NFPA No.

30

FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE 1963

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National Fire Protection Association

International

The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection. Its membership includes national and regional societies and associations (list on outside back cover) and twenty-one thousand individuals, corporations, and organizations. Anyone interested may become an Associate Member; the annual dues are $20.00. Full membership information is available on request.

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.

Approved Equipment

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.

Discount Prices on this Pamphlet

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6–11 copies: 10%	24– 47: 20%
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Flammable and Combustible Liquids Code

NFPA No. 30 — 1963

1963 Edition of No. 30

This 1963 edition of the Flammable and Combustible Liquids Code supersedes the 1962 edition and all previous editions. This Code was prepared by the Sectional Committee on General Storage of Flammable Liquids, approved by the NFPA Flammable Liquids Committee, and adopted by the National Fire Protection Association at its meeting, May 13-17.

Several very significant changes are included in this 1963 edition. A new classification for flammable and combustible liquids has been under consideration by the NFPA Committee on Flammable Liquids for many years. This edition incorporates the new system, altering the one which has been in existence since the first edition of the Code adopted in 1913.

A completely rewritten Chapter II on Tank Storage and Chapter IV on Piping, Valves and Fittings are also included in this 1963 edition. Of considerable significance are the changes in tank storage requirements to include unstable flammable liquids for the first time as well as new concepts for distances to property lines, spacing between tanks, tanks inside buildings, diking, and emergency venting for fire exposure.

Origin and Development of No. 30

From 1913 to 1957 this standard was written in the form of a municipal ordinance known as the Suggested Ordinance for the Storage, Handling and Use of Flammable Liquids. In 1957 the format was changed from a municipal ordinance to a Code although the technical provisions were retained. During the 50-year existence of this suggested ordinance and Code, numerous editions have been published as conditions and experiences have dictated; for details see NFPA Advance Reports and Proceedings.

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Interpretations Procedure of the Committee on Flammable Liquids

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

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

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

Requests for interpretations should be addressed to the National Fire Protection Association, 60 Batterymarch Street, Boston 10, Mass.

CONTENTS

The numbering system of this code is predicated on the following: Articles are two digit numbers; Sections are four digit numbers which end in a zero; Paragraphs are all other four digit numbers; and Sub-paragraphs are parenthesized letters. For example: Chapter II, Article 21, Section 2130, Paragraph 2131, and Sub-paragraph 2131(a).

APPENDICES

Other NFPA Standards on Flammable Liquids

The storage of oil in connection with oil burning equipment in fixed containers connected by piping with the oil burner, or in containers which are an integral part of the stove or heater, is not covered by this Code, but is treated in detail in NFPA Standard for the Installation of Oil Burning Equipment (No. 31).

Transportation of flammable liquids by tank truck is covered by NFPA Recommended Regulatory Standard for Tank Vehicles for Flammable Liquids (No. 385).

Certain other standards cover special uses of flammable liquids. Among them are:

No. 32 — Dry Cleaning Plants
No. 33 — Spray Finishing
No. 34 — Dip Tanks
No. 36 — Solvent Extraction Plants
No. 393 — Gasoline Blow Torches and Plumbers' Furnaces
No. 395 — Farm Storage of Flammable Liquids

The following additional NFPA standards or recommended practices may be referred to for information on special problems in this field.

No. 35M — Manufacture of Organic Coatings
No. 304L — Petroleum Wharves
No. 306 — Gas Hazards on Vessels
No. 325 — Fire Hazard Properties of Flammable Liquids
No. 325A — Flashpoint Index of Trade Name Liquids
No. 326 — Warning Labels for Containers of Flammable Liquids
No. 327 — Procedures for Cleaning or Safeguarding Small Tanks and Containers
No. 328M — Flammable Liquids and Gases in Manholes and Sewers
No. 329M — Leakage from Underground Flammable Liquid Tanks
No. 407 — Aircraft Fueling on the Ground
No. 413M — Properties Aviation Fuels
No. 704M — Identification of the Fire Hazards of Materials

Foreword

This standard, known as the Flammable and Combustible Liquids Code, is recommended for use as the basis of legal regulation. Its provisions are intended to reduce the hazard to a degree consistent with reasonable public safety, without undue interference with public convenience and necessity which requires the use of flammable liquids. Thus compliance with this standard does not eliminate all hazard in the use of flammable liquids.

The "Suggested Provisions for a Municipal Ordinance" (found in the Appendix) are intended as an advisory guide for use when this text is utilized as a basis for a municipal ordinance. It suggests a title, a statement of its application, defines restricted locations, and gives a basis for approvals. It includes suggested wording relating to retroactivity, inspections, modifications, penalties, repeal of conflicting ordinances, and severability.

Flammable and Combustible Liquids Code

NFPA No. 30

CHAPTER I.

GENERAL PROVISIONS.

10. Scope and Application.

1010. This Code applies specifically to flammable and combustible liquids with a flash point below 200° F. There are many liquids which have a flash point above 200° F. and are accordingly exempt from this Code. Such liquids, however, involve some degree of hazard, which may be controlled by application of certain provisions of this Code, with appropriate modifications. Attention is directed to the fact that liquids of flash point higher than 200° F. may assume the characteristics of lower flash liquids when heated, and under such conditions it may be appropriate to apply the provisions of the Code to liquids with flash point above 200° F.

1020. Additional requirements may be necessary for the safe storage and use of liquids which have unusual burning characteristics, which are subject to self-ignition when exposed to the air, which are highly reactive with other substances, which are subject to explosive decomposition, or have other special properties which dictate safeguards over and above those specified here.

1030. This code shall not apply to:

1031. Transportation of flammable liquids when in conformity with Interstate Commerce Commission regulations, or regulations lawfully on file with and approved by the Interstate Commerce Commission.

1032. Transportation of flammable and combustible liquids in bulk.

NOTE: These requirements are covered separately in the Standard on Tank Vehicles for Flammable Liquids, NFPA No. 385.

1033. Storage, handling and use of fuel oil tanks and containers connected with oil burning equipment.

NOTE: These requirements are covered separately in the Standard for the Installation of Oil Burning Equipment, NFPA No. 31.

1034. Materials that are solid at 100° F. or above.

11. Definitions.

AIRCRAFT SERVICE STATION shall mean that portion of an airport where flammable or combustible liquids used as aircraft fuel are stored or dispensed from fixed equipment and shall include all facilities essential thereto.

APARTMENT HOUSE shall mean a building or that portion of a building containing more than two dwelling units.

APPROVED signifies acceptance, by the authority having jurisdiction, of design, equipment, installation, or intended use as required by this code.

NOTE: Devices having been tested and accepted for a specific purpose by a nationally recognized testing laboratory may be deemed to be acceptable.

ASSEMBLY OCCUPANCY shall mean the occupancy or use of a building or structure or any portion thereof by a gathering of persons for civic, political, travel, religious or recreational purposes.

ATMOSPHERIC TANK shall mean a storage tank which has been designed to operate at pressures from atmospheric through 0.5 psig.

AUTOMOTIVE SERVICE STATION shall mean that portion of a property where flammable or combustible liquids used as motor fuels are stored and dispensed from fixed equipment into the fuel tanks of motor vehicles.

BARREL shall mean a volume of 42 U. S. gallons.

BASEMENT shall mean a story of a building or structure having ½ or more of its height below ground level and to which access for fire fighting purposes is unduly restricted.

BOILING POINT shall mean the boiling point at a pressure of 14.7 psia. Where an accurate boiling point is unavailable for the material in question, or for mixtures which do not have a constant boiling point, for purposes of this classification the initial point of a distillation performed in accordance with the test for Distillation of Petroleum Products, ASTM D-86-62, may be accepted in lieu of the boiling point of the liquid.

BOIL-OVER shall mean the expulsion of crude oil (or certain other liquids) from a burning tank. The light fractions of the crude oil burn off producing a heat wave in the residue, which on reaching a water strata may result in the expulsion of a portion of the contents of the tank in the form of froth.

BULK PLANT shall mean that portion of a property where flammable liquids are received by tank vessel, pipe lines, tank car, or tank vehicle, and are stored or blended in bulk for the purpose of distributing such liquids by tank vessel, pipe line, tank car, tank vehicle, or container.

CHEMICAL PLANT shall mean a large integrated plant or that portion of such a plant other than a refinery or distillery where flammable or combustible liquids are produced by chemical reactions or used in chemical reactions.

CLOSED CONTAINER shall mean a container as herein defined, so sealed by means of a lid or other device that neither liquid nor vapor will escape from it at ordinary temperatures.

COMMERCIAL OR INDUSTRIAL ESTABLISHMENT shall mean a place wherein the storage, handling, or use of flammable or combustible liquids is incidental to but not the principal business or process.

CONTAINER shall mean any can, bucket, barrel, or drum.

CRUDE PETROLEUM shall mean hydrocarbon mixtures that have a flash point below 150° F. and which have not been processed in a refinery.

DISTILLERY shall mean a plant or that portion of a plant where flammable or combustible liquids produced by fermentation are concentrated, and where the concentrated products may also be mixed, stored, or packaged.

DWELLING shall mean a building occupied exclusively for residence purposes and having not more than two dwelling units or as a boarding or rooming house serving not more than 15 persons with meals or sleeping accommodations or both.

DWELLING UNIT shall mean one or more rooms arranged for the use of one or more individuals living together as a single housekeeping unit, with cooking, living, sanitary and sleeping facilities.

EDUCATIONAL OCCUPANCY shall mean the occupancy or use of a building or structure or any portion thereof by persons assembled for the purpose of learning or of receiving educational instruction.

FLASH POINT of the liquid shall mean the temperature at which it gives off vapor sufficient to form an ignitible mixture with the air near the surface of the liquid or within the vessel

used as determined by appropriate test procedure and apparatus as specified below.

The flash point of liquids having a flash point at or below 175° F. (79° C.), except for fuel oils and certain viscous materials, shall be determined in accordance with the Standard Method of Test for Flash Point by the Tag Closed Tester, ASTM D-56-61.*

The flash point of liquids having a flash point above 175° F., except for fuel oils, shall be determined in accordance with the Standard Method of Test for Flash Point by the Cleveland Open Cup Tester, ASTM D-92-57.*

The flash point of fuel oil, and certain viscous materials having a flash point at or below 175° F., shall be determined in accordance with the Standard Method of Test for Flash Point by the Pensky-Martens Closed Tester, ASTM D-93-62.*

HOTEL shall mean buildings or groups of buildings under the same management in which there are sleeping accommodations for hire, primarily used by transients who are lodged with or without meals including but not limited to inns, clubs, motels and apartment hotels.

INSTITUTIONAL OCCUPANCY shall mean the occupancy or use of a building or structure or any portion thereof by persons harbored or detained to receive medical, charitable or other care or treatment, or by persons involuntarily detained.

LIQUID shall mean, when not otherwise identified, to include both flammable and combustible liquids.

COMBUSTIBLE LIQUIDS shall mean any liquid having a flash point at or above 140° F. and below 200° F., and shall be known as Class III liquids.

NOTE: The upper limit of 200° F. is given because the application of this Code does not extend to liquids having flash points above 200° F. and should not be construed as indicating that liquids with higher flash points are noncombustible.

