NFPA 505

Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operation

1999 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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This edition of NFPA 505, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operation*, was prepared by the Technical Committee on Industrial Trucks and acted on by the National Fire Protection Association, Inc., at its May Meeting held May 17–20, 1999, in Baltimore, MD. It was issued by the Standards Council on July 22, 1999, with an effective date of August 13, 1999, and supersedes all previous editions.

This edition of NFPA 505 was approved as an American National Standard on August 13, 1999.

Origin and Development of NFPA 505

Chapter 1 (formerly Part A) of this standard was originally designated as NFPA 505A and was first adopted by the Association in 1951. Chapters 4 and 5 (formerly Parts A and B), "Maintenance of Industrial Trucks" and "Operation of Industrial Trucks," were originally adopted in 1952 and published by NFPA under the designation NFPA 505B, C, *Standards for the Maintenance and Safe Operation of Industrial Trucks*. The combining of the three texts into one document, NFPA 505, was accomplished in 1955. Revisions were made in 1955, 1957, 1963, 1965, 1966, 1967, 1968, 1969, 1971, 1972, 1973, 1975, 1978, 1982, and 1987. The 1971 edition was the first edition to be approved by ANSI.

In the 1992 edition, Group F was added to the list of classified locations to correlate with NFPA 70, *National Electrical Code®*.

In the 1996 edition, changes were made to the types of trucks listed for operation in Class I, Division 2 locations, and a new Type DX designation was added. Also, a new section on compressed natural gas (CNG) was added and related changes to the chapters on dual-fuel trucks and converted trucks were made.

The 1999 edition was revised to make the entire document more user friendly and to facilitate its use with NFPA 70, *National Electrical Code*.

Technical Committee on Industrial Trucks

John K. Bouchard, *Chair*
Sedgwick of New England Inc., MA [I]

Lewis C. Barbe, World Safety Organization, MN [SE]
Bryan Bower, Buckeye Fire Equipment, NC [M]
Rep. Fire Equipment Mfrs. Assn.
Charles L. Crocker, Burlington Industries Inc., NC [U]
John A. Gutauskas, Factory Mutual Research Corp., MA [I]
Gary L. Horning, Framatome Connectors USA, Inc., PA [M]
Harry Ruetschlin, Underwriters Laboratories Inc., IL [RT]
Brian N. Tyrer, Pyroban Ltd, England [SE]
Kenneth R. Van Hook, Mitsubishi Caterpillar Forklift America Inc., TX [M]
Rep. Industrial Truck Assn.

Alternates

Kevin Bower, Buckeye Fire Equipment, NC [M]
(Alt. to B. Bower)
William H. Gray, Underwriters Laboratories Inc., IL [RT]
(Alt. to H. Ruetschlin)
Jerry L. Harpin, Factory Mutual Research Corp., MA [I]
(Alt. to J. A. Gutauskas)
William J. Montwieler, Industrial Truck Assn., DC [M]
(Alt. to K. R. Van Hook)

Christian Dubay, NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of this document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on the safe use, maintenance, and operation of industrial trucks and other material-handling equipment to minimize fire hazards.

Contents

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

Information on referenced publications can be found in Chapter 7 and Appendix B.

Chapter 1 Type Designations and Areas of Use

1-1 Scope. This standard shall apply to fork trucks, tractors, platform lift trucks, motorized hand trucks, and other specialized industrial trucks powered by electric motors or internal combustion engines. This standard shall not apply to compressed air–operated or nonflammable compressed gas–operated industrial trucks, farm vehicles, or automotive vehicles for highway use.

1-2 General.

1-2.1 The design and installation of the compressed natural gas (CNG) fuel systems on CNG–powered and dual fuel–powered (gasoline and CNG) industrial trucks shall be in accordance with the applicable provisions of NFPA 52, *Compressed Natural Gas (CNG) Vehicular Fuel Systems Code.*

1-2.2 The design and installation of the LP-Gas fuel systems on LP-Gas-powered and dual fuel–powered (gasoline and LP-Gas) industrial trucks shall be in accordance with the applicable provisions of NFPA 58, *Liquefied Petroleum Gas Code.*

1-2.3 The approved powered industrial trucks addressed in this standard are trucks that are listed by a testing laboratory for the use intended and shall be tested and labeled in accordance with UL 558, *Standard for Safety Industrial Trucks, Internal Combustion Engine-Powered*, or UL 583, *Standard for Safety Electric-Battery-Powered Industrial Trucks.*

1-3 Equivalency. Nothing in this standard is intended to prevent the use of new methods or devices, provided that sufficient technical data is submitted to the authority having jurisdiction to demonstrate that the proposed method or device is equivalent in quality, strength, fire endurance, effectiveness, durability, and safety to those prescribed by this standard.

1-4 Definitions.

Approved.* Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction.* The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Listed.* Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

Type Designation.* A system for identifying types of powered industrial trucks for operation in nonclassified and classified areas.

Type Designation CN. A compressed natural gas–powered unit that has minimum acceptable safeguards against inherent fire hazards.

Type Designation CNS. A compressed natural gas–powered unit that, in addition to meeting the requirements for Type CN units, is provided with additional safeguards to the exhaust, fuel, and electric systems.

