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Flammable Liquids

STANDARDS
for the
Installation of
OIL BURNING EQUIPMENT

MAY
1955

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NATIONAL FIRE PROTECTION ASSOCIATION
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National Fire Protection Association

International

Executive Office: 60 Batterymarch St., Boston 10, Mass.

The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the cooperation of its members in establishing proper safeguards against loss of life and property by fire. Its membership includes over a hundred and ninety national and regional societies and associations (list on outside back cover) and more than fifteen thousand individuals, corporations, and organizations. Anyone interested may become a member; membership information is available on request.

This pamphlet is one of a large number of publications on fire safety issued by the Association including periodicals, books, posters and other publications; a complete list is available without charge on request. All NFPA standards adopted by the Association are published in six volumes of the **National Fire Codes** which are re-issued annually and which are available on an annual subscription basis. The standards, prepared by the technical committees of the National Fire Protection Association and adopted in the annual meetings of the Association, are intended to prescribe reasonable measures for minimizing losses of life and property by fire. All interests concerned have opportunity through the Association to participate in the development of the standards and to secure impartial consideration of matters affecting them.

NFPA standards are purely advisory as far as the Association is concerned, but are widely used by law enforcing authorities in addition to their general use as guides to fire safety.

Definitions

The official NFPA definitions of shall, should and approved are:

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations, or that which is advised but not required.

APPROVED refers to approval by the authority having jurisdiction.

Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters.

Approved Equipment

The National Fire Protection Association does not "approve" individual items of fire protection equipment, materials or services. The standards are prepared, as far as practicable, in terms of required performance, avoiding specifications of materials, devices or methods so phrased as to preclude obtaining the desired results by other means. The suitability of devices and materials for installation under these standards is indicated by the listings of nationally recognized testing laboratories, whose findings are customarily used as a guide to approval by agencies applying these standards. Underwriters' Laboratories, Inc., Underwriters' Laboratories of Canada and the Factory Mutual Laboratories test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

Standards for the Installation of Oil Burning Equipment

NFPA No. 31 — 1955

This edition of these standards was adopted by the National Fire Protection Association on May 18, 1955 upon the recommendation of the Sectional Committee on Liquid Fuel Burning Equipment and approved by the entire Flammable Liquids Committee. This edition is a complete revision and consolidation of NFPA Standards No. 31, Oil Burning Equipments; NFPA No. 39-L, Range Oil Burner Ordinance; and NFPA No. 310, Small Heating and Cooking Appliances. The present text supersedes and replaces the above-mentioned standards and ordinance.

Oil burning equipment standards date from 1902 when they were issued by the National Board of Fire Underwriters, based upon the recommendations of their Committee of Consulting Engineers. Subsequently, the activities of this Committee were merged with those of the NFPA and a completely revised edition was presented to the Association in 1913 by the NFPA Committee on Explosives and Combustibles. At the formation of the Flammable Liquids Committee, the jurisdiction over this standard was placed under their control. With the division of the Flammable Liquids Committee into sectional committees, the responsibility for these standards was placed with the Sectional Committee on Liquid Fuel Burning Equipment with any action subject to approval by the entire NFPA Flammable Liquids Committee. These standards have been revised by the NFPA at frequent intervals and also published by the National Board of Fire Underwriters and the Dominion Board of Insurance Underwriters.

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OIL BURNING EQUIPMENT

NFPA No. 31—1955

FOREWORD

The purpose of this standard is to consolidate all pre-existing standards pertaining to oil burning equipment and present it in a form which would be more definite, specific, complete and understandable. The intent of the Committee is to have this standard written in such a manner that it will be suitable for legal adoption as well as to serve as a guide to good practice.

Previous to the issuance of this edition the NFPA had separate standards for range oil burners (NFPA No. 39-L), small heating and cooking appliances (NFPA No. 310), and oil burning equipments (NFPA No. 31). The consolidation of these standards and suggested ordinance will aid the user not only by having one standard instead of three to which to refer but also will assure a continuity of requirements.

One of the principal problems confronting the user of oil burning equipment standards is the differences which are in existence on definitions of specific types of oil burning equipment. This difference of terminology exists between industry, enforcement officials, testing laboratories and between different sections of the continent. Several pages of detailed definitions have been devoted in this standard to assist in a better understanding and uniformity of oil burning equipment.

One of the deterrents to a better understanding of oil burning equipment is the wide variety of equipment available. Also there are some types of oil burning equipment which are used only in limited areas. For examples, the conversion range oil burner is used almost exclusively in the New England area, the portable kerosene heater in the South and East, the vaporizing pot type burner in the Mid-West and Far West. Even the fuel burned may be known by several different names. For example, Fuel Oil No. 1 may be known also as kerosene, range oil or coal oil. Fuel Oil No. 1, in some sections of the country, has the same characteristics as the others but is not as highly refined and should not be used with certain types of equipment. In other sections these oils are all identical and may be used interchangeably.

These standards also include for the first time detailed requirements for combustion air and flue connections which are vitally important to the safe and efficient use of oil burning equipment. Also for the first time clearance requirements to combustible construction are given for specific types of oil burning equipment. For those specifically interested in kerosene and oil stoves, portable kerosene heaters and conversion range oil burners there is a great number of new requirements. These requirements include design features, installation and particularly the location and handling of fuel oil tanks and containers.

Contents.

STANDARDS FOR THE INSTALLATION OF OIL BURNING EQUIPMENT

CHAPTER I

General Provisions

100. Definition of Terms.

1001. For the purpose of these installation standards the following terms shall be interpreted in accordance with the following definitions.

Air Heater — An indirect oil-fired vented 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, blast furnace, brass furnace, brick kiln, cupola, 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 indirect-fired vented appliance built in conformance with the A.S.M.E. Boiler Construction Code, 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 vented appliance comprising one of the following classes as defined herein: boiler, central furnace, floor furnace or recessed heater.

Chimney — A vertical masonry or reinforced concrete shaft enclosing one or more flues.

Combustible Construction — As pertaining to materials adjacent to or in contact with heat-producing appliances and flue pipes, steam pipes and warm air ducts connected thereto, combustible construction shall mean structures made of or surfaced with wood, compressed paper and plant fibers or other material that will ignite and burn whether plastered or unplastered. Plastered construction having combustible supports regardless of the type of lath employed and gypsum or other wallboard surfaced with combustible material are classified as combustible construction.

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.

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 Oil Burner — A burner for field installation in heating appliances such as boilers, furnaces, etc. It may be furnished with or without a primary safety control. Under special circumstances it may be installed for firing ovens, water heaters, ranges, special furnaces and the like. A burner of this type may be a pressure atomizing gun type, a horizontal or vertical rotary type or a mechanical or natural draft vaporizing type.