FLAMMABLE LIQUIDS shall mean any liquid having a flash point below 140° F. and having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100° F.

*Available from American Society for Testing and Materials, 1916 Race St., Philadelphia 3, Pa.

Flammable liquids shall be divided into two classes of liquids as follows:

CLASS I liquids shall include those having flash points below 100° F. and may be subdivided as follows:

CLASS IA shall include those having flash points below 73° F. and having a boiling point below 100° F.

CLASS IB shall include those having flash points below 73° F. and having a boiling point at or above 100° F.

CLASS IC shall include those having flash points at or above 73° F. and below 100° F.

CLASS II liquids shall include those having flash points at or above 100° F. and below 140° F.

The volatility of liquids is increased when artificially heated to temperatures equal to or higher than their flash points. When so heated Class II and III liquids shall be subject to the applicable requirements for Class I or II liquids. This Code may also be applied to high flash point liquids when so heated even though these same liquids when not heated are outside of its scope.

UNSTABLE (REACTIVE) LIQUID shall mean a liquid which in the pure state or as commercially produced or transported will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shock, pressure, or temperature.

LOW PRESSURE TANK shall mean a storage tank which has been designed to operate at pressures above 0.5 psig but not more than 15 psig.

MARINE SERVICE STATION shall mean that portion of a property where flammable or combustible liquids used as motor fuels are stored and dispensed from fixed equipment on shore, piers, wharves, or floating docks into the fuel tanks of motor craft, and shall include all facilities used in connection therewith.

MERCANTILE OCCUPANCY shall mean the occupancy or use of a building or structure or any portion thereof for the displaying, selling or buying of goods, wares, or merchandise.

OFFICE OCCUPANCY shall mean the occupancy or use of a building or structure or any portion thereof for the transaction of business, or the rendering or receiving of professional services.

PRESSURE VESSEL shall mean a storage tank or vessel which has been designed to operate at pressures above 15 psig.

PROCESS AREA shall mean that location where flammable or combustible liquids are processed, or stored as a part of the current production, and may include working storage.

PROCESSING PLANT shall mean that portion of a property in which flammable or combustible liquids are mixed, heated, separated or otherwise processed as principal business, but shall not include plants defined herein as refineries, chemical plants or distilleries.

REFINERY shall mean a plant in which flammable or combustible liquids are produced on a commercial scale from crude petroleum, natural gasoline, or other hydrocarbon sources.

SAFETY CAN shall mean an approved container, of not over five gallons capacity, having a spring-closing lid and spout cover.

VAPOR PRESSURE shall mean the pressure, measured in pounds per square inch (absolute) exerted by a volatile liquid as determined by the "Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method)," (ASTM D323-58).*

VENTILATION as specified in this Code is for the prevention of fire and explosion. It is considered adequate if it is sufficient to prevent accumulation of significant quantities of vapor-air mixtures in concentration over one-fourth of the lower flammable limit.

12. Containers.

1211. A container shall not exceed 60 gallons individual capacity and shall be made of metal except that:

(a) Plastic or glass containers having an individual capacity of not more than one pint may be used for flammable and combustible liquids.

(b) Plastic or glass containers having an individual capacity of not more than one gallon may be used for medicines, beverages, foodstuff and toiletries that are flammable or combustible liquids.

(c) Plastic or glass containers having an individual capacity of not more than one gallon may be used for flammable and combustible liquids whose chemical purity would be contaminated by metal containers.

*Available from American Society for Testing and Materials, 1916 Race St., Philadelphia 3, Pa.

CHAPTER II.

TANK STORAGE.

20. Design and Construction of Tanks.

2010. Materials.

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

2012. Tanks may be built of noncombustible materials other than steel if required by the properties of the flammable or combustible liquid stored.

NOTE: In case of doubt, the supplier, producer of the flammable or combustible liquid, or other competent authority should be consulted as to the suitability of the material of construction to be used.

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

2014. Unlined concrete tanks may be used for storing flammable or combustible liquids having a gravity of 40 degrees API or heavier. Concrete tanks with special lining may be used for other services provided the design is in accordance with sound engineering practice.

2015. Tanks may have combustible or noncombustible linings.

2016. Special engineering consideration shall be required if the specific gravity of the liquid to be stored exceeds that of water or if the tanks are designed to contain flammable or combustible liquids at a liquid temperature below zero degrees F.

2020. Fabrication.

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

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

2030. Atmospheric Tanks.

2031. Atmospheric tanks shall be built in accordance with approved standards of design. Atmospheric tanks may be built in accordance with:

(a) Underwriters' Laboratories, Inc. Subjects No. 142, Standard for Aboveground Tanks for Flammable Liquids, Second Edition, October 1953; No. 58, Standard for Underground Storage Tanks, Fifth Edition, December 1961; or No. 80, Standard for Inside Tanks for Oil-Burner Fuel, Fourth Edition, February 1958.

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

(c) American Petroleum Institute Standards No. 12B, Specification for Bolted Production Tanks, Eleventh Edition, May 1958 and Supplement I, March 1962; No. 12D, Specification for Large Welded Production Tanks, Seventh Edition, August 1957; or No. 12F, Specification for Small Welded Production Tanks, Fifth Edition, March 1961. Tanks built in accordance with these standards shall be used only as production tanks for storage of crude petroleum in oil-producing areas.

2032. Tanks designed for underground service not exceeding 2,500 gallons capacity may be used aboveground.

2033. Low pressure tanks and pressure vessels may be used as atmospheric tanks.

2034. Atmospheric tanks shall not be used for the storage of Class IA liquids.

2040. Low Pressure Tanks.

2041. The normal operating pressure of the tank shall not exceed the design pressure of the tank.

2042. Low pressure tanks shall be built in accordance with approved standards of design. Low pressure tanks may be built in accordance with:

(a) American Petroleum Institute Standard No. 620, Recommended Rules for the Design and Construction of

Large, Welded, Low-Pressure Storage Tanks, First Edition, February 1956 and Addenda February 1958.

(b) The principles of the Code for Unfired Pressure Vessels, Section VIII of the ASME Boiler and Pressure Vessels Code, 1962 Edition.

2043. Atmospheric tanks built according to Underwriters' Laboratories, Inc. requirements in Paragraph 2031 may be used for operating pressures not exceeding 1 psig and shall be limited to 2.5 psig under emergency venting conditions.

2044. Pressure vessels may be used as low pressure tanks.

2050. Pressure Vessels.

2051. The normal operating pressure of the vessel shall not exceed the design pressure of the vessel.

2052. Pressure vessels shall be built in accordance with the Code for Unfired Pressure Vessels, Section VIII of the ASME Boiler and Pressure Vessels Code, 1962 Edition.

2060. Provisions for Internal Corrosion.

2061. When tanks are not designed in accordance with the American Petroleum Institute, American Society of Mechanical Engineers or the Underwriters' Laboratories, Inc. Standards or if corrosion is anticipated beyond that provided for in the design formulas used, additional metal thickness or suitable protective coatings or linings shall be provided to compensate for the corrosion loss expected during the design life of the tank.

21. Installation of Outside Aboveground Tanks.

2110. Location With Respect to Property Lines and Public Ways.

2111. Every aboveground tank for the storage of flammable or combustible liquids, except those liquids with boilover characteristics and unstable liquids, operating at pressures not in excess of 2.5 psig and equipped with emergency venting which will not permit pressures to exceed 2.5 psig shall be located in accordance with Table 1.

Table 1

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which May be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way
Floating Roof	Protection for Exposures*	½ times diameter of tank but need not exceed 90 feet	⅙ times diameter of tank but need not exceed 30 feet
	None	Diameter of tank but need not exceed 175 feet	⅙ times diameter of tank but need not exceed 30 feet
Vertical with Weak Roof to Shell Seam	Approved foam or inerting system on the tank	½ times diameter of tank but need not exceed 90 feet and shall not be less than 5 feet	⅙ times diameter of tank but need not exceed 30 feet and shall not be less than 5 feet
	Protection for Exposures*	Diameter of tank but need not exceed 175 feet	⅓ times diameter of tank but need not exceed 60 feet
	None	2 times diameter of tank but need not exceed 350 feet	⅓ times diameter of tank but need not exceed 60 feet
Horizontal and Vertical, with Emergency Relief Venting to Limit Pressures to 2.5 psig	Approved inerting system on the tank or approved foam system on vertical tanks	½ times Table 5 but shall not be less than 5 feet	½ times Table 5 but shall not be less than 5 feet
	Protection for Exposures*	Table 5	Table 5
	None	2 times Table 5	Table 5

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

2112. Every aboveground tank for the storage of flammable or combustible liquids, except those liquids with boilover characteristics and unstable flammable or combustible

liquids, operating at pressures exceeding 2.5 psig or equipped with emergency venting which will permit pressures to exceed 2.5 psig shall be located in accordance with Table 2.*

Table 2

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which May be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way
Any Type	Protection for Exposures	1½ times Table 5 but shall not be less than 25 feet	1½ times Table 5 but shall not be less than 25 feet
	None	3 times Table 5 but shall not be less than 50 feet	1½ times Table 5 but shall not be less than 25 feet

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

2113. Every aboveground tank for the storage of flammable or combustible liquids with boil-over characteristics shall be located in accordance with Table 3.

Table 3

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which May be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way
Floating Roof	Protection for Exposures	Diameter of tank but need not exceed 175 feet	⅙ times diameter of tank but need not exceed 60 feet
	None	2 times diameter of tank but need not exceed 350 feet	⅙ times diameter of tank but need not exceed 60 feet
Fixed Roof	Approved foam or inerting system	Diameter of tank but need not exceed 175 feet	⅙ times diameter of tank but need not exceed 60 feet
	Protection for Exposures	2 times diameter of tank but need not exceed 350 feet	⅔ times diameter of tank but need not exceed 120 feet
	None	4 times diameter of tank but need not exceed 350 feet	⅔ times diameter of tank but need not exceed 120 feet

2114. Every aboveground tank for the storage of unstable liquids shall be located in accordance with Table 4.

Table 4

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which May be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way
Horizontal and Vertical Tanks with Emergency Relief Venting to Permit Pressure Not in Excess of 2.5 psig	Tank protected with any one of the following: Approved water spray, Approved inerting, Approved insulation and refrigeration, Approved barricade	Table 5 but not less than 25 feet	Not less than 25 feet
	Protection for Exposures	2½ times Table 5 but not less than 50 feet	Not less than 50 feet
	None	5 times Table 5 but not less than 100 feet	Not less than 100 feet
Horizontal and Vertical Tanks with Emergency Relief Venting to Permit Pressure Over 2.5 psig	Tank protected with any one of the following: Approved water spray, Approved inerting, Approved insulation and refrigeration, Approved barricade	2 times Table 5 but not less than 50 feet	Not less than 50 feet
	Protection for Exposures	4 times Table 5 but not less than 100 feet	Not less than 100 feet
	None	8 times Table 5 but not less than 150 feet	Not less than 150 feet

2115. Reference minimum distances for use in Tables 1 to 4 inclusive.

Table 5

Capacity Tank Gallons	Minimum Distance in Feet from Property Line Which May be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way
275 or less	5	5
276 to 750	10	5
751 to 12,000	15	5
12,001 to 30,000	20	5
30,001 to 50,000	30	10
50,001 to 100,000	50	15
100,001 to 500,000	80	25
500,001 to 1,000,000	100	35
1,000,001 to 2,000,000	135	45
2,000,001 to 3,000,000	165	55
3,000,001 or more	175	60

2116. Where two tank properties of diverse ownership have a common boundary, the authority having jurisdiction may, with the written consent of the owners of the two properties, substitute the distances provided in Paragraphs 2121 through 2126 for the minimum distances set forth in Section 2110.

