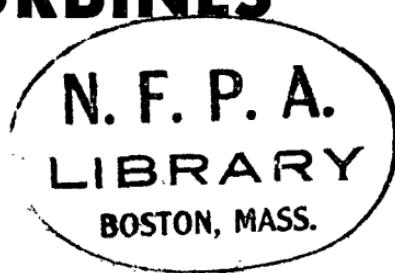


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STATIONARY COMBUSTION ENGINES AND GAS TURBINES

1970



Seventy-five Cents

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NATIONAL FIRE PROTECTION ASSOCIATION
International

60 Batterymarch Street, Boston, Mass. 02110

Official NFPA Definitions

Adopted Jan. 23, 1964; Revised Dec. 9, 1969. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

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Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines

NFPA No. 37 — 1970

1970 Edition of No. 37

The 1970 edition of the Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines contains revisions prepared by the Committee on Internal Combustion Engines and adopted at the 1970 Annual Meeting of the National Fire Protection Association. This edition supersedes the 1967 edition. 1970 amendments, other than editorial, are indicated by vertical lines in the margin of the pages in which they appear.

Origin and Development of No. 37

This Standard was initiated in 1904 as "Rules and Requirements for the Construction and Installation of Gas and Gasoline Engines" by a committee of the National Board of Fire Underwriters. NFPA published editions in 1905, 1915, 1922, 1934, 1955, 1963 and 1967. In 1955, responsibility for the standard was transferred from the Committee on Gases to the Committee on Internal Combustion Engines.

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Scope: To develop standards for the installation, operation and control of internal combustion engines, including gas turbine engines, using all types of fuel, within structures or immediately exposing structures.

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**Standard for the
Installation and Use of
Stationary Combustion Engines and Gas Turbines**

NFPA No. 37 — 1970

CHAPTER 1. GENERAL PROVISIONS

10. Purpose and Scope

101. This fire safety standard applies to the installation and operation of stationary combustion engines and gas turbines in and within 15 feet of a structure, such as a building, a travel trailer, a mobile home or a mobile laboratory. This standard also applies to portable engines used instead of, or to supplement, stationary engines.

102. This standard does not apply to engines used to propel any mobile structure.

103. Engines used to drive fire pumps shall comply with this standard and any special provisions contained in the Standard for the Installation of Centrifugal Fire Pumps, NFPA No. 20.

11. Definitions

APPROVED means acceptable to the authority having jurisdiction.

ENGINES shall include such prime movers as internal combustion engines, external combustion engines, gas turbine engines, and free piston engines, using either gaseous fuels or liquid fuels, or combinations thereof.

ENGINES, PORTABLE shall include engines mounted on skids as well as those mounted on wheels or otherwise so arranged that they can be moved from place to place as the required service indicates.

GALLON refers to 1 U.S. gallon = 0.83 Imperial gallons = 3.785 liters.

HORSEPOWER is the power (corrected brake horsepower of an engine at its operating speed) developed and measured at the flywheel or output shaft corrected to standard conditions of 29.92 inches of mercury barometric pressure, 60° F. air temperature, and 10mm water vapor pressure.

LISTED refers to equipment or materials included in a list published by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment or

materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

PSIG indicates pressure in pounds per square inch gage.

SHALL is intended to indicate requirements.

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

SPARK PROTECTED refers to electrical equipment enclosed in a tight case or protected by shields, screens or insulation which will contain sparks or prevent their emission.

TANK, DAY is a fuel oil tank located inside a structure which provides fuel to the engine.

TANK, INTEGRAL is a fuel tank furnished by the engine manufacturer and mounted on the engine.

TANK, SUPPLY is a separate fuel tank for supplying fuel to the engine or to a day tank.