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 were 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 flue pipe 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 fire-resistive or semi-fire-resistive and the wall is carried up tightly against the underside of the roof slab.

Flue — A passageway or conduit to convey products of combustion (flue gases) to the outer air.

Flue Collar — That portion of an appliance designed for attachment of the flue pipe.

Flue Pipe (Breeching) — The conduit connecting the heating appliance with the vertical flue.

Fuel Oil — Kerosene or any hydrocarbon oil as specified by U.S. Department of Commerce Commercial Standard CS12 or A.S.T.M. D396, 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 — A self-contained indirect-fired vented appliance intended primarily to supply heated air through ducts to spaces remote from or adjacent to the appliance location as well as to the space in which it is located.

Furnace, Downflow — A forced-air type central furnace designed with air flow through the furnace 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, Forced Air — A central furnace equipped with a fan or blower which provides the primary means for circulation of air.

Furnace, Gravity — A central furnace depending primarily on circulation of air by gravity.

Furnace, Heating — A central furnace or a floor-mounted unit heater.

Furnace, Horizontal — A forced-air type central furnace designed with air flow through the furnace essentially in a horizontal path.

Furnace, Stationary-Type Industrial—A low, medium or high-heat appliance 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.

Furnace, Upflow — A central furnace designed with air flow through the furnace essentially in a vertical path, discharging air at or near the top of the furnace.

Gallon — A U. S. gallon.

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 designed so that combustion products or flue gases are not mixed in the appliance with the medium (i.e. air) being heated; hence is provided with a flue collar which shall always be connected to a suitable flue for conveying the products of combustion from the appliance to the outdoors.

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

Kerosene Stove — An unvented, 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 these standards refers to equipment bearing the inspection label of a nationally recognized testing agency.

Listed — The word "listed" used throughout these standards 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 must be identifiable by means of a label or other distinguishing marking specified in the current list published by the testing agency.

Oil Burning Equipment — An oil burner of any type together with its tank, piping, wiring, controls and related devices and shall include all conversion 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, electrical 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 — An unvented, self-contained, self-supporting heater, with integral reservoir, designed to be carried from one location to another.

Prefabricated Flue — A special listed flue suitable for use with gas, oil, coal or wood-fired low-heat appliances, where the flue gas temperatures do not exceed 1000° F. continuously and do not exceed 1400° F. for infrequent brief periods of forced firing.

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 Heater — A self-contained, indirect-fired vented appliance complete with grills or equivalent, designed for incorporation in or permanent attachment to a wall, floor, ceiling 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 — An above-the-floor stove for direct heating of the space in and adjacent to that in which the device is located, without external heating pipes or ducts.

Room Heater, Circulating — A room heater designed to transfer the heat of combustion to convective heat by the circula-

tion of air heated by contact with the heating surfaces. A stove with openings in the outer jacket to permit direct radiation from the heating surfaces is classified as a radiant type from a safety point of view.

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

Sump — The receptacle employed with a vacuum tank.

Tank, Auxiliary — An auxiliary supply tank listed for the purpose to be interposed in the supply piping between a burner and its main 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, indirect-fired vented air-heating appliance, 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 is an appliance consisting of a combination of heating element and fan, having a common enclosure and placed within or adjacent to the space to be heated.

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.

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.

Wall Heater — See Recessed Heater.

Water Heater — A vented appliance for heating service water; excluding hot water heating boilers.

110. Application and Scope.

1101. These standards apply 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. These standards are 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 these standards 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 these standards. Devices listed for a specific purpose by a nationally recognized testing agency may be considered as meeting the requirements of these standards.

130. Installation.

1301. The installation shall be made in accordance with the instructions of the manufacturer, by qualified mechanics experienced in making such installations.

1302. 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.

1303. Oil-burning appliances shall be installed only in locations where combustible dusts and flammable gases or vapors are not generally present.

1304. After installation of the oil-burning equipment, a complete cycle of operation tests shall be conducted to determine that the burner is operating in a safe and acceptable manner and that all safety devices function properly.

140. Ventilation.

1401. Oil-burning equipment shall be installed in a location in which the facilities for ventilation permit satisfactory combustion of oil and proper ventilation under normal conditions of operation and use.

1402. For installations in residences and similar usages, this requirement may be met by application of one of the following:

(a) Where appliances are installed without enclosed appliance rooms in buildings of conventional brick, frame or stone construction without storm windows or tight doors, infiltration is normally adequate to provide air for combustion and ventilation.

(b) Where appliances are installed in an enclosed appliance room, air for combustion and ventilation shall be provided by openings communicating with areas of adequate air supply. See Fig. 1.

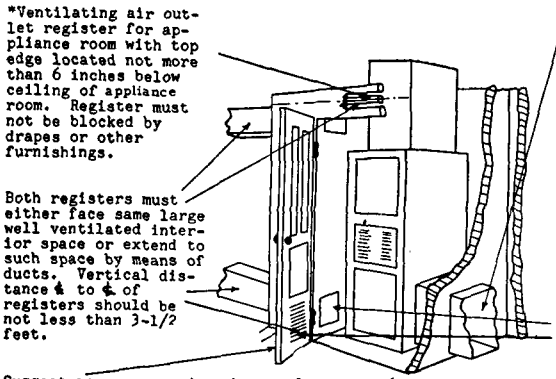
(1) Each opening shall have a total free area of not less than one square inch for each 1000 Btu per hour input (140 square inches for each gallon per hour input) to the appliance or appliances installed or not less than specified in the listing of the appliance. The openings, if not round, shall have a height approximately one-half their width.

(2) Ducts, if used as hereinafter described, shall be of the same cross-sectional area as the openings to which they are connected, and shall communicate with the source of air supply. The minimum dimension of a rectangular or oval duct shall be not less than three inches. Any duct from the top opening shall be horizontal or pitched upward. If the air inlet is obtained from a space located above the appliance room, a duct shall be used to convey the air from the source to a level not more than one foot above the base of the appliance.

(3) If the appliance is in an enclosed appliance room within a building having adequate air infiltration, two permanent openings from the appliance room shall be used.

(4) If the appliance room is within, a building of tight construction, the two openings called for in Fig. 1 shall communicate directly or by means of ducts with the outdoors or with some space that freely communicates with the outdoors.

(c) When the appliance is in a building of tight construction but not in an enclosed appliance room, a permanent opening of adequate size, or equivalent group of openings, located near the floor shall be provided, which shall communicate directly or by means of a duct to the outdoors or with some space that freely communicates with the outdoors; if the normal air change within the space is not sufficient to supply the air required for proper operation of the appliance.



*Each opening to have a total free area of not less than the area specified in 1402(b)(1)

Figure 1. Illustration Showing Air Openings Necessary to Supply Air for Combustion When Appliance is Installed in Confined Space.