2117. Where end failure of horizontal pressure tanks and vessels may expose property, the tank shall be placed with the longitudinal axis parallel to the nearest important exposure.

2120. Spacing (Shell-to-Shell) Between Aboveground Tanks.

2121. The distance between any two flammable or combustible liquid storage tanks shall not be less than three feet.

2122. Except as provided in Paragraphs 2123-2125 inclusive, the distance between adjacent tanks shall not be less than one-sixth the sum of their diameters except when the diameter of one tank is less than one-half the diameter of the adjacent tank, the distance between the two tanks shall not be less than one-half the diameter of the smaller tank.

2123. Crude petroleum in conjunction with production facilities located in noncongested areas and having capacities not exceeding 126,000 gallons (3,000 barrels), the distance between such tanks shall not be less than three feet.

2124. Crude petroleum in producing areas having capacities in excess of 126,000 gallons (3,000 barrels), the distance between such tanks shall not be less than the diameter of the smaller tank.

2125. Unstable flammable or combustible liquids, the distance between such tanks shall not be less than one-half the sum of their diameters.

2126. When tanks are compacted in three or more rows or in an irregular pattern, greater spacing or other means shall be provided at the discretion of the authority having jurisdiction so that inside tanks are accessible for fire fighting purposes.

2127. The minimum separation between a liquefied petroleum gas container and a flammable or combustible liquid storage tank shall be 20 feet. Suitable means shall be taken to prevent the accumulation of flammable or combustible liquids under adjacent liquefied petroleum gas containers such as by diversion curbs or grading. When flammable or combustible liquid storage tanks are within a diked area, the liquefied petroleum gas containers shall be outside the diked area and at least 10 feet away from the center line of the wall of the diked area. The foregoing provisions shall not apply when liquefied petroleum gas containers of 125 gallons or less capacity are installed adjacent to fuel oil supply tanks of 550 gallons or less capacity.

2130. Normal Venting for Aboveground Tanks.

2131. Atmospheric storage tanks shall be adequately vented to prevent the development of vacuum or pressure sufficient to distort the roof of a cone roof tank or exceeding the design pressure in the case of other atmospheric tanks, as a result of filling or emptying, and atmospheric temperature changes.

2132. Normal vents shall be sized either in accordance with: (1) the American Petroleum Institute Guide for Tank Venting, RP-2000; or (2) other accepted standard; or (3) shall be at least as large as the filling or withdrawal connection, whichever is larger but in no case less than 1¼ inch nominal inside diameter.

2133. Low-pressure tanks and pressure vessels shall be adequately vented to prevent development of pressure or

vacuum, as a result of filling or emptying and atmospheric temperature changes, from exceeding the design pressure of the tank or vessel. Protection shall also be provided to prevent overpressure from any pump discharging into the tank or vessel when the pump discharge pressure can exceed the design pressure of the tank or vessel.

2134. If any tank or pressure vessel has more than one fill or withdrawal connection and simultaneous filling or withdrawal can be made, the vent size shall be based on the maximum anticipated simultaneous flow.

2135. Unless the vent is designed to limit the internal pressure 2.5 psi or less, the outlet of vents and vent drains shall be arranged to discharge in such a manner as to prevent localized overheating of any part of the tank in the event vapors from such vents are ignited.

2136. Tanks and pressure vessels storing Class IA liquids shall be equipped with venting devices which shall be normally closed except when venting to pressure or vacuum conditions. Tanks and pressure vessels storing Class IB and IC liquids shall be equipped with venting devices which shall be normally closed except when venting under pressure or vacuum conditions, or with approved flame arresters.

EXCEPTION: Tanks of 3,000 bbls. capacity or less containing crude petroleum in crude-producing areas; and, outside aboveground atmospheric tanks under 1,000 gallons capacity containing other than Class IA flammable liquids may have open vents. (See Paragraph 2152.)

2137. Flame arresters or venting devices required in Paragraph 2136 may be omitted for IB and IC liquids where conditions are such that their use may, in case of obstruction, result in tank damage.

NOTE: Liquid properties justifying the omission of such devices include, but are not limited to, condensation, corrosiveness, crystallization, polymerization, freezing or plugging. When any of these conditions exist, consideration may be given to heating, use of devices employing special materials of construction, the use of liquid seals, or inerting (see Standard for Inerting for Fire and Explosion Prevention, NFPA No. 69).

2140. Emergency Relief Venting for Fire Exposure for Aboveground Tanks.

2141. Every aboveground storage tank shall have some form of construction or device that will relieve excessive internal pressure caused by exposure fires.

2142. In a vertical tank the construction referred to in 2141 may take the form of a floating roof, lifter roof, a weak roof-to-shell seam, or other approved pressure relieving construction. The weak roof-to-shell seam shall be constructed to fail preferential to any other seam.

2143. Where emergency venting is not provided in accordance with 2142, the total capacity of both normal and emergency venting devices shall be not less than that derived from Table 6, except as provided in 2144 or 2145. (See Appendix.)

Table 6
Wetted Area Versus Cubic Feet Free Air per Hour (14.7 psia and 60° F.)

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

NOTE: Interpolate for intermediate values.

The wetted area of the tank shall be calculated on the basis of 55 per cent of the total exposed area of a sphere or spheroid, 75 per cent of the total exposed area of a horizontal tank and the first 30 feet abovegrade of the exposed shell area of a vertical tank.

2144. The total emergency relief venting capacity for any specific liquid may be determined by the following formula: Cubic feet of free air per hour $= V \frac{1337}{L\sqrt{M}}$.

V = cubic feet of free air per hour from Table 6.
L = latent heat of vaporization of specific liquid in Btu per lb.
M = molecular weight of specific liquids.

2145. The required air flow rate of 2143 or 2144 may be multiplied by the appropriate factor listed in the following schedule when protection is provided as indicated. Only one factor may be used for any one tank.

.5 for drainage in accordance with Paragraph 2162 for tanks over 200 square feet of wetted area.

.3 for approved water spray.

.3 for approved insulation.

.15 for approved water spray with approved insulation.

2146. The outlet of all vents and vent drains on tanks equipped with emergency venting to permit pressures exceeding 2.5 psig shall be arranged to discharge in such a way as to prevent localized overheating of any part of the tank, in the event vapors from such vents are ignited.

2150. Vent Piping for Aboveground Tanks.

2151. Vent piping shall be constructed in accordance with Chapter IV.

2152. Where vent pipe outlets for tanks storing Class I liquids are adjacent to buildings or public ways, they shall be located so that the vapors are released at a safe point outside of buildings and not less than 12 feet above the adjacent ground level. In order to aid their dispersion, vapors shall be discharged upward or horizontally away from closely adjacent walls. Vent outlets shall be located so that flammable vapors will not be trapped by eaves or other obstructions and shall be at least five feet from building openings.

2153. When tank vent piping is manifolded, pipe sizes shall be such as to discharge, within the pressure limitations of the system, the vapors they may be required to handle when manifolded tanks are subject to the same fire exposure.

NOTE: The manifolding of tank vent piping should be avoided except where required for special purposes such as vapor recovery, vapor conservation or air pollution control.

2160. Drainage, Dikes and Walls for Aboveground Tanks.

2161. DRAINAGE AND DIKED AREAS: The area surrounding a tank or a group of tanks shall be provided with drainage as in Paragraph 2162, or shall be diked as provided in Paragraph 2163, to prevent accidental discharge of liquid

from endangering adjoining property or reaching waterways, except that in particular installations these provisions may be waived or altered at the discretion of the authority having jurisdiction when the tanks under consideration do not constitute a hazard to adjoining property.

2162. DRAINAGE: Where protection of adjoining property or waterways is by means of a natural or man-made drainage system, such systems shall comply with the following:

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

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

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

2163. DIKED AREAS: Where protection of adjoining property or waterways is accomplished by retaining the liquid around the tank by means of a diked area, such diked area shall comply with the following requirements:

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

(b) For a tank or group of tanks with fixed roofs containing crude petroleum with boil-over characteristics, the volumetric capacity of the diked area shall not be less than the tank or tanks served by the enclosure, assuming full tanks. The capacity of the diked area enclosing more than one tank shall be calculated by deducting the volume of tanks below the height of the dike.

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

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

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

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

(g) Each diked area containing two or more tanks shall be sub-divided preferably by drainage channels or at least by intermediate curbs in order to prevent spills from endangering adjacent tanks within the diked area as follows:

(1) When storing normally stable liquids in vertical cone roof tanks constructed with weak roof-to-shell seam or approved floating roof tanks or when storing crude petroleum in producing areas in any type of tank, one sub-division for each tank in excess of 10,000 bbls. and one sub-division for each group of tanks (no tank exceeding 10,000 bbls. capacity) having an aggregate capacity not exceeding 15,000 bbls.

(2) When storing normally stable flammable or combustible liquids in tanks not covered in sub-paragraph (1), one sub-division for each tank in excess of 100,000 gallons (2,500 bbls.) and one sub-division for each group of tanks (no tank exceeding 100,000 gallons capacity) having an aggregate capacity not exceeding 150,000 gallons (3,570 bbls.).

(3) When storing unstable liquids in any type of tank, one sub-division for each tank except that tanks installed in accordance with the drainage requirements of NFPA No. 15, Standard for Water Spray Systems for Fire Protection, shall require no additional sub-division.

NOTE: Since unstable liquids will react more rapidly when heated than when at ambient temperatures, sub-division by drainage channels is the preferred method.

(4) The drainage channels or intermediate curbs shall be located between tanks so as to take full advantage of the available space with due regard for the individual tank capacities. Intermediate curbs, where used, shall be not less than 18 inches in height.

2170. Stairs, Platforms and Walkways for Aboveground Tanks: Stairs, platforms and walkways shall be of metal, concrete or wood.

2180. Tank Openings Other Than Vents for Aboveground Tanks.

2181. Connections for all tank openings shall be vapor and liquid tight. Vents are covered in Sections 2130 through 2150.

2182. Each connection to an aboveground tank through which liquid can normally flow shall be provided with an internal or an external valve located as close as practical to the shell of the tank. Such valves, when external, and their connections to the tank shall be of steel except when the chemical characteristics of the liquid stored are incompatible with steel. When materials other than steel are necessary, they shall be suitable for the pressures, structural stresses and temperatures involved, including fire exposures.

NOTE: Flanged connections are preferred in sizes three inches and larger.

