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37

COMBUSTION ENGINES AND GAS TURBINES 1963

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National Fire Protection Association

International

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This is one of a large number of publications on fire safety issued by the Association. All NFPA standards and recommended practices, including this text, are prepared by the technical committees of the NFPA and adopted at an Annual Meeting of the Association. They are intended to prescribe reasonable measures for minimizing losses of life and property by fire.

This text and most other NFPA standards and recommended practices are published in the **National Fire Codes,** a compilation of NFPA's official technical material. Full information on the availability of these Codes and other NFPA publications can be secured from the Association.

Official NFPA Definitions

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. One foot = 0.3048 meters. One inch = 25.40 millimeters. One pound per square inch = 0.06805 atmospheres = 2.307 feet of water.

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The National Fire Protection Association does not "approve" individual items of fire protection equipment, materials or services. The suitability of devices and materials for installation under NFPA standards is indicated by the listing 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, the Factory Mutual Laboratories and the American Gas Association (gas equipment) test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

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

(NFPA No. 37 — 1963)

1963 Edition of No. 37

The 1963 edition of the Standard for the Installation and Use of Combustion Engines and Gas Turbines contains revisions prepared by the Committee on Internal Combustion Engines and adopted at the 1963 Annual Meeting of the National Fire Protection Association. The 1963 edition supersedes the 1959 edition. For 1963 amendments, see page 37–20.

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 and 1963. In 1955, responsibility for the standard was transferred from the Committee on Gases to the Committee on Internal Combustion Engines.

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CONTENTS

Chapter 1. General Provisions

Chapter 2. Engines

Chapter 3. Engine Protective Devices

Chapter 4. Fuel Supply for Gas Fueled Engines

Chapter 5. Fuel Supply for Liquid Fueled Engines

Chapter 6. Exhaust Piping and Chimneys

Chapter 7. Lubricating Oil

Chapter 8. Instructions

Standard for the

Installation and Use of

Combustion Engines and Gas Turbines

NFPA No. 37 — 1963

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 building. This standard also applies to portable engines used instead of, or to supplement, stationary engines.

102. 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 and materials that have been tested and meet the listing requirements of a nationally recognized testing agency. Such equipment shall be identifiable by means of a

label or other distinguishing marking specified in the current list published by the testing agency.

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 tank located inside a building 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 which are installed in buildings shall be in adequately lighted locations.

202. Engines shall be situated so that they will be readily accessible for maintenance and repair.

203. Provision shall be made to supply sufficient air for combustion and proper cooling.

204. When engine installations totalling more than 2000 horsepower are located inside buildings not frequented by the public, they shall be in rooms of fire resistive or noncombustible construction. These rooms shall have provision for venting a fuel explosion with minimum structural damage. (See the Guide for Explosion Venting, No. 68.)

205. When engine installations totalling more than 2000 horsepower are located inside buildings which are frequented by the public, they shall be in rooms having walls, floors and ceilings which shall have a 3-hour fire resistance rating. Installations on roofs are not required to comply with this section if the floor is adequately constructed for the fire resistance covered in 204, and means are provided for venting an explosion. When located on the top floor, the requirement for 3-hour construction of the roof assembly of the room shall not be necessary. These rooms shall have provision for venting a fuel explosion with minimum structural damage. (See Guide for Explosion Venting, NFPA No. 68.)

21. Foundations

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

22. Floor Protection

221. If engine is mounted on a combustible floor, 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 flam-

mable 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 building.

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 shut-down device or alarm* for high jacket water temperature, unless the engine is air-cooled

b. An automatic engine shut-down 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 shut-down device for engine overspeed

b. An automatic engine shut-down 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, when automatic sequencing is not provided.

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 shut-down 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 Standard Code for Gas Transmission and Distribution Piping Systems (ASA B-31.8 — 1962).*

402. Except as provided in paragraphs 405 and 406 piping for gas (other than undiluted liquefied petroleum gas) at a pressure in excess of ½ psig between the meter set assembly and the engine shall be installed in accordance with good practice (AGA Information Letter No. 90).**

403. Except as provided in paragraphs 405 and 406 piping for undiluted liquefied petroleum gas in the liquid or vapor phase at a pressure in excess of ½ psig shall be installed in accordance with Standard for Storage and Handling of Liquefied Petroleum Gases, NFPA No. 58.

404. Except as provided in paragraphs 405 and 406 piping for gas at a pressure ½ psig or less shall be installed in accordance with the Standard for the Installation of Gas Appliances and Gas Piping, NFPA No. 54, also ASA Z21.30.

405. Plastic pipe, carrying fuel, shall not be used in a building 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 nonmetallic connectors for the same purpose is acceptable except for

*American Standard Code for Gas Transmission and Distribution Piping Systems (ASA B31.8 — 1958) Price $2.50. Available from American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

**AGA Information Letter No. 90. Proposed American Standard for Installation of Consumer Owned Gas Piping and Equipment on Industrial and Commercial Premises not covered by ASA Z21.30 — 1954 or ASA Z21.33 — 1950 (not applicable to undiluted liquefied petroleum gas). Available from American Gas Association, 420 Lexington Ave., New York 17, N. Y.

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 supply systems shall be installed in accordance with the appropriate provisions outlined in the Basic Rules, Division I or II, and Section 4.10* of the Standard for the Storage and Handling of Liquefied Petroleum Gases, NFPA No. 58.

42. Regulators

421. A gas pressure regulator located inside a building shall be provided with either a vent to the outside of the building 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 ½ psig, a relief valve shall be installed on the downstream side of the regulator. This relief valve shall discharge to a safe location outside of buildings, and such relief valve and any connected piping shall be sized so that there will be adequate capacity to vent the volume of gas that would pass through the regulator if that device failed.

43. Shutoff Valves

431. Gas piping to engines shall have an approved shutoff valve remote from the engine and preferably outside the building. 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.

*NOTE: Section 4.10 covers ventilation requirements for stationary or portable engines in buildings.

44. Pressure Boosting Equipment

441. When low pressure gas is supplied, and pressure boosting equipment is required, this equipment should be located in or as close to the engine room supplied as practicable. 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 (1962).* When a receiver is to be maintained under pressure for emergency starting, suitable shutoff 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 17, N. Y.

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	Not Galvanized	Galvanized
Gallons	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 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 buildings.

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 buildings.

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 building, shall be not less than 10 feet.

515. Underground supply tanks or tanks under a building 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 building 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 and 22 of the Flammable Liquids Code, NFPA No. 30.

52. Fuel Tanks for Diesel and Fuel Oils

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

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 buildings 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 building, shall comply with the applicable provisions of Articles 21 and 22 of the Flammable 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 building. 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 building. 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. 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.

533. 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 Sections 2240 and 2250 of the Flammable Liquids Code, NFPA No. 30.

55. Vent Piping

551. Vent piping shall be installed in accordance with Sections 2130 or 2230 of the Flammable 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 paragraph 562, they shall be of steel or other metal. Piping shall be in accordance with Chapter IV of the Flammable 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 non-metallic, 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.

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, Flues and Vents, 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 building 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.