1403. Operation of exhaust fans, kitchen ventilation systems or fireplaces may create conditions requiring special attention to avoid unsatisfactory appliance operation.

1404. For the installation of commercial and industrial equipment, permanent facilities for supplying an ample amount of outside air shall be provided in accordance with the burner manufacturer's instructions. Where no manufacturer's instructions are available, an opening to outside air should be

provided having an area of at least ten square inches for each gallon of fuel burned per hour.

150. Appliances Required to be Flue Connected.

1501. All oil-fired appliances shall be flue-connected except:

(a) Direct-fired heaters.

(b) Listed kerosene stoves.

1502. Oil-fired appliances requiring flues shall be flue connected by one of the methods specified in Section 160.

160. Chimneys, Smokestacks and Flues.

1601. Chimneys and Smokestacks.

(a) Chimneys and smokestacks may be employed for flue connections and shall be built in conformance with accepted building code practice.*

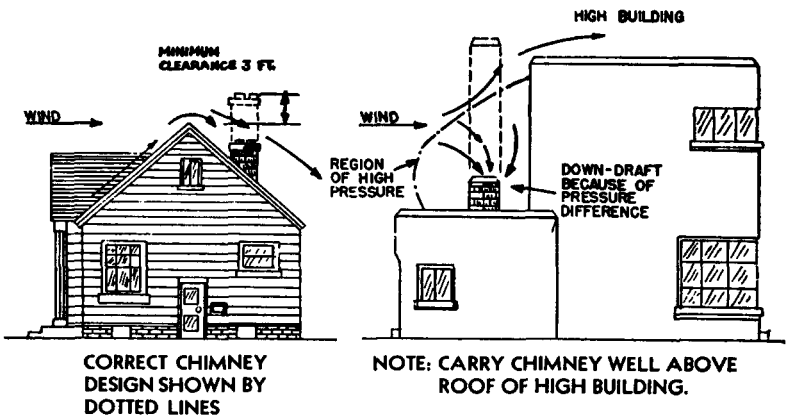


Figure 2. Typical Chimney Conditions Apt to Result in Back Drafts.

(b) A chimney, smokestack, or a prefabricated flue shall extend at least three feet above the highest point where it passes through the roof of a building and at least two feet higher than any ridge within ten feet of such building (see Figure 2).

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*Reference may be made to the National Building Code of the National Board of Fire Underwriters, 85 John St., New York 38, N. Y.

1602. Prefabricated Flues.

(a) Prefabricated flues for low-heat appliances listed by a nationally recognized testing agency and installed in full compliance with listing requirements and the manufacturer's instructions may be employed for flue connections. (Also see 1601 "b".)

1603. Flue Pipe.

(a) Every flue pipe shall connect to a chimney, smokestack or a prefabricated flue as specified in 1601 or 1602.

(b) No flue pipe shall pass through any floor or ceiling.

(c) No flue pipe of any medium or high-heat appliance shall pass through any combustible wall or partition. Flue pipes 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 pipe, or (2) metal or burned fire-clay thimbles built in brickwork or other approved fireproofing materials extending not less than eight inches beyond all sides of the thimble; or in lieu of such protection all combustible material in the wall or partitions shall be cut away from the flue pipe a sufficient distance to provide the clearance required from such flue pipe — any material used to close up such opening shall be noncombustible insulating material.

(d) The flue pipe 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 flue pipe for cleaning, in which case the thimble shall be permanently cemented in place with high-temperature cement.

(e) The flue pipe shall not be smaller than the flue collar of the appliance or sized as recommended by the appliance manufacturer, and the flue shall be readily accessible for cleaning.

(f) The flue pipe shall be of steel and shall be in good condition. A breeching may be made of refractory masonry.

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

(h) The flue pipe shall be located to avoid sharp turns or other construction features which would create excessive resistance to the flow of flue gases.

(i) The flue pipe shall be securely supported and joints fastened by sheet metal screws or rivets.

(j) An appliance should be placed so that the flue pipe connecting the appliance to the chimney or vertical flue will be as short as practicable. The horizontal length of the flue pipe for natural draft burners shall not exceed ten feet unless a draft booster is used. For appliances requiring a negative chimney draft, the flue pipe should be not longer than 75 per cent of the portion of the chimney or vertical flue above the flue pipe inlet.

1604. Draft.

(a) Chimneys, smokestacks and prefabricated flues shall be capable of producing a draft not less than that for which they are listed and recommended by the manufacturer of the appliance. To conform with this requirement, a draft booster may be used to increase low draft. A natural draft burner should be connected to an individual chimney or flue used for no other appliance.

(b) Flue downdraft conditions cause faulty operations thereby creating a hazard and where this condition exists corrective steps shall be taken.

1605. Draft Regulators.

(a) A draft regulator shall be provided for each oil-fired appliance unless the burner 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 flue pipe from an oil-fired appliance. Fixed baffles, downstream of the draft regulator, shall not be classified as dampers. Fixed baffles shall be so constructed that they can not close off more than 80 per cent of the cross-sectional area of the flue pipe.

170. Electrical Wiring and Equipment.

1701. Electrical wiring and equipment used in connection with oil-burning equipment shall be installed in accordance with the National Electrical Code (No. 70)*.

*NFPA Standard No. 70 published by the National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass. in National Fire Codes, Vol. V and in separate form; also available from the National Board of Fire Underwriters, 85 John St., New York 38, N. Y. (NBFU No. 70).

180. Fuel Oil.

1801. A burner shall be used only with a grade of fuel oil for which it is listed and as stipulated by the manufacturer. Crankcase oil or any oil containing gasoline shall not be used.

NOTE: The Gas and Oil Equipment List issued by Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada states, for each burner, the grade of fuel oil used in a burner shall be that for which the burner is listed and stipulated by the manufacturer.

190. Preheating of Oil.

1901. Where heavy oils are used, provision should 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.

1902. If a water or steam coil is installed in an oil tank, the coil should be connected to an indirect heater but in no case shall such coils be connected directly to a steam boiler operating at a pressure greater than 15 pounds per square inch gauge.

CHAPTER II

TANKS

200. Design and Construction of Tanks.

2001. GENERAL: A tank shall be used under substantially atmospheric pressure and shall be built of steel, concrete or other suitable material. Steel commonly known as "mill seconds" shall not be used. A tank built of material other than steel shall be designed to specifications embodying safety factors equivalent to those obtained in steel tanks built as specified herein. Joints shall be welded, riveted and caulked, or made tight by other approved process. All shop built tanks shall be tested by the manufacturer and proved tight against leakage under a test pressure of not less than five nor more than ten pounds per square inch (measured at the top of the tank). The thickness of steel employed in shop built tanks shall be not less than specified in the following requirements.