CHAPTER 2. ENGINES

20. General Locations

201. Engines, with or without their "weatherproof" housings, which are attached to the engine subbase, may be installed outdoors, inside structures, or on roofs of structures, as follows:

- (a) Engines or their "weatherproof" housings, installed outdoors or outdoors on roofs of structures, shall be located at least 5 feet from openings in walls, and at least 3 feet from structures having combustible adjacent walls.
- (b) Engines rated at more than 50 hp shall be located in accordance with 201(a), or be installed in detached structures reserved exclusively for the purpose (or with equipment and processes having similar hazard), or in rooms within or attached to other structures.
 - (1) Detached structures shall be of noncombustible or fire-resistive construction (see NFPA No. 220, Standard Types of Building Construction). Provision shall be made for venting a fuel explosion with minimum structural damage (see NFPA No. 68, Guide for Explosion Venting) or ventilation adequate to prevent a hazardous accumulation of flammable vapors or gases shall be provided both when the engine is operating or shut down (see 204).
 - (2) Rooms located within structures shall have interior walls, floors, and ceilings of at least one hour fire resistance rating. (The ceiling of such a room located on the top floor of a structure need not be fire-resistive but shall be either noncombustible or protected with automatic sprinklers.)

These rooms shall have provision for venting a fuel explosion with minimum structural damage (see NFPA No. 68) or ventilation adequate to prevent a hazardous accumulation of flammable vapors or gases shall be provided both when the engine is operating or shut down (see 204).

Openings in the engine room that open into other sections of the structure shall be provided with automatic or self-closing fire doors or dampers to confine a fire to the engine room.

- (3) Rooms attached to structures shall comply with 201(b)1 except that the common wall shall have a fire resistance

rating of at least one hour. Openings in the engine room should preferably be in outside walls but, if they open into other sections of the structure, they shall be provided with automatic or self-closing fire doors or dampers.

202. Engines which are installed in structures shall be in adequately lighted locations.

203. Engines shall be situated so that they will be readily accessible for maintenance, repair and fire fighting.

204. Provision shall be made to supply sufficient air for combustion, proper cooling, and adequate ventilation.

NOTE: Requirements for air vary with the types and sizes of engines and the driven equipment and the nature of the engine room.

21. Foundations

211. Stationary engines shall be supported on firm foundations or suitable steel framework properly secured.

22. Floor and Roof Protection

221. If engine is mounted on a combustible floor or roof, the surface of the floor beneath the engine and beyond the engine to a minimum distance of 12 inches shall be covered with sheet metal.

23. Hazardous Locations

231. In areas where flammable gases or liquids, combustible dusts or flyings normally exist, engines not compressing a flammable gas or not pumping a flammable liquid shall be installed in an enclosure of fire resistive construction, with outside access only and well ventilated from a nonhazardous outside area.

24. Units Handling Hazardous Materials (Other Than Their Own Fuel Supply).

241. The use of an integral engine-driven unit for compressing a flammable gas or pumping a flammable liquid is permitted provided the combined unit or group of such combined units are suitably isolated by fire resistive construction or by being placed in a separate room or structure.

242. Each engine comprising part of a unit for compressing a flammable gas or pumping a flammable liquid shall have magnetos or distributors and coils of the spark protected type and have all leads positively attached. Ventilation openings in such devices shall be adequately protected by a fire screen unless the device is purged, pressurized, or otherwise protected.

243. Ignition wire shall be positively attached at each end by use of the outer sheath or the insulation.

244. Spark plugs shall be fully shielded against flashover. Spark plugs either fully radio shielded or provided with insulating boots are acceptable.

245. Flame arresting equipment shall be securely attached to the engine air intake to avoid blowoff or rupture. A firmly fixed air filter shall be considered as meeting this requirement.

246. Starter, generator and associated electrical equipment, attached to engines, shall be of the spark protected type.

247. Batteries, wiring and electrical protective devices shall be adequately protected against flashover and accidental shorting.

248. Means shall be provided for shutting down the engine at a readily accessible location remote from the engine.

CHAPTER 3. ENGINE PROTECTIVE DEVICES

30. All Engines

301. Each stationary engine shall have an automatic engine speed governor.

31. Engines — 10 Horsepower or More

311. Engines of 10 horsepower or more shall be equipped with the device specified in 301 and the following additional protection shall be provided:

- a. An automatic engine shutdown device or alarm* for high jacket water temperature, unless the engine is air-cooled
- b. An automatic engine shutdown device or alarm* for low lubricating oil pressure or for low oil level except when the engine is splash lubricated.

