

NFPA No.

**37**

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Flammable Liquids*



**Standard for the  
Installation and Use of  
COMBUSTION ENGINES and  
GAS TURBINES**

**June  
1959**



**Fifty Cents\***

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**NATIONAL FIRE PROTECTION ASSOCIATION**  
**International**

**60 Batterymarch Street, Boston 10, Mass.**

# 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 two hundred national and regional societies and associations (list on outside back cover) and seventeen 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.

# COMBUSTION ENGINES AND GAS TURBINES

NFPA No. 37 — 1959

This edition adopted by the NFPA, June 3, 1959, supersedes all previous editions. The previous edition published in 1934 was completely revised. This standard was initiated in 1904 as "Rules and Requirements for the Construction and Installation of Gas and Gasoline Engines" by a committee of NBFU. NFPA published editions in 1905, 1915, 1922 and 1934.

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

NFPA No. 37

**CHAPTER I. 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

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\*See Appendix for availability.

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

PSIG indicates pressure in pounds per square inch gauge.

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 II. 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, they shall be in rooms of non-combustible or fire resistive construction. These rooms shall have provision for venting a fuel explosion with minimum structural damage. (See the Guide for Explosion Venting, No. 68.)\*

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\*See Appendix for availability.

## **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 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**

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 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 III. 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 paragraph 301, and the following additional protective devices:

- 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 paragraphs 301 and 311 and the following additional protective devices:

- a. An automatic engine shut-down device for engine over-speed
- 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

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\*Alarms should be selected rather than automatic shut-down devices only if the engine is intended for emergency use or is constantly attended.

### 33. Gas Turbines

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

- a. An automatic engine shut-down device or alarm\* for high exhaust temperatures

## CHAPTER IV.

### 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 — 1958).\*\*

402. Except as provided in paragraphs 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 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  $\frac{1}{2}$  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  $\frac{1}{2}$  psig or less shall be installed in accordance with the Standard for the Installation of Gas Appliances and Gas Piping, NFPA No. 54.\*\*

405. Plastic pipe shall not be used in a building housing an engine or engines.

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\*Alarms should be selected rather than automatic shut-down devices only if the engine is intended for emergency use or is constantly attended.

\*\*See Appendix for availability.



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 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. Meters and Regulators**

421. Meters or reducing valves or both operating at an inlet pressure of 60 psig or above in the gas piping to the engine room shall be located outside of any engine room and should be preferably outdoors. If an inside location is used, these devices shall be in a fire resistive enclosure which is well ventilated from the outside and which is gas tight to adjacent rooms.

422. 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  $\frac{1}{2}$  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. Manual Shutoff Valves**

431. Gas piping to engines shall have a shutoff valve outside of the building, except that a gas service shutoff valve even if inside the building shall be considered as meeting this requirement.

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\*See Appendix for availability.

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

If the valve is locked open, the key shall be in a convenient location near the valve.

#### 44. Automatic Shutoff Valves

441. 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.

442. 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 flexible connector to the carburetion valve, zero governor, or other controls.

## CHAPTER V.

### 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

<u>Capacity</u> Gallons	<u>Not Galvanized</u>	<u>Galvanized</u>
	Mfra. Std. Gage No.	Mfra. 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. 12C, 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.\*

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\*See Appendix for availability.

## 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 day tank shall be connected to one engine, and not more than two such tanks shall be installed in a building unless an enclosure built according to paragraph 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. 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 5 feet.

526. Underground supply tanks or tanks located beneath a building shall have a minimum distance from any part of the tank to the nearest wall of any basement or pit of not less than one foot. These tanks shall be so located with respect to existing building foundations and supports that loads carried by the latter cannot be transmitted to the tank.

527. 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.\*

### 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.

\*See Appendix for availability.

534. 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.

535. 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.

#### **54. Fill Piping**

541. 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. Pipe wall thicknesses shall be in accordance with Section 3 of the American Standard Code for Pressure Piping (ASA B31.1 — 1955).\*

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.

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\*See Appendix for availability.

## CHAPTER VI. EXHAUST PIPING AND CHIMNEYS

### 60. Design and Construction

601. For the purpose of determining engine exhaust discharge requirements, the engines shall be classified as low-heat appliances: *i.e.*, the gas temperature normally does not exceed 1000° F. continuously and does not exceed 1400° F. except for infrequent brief periods.

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.

### 61. Installation

611. Exhaust pipes shall be adequately supported and 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 gas tight 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.

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

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

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\*See Appendix for availability.

## **62. Clearance from Combustible Material**

621. Exhaust pipes shall be installed with clearances of at least 9 inches to combustible material, except as provided in paragraphs 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 12 inches larger in diameter than the pipe. If double ventilated metal thimbles are used, the same requirements apply except that the thimble should be at least 6 inches larger in diameter 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 shall be installed between the engine and the point where the exhaust pipe enters the chimney. The exhaust pipe shall be extended up into the chimney beyond any other flue collars from other fuel-burning appliances which are vented into the chimney.

## **63. Condensate Drains**

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

## **64. Exhaust Pots**

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