PORTABLE SHIPPING TANKS 1970

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NATIONAL FIRE PROTECTION ASSOCIATION
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Official NFPA Definitions

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

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

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*Among the laboratories nationally recognized by the authorities having jurisdiction in the United States and Canada are the Underwriters' Laboratories, Inc., the Factory Mutual Research Corp., the American Gas Association Laboratories, the Underwriters' Laboratories of Canada, the Canadian Standards Association Testing Laboratories, and the Canadian Gas Association Approvals Division.

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Statement on NFPA Procedures

This material has been developed in the interest of safety to life and property under the published procedures of the National Fire Protection Association. These procedures are designed to assure the appointment of technically competent Committees having balanced representation from those vitally interested and active in the areas with which the Committees are concerned. These procedures provide that all Committee recommendations shall be published prior to action on them by the Association itself and that following this publication these recommendations shall be presented for adoption to the Annual Meeting of the Association where anyone in attendance, member or not, may present his views. While these procedures assure the highest degree of care, neither the National Fire Protection Association, its members, nor those participating in its activities accepts any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

Standard for

Portable Shipping Tanks

NFPA No. 386 — 1970

This standard was prepared by the Sectional Committee on Transportation of Flammable Liquids. It was approved by the Flammable Liquids Correlating Committee and adopted at the NFPA Annual Meeting in Toronto, Ont., on May 19, 1970.

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SCOPE: To develop fire safety codes, standards, recommended practices, and manuals as may be desirable, covering the transportation of flammable and combustible liquids by tank motor vehicles, portable tanks, and containers.

Committee on Flammable Liquids

Correlating Committee

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Corresponding Members†

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Dr. Ing. Gert Magnus, Mannheim, Germany.

SCOPE: To direct the activities of the eight Sectional Committees assigned to it which have primary responsibility for the development and revision of NFPA Codes, Standards, Recommended Practices, and Manuals pertaining to the storage, transportation, handling, and use of flammable and combustible liquids. This Correlating Committee shall act in an administrative and judicial capacity to establish that no conflicts exist and that satisfactory correlation is achieved among the recommendations of the Sectional Committees operating under its jurisdiction. Each report of a Sectional Committee shall be reviewed by, and a two-thirds affirmative vote secured from, the Correlating Committee before the report is submitted to an NFPA Annual Meeting. In cases where the Correlating Committee finds reason to object to a report, it shall refer the report back to the appropriate Sectional Committee with explanation as to its reasons for so doing, but shall not, itself, modify the report.

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, Mass. 02110.

Standard for

Portable Shipping Tanks

NFPA No. 386 — 1970

CHAPTER 1. GENERAL PROVISIONS

10. Scope and Application.

1010. This Standard applies to portable shipping tanks with capacity larger than 60 gallons and not exceeding 660 gallons used for the transportation of normally stable flammable and combustible liquids having a flash point below 200°F. and handled at temperatures below their boiling point.

NOTE: Normally stable materials are those having the relative capacity to resist changes in their chemical composition which would produce violent reactions or detonations despite exposure to air, water, heat, including the normal range of conditions encountered in handling, storage, or transportation. Unstable (reactive) flammable and combustible 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.

1020. Attention is directed to the fact that cutback asphalts can have flash points in the range of Class I liquids. Also liquids having a flash point higher than 200°F. may assume the characteristics of lower flash point liquids when heated. Under such conditions it shall be appropriate to apply the provisions of this Standard unless otherwise specifically exempted.

1030. Additional safeguards may be necessary for portable shipping tanks used in the transportation of liquids having special properties which dictate safeguards in addition to those specified here.

1040. This Standard does not apply to:

1041. The use of portable shipping tanks as storage containers. See NFPA No. 30, Flammable and Combustible Liquids Code, for information on storage.

1042. Drums as defined by the United States Department of Transportation when constructed according to specifications of the United States Department of Transportation.

NOTE: For construction and use of portable shipping tanks exceeding 660 gallons capacity, reference may be made to the specifications of the United States Department of Transportation or equivalent authorities having jurisdiction.

11. Definitions.

ASPHALT. The term asphalt shall include other materials having similar characteristics when heated above ambient temperatures.

BAFFLE. A non-liquidtight partition in a portable shipping tank.

COMPARTMENT. A liquidtight division in a portable shipping tank.

FLASH POINT shall mean the minimum temperature of a liquid at which sufficient vapor is given off to form an ignitable mixture with the air near the surface of the liquid or within the tank used as determined by appropriate test procedure and apparatus as specified.