2002. UNDERGROUND TANKS OR ENCLOSED TANKS INSIDE OF BUILDINGS:

CAPACITY Gallons	MINIMUM THICKNESS OF STEEL Not Galvanized Manufacturers' Standard Gauge No.	Galvanized Manufacturers' Standard Gauge No.
285 or less	14	16
286 to 560	12	14
561 to 1,100	10	12
1,101 to 4,000	7	
4,001 to 12,000	3	
12,001 to 20,000	0	
20,001 to 30,000	000	

If adequate internal bracing is provided, tanks of 12,001 to 30,000 gallons capacity may be built of No. 3 gauge Steel.

NOTE: Tanks in this category labeled "Underground Storage Tanks" by Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada may be considered as meeting the requirements of this section.

2003. CONCRETE TANKS: Unlined concrete tanks shall be used only for storage of liquids having a gravity of 40 degrees API or heavier. Concrete tanks should be built in accordance with sound engineering practice. For general requirements reference should be made to the Standards for the Design and Con-

struction of Concrete Fuel Oil Storage Tanks (NFPA No. 30D-1922)*.

2004. UNENCLOSED TANKS INSIDE OF BUILDINGS: Unenclosed tanks inside of buildings shall not exceed 275 gallons individual capacity. They may be cylindrical or of a special form which has been demonstrated by appropriate tests to possess strength and tightness of an acceptable degree.

CAPACITY Gallons	MINIMUM THICKNESS OF STEEL Not Galvanized Manufacturers' Standard Gauge No.	Galvanized Manufacturers' Standard Gauge No.
10 or less	18	20
11 to 180	16	
181 to 275	14	

NOTE: Tanks in this category labeled "Inside Storage Tanks for Oil Burners" by Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada may be considered as meeting the requirements of this section.

2005. ABOVEGROUND TANKS, SHOP BUILT:

(a) Small, shop built, vertical tanks. Vertical tanks not over 1,100 gallons shall comply with the following:

CAPACITY Gallons	MINIMUM THICKNESS OF STEEL Manufacturers' Standard Gauge No.
60 or less	18
61 to 350	16
351 to 560	14
561 to 1,100	12

(b) Large, shop built, vertical tanks. Vertical tanks over 1,100 gallons shall comply with the following:

(1) The tops shall be either dished or cone-shaped and of not less than No. 10 gauge steel.

(2) The shell of the tank shall comply with the following:

MAXIMUM HEIGHT		MINIMUM THICKNESS OF STEEL Manufacturer's Standard Gauge No.
25′ or less	All Rings	7
25′–1″ to 30′	Bottom Ring	3
	Other Rings	7
30′–1″ to 35′	1st Two Bottom Rings	3
	Other Rings	7

*Published by the National Fire Protection Association in National Fire Codes, Vol. I; also available from the National Board of Fire Underwriters (No. 30), 85 John St., New York 38, N. Y.

All shell rings that are No. 3 gauge or heavier shall be at least five feet wide.

(3) The roof of the tank shall be securely fastened to the top ring of the shell with a joint having the same tightness as the joints between rings. The joint between roof and shell shall be weaker than any other joints in the shell of the tank, or the tank provided with other means for emergency relief in accordance with 2508 (b). Joints in the roof shall be welded or riveted or made tight by other process. The roofs of tanks shall have no unprotected openings.

(c) Small, shop built, horizontal tanks. Horizontal tanks not over 1,100 gallons capacity shall comply with the following:

CAPACITY Gallons	MINIMUM THICKNESS OF STEEL Manufacturers' Standard Gauge No.
60 or less	18
61 to 275	14
276 to 550	12
551 to 1,100	10

(d) Large, shop built, horizontal tanks. Horizontal tanks over 1,100 gallons capacity shall comply with the following:

MAXIMUM DIAMETER	MINIMUM THICKNESS OF STEEL Manufacturers' Standard Gauge No.
6′ or less	7
6′–1″ to 12′	3

Tank heads shall be dished, stayed, braced or reinforced.

NOTE: Underground tanks smaller than 2,500 gallons capacity, aboveground tanks and inside storage tanks for oil burners labeled by Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada may be considered as meeting the requirements of this section.

2006. ABOVEGROUND TANKS, FIELD ERECTED: Vertical tanks erected in the field and built in accordance with American Petroleum Institute Standard No. 12A, 7th Edition, March 1941, "Specification for Standard Tanks with Riveted Shells for Oil Storage" or American Petroleum Institute Standard No. 12C, 12th Edition, October 1954 "Specification for All Welded Oil Storage Tanks"* may be considered as meeting the requirements of this section.

*Copies of these standards are available from: American Petroleum Institute, 50 West 50th St., New York 20, N. Y.

210. Installation of Underground Tanks.

2101. Only a tank meeting the requirements of 2002 shall be buried underground.

2102. An underground tank shall be set on a firm foundation and surrounded with soft earth or sand well tamped in place and shall not be backfilled with cinders. A tank shall be covered with a minimum of two feet of earth, or shall be covered with not less than one foot of earth on top of which shall be placed a slab of reinforced concrete not less than four inches thick. When subjected to traffic or is likely to be so subjected in the future, a tank shall be protected against damage from vehicles passing over it by at least three feet of earth cover, or 18 inches of well tamped earth, plus either eight inches of asphaltic concrete or six inches of reinforced concrete. When asphaltic or reinforced concrete paving is used as part of the protection it shall extend at least one foot horizontally beyond the outline of the tank in all directions.

2103. Where a tank may become buoyant due to a rise in the level of the water table or due to its location in an area that may be subjected to flooding, precautions shall be observed to anchor the tank in place.*

2104. A tank for fuel oil shall be located not less than one foot measured horizontally from the nearest point of the shell to the nearest line of adjoining property that may be built upon and the nearest outside wall of any basement or pit. No tank shall be installed in such a manner as to endanger the foundation of any building.

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 Section 3402.)

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*Protection of Tanks Containing Flammable Liquids in Locations That May Be Flooded, NFPA No. 30A published in NFPA No. 30-L and in National Fire Codes, Vol. I; also available from the National Board of Fire Underwriters, 85 John St., New York 38, N. Y. (No. 30).

Table 1

Capacity of Tank, Gallons	Diameter of Vent, Iron Pipe Size
500 or less	1¼ in.
501 to 3,000	1½ in.
3,001 to 10,000	2 in.
10,001 to 20,000	2½ in.
20,001 to 30,000	3 in.

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.

220. Installation of Unenclosed Supply Tank Inside Building.

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

(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 275 gallons capacity shall meet the requirements of 2004.

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 standard 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 capacity and the total capacity of tanks so located shall not exceed 60 gallons.

(c) A supply tank shall be not larger than 275 gallons. Not more than four such tanks may be installed in the lowest story, cellar or basement of a building except as permitted by paragraph (d) below. Not more than two such tanks shall be connected to one oil burning appliance.