2183. Each connection below the liquid level through which liquid does not normally flow shall be provided with a liquid-tight closure. This may be a valve, plug or blind, or a combination of these.

2184. Openings for gaging shall be provided with a vapor-tight cap or cover.

2185. For Class IB and Class IC liquids other than crude oils, gasolines and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity. A fill pipe entering the top of a tank shall terminate within six inches of the bottom of the tank and shall be installed to avoid excessive vibration.

2186. Filling and emptying connections which are made and broken shall be located outside of buildings at a location

free from any source of ignition and not less than five feet away from any building opening. Such connection shall be closed and liquid tight when not in use. The connection shall be properly identified.

22. Installation of Underground Tanks.

2210. Location: Excavation for underground storage tanks shall be made with due care to avoid undermining of foundations of existing structures. Underground tanks or tanks under buildings shall be so located with respect to existing building foundations and supports that the loads carried by the latter cannot be transmitted to the tank. The distance from any part of a tank storing Class I liquids to the nearest wall of any basement or pit shall be not less than one foot, and to any property line that may be built upon, not less than three feet. The distance from any part of a tank storing Class II or Class III liquids to the nearest wall of any basement, pit or property line shall be not less than one foot.

2220. Depth and Cover: Underground tanks shall be set on firm foundation and surrounded with noncorrosive, inert materials such as clean sand, earth or gravel well tamped in place. Tanks 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 underground tanks are, or are likely to be, subjected to traffic, they shall be protected against damage from vehicles passing over them by at least three feet of earth cover, or 18 inches of well-tamped earth, plus six inches of reinforced concrete or eight inches of asphaltic 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.

2230. Vents.

2231. Location and Arrangement of Vents for Class I Liquids: Vent pipes from tanks storing Class I liquids shall be so located that the discharge point is outside of buildings, higher than the fill pipe opening, and not less than 12 feet above the adjacent ground level. Vent pipes shall discharge only upward in order to disperse vapors. Vent pipes two inches or less in nominal inside diameter shall not be obstructed by devices that will cause excessive back pressure.

Vent pipe outlets shall be so located that flammable vapors will not enter building openings, or be trapped under eaves or other obstructions. If the vent pipe is less than ten feet in length or greater than two inches in nominal inside diameter, the outlet shall be provided with a vacuum and pressure relief device or there shall be an approved flame arrester located in the vent line at the outlet or within the approved distance from the outlet. In no case shall a flame arrester be located more than 15 feet from the outlet end of the vent line.

2232. SIZE OF VENTS: Each tank shall be vented through piping adequate in size to prevent blow-back of vapor or liquid at the fill opening while tank is being filled. Vent pipes shall be not less than 1¼ inch nominal inside diameter.

NOTE: The vent size depends upon the filling or withdrawal rate whichever is larger, the vent line length and the tank design pressure. Vent piping sized in accordance with Table 7 will prevent the pressure in the tank from exceeding 2.5 psig.

Table 7

Vent Line Length in Feet
Maximum Flow in GPM

	50	100	200
100	1¼-inch	1¼-inch	1¼-inch
200	1¼-inch	1¼-inch	1¼-inch
300	1¼-inch	1¼-inch	1½-inch
400	1¼-inch	1½-inch	2-inch
500	1¼-inch	1½-inch	2-inch

2233. LOCATION AND ARRANGEMENT OF VENTS FOR CLASS II OR CLASS III LIQUIDS: Vent pipes from tanks storing Class II or Class III flammable liquids shall terminate outside of building and higher than the fill pipe opening. Vent outlets shall be above normal snow level. They may be fitted with return bends, coarse screens or other devices to minimize ingress of foreign material.

2234. Vent piping shall be constructed in accordance with Chapter IV. Vent pipes shall be so laid as to drain toward the tank without sags or traps in which liquid can collect. They shall be located so that they will not be subjected to physical damage. The tank end of the vent pipe shall enter the tank through the top.

2240. Tank Openings Other Than Vents.

2241. Connections for all tank openings shall be vapor or liquid tight.

2242. Openings for manual gaging, if independent of the fill pipe, shall be provided with a liquid-tight cap or cover. If inside a building, each such opening shall be protected against liquid overflow and possible vapor release by means of a spring loaded check valve or other approved device.

2243. Fill and discharge lines shall enter tanks only through the top. Fill lines shall be sloped toward the tank.

2244. For Class IB and Class IC liquids other than crude oils, gasolines and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity by terminating within six inches of the bottom of the tank.

2245. Filling and emptying connections which are made and broken shall be located outside of buildings at a location free from any source of ignition and not less than five feet away from any building opening. Such connection shall be closed and liquid tight when not in use. The connection shall be properly identified.

23. Installation of Tanks Inside of Buildings.

2310. Location: Tanks shall not be permitted inside of buildings except as provided in Chapters VI, VII, VIII or IX.

2320. Vents: Vents for tanks inside of buildings shall be as provided in Sections 2130, 2140, 2152 and 2230 except that emergency venting by the use of weak roof seams on tanks shall not be permitted. Vents shall discharge vapors outside the buildings.

2330. Vent Piping: Vent piping shall be constructed in accordance with Chapter IV.

2340. Tank Openings Other Than Vents.

2341. Connections for all tank openings shall be vapor or liquid tight. Vents are covered in Section 2320.

2342. Each connection to a tank inside of buildings through which liquid can normally flow shall be provided

with an internal or an external valve located as close as practical to the shell of the tank. Such valves, when external, and their connections to the tank shall be of steel except when the chemical characteristics of the liquid stored are incompatible with steel. When materials other than steel are necessary, they shall be suitable for the pressures, structural stresses and temperatures involved, including fire exposures.

NOTE: Flanged connections are preferred in sizes three inches and larger.

2343. Flammable or combustible liquid tanks located inside of buildings, except in one-story buildings designed and protected for flammable or combustible liquid storage, shall be provided with an automatic-closing heat-actuated valve on each withdrawal connection below the liquid level, except for connections used for emergency disposal, to prevent continued flow in the event of fire in the vicinity of the tank. This function may be incorporated in the valve required in Paragraph 2342, and if a separate valve, shall be located adjacent to the valve required in Paragraph 2342.

2344. Openings for manual gaging, if independent of the fill pipe (see Paragraph 2336), shall be provided with a vapor-tight cap or cover. Each such opening shall be protected against liquid overflow and possible vapor release by means of a spring loaded check valve or other approved device.

NOTE: Manual gaging of tanks containing Class I liquids should be avoided. Substitutes for manual gaging include, but are not limited to, heavy duty flat gage glasses, magnetic, hydraulic or hydrostatic remote reading devices and sealed float gages.

2345. For Class IB and Class IC liquids other than crude oils, gasolines and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity by terminating within six inches of the bottom of the tank.

2346. The fill pipe inside of the tank shall be installed to avoid excessive vibration of the pipe.

2347. The inlet of the fill pipe shall be located outside of buildings at a location free from any source of ignition and not less than five feet away from any building opening. The inlet of the fill pipe shall be closed and liquid tight when not in use. The fill connection shall be properly identified.

2348. Tanks inside buildings shall be equipped with a device, or other means shall be provided, to prevent overflow into the building.

NOTE: Suitable devices include, but are not limited to, a float valve, a preset meter on the fill line, a valve actuated by the weight of the tank contents, a low head pump which is incapable of producing overflow, or a liquid-tight overflow pipe at least one pipe size larger than the fill pipe discharging by gravity back to the outside source of liquid or to an approved location.

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

2410. Tank supports shall be installed on firm foundations. Tank supports shall be of concrete, masonry or protected steel. Single wood timber supports (not cribbing) laid horizontally may be used for outside aboveground tanks if not more than 12 inches high at their lowest point.

2420. Steel supports or exposed piling shall be protected by materials having a fire resistance rating of not less than two hours, except that steel saddles need not be protected if less than 12 inches high at their lowest point. At the discretion of the authority having jurisidiction, approved water spray protection or its equivalent may be used in lieu of fire-resistive materials to protect supports.

2430. The design of the supporting structure for tanks such as spheres shall require special engineering consideration.

NOTE: Appendix N of the API Standard 620, Recommended Rules for the Design and Construction of Large, Welded, Low-Pressure Storage Tanks, contains information regarding supporting structures.

2440. Every tank shall be so supported as to prevent the excessive concentration of loads on the supporting portion of the shell.

2450. Tanks shall rest on the ground or on foundations made of concrete, masonry, piling or steel. Tank foundations shall be designed to minimize the possibility of uneven settling of the tank and to minimize corrosion in any part of the tank resting on the foundation.

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

2460. Where a tank is located in an area that may be subjected to flooding, the applicable precautions outlined in NFPA No. 30A, Protection of Tanks Containing Flammable or Combustible Liquids in Locations That May Be Flooded, shall be observed.

2470. In areas subject to earthquakes, the tank supports and connections shall be designed to resist damage as a result of such shocks.

25. Sources of Ignition.

2510. In locations where flammable vapors may be present, precautions shall be taken to prevent ignition by eliminating or controlling sources of ignition. Sources of ignition may include open flames, lightning, smoking, cutting and welding, hot surfaces, frictional heat, sparks (static, electrical and mechanical), spontaneous ignition, chemical and physical-chemical reactions and radiant heat.

NOTE: NFPA No. 77M, Static Electricity, and NFPA No. 78, Code for Lightning Protection, provide information on such protection.

26. Testing.

2610. All tanks, whether shop-built or field-erected, shall be strength tested before they are placed in service in accordance with the applicable paragraphs of the Code under which they were built. The ASME Code stamp, API monogram, or the label of the Underwriters' Laboratories, Inc. on a tank shall be evidence of compliance with this strength test. Tanks not marked in accordance with the above Codes shall be strength tested before they are placed in service in accordance with good engineering principles and reference shall be made to the sections on testing in the Codes listed in Paragraphs 2031, 2042 or 2052.

2620. When the vertical length of the fill and vent pipes is such that when filled with liquid the static head imposed upon the bottom of the tank exceeds 10 pounds per square inch, the tank and related piping shall be tested hydrostatically to a pressure equal to the static head thus imposed. In special cases where the height of the vent above the top of the tank is excessive the hydrostatic test pressure shall be specified by the authority having jurisdiction.

2630. In addition to the strength test called for in Sections 2610 and 2620, all tanks and connections shall be tested for tightness. Except for underground tanks, this tightness test shall be made at operating pressure with air, inert gas or water prior to placing the tank in service. In the case of field-erected tanks the strength test may be considered to be the test for tank tightness. Underground tanks and piping, before being

covered, enclosed, or placed in use, shall be tested for tightness hydrostatically, or with air pressure at not less than three pounds per square inch and not more than five pounds per square inch. (See Section 4610 for testing pressure piping.)

2640. All leaks or deformations shall be corrected in an acceptable manner before the tank is placed in service. Mechanical caulking is not permitted for correcting leaks in welded tanks except pin hole leaks in the roof.

2650. Tanks to be operated at pressures below their design pressure may be tested by the applicable provisions of Sections 2610 or 2620 based upon the pressure developed under full emergency venting of the tank.