32. Engines — 500 Horsepower or More

321. Engines of 500 horsepower or more shall have the devices specified in 301 and 311 and the following additional protection shall be provided:

- a. An automatic engine shutdown device for engine overspeed
- b. An automatic engine shutdown device or alarm* for high lubricating oil temperature
- c. Some means of shutting down the engine at a readily accessible location remote from the engine
- d. A remote means of shutting off the fuel supply and of shutting down lubricating oil pumps not directly driven by the engine.

33. Gas Turbines

331. Gas turbine engines shall be equipped with the devices specified in 301, 311 and 321 and the following additional protection shall be provided:

*If the engine is intended for emergency use or is constantly attended, only then may alarms be selected instead of automatic shutdown devices.

a. An automatic engine shutdown device or alarm* for high exhaust temperatures

b. A means for shutting off the fuel supply in the event of flameout.

332. In the event of a turbine shutdown, the turbine starting sequence shall be repeated, and shall include a purge cycle adequate to insure a nonflammable atmosphere in the turbine and all connected equipment prior to ignition.

*If the engine is intended for emergency use or is constantly attended, only then may alarms be selected instead of automatic shutdown devices.

CHAPTER 4.

FUEL SUPPLY FOR GAS FUELED ENGINES

40. Gas Piping

401. Except as provided in paragraphs 405 and 406 piping for gas (other than undiluted liquefied petroleum gas) from the source of supply to the outlet of the customer's meter set assembly or to the engine regulator if there is no meter shall be installed in accordance with the American National Standard Code for Gas Transmission and Distribution Piping Systems (ANSI B31.8 — 1968).*

402. Except as provided in 405 and 406, piping for gas (other than undiluted liquefied petroleum gas) at a pressure in excess of $\frac{1}{2}$ psig between the meter set assembly and the engine shall be installed in accordance with NFPA No. 54A (ANSI Z83.1), Gas Piping and Gas Equipment on Industrial Premises and Certain Other Premises.

403. Except as provided in 405 and 406, piping for undiluted liquefied petroleum gas in the liquid or vapor phase at a pressure in excess of $\frac{1}{2}$ psig shall be installed in accordance with NFPA No. 58 (ANSI Z106.1), Storage and Handling of Liquefied Petroleum Gases and applicable sections of NFPA No. 54A (ANSI Z83.1).

404. Except as provided in paragraphs 405 and 406 piping for gas at a pressure $\frac{1}{2}$ psig or less shall be installed in accordance with the Standard for the Installation of Gas Appliances and Gas Piping, NFPA No. 54 (ANSI Standard Z21.30).

405. Plastic pipe, carrying fuel, shall not be used in a structure housing an engine or engines.

406. The use of approved metallic flexible connectors for protection against damage caused by settlement, vibration, expansion, contraction or corrosion is acceptable. The use of approved non-metallic connectors for the same purpose is acceptable except for

*Available from American Society of Mechanical Engineers, 345 E. 47th St., New York, N. Y. 10017.

LP-Gas in the liquid phase. If flexible connectors containing LP-Gas in the liquid phase are located so that they may be exposed to a fire of short duration the approval shall consider the ability of the connector to stand up under such conditions.

41. LP-Gas Systems

411. Liquefied petroleum gas (LP-Gas) supply systems shall be installed in accordance with the appropriate provisions of the Standard for the Storage and Handling of Liquefied Petroleum Gases, NFPA No. 58 (ANSI Z106.1).

42. Regulators

421. A gas pressure regulator located inside a structure shall be provided with either a vent to the outside of the structure and discharge at least five feet away from any structure opening, or a listed vent limiting device, except any regulator or zero governor that operates with gas pressure on both sides of the diaphragm does not require venting. When the gas pressure on the upstream side of the regulator is more than $\frac{1}{2}$ psig, a relief valve shall be installed on the downstream side of the regulator. Relief valves shall be connected to the outside of the structure and discharge at least 5 feet away from any structure opening, and such relief valves and any connected piping shall be sized to vent the required volume of gas.