The flash point of liquids having a viscosity less than 45 SUS at 100°F. (37.8°C.) and a flash point below 175°F. (79.4°C.), shall be determined in accordance with the Standard Method of Test for Flash Point by the Tag Closed Tester, ASTM D-56-70.*

The flash point of liquids having a viscosity of 45 SUS or more at 100°F. (47.8°C.) or a flash point of 175°F. (79.4°C.) or higher shall be determined in accordance with the Standard Method of Test for Flash Point by the Pensky-Martens Closed Tester, ASTM D-93-70.*

LIQUID shall mean, for the purpose of this Standard, any material which has a fluidity greater than that of 300 penetration asphalt when tested in accordance with ASTM Test for Penetration for Bituminous Materials, D-5-65.* When not otherwise identified, the term liquid shall include both flammable and combustible liquids.

COMBUSTIBLE LIQUIDS shall mean any liquid having a flash point at or above 140°F. (60°C.), and shall be known as Class III liquids. Class IIIA shall include those having flash points at or above 140°F. (60°C.) and below 200°F. (93.4°C.). Class IIIB shall include those having flash points at or above 200°F. (93.4°C.). This Standard does not cover Class IIIB liquids (see 1010.). Where the term combustible liquids or Class III liquids is used in this Standard, it shall mean only Class IIIA liquids.

NOTE: The upper limit of 200°F. (93.4°C.) is given because the application of this Standard does not extend to liquids having flash points above 200°F. (93.4°C.) 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. (60°C.) and having a vapor pressure not exceeding 40 pounds per square inch absolute at 100°F. (37.8°C.). This Standard does not apply to those liquids which are handled at or above their boiling points (see 1010).

*Available from American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa. 19103.

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

Class I liquids shall include those having flash points below 100°F. (37.8°C.).

Class II liquids shall include those having flash points at or above 100°F. (37.8°C.) and below 140°F. (60°C.).

NOTE: This classification does not apply to:

(1) Liquids without flash points that may be flammable under some conditions, such as certain halogenated hydrocarbons and mixtures containing petroleum fractions and hydrocarbons.

(2) Mists, sprays or foams.

PORTABLE SHIPPING TANK shall mean any container having a liquid capacity in excess of 60 U.S. gallons and not exceeding 660 U.S. gallons which is readily movable from place to place either with or without special handling equipment and which is not permanently attached to its transporting vehicle.

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 D-323-58.*

CHAPTER 2. DESIGN AND CONSTRUCTION OF PORTABLE SHIPPING TANKS

20. Basic Design.

2010. Portable Shipping Tanks shall be of all welded construction and fabricated in accordance with good engineering practice.

2020. Portable shipping tanks built under Specifications of the United States Department of Transportation shall be permitted when used in accordance with the conditions specified by the United States Department of Transportation.

2030. The material used in the construction of tanks shall be compatible with the chemical characteristics of the liquid to be transported. In case of doubt, the supplier or producer of the liquid, or other competent authority should be consulted as to the suitability of the material to be used in construction.

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*Available from American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa. 19103.

2040. TANK MOUNTINGS. Tanks shall be designed and fabricated with mountings to provide a secure base while in transit. "Skids" or similar devices shall be deemed to be included within this requirement.

2050. SAFETY FACTOR. All tank mountings such as skids, fastenings, brackets, lifting or hold-down lugs shall be permanently secured to tanks and shall be designed to withstand static loadings in any direction, equal to twice the weight of the tank and attachments when filled with the product being carried without significant permanent deformation.

21. Construction Materials.

2110. Steel used in the construction of mild steel (MS) tanks shall meet the following minimum requirements:

Yield Point, minimum	25,000 pounds per square inch
Ultimate Strength, minimum	45,000 pounds per square inch
Minimum Elongation, standard 2-inch sample	20 percent

2120. Steel used in the construction of low alloy low carbon (high tensile) steel (HS) tanks shall meet the following minimum requirements:

Yield Point, minimum	45,000 pounds per square inch
Ultimate Strength, minimum	60,000 pounds per square inch
Minimum Elongation, standard 2-inch sample	25 percent

2130. Steel used in the construction of stainless steel (SS) tanks shall meet the following minimum requirements:

Yield Point, minimum	25,000 pounds per square inch
Ultimate Strength, minimum	70,000 pounds per square inch
Minimum Elongation, standard 2-inch sample	30 percent

2140. Aluminum used in the construction of tanks of aluminum alloys for high strength welded construction shall meet the following minimum requirements:

All sheets for shell, including tops and bottoms, baffles, and bulkheads of portable shipping tanks shall be of aluminum alloys (commercial designation) 5052, 5454, 5154, 5086, 5254, or 5652, conforming to American Society for Testing and Materials Specification B209-62. All bulkheads, baffles, tops and bottoms and other shell stiffeners may use O temper (annealed) or stronger tempers. All shells shall be of H32 temper or H34 temper, except that when shell thicknesses of 0.250 inch or thicker are used, the H112 temper is additionally permitted.