(d) In the case of buildings with multiple units of occupancy, each occupancy may contain not more than two 275-

gallon tanks provided there is separation between each occupancy consisting of an unpierced masonry wall or partition with a fire resistance rating of two hours. Such masonry wall or partition shall extend from the lowest floor to the ceiling above the tanks.

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 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. It is recommended that supply tanks larger than ten gallons be provided with a drain opening and proper fittings and valve to drain water and sediment. When a drain opening is provided the bottom of the tank shall be pitched toward the drain opening with a slope of not less than ¼ inch per foot of length.

2207. A shut-off 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 1¼ inch pipe size 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 designed and installed so that no oil or vapor will be discharged from the fuel supply system into the building.

2210. A glass gauge or sight feed, the breakage of which will allow the discharge of fuel from the fuel supply system, and the gauging of a tank by inserting a measuring stick are pronounced hazards and shall not be used.

2211. An inside tank provided with fill and vent pipes should be equipped with a device to indicate either visually or audibly at the fill point when the oil in the tank has reached a safe level.

2212. 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.

2213. Two supply tanks connected to the same burner as permitted by 2202, (c) and (d), may be cross-connected and provided with a single fill and a single vent pipe as described in Appendix A.

230. Installation of Enclosed Supply Tanks Inside Buildings.

2301. A supply tank larger than 275 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) and (d), shall be enclosed.

2303. Only a tank meeting the requirements of 2002 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 in buildings of ordinary construction.

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

(c) 50,000 gallons with an individual tank capacity not exceeding 25,000 gallons in any building; provided that the tank or tanks, enclosed as specified in 2307, are located in a fire-resistive or detached room cut off vertically and horizontally from other floors of the main building. These cutoffs, namely, walls, floor, and ceiling shall have a fire-resistive 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 275 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 6 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 2.

Table 2

Capacity of Tank, Gallons	Diameter of Vent, Iron Pipe Size
500 or less	1¼ in.
501 to 3,000	1½ in.
3,001 to 10,000	2 in.
10,001 to 20,000	2½ in.
20,001 to 30,000	3 in.

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.

2311. An enclosed supply tank shall be provided with a gauging device installed so that no oil or vapor will be discharged from the fuel supply system into the building and 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 level.

240. Installation of Outside Aboveground Tanks Not Larger Than 275 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 or the line of adjoining property. 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 capacity may be an ICC-5 Shipping Container (drum) and so marked, a listed safety can, or a tank meeting the requirements of 2004.

2403. A tank other than an ICC-5 Shipping Container having a capacity of not more than 275 gallons shall meet the requirements of 2004.

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

2405. Not more than two such tanks 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 275 gallons or less shall be securely supported by rigid noncombustible supports to prevent settling, sliding or lifting.

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

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

2410. A tank not larger than 275 gallons capacity shall be equipped with an open vent not smaller than 1¼ inch pipe size.

2411. A tank shall be provided with a means to determine the liquid level. A test opening shall be closed tight, when not in use, by a metal cover designed to discourage tampering. No glass gauge or any gauge which, when broken, will permit the escape of oil from the tank shall be used.

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

250. Installation of Outside Aboveground Tanks Larger Than 275 Gallons.

2501. A tank having a capacity of more than 275 gallons shall meet the requirements of 2005 or 2006 except that a tank having a capacity less than 2,500 gallons may meet the requirements of 2002.

2502. A tank having a capacity of more than 275 gallons shall not be located in closely built-up areas.

2503. The location of the tank with respect to distance from the nearest line of adjoining property which may be built upon, shall be such that the distance between any part of the tank and the line shall be not less than that specified in Table 3.

Table 3

Minimum Distance of Outside Aboveground Tanks to Line of Adjoining Property Which May be Built Upon

Capacity of Tank, Gallons	Minimum Distance Feet
0 to 275	0
276 to 750	5
751 to 12,000	10
12,001 to 24,000	15
24,001 to 30,000	20
30,001 to 50,000	25

2504. Spacing Between Tanks.

(a) The location of a tank with respect to any such other tank except tanks of 275 gallons capacity or less shall be such that the distance between them shall be not less than three feet.

(b) Where liquefied petroleum gas containers are located in the area of fuel oil tanks over 275 gallons capacity, the minimum separation shall be 20 feet and the minimum separation between a liquefied petroleum container and the center line of a dike shall be ten feet. Suitable means shall be taken to prevent the accumulation of fuel oil under adjacent liquefied petroleum gas containers such as by diking, diversion curbs or grading. Where dikes are used with fuel oil tanks, no liquefied petroleum gas container shall be located within the fuel oil tank dike.

2505. An outside aboveground tank larger than 275 gallons capacity shall rest on a foundation or support of concrete, masonry piling or steel. Exposed piling or steel support shall be protected by fire-resistive material to provide a fire-resistance rating of not less than two hours.

2506. Each connection to an aboveground tank storing fuel oil, located below normal liquid level, shall be provided with an internal or external shut-off valve located as close as practicable to the shell of the tank. Such valves and their connections to the tank shall be of steel.

2507. A tank shall be provided with a means to determine the liquid level. A test opening, if used, shall be closed tight, when not in use, by a metal cover designed to discourage tampering. No glass gauge or any gauge which, when broken, will permit the escape of oil from the tank shall be used.

2508. Vents.

(a) Normal Breathing: Tanks shall have normal venting capacity sufficient to permit the filling and emptying of such tanks, plus their breathing due to temperature changes, without distortion of tank shell or roof.

(b) Emergency Relief: Every aboveground tank larger than 275 gallons capacity shall have some form of construction or device that will relieve excessive internal pressure, caused by exposure fires, that might cause the rupture of the tank shell or bottom. In a vertical tank, this construction may take the form of a weakened seam in the roof. The joint between the roof and the shell of a tank 36 feet or more in diameter, if built in accordance with 2006 of these Standards shall be deemed to be a weakened seam for this purpose. Where entire dependence for such additional relief is placed upon some device other than a weak roof seam or joint, the total venting capa-

city of both normal and emergency vents shall be enough to prevent rupture of the shell or bottom of the tank if vertical, or of the shell or heads if horizontal. Such device may be a self-closing manhole cover, or one using long bolts that permit the cover to lift under internal pressure, or an additional or larger relief valve or valves. For the purpose of computing the number and area of such vents and emergency relief devices, reference may be made to Table 4.

Table 4

Required Total Pressure Relief Capacity of Vents

NOTE: Venting equipment installed for normal operation may serve as emergency relief, provided that it has the requisite capacity under the pressure limitation fixed by this table. Responsibility for selecting the limiting pressure is placed on the owner or operator.