27. Special Situations.

2710. In particular installations the provisions of this chapter may be altered at the discretion of the authority having jurisdiction after consideration of the special features such as topographical conditions, barricades, walls, nature of occupancies and proximity to buildings or adjoining property and height and character of construction of such buildings; capacity and construction of proposed tanks and character of liquids to be stored, degree of private fire protection to be provided and the adequacy of facilities of the fire department to cope with flammable or combustible liquid fires.

CHAPTER III.

CLOSED CONTAINER STORAGE.

30. Storage in Closed Containers Inside Buildings.

3010. Scope.

3011. This Article 30 shall apply to the storage of flammable or combustible liquids in drums or other portable closed containers not exceeding 60 gallons individual capacity inside buildings.

3012. This Article 30 shall not apply to the storage of closed containers in bulk plants, service stations, refineries, chemical plants and distilleries. These requirements are covered separately in Chapters V, VI and IX respectively.

3013. This Article 30 shall not apply to areas where containers are opened for dispensing, mixing or handling. Container Storage in such locations is covered separately in Chapter V — Bulk Plants, Chapter VI — Service Stations, and Chapter IX — Refineries, Chemical Plants and Distilleries.

3020. Design and Construction of Inside Storage Rooms.

3021. Inside Storage Rooms shall comply with the following general construction requirements: Walls, floors and ceilings shall be of noncombustible construction having a fire-resistive rating of not less than two hours. Openings to other rooms or buildings shall be provided with noncombustible liquid-tight raised sills or ramps at least six inches in height and with approved fire doors arranged to close automatically in case of fire. A permissible alternate to either sills and ramps is open trenches covered with steel grating which are drained to a safe location. Where other portions of the building or other properties are exposed, windows shall be protected in a standard manner. Wood at least one inch nominal thickness may be used for shelving, racks, dunnage, scuffboards, floor overlay and similar installations. Proper ventilation shall be provided and natural ventilation is preferred over mechanical ventilation. Heating shall be restricted to low pressure steam or hot water or to electrical units complying with Paragraph 3022.

3022. Electrical wiring and equipment located in Inside Storage Rooms used for Class I liquids shall be approved for

Class I, Division 2 Hazardous Locations; for Class II and Class III liquids, shall be approved for general use.

NOTE: NFPA No. 70, National Electrical Code provides information on the design and installation of electrical equipment.

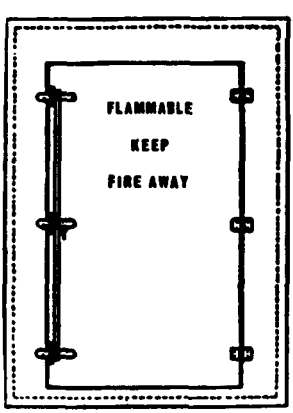
3023. Rooms or portions of buildings, affording a type of building construction and other features equivalent to that required for Inside Storage Rooms (Paragraphs 3021 and 3022) may be utilized for storage of flammable or combustible liquids if not used for any other storage or operation which, in combination, create a greater fire hazard.

3024. Storage rooms shall be located to minimize damage in the event of an explosion.

3025. Where practical, Inside Storage Rooms shall be equipped with large vents to provide fire and explosion relief.

3030. Storage Cabinets.

3031. Storage cabinets shall be constructed as follows or built to equivalent requirements. The bottom, top, door and sides of cabinet shall be at least No. 18 gage sheet iron and double walled with 1½-inch air space. Joints shall be riveted, welded or made tight by some equally effective means. The door shall be provided with a 3-point lock, kept closed when not in use, and the door sill shall be raised at least two inches above the bottom of the cabinet. When deemed necessary by the authority having jurisdiction, cabinets shall be vented. The cabinet shall be conspicuously labeled in red letters "FLAMMABLE—KEEP FIRE AWAY" See Figure 1.



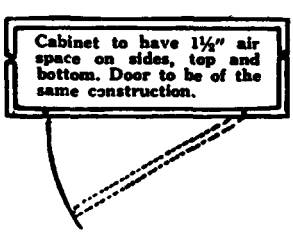


Fig. 1

Typical storage cabinet recommended for quantities less than 50 gals. Material is 18 gage sheet iron, tight joints.

3032. Storage cabinets may be used where it is desired to keep more than ten gallons of flammable or combustible liquids inside buildings. No individual container shall exceed five gallons capacity and not over 50 gallons shall be stored in any one cabinet.

3040. Manner of Storage and Limitations.

3041. Flammable or combustible liquids shall not be stored (including stock for sale), near exits, stairways or areas normally used for the safe egress of people.

3042. The storage of flammable or combustible liquids in closed containers shall comply with the following occupancy schedule except that the authority having jurisdiction may impose a quantity limitation or require greater protection where, in his opinion, unusual hazard to life or property is involved, or he may authorize increase of these amounts where the type of construction, fire protection provided or other factors substantially reduce the hazard.

3043. DWELLINGS AND APARTMENT HOUSES CONTAINING NOT MORE THAN THREE DWELLING UNITS AND ACCOMPANYING ATTACHED AND DETACHED GARAGES: Storage other than fuel oil shall be prohibited except that which is required for maintenance or equipment operation which shall not exceed ten gallons. Such flammable or combustible liquid shall be stored in metal closed containers or safety cans.

3044. ASSEMBLY AND OFFICE OCCUPANCIES, APARTMENT HOUSES CONTAINING MORE THAN THREE DWELLING UNITS, AND HOTELS: Storage shall be prohibited except that which is required for maintenance and operation of building and operation of equipment. Such storage shall be kept in closed metal containers stored in a storage cabinet or in safety cans or in an Inside Storage Room not having a door that opens into that portion of the building used by the public.

3045. EDUCATIONAL AND INSTITUTIONAL OCCUPANCIES: Storage shall be limited to that required for maintenance, demonstration, treatment and laboratory work. Flammable or combustible liquids in the laboratories and at other points of use shall be in containers not larger than one quart or in safety cans or in storage cabinets.

NOTE: Inside Storage Rooms preferably should be at ground level with at least one exterior wall.

3046. MERCANTILE OCCUPANCIES: In rooms or areas accessible to the public, storage shall be in closed containers and limited to quantities needed for display and normal merchandising purposes. Where the aggregate quantity of additional stock exceeds 180 gallons of which not more than 60 gallons may be Class I it shall be stored in rooms or portions of buildings that comply with the construction requirements of Section 3020, except that one story retail stores may have walls, floors and ceilings having a fire resistance rating of not less than one hour.

3047. GENERAL PURPOSE AND PUBLIC WAREHOUSES: Storage shall be in accordance with Table 4 in fire resistive buildings or in portions of such buildings cut off by standard fire walls. Noncombustible material, creating no hazard to the flammable liquids, may be stored in the same area.

3048. FLAMMABLE AND COMBUSTIBLE LIQUID WAREHOUSES OR STORAGE BUILDINGS: Storage shall be in accordance with Table 4. Storage buildings shall be of noncombustible construction. If storage building is located 30 to 50 feet from a building or line of adjoining property that may be built upon, the exposing wall shall be a noncombustible blank wall having a fire resistance rating of at least two hours. If storage building is located 10 to 30 feet from a building or line of adjoining property that may be built upon, the exposing wall shall be a blank wall having a fire resistance rating of at least three hours. If storage building is less than ten feet from the line of adjoining property that can be built upon, the exposing wall shall be a blank wall having a fire resistance rating of at least four hours. In particular installations the distance requirements between the storage building and other buildings may be altered at the discretion of the authority having jurisdiction after consideration of the height, size and character of construction and occupancy of the exposed buildings.

NOTE: At the discretion of the authority having jurisdiction, approved Class A fire doors may be installed in a standard manner on the otherwise blank walls.

3050. Fire Control.

3051. Suitable fire-control devices, such as small hose or portable fire appliances, shall be available at locations where flammable or combustible liquids are stored.

TABLE 8. ARRANGEMENT OF CONTAINER STORAGE

CLASS OF LIQUID	STORAGE LEVEL	SPRINKLERED OR EQUIVALENT PROTECTION					UNPROTECTED				
		Maximums Per Pile			AISLE WIDTH		Maximums Per Pile			AISLE WIDTH	
		TOTAL Gallons	WIDTH Feet	HEIGHT Feet	Main Feet	Side Feet	TOTAL Gallons	WIDTH Feet	HEIGHT Feet	Main Feet	Side Feet
I	Ground and Upper Floors	2,640 (48)	8 (4)	6 (2)	8	5	660 (12)	4 (2)	3 (1)	8	7
	Basement	not permitted					not permitted				
II	Ground and Upper Floors	5,280 (96)	8 (4)	6 (2)	8	4	1,320 (24)	4 (2)	3 (1)	8	5
	Basement	not permitted					not permitted				
III	Ground and Upper Floors	11,000 (200)	12 (6)	3 ft. under sprinkler heads	8	4	2,640 (48)	8 (4)	12 (4)	8	4
	Basement	5,500 (100)	(8) (4)	9 (3)	8	4	not permitted				

NOTE: The figures in the column, Total Gallons, represent the number of gallons that may be stored per pile and the figures in parenthesis are the corresponding number of 55 gallon drums. The figures in the Width and Height Columns are the width and height of the pile in feet and the figures in parenthesis are the corresponding number of 55 gallon drums which when stored on end will produce this size pile.

3052. When sprinklers are required, they shall be installed in an approved manner.

NOTE: NFPA No. 13, Standard for the Installation of Sprinkler Systems, provides information on the installation of sprinkler systems.

3053. Open flames, smoking and other sources of ignition shall not be permitted in flammable or combustible liquid storage rooms.

3054. Materials which will react with water to produce flammable vapors shall not be stored in the same room with flammable or combustible liquids.

31. Storage in Closed Containers Outside Buildings.

3110. Scope.

3111. This Article 31 applies to the storage of flammable or combustible liquids in drums or other portable closed containers not exceeding 60 gallons individual capacity outside of buildings in areas used solely for such storage.

3112. This Article 31 shall not apply to the storage of flammable or combustible liquids in drums or portable closed containers in bulk plants, service stations, and refineries. These requirements are covered separately in Chapters V, VI and IX respectively.

3120. Basic Safeguards.

3121. Drums constructed in accordance with ICC Specifications or containers of equivalent construction may be stored out of doors.

3122. Drums shall not be stored outside on building platforms or between buildings, or in locations adjacent thereto, in such a manner that they would contribute to the spread of fire.

3123. Storage of over 100 drums of Class I liquids shall be limited to groups of 100 drums, located at least 60 feet from the nearest building or line of adjoining property that may be built upon and each group shall be separated by at least 40 feet. Storage of over 300 drums of Class II or Class III liquids shall be limited to groups of 300 drums located at least 50 feet from nearest building or line of adjoining property that may be built upon and each group shall be

separated by at least 30 feet. These distances may be reduced 50 per cent if sprinklers and drainage away from exposures are provided. In particular installations the distance requirements to buildings may be altered at the discretion of the authority having jurisdiction after consideration of the height, size and character of construction and occupancy of the exposed buildings.

3124. The drum storage shall be located to prevent "run-off" or drainage toward other storage or buildings. The area shall be kept clear of grass, weeds and other foreign combustibles. Signs shall be posted prohibiting open flames and smoking.