43. Shutoff Valves

431. Gas piping to engines shall have an approved shutoff valve remote from the engine and preferably outside the structure. If the valve is locked open, the key shall be in a convenient location near the valve.

432. Every gas engine shall have a carburetion valve, zero governor type regulating valve or an auxiliary valve which will automatically shut off the flow of gas in case the engine stops from any cause.

433. Automatically started or unattended engines shall be provided with an auxiliary valve which will stop the flow of gas in case the engine stops for any cause. A zero governor type regulator alone is not adequate protection in such installations. The auxiliary valve shall be installed ahead of any unlisted flexible connector to the carburetion valve, zero governor, or other controls.

44. Pressure Boosting Equipment

441. When low pressure gas is supplied and pressure boosting equipment is required, compressors shall be approved for the service intended. Receivers, where required, shall be designed, constructed and tested in accordance with Section VIII of the ASME Pressure Vessel Code (1968).* When a receiver is to be maintained under pressure for emergency starting, suitable shut-off valves shall be provided at receiver intake and discharge.

*ASME Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels. Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, N. Y. 10017.

CHAPTER 5.

FUEL SUPPLY FOR LIQUID FUELED ENGINES

50. Design and Construction of Liquid Fuel Tanks

501. Integral tanks shall be of steel with welded or brazed joints.

502. Day tanks shall be of steel with welded joints constructed with the following metal thicknesses:

MINIMUM THICKNESS OF STEEL

Capacity Gallons	Not Galvanized			Galvanized		
	Mfrs.	Std.	Gage No.	Mfrs.	Std.	Gage No.
10 or less			18			20
11 to 180			16			18
181 to 275			14			16
276 to 550			12			14

NOTE: Tanks in this category listed and labeled "Inside Storage Tanks for Oil Burner Fuel" by Underwriters' Laboratories, Inc., may be considered as meeting the requirements of this Paragraph 502.

503. Outside aboveground or underground fuel supply tanks shall be constructed in accordance with the applicable tank specification in Article 20 of the Flammable and Combustible Liquids Code, NFPA No. 30.

NOTE: Underground tanks smaller than 2,500 gallons capacity listed and labeled as "Underground Tank for Flammable Liquids," and aboveground tanks listed and labeled as "Aboveground Tank for Flammable Liquids" by Underwriters' Laboratories, Inc., and tanks constructed in accordance with A.P.I. Standard No. 650, may be considered as meeting the requirements of this Paragraph No. 503.

51. Fuel Tanks for Gasoline

511. Only integral tanks shall be permitted inside or on roofs of structures.

512. An integral tank shall not exceed 25 gallons capacity and not more than one tank shall be installed on each engine. It shall be securely mounted on the engine assembly, protected against vibration, physical damage, engine heat and the heat of exhaust piping.

513. Tanks other than integral tanks shall be located underground or aboveground outside of structures.

514. Aboveground supply tanks shall be located so that the minimum distance from any part of the tank to the nearest line of adjoining property which may be built upon, or the nearest important structure, shall be in accordance with Article 21 of NFPA No. 30.

515. Underground supply tanks or tanks under a structure shall be located so that the minimum distance from any part of tank to nearest wall of any basement or pit shall be not less than one foot, and from any line of adjoining property that may be built upon shall be not less than 3 feet. These tanks shall be so located with respect to existing structure foundations and supports that the loads carried by the latter cannot be transmitted to the tank.

516. Other installation requirements such as spacing, dikes, foundations, supports, depth and cover, anchorage and normal and emergency vents shall be in accordance with the applicable requirements of Articles 21, 22, and 24 of the Flammable and Combustible Liquids Code, NFPA No. 30.

52. Fuel Tanks for Diesel and Fuel Oils

521. Fuel tanks inside structures shall comply with provisions of paragraphs 522, 523 and 524, respectively. Fuel tanks on roofs of structures shall comply with 522 and 523.

522. Not more than one integral tank shall be installed on each engine. It shall be securely mounted on the engine assembly, protected against vibration, physical damage, engine heat and the heat of exhaust piping.

