and accessibility. See Sections 130 and 140. For installation of chimney connector see Paragraph 1602.

(c) Appliances may 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 Appendix B.

(d) Floor-mounted appliances, except as provided in Paragraphs (e) and (f), shall be placed on the ground, or on floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material against the underside thereof, or on fire-resistive slabs or arches having no combustible material against the underside thereof. Such construction shall extend not less than 12 inches beyond the appliance on all sides.

(continued on page 31–57)

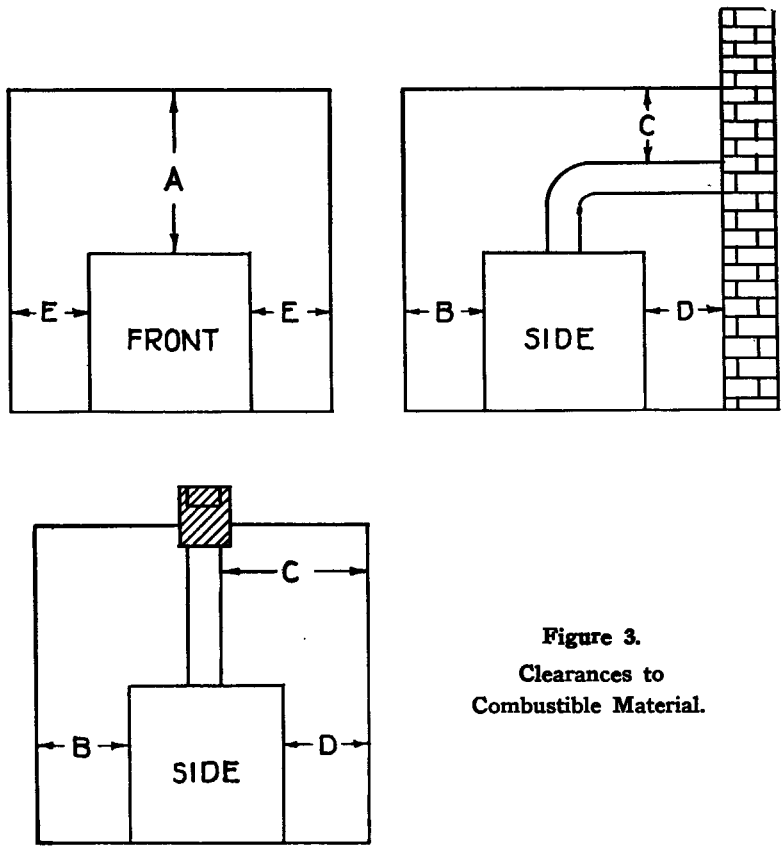


Figure 3.
Clearances to Combustible Material.

TABLE 6

CLASSIFICATION AS TO TYPE OF APPLIANCE	A ABOVE(1)	B FRONT	C CHIMNEY CONNECTOR(4)	D REAR	E SIDES
Form I	2(2)	24	18	6	6
Form II(3)	6	24	18	6	6
Form III	18	48	18	18	18
Form IV	48	96	36	36	36
Form V(3)	6	24	18	18	18

NOTES: (1) This column indicates clearances above the top of the appliance or above the top and from the sides of furnace bonnet or plenum.

(2) This clearance may be reduced to 1 inch for a listed, forced air or gravity system equipped with a limit control that cannot be set higher than 200° F.

(3) The clearance from the bottom of a suspended furnace or unit heater to combustible material shall be not less than 18 inches.

(4) See Paragraph 1602 for installation of chimney connectors.

Description of Classifications — Refer to Table 6.