CHAPTER IV.

PIPING, VALVES AND FITTINGS.

40. General.

4010. The design (including selection of materials), fabrication, assembly, test and inspection of piping systems containing flammable or combustible liquids shall be suitable for the expected working pressures and structural stresses. Conformity with the applicable provisions of ASA B31 American Standard Code for Pressure Piping, and the provisions of this chapter, shall be considered prima facie evidence of compliance with the foregoing provisions.

4020. This chapter does not apply to any of the following:

(a) Tubing or casing on any oil or gas wells and any piping connected directly thereto.

(b) Floating craft or aircraft.

(c) Piping within the scope of any applicable boiler and pressure vessel Code.

4030. Piping systems consist of pipe, flanges, bolting, gaskets, valves, fittings, the pressure containing parts of other components such as expansion joints and strainers, and devices which serve such purposes as mixing, separating, snubbing, distributing, metering, or controlling flow.

41. Materials.

4110. Piping materials shall be steel except as provided in Paragraphs 4120, 4130, 4140 and 4150 or other material suitable for use with the liquid being handled.

4120. Piping may be built of noncombustible materials other than steel if required by the properties of the flammable or combustible liquid handled.

NOTE: In case of doubt, the supplier, producer of the flammable or combustible liquid, or other competent authority should be consulted as to the suitability of the material of construction to be used.

4130. Piping built of materials other than steel shall be designed to specifications embodying principles recognized as good engineering design for the material used and shall be approved by the authority having jurisdiction.

4140. Piping may have combustible or noncombustible linings.

4150. When low melting point materials such as aluminum and brass or materials that soften on fire exposure such as plastics, or nonductile materials such as cast iron, are necessary, special consideration shall be given to their behavior on fire exposure. If such materials are used in aboveground piping systems or inside buildings, they shall be suitably protected against fire exposure or so located that any spill resulting from the failure of these materials could not unduly expose persons, important buildings or structures or can be readily controlled by remote valves.

42. Pipe Joints.

4210. Pipe joints dependent upon the friction characteristics of combustible materials for mechanical continuity of piping shall not be used inside buildings. They may be used outside of buildings above or below ground. If used aboveground, the piping shall either be secured to prevent disengagement at the fitting or the piping system shall be so designed that any spill resulting from such disengagement could not unduly exposes persons, important buildings or structures, and could be readily controlled by remote valves.

43. Supports.

4310. Piping systems shall be substantially supported and protected against physical damage and excessive stresses arising from settlement, vibration, expansion or contraction.

44. Protection Against Corrosion.

4410. All piping for flammable or combustible liquids, both aboveground and underground, where subject to external corrosion, shall be painted or otherwise protected.

45. Valves.

4510. Piping systems shall contain a sufficient number of valves to operate the system properly and to protect the plant. Piping systems in connection with pumps shall contain a sufficient number of valves to control properly the flow of liquid in normal operation and in the event of physical damage. Connections to pipe lines, by which equipment such as

tank cars or tank trucks discharge liquids by means of centrifugal pumps into aboveground storage tanks, shall be provided with check valves for automatic protection against back-flow.

NOTE: See also Paragraph 2182.

46. Testing.

4610. All piping before being covered, enclosed or placed in use shall be tested hydrostatically or with air pressure at not less than 1½ times the maximum anticipated pressure of the system, but not less than five pounds per square inch gage at the highest point of the system. This test shall be maintained for at least 30 minutes or for sufficient time to complete visual inspection of all joints and connections.

CHAPTER V.

BULK PLANTS.

50. Storage.

5010. Class I liquids shall be stored in closed containers, or in storage tanks aboveground outside of buildings, or underground in accordance with Chapter II.

5020. Class II and Class III liquids shall be stored in containers, or in tanks within buildings or aboveground outside of buildings, or underground in accordance with Chapter II.

5030. Containers of flammable or combustible liquids when piled one upon the other shall be separated by dunnage sufficient to provide stability and to prevent excessive stress on container walls. The height of pile shall be consistent with stability and strength of containers.

51. Buildings.

5110. Exits: Rooms in which flammable or combustible liquids are stored or handled by pumps, shall have exit facilities arranged to prevent occupants being trapped in the event of fire.

NOTE: NFPA No. 101, Building Exits Code provides information on the number and location of exits.

5120. Heating: Rooms in which Class I liquids are stored or handled shall be heated only by means not constituting a source of ignition, such as steam or hot water. Rooms containing heating appliances involving sources of ignition shall be located and arranged to prevent entry of flammable vapors.

5130. Ventilation.

5131. Ventilation shall be provided for all rooms, buildings, or enclosures in which Class I liquids are pumped or dispensed. Design of ventilation systems shall take into account the relatively high specific gravity of the vapors. Ventilation may be provided by adequate openings in outside walls at floor level unobstructed except by louvers or coarse screens. Where natural ventilation is inadequate, mechanical ventilation shall be provided.

NOTE: NFPA No. 91, Standard for the Installation of Blower and Exhaust Systems, provides information on the installation of mechanical exhaust systems.

5132. Class I liquids shall not be stored or handled within a building having a basement or pit into which flammable vapors may travel, unless such area is provided with ventilation designed to prevent the accumulation of flammable vapors therein.

5133. Containers of Class I liquids shall not be drawn from or filled within buildings unless provision is made to prevent the accumulation of flammable vapors in hazardous concentrations. Where mechanical ventilation is required, it shall be kept in operation while flammable liquids are being handled.

52. Loading and Unloading Facilities.

5210. Truck Loading Racks.

5211. LOCATION: Truck loading racks dispensing Class I liquids shall be separated from tanks, warehouses, other plant buildings, and nearest line of property that may be built upon by a clear distance of not less than 25 feet, measured from the nearest position of any fill stem. Buildings for pumps or for shelter of loading personnel may be part of the loading rack.

5212. STATIC PROTECTION: The following types of truck loading racks shall be equipped with protection against static sparks during truck filling:—racks dispensing Class I liquids into open domes of tank trucks, and racks dispensing Class II or Class III liquids into open domes of tank trucks which may contain flammable vapors from previous cargoes of Class I liquids. Protection shall consist of a metallic bond-wire permanently electrically connected to the fill stem or some part of the fill-stem piping. The free end of such wire shall be provided with a clamp or similar device for convenient attachment to some metallic part of the cargo tank of the tank truck. The bond-wire connection shall be made prior to opening the dome covers. It shall be maintained in place during the entire filling operation and the dome covers shall be securely closed before the bond-wire is disconnected from the cargo tank.

NOTE: Drag chains and straps formerly specified for the purpose of eliminating static charges, have been shown by experience to be ineffective and their elimination is recommended.

5220. Tank Car Racks: Class I liquids shall not be discharged from or loaded into tank cars unless protection against stray currents has been provided and is used. Protection shall be designed and installed in accordance with Static Electricity, NFPA No. 77M.

5230. Container Filling Facilities: Class I liquids shall not be run into containers unless the nozzle and container are electrically interconnected. Where the metallic floorplate on which the container stands while filling is electrically connected to the fill stem or where the fill stem is bonded to the container during filling operations by means of a bond-wire, the provisions of this section shall be deemed to have been complied with.

53. Electrical Equipment.

5310. This article shall apply to areas where Class I liquids are stored or handled. For areas where Class II or Class III liquids only are stored or handled, the electrical equipment may be installed in accordance with the provisions of the National Electrical Code, NFPA No. 70, for ordinary locations.

5320. All electrical equipment and wiring shall be of a type specified by and shall be installed in accordance with the National Electrical Code.

5330. So far as it applies Table 9 shall be used to delineate and classify hazardous areas for the purpose of installation of electrical equipment under normal circumstances. In Table 9 a classified area shall not extend beyond an unpierced wall, roof or other solid partition.

NOTE: The designation of classes and divisions is defined in Chapter 5, Article 500, of the National Electrical Code.

5340. The area classifications listed in Section 5330 shall be based on the premise that the installation meets the applicable requirements of the Flammable and Combustible Liquids Code in all respects. Should this not be the case, the authority having jurisdiction shall have the authority to classify the extent of the hazardous area.

Table 9 — Electrical Equipment Hazardous Areas—Bulk Plants.

Location	NEC Class I, Group D Division	Extent of Classified Area
TANK VEHICLE AND TANK CAR*		
Bottom Loading or Unloading	2	Within 3 feet of point of connection, extending in all directions. Also up to 18 inches above grade within a horizontal radius of 10 feet from point of connection.
Loading Through Open Dome	1	Within 3 feet of edge of dome, extending in all directions.
	2	Area between 3 feet and 5 feet from edge of dome, extending in all directions.
Loading Through Closed Dome With Atmospheric Venting	1	Within 3 feet of open end of vent, extending in all directions.
	2	Area between 3 feet and 5 feet from open end of vent, extending in all directions.
	2	Within 3 feet of edge of dome, extending in all directions.
Loading Through Closed Dome With Vapor Recovery	2	Within 3 feet of point of connection from both fill and vapor line, extending in all directions.
DRUM AND CONTAINER FILLING		
Outdoors, or Indoors With Adequate Ventilation	1	Within 3 feet of vent and fill opening, extending in all directions.
	2	Area between 3 feet and 5 feet from vent or fill opening, extending in all directions. Also up to 18 inches above floor or grade level within a horizontal radius of 10 feet from vent or fill opening.

*When classifying extent of area, consideration shall be given to fact that tank cars or tank vehicles may be spotted at varying points. Therefore, the extremities of the loading or unloading positions shall be used.

Table 9 — Continued

Location	NEC Class I, Group D Division	Extent of Classified Area
TANK — ABOVEGROUND*		
Shell, Ends, or Roof and Dike Area	2	Within 10 feet from shell, ends, or roof of tank. Area inside dikes to level of top of dike within 25 feet of tank.
Vent	1	Within 5 feet of open end of vent, extending in all directions.
	2	Area between 5 feet and 10 feet from open end of vent, extending in all directions.
Floating Roof	1	Area above the roof and within the shell.
PITS		
Without Mechanical Ventilation	1	Entire area within pit if any part is within a Division 1 or 2 classified area.
With Mechanical Ventilation	2	Entire area within pit if any part is within a Division 1 or 2 classified area.
Containing Valves, Fittings or Piping, and Not Within a Division 1 or 2 Classified Area	2	Entire pit.
PUMPS, BLEEDERS, WITHDRAWAL FITTINGS, METERS AND SIMILAR DEVICES		
Indoors	2	Within 5 feet of any edge of such devices, extending in all directions. Also up to 3 feet above floor or grade level within 25 feet horizontally from any edge of such devices.
Outdoors	2	Within 3 feet of any edge of such devices, extending in all directions. Also up to 18 inches above grade level within 10 feet horizontally from any edge of such devices.

*For Tanks — Underground, see Article 64 of Chapter VI.