2150. Material thickness shall not be less than shown in the following table:

	Manf. Std. Gage Number*						Approx. Thick. Decimal Inch
	Gage No. MS	Approx. Thick. Decimals of In.	Gage No. HS	Approx. Thick. Decimals of In.	Gage No. SS	Approx. Thick. Decimals of In.	AL
CYLINDRICAL							
120–300	13	0.0897	14	0.0747	14	0.0747	.090
301–450	13	0.0897	14	0.0747	14	0.0747	.125
451–660	11	0.1196	12	0.1046	12	0.1046	.125
Bottoms of vertical and ends of horizontal tanks	7	0.1793	7	0.1793	10	0.1345	.250
Tops of vertical tanks	13	0.0897	14	0.0747	14	0.0747	.125
CUBICAL TANKS							
Sides and Tops							
120–300	11	0.1196	12	0.1046	14	0.0747	.250
301–500	9	0.1495	10	0.1345	12	0.1046	.250
501–660	7	0.1793	7	0.1793	12	0.1046	.250
Bottoms							
120–300	7	0.1793	7	0.1793	12	0.1046	.250
301–500	7	0.1793	7	0.1793	10	0.1345	.250
501–660	7	0.1793	7	0.1793	10	0.1345	.3125

*Manufacturers Standard Gage and approximate equivalent thickness in decimals of inch.

22. Construction of Tanks.

2210. JOINTS. All side, top and bottom joints shall be welded.

2220. ALUMINUM ALLOYS. All welded aluminum joints shall be made in accordance with recognized good practice, and the strength of a joint shall be not less than 85 percent of that of the adjacent metal. Alloys shall be jointed by an inert gas arc welding process using aluminum-magnesium type filler metal which is consistent with material suppliers recommendations.

2230. MILD STEEL, HIGH TENSILE STEEL, STAINLESS STEEL. Joints shall be welded in accordance with recognized good practice and the efficiency of all joints shall be not less than 85 percent of that of the adjacent metal in the portable shipping tank.

2231. Combinations of mild steel (MS), high tensile steel (HS) or stainless steel (SS), may be used in the construction of a single tank, provided that each material, where used, shall comply with the minimum requirements specified in Article 21 for the material used in the construction of that section of the tank. Whenever stainless steel sheets are used in combination with sheets of other types of steel, joints made by welding shall be formed by the use of stainless steel electrodes or filler metal, on condition that the stainless steel electrodes or filler metal used in the welding be suitable for use with the grade of stainless steel concerned, according to the recommendations of the manufacturer of the stainless steel electrodes or filler metal.

23. Tests.

2310. Portable shipping tanks shall be tested at the time of manufacture; when alteration or repairs are made which involve tank integrity; and when there is an indication of necessity for a retest.

2320. Portable shipping tanks shall be tested to a minimum pressure of 7.5 psig. Such pressure shall be maintained for a period of at least 5 minutes. Hydrostatic pressure, if used, shall be gaged at the top of the tank.

CHAPTER 3. APPURTENANCES

30. Acceptability and Protection.

3010. All valves, piping and appurtenances shall be acceptable to the authority having jurisdiction and shall be attached to the tank in a substantial manner.

3011. All valves, piping, fittings, accessories and safety devices shall be adequately protected against handling damage, overturn or other mechanical forces.

31. Vents.

3110. Emergency Venting for Fire Exposure. Tanks shall be provided with one or more devices installed in the top with sufficient venting capacity to limit the tank internal pressure under fire exposure conditions to 10 psig or not to exceed 30 percent of

the bursting pressure of the tank, whichever is greater. At least one pressure actuated vent shall be used. It shall be set to open at not less than 5 psig. If fusible vents are used, they shall be actuated by elements that operate at a temperature not less than 220°F. and not exceeding 300°F. when the tank pressure is between 5 and 10 psig.

3111. CAPACITY. The total emergency venting capacity shall be not less than that determined from the following table using the entire external surface of the tank as the exposed area.

MINIMUM EMERGENCY VENT CAPACITY IN CUBIC FEET FREE AIR/HOUR (14.7 PSIA AND 60°F.)

Exposed Area Square Feet	Cubic Feet Free Air per Hour
20	15,800
30	23,700
40	31,600
50	39,500
60	47,400
70	55,300
80	63,300
90	71,200
100	79,100
120	94,900
140	110,700
160	126,500

NOTE 1: Interpolate for intermediate sizes.

NOTE 2: The venting capacities have been calculated on the basis of 75 percent of the square feet of the total exposed area of the cargo tank, using the formulas for heat input contained in Flammable and Combustible Liquids Code, NFPA No. 30, where the derivation of these formulas is explained.