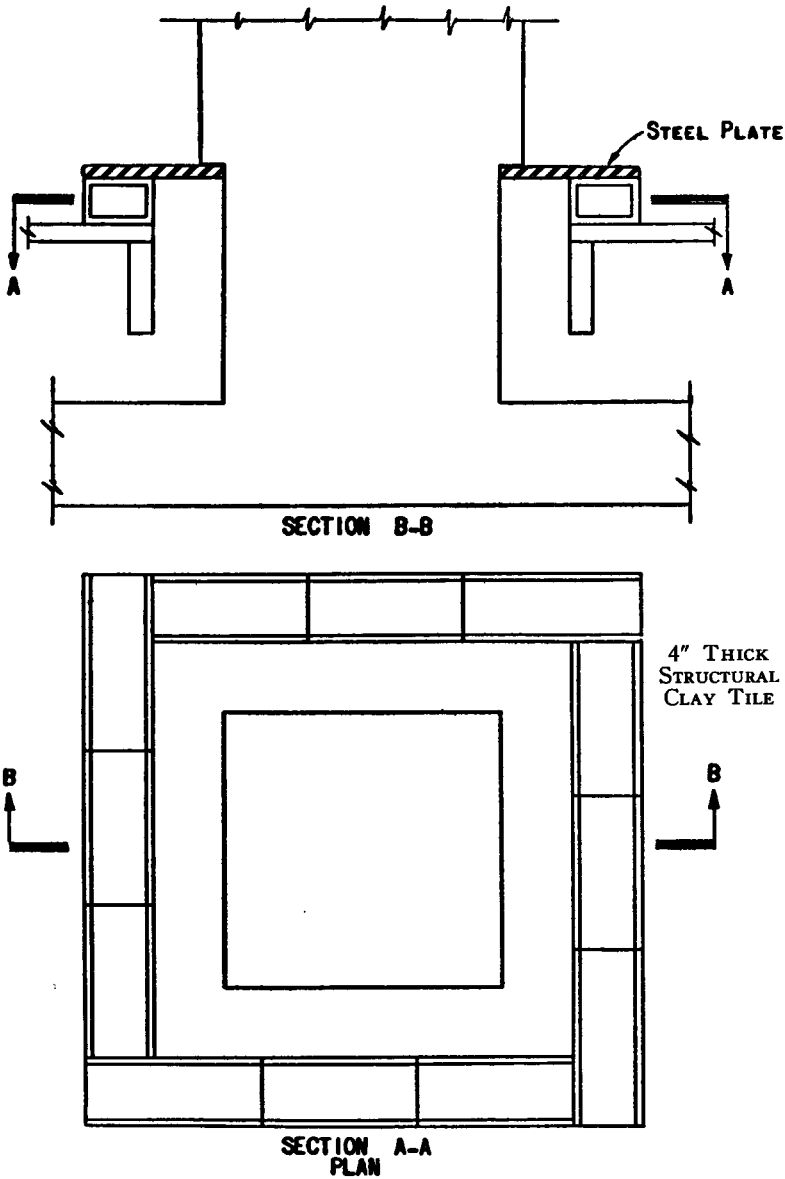
FORM I. Automatically fired warm-air furnaces, except horizontal types, and floor mounted unit heaters equipped with approved limit controls that cannot be set higher than 250° F., not larger than 100 cubic feet in size (excluding blower compartments and burner equipment).

FORM II. Horizontal type warm-air furnaces, and water-wall type heating boilers operating at not in excess of 250° F. for water boilers and at not over 15 pounds per square inch gauge pressure for steam boilers, and water heaters, not larger than 100 cubic feet in size (excluding burner equipment and blower compartments of furnaces).

FORM III. Low-heat appliances, which include steam boilers operating at not more than 50 pounds per square inch gauge pressure, or not larger than ten boiler horsepower regardless of operating pressure, and boilers, furnaces except floor furnaces, and heaters not classified under Forms I, II, IV, and V.

FORM IV. Medium-heat appliances, which include steam boilers other than as classified above.

FORM V. Suspended-type unit heaters not more than 100 cubic feet in size (excluding fan and burner equipment).



Installation of Downflow Furnace on Combustible Floor
Figure 4.

(e) Appliances listed specifically for installation on a floor constructed of combustible material may be placed in accordance with the conditions of such listing.