Table 9 — Continued

Location	NEC Class I, Group D Division	Extent of Classified Area
STORAGE AND REPAIR GARAGE FOR TANK VEHICLES	1	All pits or spaces below floor level.
	2	Area up to 18 inches above floor or grade level for entire storage or repair garage.
DRAINAGE DITCHES, SEPARATORS, IMPOUNDING BASINS	2	Area up to 18 inches above ditch, separator or basin. Also up to 18 inches above grade within 15 feet horizontally from any edge.
GARAGES FOR OTHER THAN TANK VEHICLES	Ordinary	If there is any opening to these rooms within the extent of an outdoor classified area, the entire room shall be classified the same as the area classification at the point of the opening.
OUTDOOR DRUM STORAGE	Ordinary	
INDOOR WAREHOUSING WHERE THERE IS NO FLAMMABLE LIQUID TRANSFER	Ordinary	If there is any opening to these rooms within the extent of an indoor classified area, the room shall be classified the same as if the wall, curb or partition did not exist.
OFFICE AND REST ROOMS	Ordinary	

54. Sources of Ignition.

5410. Class I liquids shall not be handled, drawn, or dispensed where flammable vapors may reach a source of ignition. Smoking shall be prohibited except in designated localities. "NO SMOKING" signs shall be conspicuously posted where hazard from flammable liquids vapors is normally present.

55. Drainage and Waste Disposal.

5510. Provision shall be made to prevent flammable or combustible liquids which may be spilled at loading or unloading points from entering public sewers and drainage systems, or natural waterways. Connection to such sewers, drains, or waterways by which flammable or combustible liquids might enter shall be provided with separator boxes or other approved

means whereby such entry is precluded. Crankcase drainings and flammable or combustible liquids shall not be dumped into sewers, but shall be stored in tanks or tight drums outside of any building until removed from the premises.

56. Fire Control.

5610. Suitable fire-control devices, such as small hose or portable fire extinguishers, shall be available to locations where fires are likely to occur. Additional fire-control equipment may be required where a tank of more than 50,000 gallons individual capacity contains Class I liquids and where an unusual exposure hazard exists from surrounding property. Such additional fire-control equipment shall be sufficient to extinguish a fire in the largest tank. The design and amount of such equipment shall be in accordance with approved engineering standards.

NOTE: This code does not cover the design or operation of petroleum wharves, found in bulk terminals (shore). A guide to regulation of petroleum wharves is published by the NFPA under the title "Suggested Ordinance for Petroleum Wharves", NFPA No. 304-L, and may be consulted for applicable sections.

CHAPTER VI.

SERVICE STATIONS.

60. Location.

6010. Apparatus dispensing Class I liquids into the fuel tanks of motor vehicles of the public shall not be located at a bulk plant unless separated by a fence or similar barrier from the area in which bulk operations are conducted.

61. Storage and Handling.

6110. General Provisions.

6111. Class I liquids shall be stored in approved closed containers not exceeding 60 gallons capacity, in tanks located underground or in tanks in special enclosures as described in Section 6120.

6112. Class II and Class III liquids shall be stored in containers, in tanks located underground or in tanks in special enclosures as described in Section 6120 or as provided in Section 6320.

6113. Aboveground tanks, located in an adjoining bulk plant, may be connected by piping to service station underground tanks if, in addition to valves at aboveground tanks, a valve is also installed within control of service station personnel.

6114. The provisions of Paragraphs 6111 and 6112 shall not prohibit the temporary use of portable or semi-portable tanks in conjunction with the dispensing of flammable or combustible liquids into the fuel tanks of motor vehicles or other motorized equipment on premises not normally accessible to the public. Such installations shall only be made under permit from the enforcing authority. The permit shall include a definite time limit.

6115. Class I liquids shall not be stored or handled within a building having a basement or pit into which flammable vapors may travel, unless such area is provided with ventilation designed to prevent the accumulation of flammable vapors therein.

6120. Special Enclosures.

6121. When installation of tanks in accordance with Article 22 is impractical because of property or building limitations, tanks for flammable or combustible liquids may be installed in buildings if enclosed and upon specific approval of the authority having jurisdiction.

6122. Enclosure shall be substantially liquid and vapor tight without backfill. Sides, top and bottom of the enclosure shall be of reinforced concrete at least six inches thick, with openings for inspection through the top only. Tank connections shall be so piped or closed that neither vapors nor liquid can escape into the enclosed space. Means shall be provided whereby portable equipment may be employed to discharge to the outside any vapors which might accumulate should leakage occur.

6123. At automotive service stations provided in connection with tenant or customer parking facilities at or below grade level beneath large buildings of commercial, mercantile or residential occupancy, tanks containing Class I liquids installed of necessity in accordance with Paragraph 6122, shall not exceed 5,000 gallons individual or 10,000 gallons aggregate capacity.

6130. Inside Buildings.

6131. Except where stored in tanks as provided in Section 6120, no Class I liquids shall be stored within any service station building except in approved closed containers. A container equipped with an approved pump or an approved self-closing faucet shall be considered a closed container for purposes of storage only.

6132. No Class I liquids shall be dispensed, or transferred from one container to another, inside of a service station building, except flammable anti-freeze liquids. Such anti-freeze may be dispensed in rooms of a service station building provided such rooms have approved heating devices and there is no open flame in such room lower than eight feet above floor level. Service station areas other than lubritoriums or rooms in which flammable liquids are transferred or dispensed may be heated in any conventional manner.

6133. Class II and Class III liquids may be stored and dispensed inside service station buildings from tanks of not more than 120 gallons capacity each.

6140. Labeling: No sale or purchase of any Class I, II or III liquids shall be made in containers unless such containers are clearly marked with the name of the product contained therein.

6150. Dispensing Containers: No delivery of any Class I liquids shall be made into portable containers unless the container has a tight closure with screwed or spring cover and is fitted with a spout or so designed that the contents can be poured without spilling and conforms to Article 12.

62. Dispensing Systems.

6210. Location: Dispensing devices at automotive service stations shall be so located that all parts of the vehicle being served will be on the premises of the service station.

6211. INSIDE LOCATION: Approved dispensing units may be located inside garages upon specific approval of the authority having jurisdiction. The dispensing area shall be separated from motor vehicle repair areas in a manner approved by the authority having jurisdiction. The dispensing unit and its piping shall be protected against physical damage by vehicles either by mounting on a concrete island or by equivalent means and shall be located in a position where it cannot be struck by a vehicle descending a ramp or other slope out of control. The dispensing area shall be provided with an approved mechanical or gravity ventilation system. A clearly identified switch, readily accessible in case of fire or physical damage to any dispensing unit, shall be provided to shut off the power to dispensing units. When dispensing units are located below grade only approved mechanical ventilation shall be used and the entire dispensing area shall be protected by an approved automatic sprinkler system. The ventilating systems shall be electrically interlocked with the gasoline dispensing units so that the dispensing units cannot be operated unless the ventilating fan motors are energized.

6220. Dispensing Units.

6221. Class I liquids shall be transferred from underground tanks by means of fixed pumps so designed and equipped as to allow control of the flow and to prevent leakage or accidental discharge. Class I liquids shall not be transferred from any storage tank by any equipment or procedure which subjects the shell of the storage tank to pressures above its allowable working pressure. Air or gas pressure shall not be used for this purpose.

6222. Supplemental means shall be provided outside of the dispensing device whereby the source of power may be readily disconnected in the event of fire or other accident.

6223. Dispensing devices for Class I liquids shall be of approved type. Devices meeting the standards of the Underwriters' Laboratories, Inc., shall be deemed to be in compliance with this Section.

6224. Class I liquids shall not be dispensed by pressure from drums, barrels, and similar containers. Approved pumps taking suction through the top of the container or approved self-closing faucets shall be used.

6230. Remote Pumping Systems.

6231. SCOPE: This Section shall apply to systems for dispensing Class I liquids where such liquids are transferred from underground storage to individual or multiple dispensing units by pumps located elsewhere than at the dispensing units.

6232. PUMPS: Pumps shall be designed or equipped so that no part of the system will be subjected to pressures above its allowable working pressure. Pumps installed above grade, outside of buildings, shall be located not less than ten feet from lines of adjoining property which may be built upon, and not less than five feet from any building opening. When an outside pump location is impractical, pumps may be installed inside of buildings as provided for dispensers in Paragraph 6211, or in pits as provided in Paragraph 6233. Pumps shall be substantially anchored and protected against physical damage by vehicles.

6233. PITS: Pits for subsurface pumps or piping manifolds of submersible pumps shall withstand the external forces to which they may be subjected without damage to the pump, tank, or piping. The pit shall be no larger than necessary for inspection and maintenance and shall be provided with a tight fitting cover.

6234. CONTROLS.

(a) A control shall be provided that will permit the pump to operate only when a dispensing nozzle is removed from its bracket on the dispensing unit and the switch on this dispensing unit is manually actuated. This control shall also stop the pump when all nozzles have been returned to their brackets.

(b) There shall be a means, visible from the operating area, to indicate when the pump motor is running.

(c) A clearly identified switch, readily accessible in case of fire or physical damage at any dispensing unit, shall be provided to shut off the power to the pump motors.

6235. TESTING: After the completion of the installation including any paving, that section of the pressure piping system between the pump discharge and the connection for the dispensing facility, shall be tested for at least thirty minutes at a pressure fifty per cent above the maximum operating pressure. Such tests shall be repeated at five year intervals thereafter.

6240. Automatic Dispensing Units: The installation and use of unattended coin-operated dispensing devices for Class I liquids is prohibited.

6250. Delivery Nozzles.

6251. MANUAL NOZZLE: The dispensing of Class I liquids into a fuel tank or into a container shall be under the control of a competent attendant at all times. The use of any device which permits the dispensing of Class I liquids when the hand of the operator of the discharge nozzle is removed from the nozzle control lever is hereby forbidden except when using an automatic nozzle at an automatic service station as provided in Paragraph 6252.

6252. AUTOMATIC NOZZLES WITH LATCH-OPEN DEVICES: In lieu of being held open by hand, an approved automatic nozzle may be used at automotive service stations for dispensing Class I liquids into the fuel tank of a vehicle. Such a nozzle shall have the latch-open device as an integral part of the assembly and shall shut off the liquid reliably and positively when the gasoline tank is filled, when it falls from the filling neck of an automobile tank, when it is subject to rough usage such as dropping or lack of proper lubrication, or when an automobile is driven away while the nozzle is still in the tank. A competent attendant shall be in the immediate vicinity of the vehicle being filled by such an approved nozzle.

63. Marine Service Stations.

6310. Tanks and pumps, other than those integral with approved dispensing units, supplying Class I liquids at marine service stations shall be located only on shore, or upon express

permission of the authority having jurisdiction on a pier of solid-fill type. Approved dispensing units with or without integral pumps may be located on shore, piers of solid-fill type, open piers, wharves or floating docks.

NOTE: Floating marine service stations are not covered by this Code. They are subject in the U.S.A. to the Tank Vessel Regulations of the United States Coast Guard.

6320. Tanks and pumps supplying Class II or Class III liquids at marine service stations may be located on shore, on a pier of solid-fill type or on open piers, wharves or floating docks. Class II or Class III flammable liquid tanks which are located other than on shore or on piers of the solid-fill type shall be limited to 550 gallons aggregate capacity. Pumps not a part of the dispensing unit shall be located adjacent to the tanks.