Capacity of Tank		Total Pressure Relief Capacity	Approximate Diameter in Inches of Free Circular Opening for Various Pressures			
Gallons	42-Gallon Barrels	(Cu. Ft. of Free Air Per Hour)	3 In. of Water	1 PSI	2½ PSI	5 PSI
1,000 or less	23.8	25,300	4	2½	2	1½
4,000	95.2	69,500	6¾	3¾	3	2½
18,000	428	139,000	9½	5½	4¼	3¾
25,000	595	166,000	10¼	6	4¾	4
56,000	1,330	253,000	12¾	7¼	5¾	5
100,000	2,380	363,000	15¼	8¾	7	6
155,000	3,690	458,000	17¼	9¾	7¾	6½
222,000	5,290	522,000	18¼	10½	8¼	7
475,000	11,300	624,000	20	11¼	9	7¾
735,000	17,500	648,000	20	11½	9¼	7¾
Unlimited		648,000	20	11½	9¼	7¾

2509. Dikes and Walls.

(a) Individual tanks or groups of tanks, where deemed necessary by the authority having jurisdiction on account of proximity to waterways, character of topography, or nearness to structures of high value, or to places of habitation or assembly, shall be diked or the yard shall be provided with a curb or other suitable means taken to prevent the spread of liquid onto other property or waterways. Where a diked enclosure is required under this section, it shall have a net capacity not less than that of the largest tank plus ten per cent of the aggregate capacity of all other tanks served by the enclosure.

(b) Dike Construction: Except where protection is provided by natural topography, dikes or retaining walls required under the foregoing section shall be of earth, concrete or solid masonry designed to be liquid tight and to withstand the full hydraulic head, and so constructed as to provide the required protection. Earthen dikes three feet or more in height shall have a flat section at the top not less than two feet wide. The slope shall be consistent with the angle of repose of the material of which the dikes are constructed.

(c) Drainage: Where provision is made for draining rain water from diked areas, such drains shall normally be kept closed and shall be so designed that when in use, they will not permit flammable liquids to enter natural water courses, public sewers, or public drains, if their presence would constitute a hazard.

CHAPTER III

INSTALLATION OF FILL, RETURN, SUPPLY, AND VENT PIPING

300. Fill and Return Piping.

3001. 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. Fill terminal shall be equipped with a tight metal cover designed to discourage tampering.

3002. A return line from a burner or pump to a supply tank shall enter the top of the tank. If the top of the supply tank is located above the level of the burner or piping, the return line shall extend into the tank not more than one inch.

3003. Cross connections, except between two supply tanks not exceeding 275 gallons individual capacity, permitting gravity flow from one tank to another shall be prohibited. This, however, shall not be construed as prohibiting the filling of an outside tank by gravity, providing filling is through an open connection located within a dike surrounding the tank and provided further that such dike shall have a capacity equal to 1½ times the capacity of the tank being filled.

3004. An auxiliary tank shall be filled by a pump transfering the oil through continuous piping from the supply tank.

3005. An âuxiliary tank shall be located at a level above the top of the supply tank from which it is filled.

3006. 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.

3007. An overflow pipe from an auxiliary tank and a return line from a burner or pump shall have no valves or obstructions.

310. Supply Piping.

3101. Connections to tanks shall be as follows:

(a) All piping, except the burner supply line from a 275 gallon tank and the cross connection between two such tanks, shall be connected into the top of a supply tank.

(b) The burner supply connection to tankage having a capacity of more than 550 gallons shall be connected into the top of the tank, except as permitted by 3102.

(c) A transfer pump may be used to deliver oil from a supply tank to a burner or to an auxiliary tank. Except as permitted by 3102, such a pump shall be connected to tankage having a capacity of not more than 550 gallons.

3102. For commercial and industrial installations the oil supply from tankage of any capacity permitted by these Standards may be in accordance with the following:

(a) The burner supply line may be connected to an outside supply tank for Nos. 5 and 6 oil at a point below the liquid level.

(b) A transfer pump may be used. For such installations, devices should be provided to automatically shut off the oil supply in case of breakage of the oil supply or return piping.

3103. For commercial and industrial installations, connections to outside aboveground storage tanks may be located below the normal liquid level but each such connection shall be provided with an internal or external shut-off valve located as close as practicable to the shell of the tank. The valves and their connections to the tank shall be of steel.

320. Vent Piping.

3201. 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.

3202. Vent pipes shall terminate outside of buildings at a point not less than two feet measured vertically or horizontally from any window or other 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. 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. The static head with a vent pipe filled with oil shall not exceed the tested pressure of the tank.

3203. Vent pipes shall not be cross connected with fill pipes, return lines from burners or overflow lines from auxiliary tanks.

330. Pressure Tank Feed.

3301. Pressure feed from tanks shall not be used.

340. Oil Gauging.

3401. 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.

3402. 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.

3403. 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

3404. 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.

3405. 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.

CHAPTER IV.

PUMPS, PIPING AND VALVES.

400. Oil Pumps.

4001. 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.

4002. An automatic pump not an integral part of a burner shall be a listed type installed in full compliance with its listing.

410. Piping.

4101. All piping shall be standard full weight wrought iron, steel or brass pipe with standard fittings or brass or copper tubing with fittings of a listed type, except that listed flexible metal hose may be used for reducing the effects of jarring and vibration or where rigid connections are impracticable. Cast iron fittings shall not be used.

4102. Aluminum tubing shall not be used between the fuel oil tank and the burner unit.

4103. Pipe used in the installation of all burners and appliances other than conversion range oil burners shall be not smaller than ⅜ inch iron pipe size or ⅜ inch OD tubing. Copper or brass tubing shall have 0.035 inch nominal and 0.032 inch minimum wall thickness. Flexible metal hose shall be installed in full compliance with its listing.

4104. 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.

4105. Pipe joints and connections shall be made tight with suitable lubricant or pipe compound. Unions requiring gaskets or packing, right and left couplings, and sweat fittings shall not be used in oil lines.

4106. 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 arranged to

permit the tanks to settle without impairing the tightness of the pipe connections.

4107. 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.

420. Valves.

4201. A readily accessible manual shut-off valve shall be installed at each point where required to avoid oil spillage during servicing. The valve shall be installed to close against the supply.

4202. 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 shut-off 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.

4203. 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.

4204. 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.

430. Tests of Tanks and Piping.

4301. After installation and before an underground tank is covered, tests shall be made 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. Instead of a pressure test, suction lines may be tested under a vacuum of not less than 20 inches of mercury.

4302. Tests should continue for at least 60 minutes without a noticeable drop in pressure or vacuum.

CHAPTER V.

INSTALLATION OF CONVERSION OIL BURNERS AND OIL-FIRED UNITS.