(f) Appliances may 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.* An appliance listed for installation under Form I or II in Table 6 may be placed on a combustible floor protected with hollow masonry not less than four inches thick covered with sheet metal not less than 24 gauge. 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. Figure 4 shows a permissible variation for placing the hollow masonry to accommodate a downflow furnace. For such installations the furnace shall be securely anchored to maintain the clearances required in Table 6.

(g) The supply and return duct system of a central heating appliance shall be installed in accordance with the Standards for Air Conditioning and Ventilating Systems of Other Than Residence Type, No. 90A and Residence Type Warm Air Heating and Air Conditioning Systems, No. 90B.**

(h) 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.

(i) A downflow 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.

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

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*For details of protection reference may be made to the Code for the Installation of Heat Producing Appliances, obtainable from the National Board of Fire Underwriters, 85 John St., New York, N. Y. 10038, or Part 6 of the National Building Code of Canada published by The National Research Council, Ottawa.

**Published in National Fire Codes, Vol. 4, and printed in separate pamphlets; also available from the National Board of Fire Underwriters, 85 John St., New York, N. Y. 10038, and The Canadian Underwriters Association, Montreal.

4302. Attic Furnaces.

(a) A furnace may be installed in an attic provided it is listed for such installation and installed in accordance with its conditions of listing.

4303. Duct Furnaces.

(a) A duct furnace except as provided in Paragraph (c) below shall be installed with clearances of at least 6 inches to adjacent walls, ceilings and floors of combustible material except a duct furnace listed for installation at lesser clearance may be installed in accordance with its listing.

(b) A duct furnace flue pipe shall be installed to provide a clearance to combustible material of not less than 18 inches.

(c) A duct furnace and its chimney connector may 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 8 and the requirements for combustion air and accessibility comply with Sections 130 and 140.

(d) A duct furnace shall be firmly supported.

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

(f) Controls shall be located outside the duct except for the sensing element of a control.

4304. Floor Furnaces.

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

(b) The floor around the furnace shall be braced and headed with a framework of material not lighter than the joists. Floor furnaces shall be supported independently of the floor grills.

(c) With the exception of wall-register models, a floor furnace shall be placed not closer than six inches to the nearest wall, and wall-register models shall be placed not closer than six inches to a corner. The furnace shall be so placed that a door, drapery, or similar object cannot be nearer than 12 inches to any portion of the register of the furnace.

(d) The bottoms of the floor furnaces shall have at least six inches clearance from the ground. Where the ground must be excavated to provide this clearance, the excavation shall extend at least 12 inches beyond the furnace on all sides, and not less than 18 inches on the control side. Where such excavation exceeds 12 inches, or the ground contour and ground moisture conditions are such that water seepage is likely, a watertight pan constructed of copper, galvanized iron, or other suitable corrosion resistant material and properly anchored in place, or a waterproof concrete pit shall be provided under the furnace. The sides of a pan or pit shall extend four inches above ground level.

(e) Floor furnaces shall be made readily accessible. Openings in foundation walls and trap doors in floors shall be not smaller than 18 by 24 inches. Under-floor passageways to the furnace shall be not less than 24 inches high by 24 inches wide.

(f) Provision shall be made for proper air supply for combustion.

(g) Listed floor furnaces may be installed in an upper floor provided the furnace assembly projects below into a utility room, closet, garage, or similar nonhabitable space. In such installations, the floor furnace shall be enclosed completely (entirely separated from the nonhabitable space) with means for air intake and with access facilities for servicing on the control side. The minimum furnace clearances shall be six inches to all sides and bottom. The enclosure shall be constructed of Portland cement plaster on metal lath or material of equal fire resistance.

(h) No floor furnace shall be installed in the floor of any aisle or passageway of any auditorium, public hall or public assembly room or in an exit way from any such room or space.

(i) Except as indicated in (j) below, a floor furnace chimney connector shall be installed with clearances to combustible material of not less than nine inches.

(j) A floor furnace chimney connector may be installed with lesser clearances to combustible material provided the combustible material is protected as described in Appendix B.