6330. Pipe lines attached to piers, wharves or floating docks shall be protected against physical damage. A readily accessible valve to shut off the supply from shore shall be provided in each pipe line at or near the approach to the pier, wharf or floating dock.

6331. Pipe lines to floating docks shall be so designed and installed as to make appropriate provision for changes in water level or tide. Transition from the fixed portion of the installation to the floating unit shall provide product control, flexibility, and protection against physical damage.

64. Electrical Equipment.

6410. This article shall apply to areas where Class I liquids are stored or handled. For areas where Class II or Class III liquids are stored or handled, the electrical equipment may be installed in accordance with the provisions of the National Electrical Code, NFPA No. 70, for ordinary locations.

6420. All electrical equipment and wiring shall be of a type specified by and shall be installed in accordance with the National Electrical Code.

6430. So far as it applies Table 10 shall be used to delineate and classify hazardous areas for the purpose of installation of electrical equipment under normal circumstances. In the following a classified area shall not extend beyond an unpierced wall, roof or other solid partition.

NOTE: The designation of classes and divisions is defined in Chapter 5, Article 500, of the National Electrical Code.

Table 10 — Electrical Equipment Hazardous Areas—Service Stations.

Location	NEC Class I, Group D Division	Extent of Classified Area
UNDERGROUND TANK		
Fill Opening	1	Any pit, box or space below grade level, any part of which is within the Division 1 or 2 classified area.
	2	Up to 18 inches above grade level within a horizontal radius of 10 feet from a loose fill connection and within a horizontal radius of 5 feet from a tight fill connection.
Vent — Discharging Upward	1	Within 3 feet of open end of vent, extending in all directions.
	2	Area between 3 feet and 5 feet of open end of vent, extending in all directions.
DISPENSER		
Pits	1	Any pit, box or space below grade level, any part of which is within the Division 1 or 2 classified area.
Dispenser Enclosure	1	The area 4 feet vertically above grade within the enclosure and 18 inches in all directions.
Outdoor	2	Up to 18 inches above grade level within 20 feet horizontally of any edge of enclosure.
Indoor With Mechanical Ventilation	2	Up to 18 inches above grade or floor level within 20 feet horizontally of any edge of enclosure.
With Gravity Ventilation	2	Up to 18 inches above grade or floor level within 25 feet horizontally of any edge of enclosure.

Table 10 — Continued

Location	NEC Class I, Group D Division	Extent of Classified Area
REMOTE PUMP — OUTDOOR	1	Any pit, box or space below grade level if any part is within a horizontal distance of 10 feet from any edge of pump.
	2	Within 3 feet of any edge of pump, extending in all directions. Also up to 18 inches above grade level within 10 feet horizontally from any edge of pump.
REMOTE PUMP — INDOOR	1	Entire area within any pit.
	2	Within 5 feet of any edge of pump, extending in all directions. Also up to 3 feet above floor or grade level within 25 feet horizontally from any edge of pump.
LUBRICATION ROOM	1	Entire area within any pit.
	2	Area up to 18 inches above floor or grade level within entire lubrication room.
Dispenser for Class I Liquids	2	Within 3 feet of any fill or dispensing point, extending in all directions.
SPECIAL ENCLOSURE INSIDE BUILDING PER SECTION 6120	1	Entire enclosure.
SALES, STORAGE AND REST ROOMS	Ordinary	If there is any opening to these rooms within the extent of an outdoor classified area, the entire room shall be classified the same as the area classification at the point of the opening. If there is any opening to these rooms within the extent of an indoor classified area, the room shall be classified the same as if the wall, curb or partition did not exist.

6440. The area classifications listed in Section 6430 shall be based on the premise that the installation meets the applicable requirements of the Flammable and Combustible Liquids Code in all respects. Should this not be the case, the authority having jurisdiction shall have the authority to classify the extent of the hazardous area.

65. Drainage and Waste Disposal.

6510. Provision shall be made in the area where Class I liquids may be spilled to prevent liquids from flowing into interior or service-station buildings. Such provision may be by grading driveway, raising door sills, or other equally effective means. Crankcase drainings and flammable or combustible liquids shall not be dumped into sewers, but shall be stored in tanks or tight drums outside of any building until removed from the premises.

66. Sources of Ignition.

6610. In addition to the previous restrictions of this chapter, the following shall apply: There shall be no smoking or open flames in the areas used for fueling, servicing internal combustion engines, receiving or dispensing of flammable or combustible liquids. Conspicuous and legible signs prohibiting smoking shall be posted within sight of the customer being served. The motors of all equipment being fueled shall be shut off during the fueling operation.

67. Fire Control.

6710. Suitable fire-control devices, such as small hose or portable fire extinguishers, shall be available to locations where fires are likely to occur.

CHAPTER VII.

COMMERCIAL AND INDUSTRIAL ESTABLISHMENTS.

70. Storage.

7010. General: Flammable or combustible liquids shall be stored in tanks, closed containers or approved safety cans.

7020. Tanks: The storage of flammable or combustible liquids in tanks shall conform to the applicable requirements of Chapter II.

7030. Containers: The storage of flammable or combustible liquids in drums and other closed containers shall conform to the applicable requirements of Chaper III.

71. Handling and Use.

7110. Location: The indoor handling and use of Class I liquids in excess of six gallons and Class II and Class III liquids in excess of 25 gallons shall be limited to buildings, portions of buildings or rooms designed and constructed in accordance with the requirements of Section 7120 and limits designated in Section 7130.

7120. Design and Construction of Inside Mixing and Handling Rooms: Rooms shall have at least one exterior wall. Walls, floors and ceilings shall be of noncombustible construction having at least a two hour fire-resistive rating. Doors shall be provided with noncombustible liquid-tight sills at least six inches high and provided with an approved Class B fire door of the self-closing type. Adequate drainage to a safe location shall be provided. Adequate natural or mechanical ventilation shall be provided. Heating shall be by low pressure steam or hot water or by electrical units approved for Class I hazardous locations. Lighting and electrical devices shall be approved for Class I Hazardous Locations. All equipment such as mixers, filters, pumps, motors, shafting shall be permanently and effectively grounded.

NOTE: No. 91, Standard on Blower and Exhaust Systems for Dust, Stock and Vapor Removal, provides information on the design and installation of mechanical ventilation as does No. 70, National Electrical Code, for the design and installation of electrical equipment in hazardous locations.

7130. Storage Limits for Inside Mixing and Handling Rooms.

7131. An Inside Mixing and Handling Room not protected by an approved automatic fire extinguishing system shall contain not more than

(a) 1,100 gallons total of Class I, II and III liquids of which not more than,

(b) 550 gallons may be of Class I liquids of which not more than,

(c) 275 gallons may be of Class IA liquids.

7132. An Inside Mixing and Handling Room protected by an approved automatic fire extinguishing system shall not contain more than

(a) 11,000 gallons total of Class I, II and III liquids of which not more than,

(b) 2,750 gallons may be of Class I liquids of which not more than,

(c) 550 gallons may be of Class IA liquids.

(d) These amounts may be increased to not more than one day's supply where daily consumption exceeds the above limits.

7140. Installations made in accordance with the applicable requirements of Standards for Dry Cleaning Plants, No. 32; for Dip Tanks Containing Flammable or Combustible Liquids, No. 34; and Spray Finishing Using Flammable Materials, No. 33 shall be deemed to be in compliance with this code.

72. Dispensing.

7210. Class I liquids shall be dispensed only in an Inside Mixing and Handling Room.

7220. Class I liquids shall not be drawn from or dispensed into vessels or containers within a building except by means of a device drawing from top of the tank or the container. Gravity discharge within a building of Class I liquids from tanks, drums, or containers other than safety cans, is forbidden, except where the nature of the manufacturing process requires gravity flow. Upon approval of the authority having jurisdiction, such gravity flow shall be permitted only from vessels storing flammable liquids sufficient for not more than one day's operation.

7230. Class I liquids shall not be dispensed within a room or building which normally contains source of ignition, within the possible path of vapor travel. Dispensing devices shall be provided with iron or steel valves where compatible with the flammable liquid handled. Where practicable, there shall be, in addition to the outlet valve, a secondary control device or valve outside of the immediate area, by which the flow may be stopped in the event of fire or other accident at the outlet. Outlet valves, where practicable, shall be of the self-closing type.

7240. Container Filling Facilities: Class I liquids shall not be run into containers unless the nozzle and container are electrically interconnected. Where the metallic floor plate on which the container stands while filling is electrically connected to the fill stem or where the fill stem is bonded to the container during filling operations by means of a bond-wire, the provisions of this Section shall be deemed to have been complied with.

7250. Exits: Exit facilities shall be provided to prevent occupants being trapped in the event of fire.

73. Ventilation.

7310. Buildings, or rooms or other enclosures in which Class I liquids are used or stored in open vats or dip tanks shall be provided with ventilation sufficient at all times to prevent accumulation of flammable vapors. Where natural ventilation is insufficient under all conditions to prevent the accumulation of flammable vapors, mechanical ventilation shall be provided and used. The accumulation of flammable vapors within the combustible or explosive range under normal operating conditions, as determined by an approved flammable-vapor indicator, shall be evidence of the violation of this Section.

7320. Design of ventilating systems shall take into account the relatively high specific gravity of the vapors. Openings to the outside for natural ventilation shall be at floor level and shall be unobstructed except by louvers or coarse screens.

NOTE: No. 91, Standard for the Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal, provides information on the design and installation of mechanical ventilation systems.

74. Electrical Equipment.

7410. Artificial lighting shall be by electricity only. Electrical devices located within the possible path of vapor travel shall be of a type approved for such locations.

NOTE: No. 70, National Electrical Code, provides information on the design and installation of electrical equipment for hazardous locations.

75. Sources of Ignition.

7510. Open flames, heating devices and processes employing temperatures capable of igniting the vapors of the flammable liquids used shall be prohibited in buildings, rooms and other confined spaces in which Class I liquids are used in the open, or in which Class II and Class III liquids are used for the purpose of saturating, coating or otherwise treating goods or materials. Smoking shall be prohibited and suitable signs to that effect shall be displayed.

76. Housekeeping.

7610. Wherever flammable or combustible liquids are stored in containers, provisions shall be made and maintained for the detection of leakage. Leaking containers shall be immediately removed or made tight.

7620. Access shall be provided by unobstructed aisles whereby first-aid fire-control apparatus may be brought to bear on any part of such flammable or combustible liquids storage.

7630. In buildings, rooms or other confined spaces in which flammable or combustible liquids are stored, combustible waste materials shall not be allowed to accumulate, except in closed metal containers.

7640. Flammable or combustible liquids shall not be dumped into sewers unless they are designed for this purpose, but shall be stored in tanks or tight drums outside of any building until removed from the premises.

77. Fire Control.

7710. Inside Mixing and Handling Rooms may be sprinklered or unsprinklered. Where flammable or combustible liquids are used or dispensed, portable fire extinguishers shall be provided.

NOTE: No. 10, Portable Fire Extinguishers, provides information as to the suitability of various types of extinguishers and their number and location.