523. A day tank shall not exceed 550 gallons capacity. Not more than one 550-gallon tank nor two or more tanks with an aggregate capacity of not more than 550 gallons shall be connected to one engine. The aggregate capacity of all day tanks shall not exceed 1,100 gallons unless an enclosure built according to 524 is provided. Day tanks shall be securely mounted on substantial noncombustible supports.

524. Supply tanks in excess of 550 gallons individual capacity located inside of structures shall be enclosed in accordance with the following requirements:

- (a) The walls of the tank enclosure shall be constructed of solid masonry units or poured concrete construction having

a fire resistance rating of not less than 3 hours and shall be bonded to the floor. The floor shall be of concrete or other fire resistive construction. The top shall be of reinforced concrete at least 5 inches thick or equivalent fire resistive construction, except that where the floor or roof construction above the enclosure is of 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.

- (b) Each tank enclosure shall be provided with an opening which is closed by a self-closing Class A fire door and equipped with a noncombustible liquid-tight sill or ramp at least 6 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.
- (c) Provision shall be made for adequate ventilation of such enclosures prior to entering for inspection or repair of tanks.

525. Supply tanks located outside aboveground or underground, or beneath a structure, shall comply with the applicable provisions of Articles 21 and 22 of the Flammable and Combustible Liquids Code, NFPA No. 30.

53. Fuel Flow Control

531. Liquid fuel supply systems, including drains from carburetors, shall be designed and installed to minimize as far as practicable the accidental discharge of fuel into the engine room or structure. This shall include properly sized and located drains and overflow connections discharging to a tank (inside or outside) or to a safe area outside the structure. Adequate alarms, float controlled valves or mechanical or remote-reading level gages or protected sight glass gages shall be installed to aid personnel in properly operating the fuel system. Stationary powered fuel pumps supplying integral or day tanks shall have "stop" controls sensitive to high tank liquid level.

532. When supplied by pumps, day tanks or integral tanks shall be provided with an overflow line, a high level alarm, and a high level automatic shutoff. The overflow line shall be continuous piping to the supply tank without valves or traps. Its

capacity shall exceed the delivery capacity of the supply lines it serves.

533. Overflows, vents, fuel piping or fuel tanks shall not be located at or near engine air intake, exhaust piping, mufflers or filters.

NOTE: The possibility of fuel entering engine air intake is dangerous from an overspeed standpoint.

534. Where residual oils are utilized as engine fuel, it is sometimes necessary to heat the fuel above the flash point for satisfactory handling and injection into the engine. This necessitates special storage, purifying and heating systems. When fuel is heated, care should be taken to maintain circulation through heaters regardless of engine fuel demand by means of constant recirculation to fuel tank, as well as to provide thermostatic control and suitable pressure and temperature gages. Pressure relief valves and relief piping returns to supply tank should be incorporated where necessary.

54. Filling

541. Integral tanks for gasoline shall be filled by a closed piping system except filling may be done by approved safety cans when the engine is shut down.

542. Integral tanks for diesel and fuel oils shall be filled by a closed piping system except that filling may be done from a container when the engine is shut down.

543. Fill piping shall be installed in accordance with 2190, 2250 and 2340 of the Flammable and Combustible Liquids Code, NFPA No. 30.

55. Vent Piping

551. Vent piping shall be installed in accordance with 2160, 2240 or 2320 of the Flammable and Combustible Liquids Code, NFPA No. 30.

56. Fuel Piping, Valves and Fittings

561. Piping, valves and fittings for liquid fuels shall be designed for the working pressures and structural stresses to which they may be subjected and suitable for use with the liquid being handled. Except as provided in 562, they shall be of steel or

other metal. Piping shall be in accordance with Chapter III of the Flammable and Combustible Liquids Code, NFPA No. 30.

562. Piping systems shall be substantially supported, protected against physical damage and excessive stresses. The use of approved, metallic or nonmetallic, flexible connectors for protection against damage caused by settlement, vibration, expansion, contraction or corrosion is acceptable. If flexible connectors are located so that they may be exposed to a fire of short duration, the approval shall consider the ability of the connectors to stand up under such conditions.