4305. Furnaces Used with Refrigeration Systems.

(a) A furnace shall not be installed in conjunction with a refrigeration coil when 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 the cooling coil at the air throughput required for heating or cooling whichever is greater.

(b) 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. 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.

(c) When furnaces are to be located upstream from cooling units, the cooling unit shall be so designed or equipped as to not develop excessive temperatures or pressures.

(d) Furnaces may be installed downstream from evaporative coolers or air washers if the heating element is made of corrision-resistant material. 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, are considered to be corrosion resistant. Air washers operating with chilled water which delivers air below the dew point of the ambient air at the appliance are considered as refrigeration systems.

4306. Industrial Furnaces and Boilers, Stationary Type.

(a) Industrial furnaces and power boilers, stationary type, shall include low heat, medium heat and high heat appliances. See Definitions for examples of each.

(b) Low-heat appliances:

(1) Low-heat appliances shall be installed with clearances not less than those indicated by Form III, in Table 5.

(2) Low-heat appliances which are approved for installation with lesser clearances than specified in paragraph (1) above, may be installed in accordance with their listing.

(3) Low-heat appliances may be installed with lesser clearances to combustible material provided the combustible material is protected as described in Appendix B.

(4) Floor-mounted low-heat appliances, except as provided in Paragraphs (5) and (6) below, shall be placed on the ground, or on floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material against the underside thereof, or on fire-resistive slabs or arches having no combustible material against the underside thereof. Such construction shall extend not less than 12 inches beyond the appliance on all sides.

(5) Appliances which are listed specifically for installation on a floor constructed of combustible material may be placed in accordance with the conditions of such listing.

(6) Low-heat appliances may 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.*

(c) Medium-heat appliances:

(1) Medium-heat appliances shall be installed with clearances not less than those indicated by Form IV, Table 6.

(2) Medium-heat appliances, except as provided in Paragraph (3) below, shall be placed on the ground or on floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material against the underside thereof, or on fire-resistive slabs or arches having no combustible material against the underside thereof. Such construction shall extend not less than three feet beyond the appliance on all sides.

(3) Medium-heat appliances may 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.*

(4) Rooms containing medium heat appliances shall be provided with means of ventilation adequate to prevent accumulation of hot air over or near the appliance.

(d) High-heat appliances:

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

(2) Rooms containing high-heat appliances shall be provided with means of ventilation adequate to prevent accumulation of hot air over or near the appliance.

*For details of protection reference may be made to the Code for the Installation of Heat Producing Appliances, obtainable from the National Board of Fire Underwriters, 85 John St., New York, N. Y. 10038, or Part 6 of the National Building Code of Canada published by The National Research Council, Ottawa.

(3) High-heat appliances shall be mounted on the ground, or on floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material or construction against the underside thereof, which floors shall in all cases extend not less than ten feet on all sides and not less than 30 feet at the front or side where hot products are removed.

4307. Miscellaneous Heaters. (Air Heater, Salamander, etc.).

(a) A direct-fired heater, salamander, shall not be used within an enclosed space or in proximity to combustible material. It may be used where salamanders fired by coal or coke are allowed.

(b) An air heater shall be of a type designed to discharge air at a temperature of not more than 250° F.

(c) A flexible duct, if used, shall be made of material resistant to heat and flame and that will withstand prolonged exposure to temperatures as high as 250° F.

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

4308. Recessed Wall Furnaces.

(a) Listed recessed wall furnaces may be installed in combustible construction. Because of the necessity for closely correlating the installation of recessed wall furnaces with the building construction, the authority having jurisdiction shall be consulted for the proper installation methods to be followed. Recessed wall furnaces shall be installed in accordance with the manufacturer's instructions.

(b) Recessed wall furnaces shall be located so as not to cause a hazard to walls, floors, curtains, furniture, doors, etc. The face of a warm air register shall be not less than 36 inches from any wall or combustible surface directly opposite the register.

(c) Panels, grills, and access doors which must be removed for normal servicing operations shall not be attached to the building construction.

(d) Adequate combustion and circulating air shall be provided.