3120. TANK OPENINGS. Tanks shall have at least one opening in the top not less than 6 inches in diameter provided with an approved closure device. Provision shall be made to prevent cover from fully opening when there is internal pressure. The closure shall be liquid and vapor tight and shall be kept closed while the tank is in transit. If gaskets are used, they shall be compatible with the product being transported. In addition, there shall be on the top of the tank a 1½-inch or larger nominal pipe size threaded opening for attaching vent piping for "off highway" use. Openings in the tank shall not release vapor or liquid at pressure below 5 psig while the tank is in transit.

3121. OUTLET VALVES, FITTINGS OR PIPING. The drawoff outlet of each tank shall be equipped with a suitable shutoff valve, located internally, designed so the valve will remain closed if the external piping is broken off, except:

(a) When exterior valve or piping is provided with substantial and adequate protection against damage in handling. Bottom outlet equipment shall not extend closer than 1 inch to the bottom bearing surface of the skids or tank mountings. Discharge or drawoff valve shall be equipped with liquid tight plugs or caps while in transit.

(b) When drawoff outlet is located on top of tank.

3122. BOTTOM CONNECTION. Bottom internal valves or drawoff piping shall be attached directly to a welded flange or boss except that threaded joints may be used if such opening does not exceed 2½-inch nominal pipe size.

CHAPTER 4. OPERATION AND USE

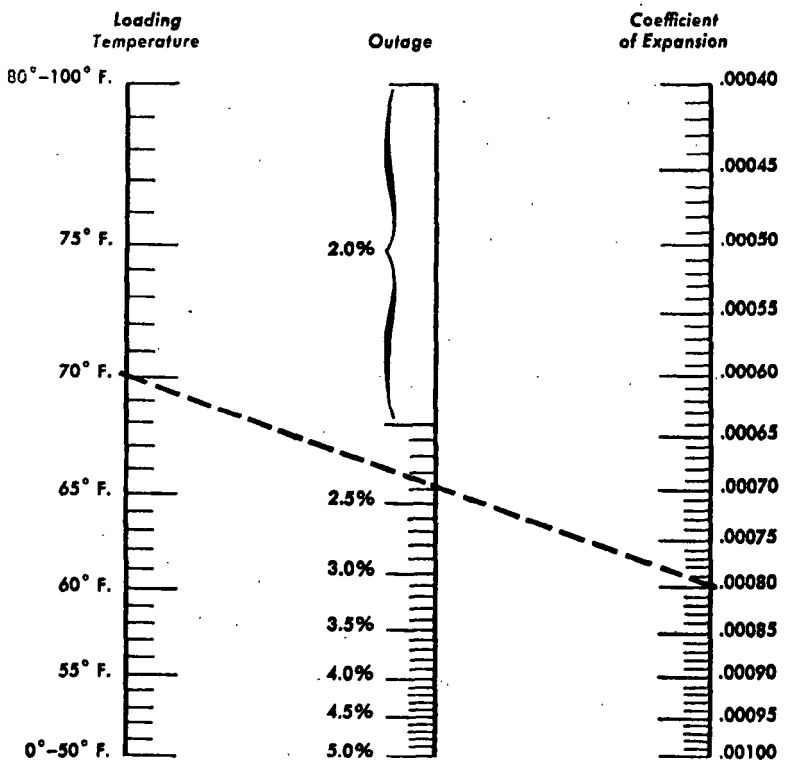
40. Filling and Emptying.

4010. OUTAGE. No tank shall be filled liquid full. To prevent leakage from or distortion of the tank by expansion of its contents due to rise of temperature while in transit, outage shall be not less than 5 percent of the total tank volume when filled, unless outage calculated by the method in par. 4011 demonstrates a lesser outage is adequate.

NOTE: In portable containers containing alcohol, cologne spirits, high wines or other distilled spirits of 150 proof or over, the vacant interior space must be the maximum permitted by law such as the United States Internal Revenue Regulations, Alcohol Tax Unit.

4011. The following chart may be used to determine the required outage when filling portable shipping tanks.

EXAMPLE: Suppose the temperature of the liquid at time of loading is 70°F. and its coefficient expansion is 0.00080; lay a ruler on the chart running from 70° to 0.00080 as shown by the dotted line and the required outage is 2.4 percent where the ruler crosses the outage scale.



The following coefficients of expansion per degree Fahrenheit, of the principal flammable liquids shall be used in determining outages:

Acetone	0.00085
Amyl Acetate	.00068
Benzol (benzene)	.00071
Carbon bisulfide	.00070
Ether	.00098
Ethyl acetate	.00079
Ethyl (grain) alcohol	.00062
Methyl (wood) alcohol	.00072
Toluol (toluene)	.00063