563. Sufficient valves shall be provided to control flow of liquid fuel in normal operation and to shut off the flow of fuel in the event of a pipe break.

564. Piping to aboveground supply tanks filled from tank cars or tank vehicles by centrifugal pumps shall be provided with check valves to prevent back flow.

57. Transfer of Liquid Fuel to Engines

571. Liquid fuel shall feed to engines by pumps only, except that gravity feed is permitted from integral tanks.

572. When engines are installed on roofs or upper floors, the fuel supply may be pumped to day or integral tanks.

CHAPTER 6. EXHAUST PIPING AND CHIMNEYS

60. Design and Construction

601. Engine exhaust discharge systems shall be designed on the basis that the flue gas temperatures* normally do not exceed 1000° F. continuously, and do not exceed 1400° F. except for infrequent brief periods. Such engines shall be classified as low heat appliances. If these temperatures are exceeded, special consideration shall be given to the higher temperatures.

602. Exhaust pipes shall be of wrought iron or steel, and of sufficient strength to withstand the service. Fittings of cast iron are acceptable.

603. Chimneys shall be built and installed in accordance with the Standard for Chimneys, Fireplaces, and Venting Systems, NFPA No. 211.

604. Provision shall be made in exhaust systems to prevent damage resulting from the ignition of unburned fuel. Normally, this is accomplished by built-in strength in the system but also may be accomplished by use of devices such as relief valves, rupture discs, or their equivalent.

605. Low points in exhaust systems shall be provided with suitable means for draining of condensate.

606. Exhaust pots shall be placed on a firm foundation.

61. Installation

611. Exhaust pipes shall be adequately supported and shall be connected to the engine, exhaust pot or muffler so that emission of sparks, flame or gas within the structure is prevented.

612. When necessary, a flexible connector should be provided in the exhaust pipe from the engine to minimize the possibility of a break in the engine exhaust system because of engine vibration or heat expansion. This connection shall not permit the release of dangerous quantities of gas into the engine room.

*Flue gas temperatures are the temperatures of the flue products at the point or points of passing close to or through combustible materials, or at the entrance to a chimney, whichever is applicable.

613. Exhaust pipes, except as permitted in 624, shall terminate outside the structure at a point where the hot gases or sparks will be discharged harmlessly and not be directed against combustible material or structures, or into atmospheres containing flammable gases or vapors or combustible dusts. Exhaust pipes shall not terminate under loading platforms or structures, or near ventilation air inlets.

614. Where necessary, exhaust systems shall be guarded to prevent personnel burns.

62. Clearance from Combustible Material for Low Heat Appliances

621. Exhaust pipes shall be installed with clearances of at least 9 inches to combustible material, except as provided in 622 and 623.

622. Exhaust pipes, passing directly through combustible roofs, shall be guarded at the point of passage by ventilated metal thimbles which extend not less than 9 inches above and 9 inches below roof construction, and which are 6 inches larger than the pipe.

623. Exhaust pipes, passing directly through combustible walls or partitions, shall be guarded at the point of passage by one of the following methods:

- a. Metal ventilated thimbles not less than 12 inches larger in diameter than the exhaust pipe; or
- b. Metal or burned fire clay thimbles built in brickwork or other approved fireproofing materials providing not less than 8 inches of insulation between the thimble and combustible material.

624. Exhaust pipes shall be connected to or pass inside of a metal, masonry, or factory-built chimney when the exhaust gases go through a floor, ceiling, attic, or concealed space. When an exhaust pipe is connected to a chimney, a muffler, when necessary, shall be installed between the engine and the point where the exhaust pipe enters the chimney. The exhaust pipe shall be connected to or extended up into the chimney beyond any other flue connector from other fuel-burning appliances which are vented into the chimney.

63. Clearance from Combustible Material for Medium or High Heat Appliances

631. Exhaust systems from medium or high heat appliances shall be given special consideration as to clearances from combustible materials and as to design of exhaust, and shall comply with NPPA No. 211.

64. Exhaust Pots

641. Exhaust pots shall be placed on a firm foundation.