500. General Requirements.

5001. Conversion 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.

5002. Where conversion oil burners are installed in appliances originally designed for solid fuel, the ash door of the appliance should 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.

5003. Oil-fired appliances should be installed in rooms that are large compared with the size of the heating units. In no case shall an oil-fired unit be installed with less clearance from combustible construction than that for which it is listed.

5004. 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.

5005. 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.

510. Posting of Instructions.

5101. Complete instruction for the care and operation of the central heating appliances as furnished by the manufacturer shall be conspicuously posted near the equipment.

520. Controls.

5201. 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.

5202. 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 Conversion Oil Burners with primary safety controls and Oil-Fired Units with primary safety controls respectively.

5203. 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.

5204. 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.

5205. Each appliance fired by conversion 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: "Closed" hot water space heating and process water heating 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 shall 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 relief 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.

5206. 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.

5207. 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. A cold water tube with a hole near the top is commonly accepted for this purpose.

5208. Electric motor-driven oil burners of the type described in 5203 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".

5209. 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.

5210. 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.

5211. 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.

5212. An acceptance test should 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.

530. Approval of Plans.

5301. Before installing, or remodelling 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, should be submitted to the authority having jurisdiction.

540. Contractor's Drawings.

5401. 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.

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

5501. Boilers, Furnaces, Floor-Mounted Unit Heaters and Water Heaters.

(a) Oil-fired appliances should be installed in rooms that are large compared with the size of the heating units. Appliances shall not be installed in a confined space such as an alcove or closet unless specifically listed for such installation and then only when installed in strict compliance with the listing and with the clearance from the appliance to the walls and ceiling of the alcove or closet not less than specified regardless of the type of construction.

(b) Appliances shall be installed with clearances from combustible construction not less than as indicated in Figure 3 and Table 5 of this Standard or as provided in Table 1 of NFPA No. 90B, Residence Type Warm Air Heating and Air Conditioning Systems, 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 of combustion air and accessibility. See Sections 130, 140.

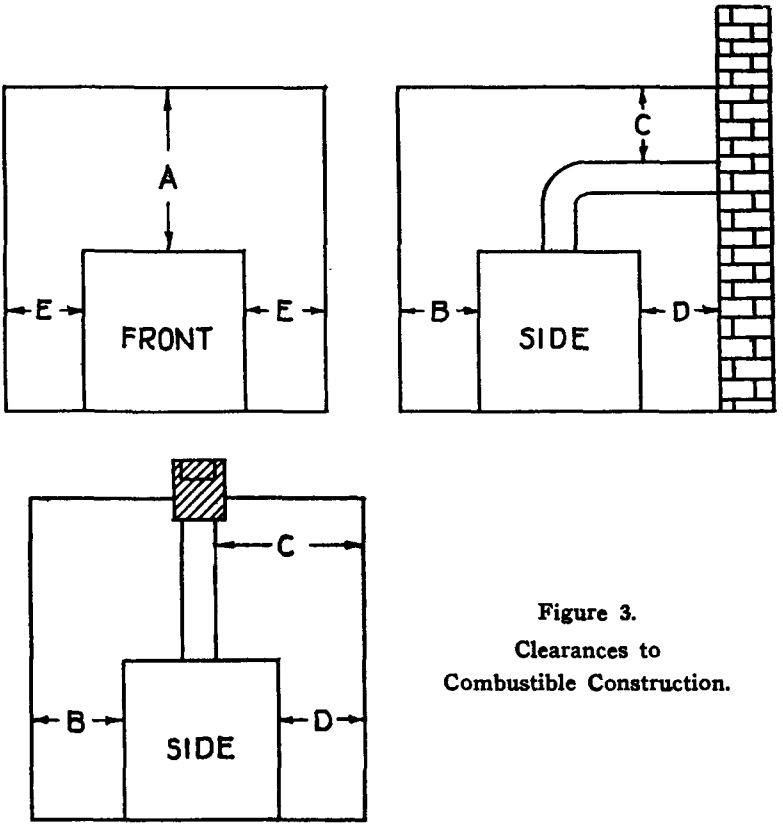


Figure 3.
Clearances to Combustible Construction.

Table 5

Classification as to Type of Appliance	Minimum Clearance, Inches				
	A Above	B Front	C Flue Pipe	D Rear	E Sides
Form I	6	48	18	6	6
Form II	18	48	18	6	6
Form III	18	48	18	18	18
Form IV	48	96	36	36	36
Form V	6	48	18	18	18

NOTE: See Section 160 for clearances from flues.

Description of Classification—Refer to Table 5.

FORM I. Forced warm-air furnaces which are equipped with approved temperature-limit controls that cannot be set higher than 250° F., water-wall type hot-water boilers operating at not in excess of 250° F., water-wall type steam boilers operating at not over 15 pounds per square inch gauge pressure, floor-mounted unit heaters, and water heaters, not larger than 100 cubic feet in size (excluding blower compartments of furnaces and burner equipment).

FORM II. Gravity warm-air furnaces not larger than 100 cubic feet in size equipped with approved temperature-limit controls that cannot be set higher than 250° F.

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.

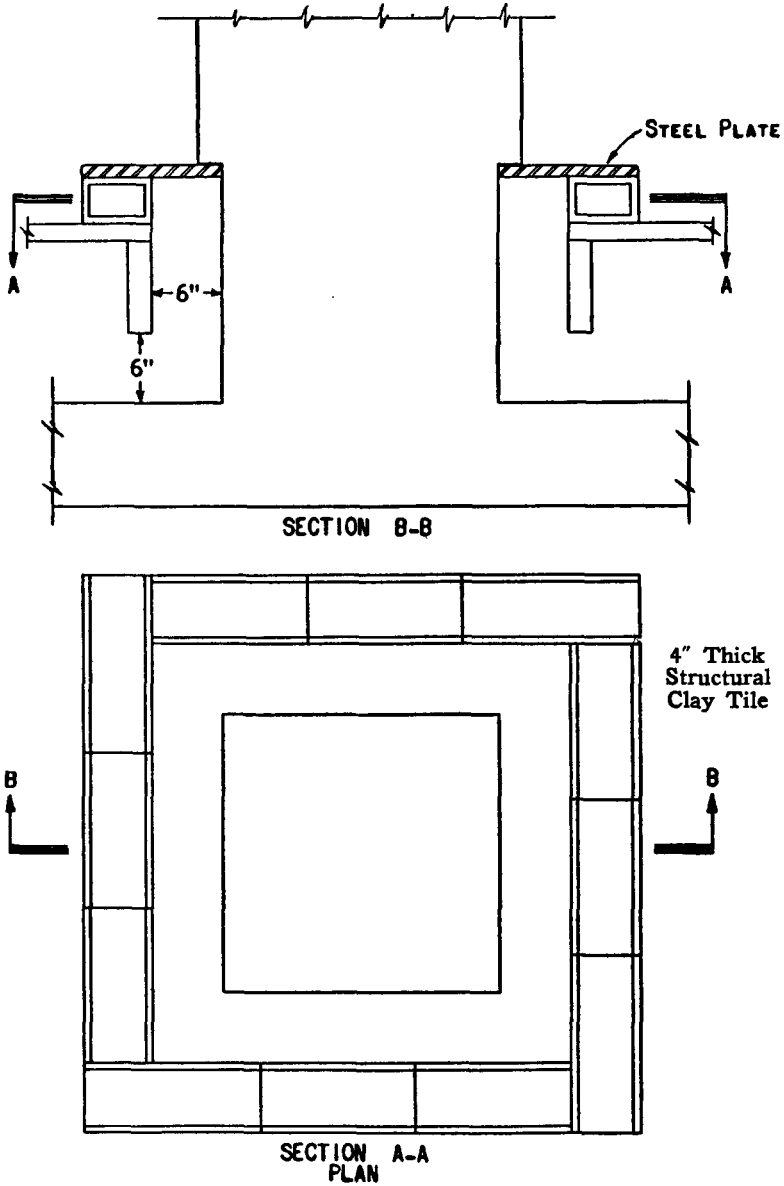
FORM V. Suspended-type unit heaters not more than 100 cubic feet in size (excluding fan and burner equipment).

(c) Appliances may be installed in rooms, but not in alcoves or closets, with lesser clearances to combustible construction, provided the combustible construction or appliance is protected as described in Appendix B.

(d) Floor-mounted appliances, except those specifically listed for installation on combustible floor shall be placed on noncombustible floors or on floors protected as described in paragraph (e) below.*

(e) Heating furnaces and boilers listed for installation under Form I or II above may be mounted on combustible floors although not designed for such installation provided the floor under the appliance is protected with hollow clay tile not less than four inches in thickness or its equivalent covered with a steel plate. The tile shall be laid with ends unsealed and joints matched in such a manner that the air space is vented. Figure 4 shows application of tile for installing a downflow furnace. Protection for combustible floors in connection with all other appliances of this class shall be as specified in 5506.

*For details of protection reference may be made to the Building Code Standard of the National Board of Fire Underwriters for the Installation of Heat Producing Appliances, obtainable from the National Board of Fire Underwriters, 85 John St., New York 38, N. Y.



Installation of Downflow Furnace on Combustible Floor

Figure 4.

(f) 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 then residence Type, No. 90A and residence Type Warm Air Heating and Air Conditioning Systems, No. 90B.*

(g) Circulating air shall not be taken from the same enclosure or space from which combustion air is supplied to the furnace.

(h) 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.

5502. Attic Furnaces.

(a) Furnaces shall not be installed in attics unless of a type listed for such use with installation in accordance with the mounting and clearance provisions of this section. Otherwise attic furnaces shall be installed in accordance with Section 5501.

5503. Duct Furnaces.

(a) A duct furnace shall be installed with clearance of at least six inches between walls, ceiling and floors of combustible construction, except that a duct furnace listed for installation at lesser clearance may be installed in accordance with its listing. Otherwise a duct furnace shall be installed in accordance with Section 5501. In no case shall the clearance be such as to interfere with the requirements for combustion air and accessibility. See Sections 130 and 140.

(b) A duct furnace shall be firmly supported.

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

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

5504. 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.

*Published in National Fire Codes, Vol. III, also printed in a separate pamphlet; also available from the National Board of Fire Underwriters, 85 John St., New York 38, N. Y.

(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 flue pipe shall be installed with clearances to combustible construction of not less than nine inches.

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

5505. Furnaces Used with Refrigeration Systems.

(a) A furnace shall be installed so that inlet air to the heat exchanger may not be at a temperature which will cause condensation from the air on external or internal surfaces of the heat exchangers unless the furnace is specifically listed for such service.

(b) A furnace shall be installed so that air heated by it will not pass through a refrigeration unit unless the refrigeration unit is specifically listed for such service.

5506. Industrial Furnaces and Power 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 construction provided the combustible construction is protected as described in Appendix B.

(4) Low-heat appliances, except those specifically listed for installation on combustible floor, shall be mounted on the ground, on floors of fire-resistive

construction, or on floors that are protected.* Such fire-resistive construction shall in all cases extend not less than 12 inches beyond the appliance on all sides.

(c) Medium-heat appliances:

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

(2) Medium-heat appliances shall be mounted on the ground, on floors of fire-resistive construction, or on floors that are protected.* Such construction shall in all cases extend not less than three feet on all sides.

(d) High-heat appliances:

(1) High-heat appliances shall be installed with clearances to combustible construction 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.

(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.

5507. 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.

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*For details of protection reference may be made to the Building Code Standard of the National Board of Fire Underwriters for the Installation of Heat Producing Appliances, obtainable from the National Board of Fire Underwriters, 85 John St., New York 38, N. Y.

(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 flue pipe to conduct the flue gases to the outside.

5508. Recessed Heaters.

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

(b) Recessed heaters 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.

5509. Restaurant-Type Cooking Appliances, Floor Mounted.

(a) Floor-mounted restaurant-type cooking appliances shall be installed with clearances to combustible construction of not less than 18 inches at the sides and rear of the appliance and from the flue pipe thereof, and not less than 48 inches above the cooking top and at the front of the appliance.

(b) Floor-mounted restaurant-type cooking appliances which are listed for installation with lesser clearances than specified in (a) above, may be installed in accordance with the conditions of their listing.

(c) Floor-mounted restaurant-type cooking appliances may be installed with lesser clearances to combustible construction provided the combustible construction is protected as described in Appendix B. Where a wall of combustible construction adjacent to the cooking top of an appliance is not shielded by a high shelf or other such

part of the appliance the wall protection shall extend at least two feet above the surface of the cooking top.

(d) Floor-mounted appliances, except those specifically listed for installation on combustible floors, shall be placed on noncombustible floors or on floors protected as described in (d) of Section 5501.

5510. Unit Heaters, Suspended Type.

(a) Suspended-type unit heaters shall be installed with clearances to combustible construction of not less than 18 inches. The clearance from the flue pipe of such an appliance shall be not less than 18 inches.

(b) Suspended-type unit heaters which are listed for installation with lesser clearances than specified in (a) above, may be installed in accordance with their listing.

(c) Suspended-type unit heaters may be installed with lesser clearances to combustible construction provided the combustible construction is protected as described in Appendix B.

(d) Suspended-type heaters shall be safely and adequately supported. Hangers or brackets supporting heaters shall be metal.

(e) The location of any suspended unit heater or the duct work attached thereto shall be such that a negative pressure will not be created in the room in which the unit heater is located.

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