Type Designation D. A diesel-powered unit that has minimum acceptable safeguards against inherent fire hazards.

Type Designation DS. A diesel-powered unit that, in addition to meeting all the requirements for Type D units, is provided with additional safeguards to the exhaust, fuel, and electric systems.

Type Designation DX. A diesel-powered unit that differs from Type DS and DY units in that the diesel engine and the electric fittings and equipment are so designed, constructed, and assembled that the unit can be used in atmospheres that contain specifically named flammable vapors, dusts, and, under certain conditions, fibers. Such units are specifically tested and classified for use in Class I, Group D locations or for Class II, Group F or Group G locations as defined in NFPA 70, *National Electrical Code.*

Type Designation DY. A diesel-powered unit that has all the safeguards of Type DS units and, in addition, any electric equipment is completely enclosed; such units are equipped with temperature-limitation features.

Type Designation E. An electrically powered unit that has minimum acceptable safeguards against inherent fire and electrical shock hazards.

Type Designation ES. An electrically powered unit that, in addition to meeting all the requirements for Type E units, is provided with additional safeguards to the electric system to prevent the emission of hazardous sparks and to limit surface temperatures.

Type Designation EE. An electrically powered unit that, in addition to meeting all the requirements for Type E and ES units, has its electric motors and all other electric equipment completely enclosed.

Type Designation EX. An electrically powered unit that differs from a Type E, Type ES, or Type EE unit in that the electric fittings and equipment are so designed, constructed, and assembled that the unit can be used in atmospheres containing specifically named flammable vapors, dusts, and, under certain conditions, fibers. Such units are specifically tested and classified for use in Class I, Group D locations or for Class II, Group F or Group G locations as defined in NFPA 70, *National Electrical Code*.

Type Designation G. A gasoline-powered unit that has minimum acceptable safeguards against inherent fire hazards.

Type Designation GS. A gasoline-powered unit that, in addition to meeting all the requirements for Type G units, is provided with additional safeguards to the exhaust, fuel, and electric systems.

Type Designation LP. An LP-Gas-powered unit that has minimum acceptable safeguards against inherent fire hazards.

Type Designation LPS. An LP-Gas-powered unit that, in addition to meeting the requirements for Type LP units, is provided with additional safeguards to the exhaust, fuel, and electric systems.

Type Designation G/CN. A unit that operates on either gasoline or compressed natural gas that has minimum acceptable safeguards against inherent fire hazards.

Type Designation GS/CNS. A unit that operates on either gasoline or compressed natural gas and, in addition to meeting all the requirements for Type G/CN units, is provided with additional safeguards to the exhaust, fuel, and electric systems.

Type Designation G/LP. A unit that operates on either gasoline or liquefied petroleum gas and that has minimum acceptable safeguards against inherent fire hazards.

Type Designation GS/LPS. A unit that operates on either gasoline or liquefied petroleum gas and, in addition to meeting all the requirements for the Type G/LP units, is provided with additional safeguards to the exhaust, fuel, and electric systems.

1-5 Hazard Classification.

1-5.1* The authority having jurisdiction shall determine the hazard classification for any specific location as defined in NFPA 70, *National Electrical Code*. The location shall be classified prior to considering the use of industrial trucks therein, and the type of industrial truck required shall be as specified in Section 1-6 for the given location.

1-5.2 Different areas of any single plant or building can be classified differently. The authority having jurisdiction shall limit the use of industrial trucks in classified areas in plants or buildings according to the hazard classification of each area. The management shall be responsible for the enforcement of restricted use in such areas.

1-5.3 The industrial trucks specified in Section 1-6 shall be the minimum types required. Industrial trucks with safeguards greater than those specified in Section 1-6 shall be permitted to be used.

1-6 Specific Areas of Use. Table 1-6 shall be used as a reference for industrial truck types for specific areas of use and is based on the information contained in this section.

The references to class, group, and division in the boldface headings in 1-6.1 through 1-6.9 correspond to classifications that shall be considered to be in accordance with NFPA 70, *National Electrical Code,* and are provided for the convenience of the user.

1-6.1* Class I, Division 1, Groups A, B, C. Power-operated industrial trucks shall not be permitted to be used in such locations.

For examples of chemicals whose vapors, if mixed in air, are classified as Class I, Group A, B, or C, see Section 500-5 of NFPA 70, *National Electrical Code*, and A-1-6.1 of this standard.

1-6.2 Class I, Division 1, Group D.

1-6.2.1* Approved power-operated industrial trucks designated as Type DX or Type EX and classified for Class I, Group D chemicals shall be permitted to be used in locations that contain gases or vapors.

1-6.2.2 Class I, Division 1, Group D areas shall include the following:

(1) Locations where volatile flammable liquids or liquefied flammable gases are transferred from one container to another
(2) Interiors of spray booths and areas in the vicinity of spraying and painting operations where volatile flammable solvents are used
(3) Locations containing open tanks or vats of volatile flammable liquids
(4) Drying rooms or compartments for the evaporation of flammable solvents
(5) Locations containing fat- and oil-extraction apparatus that uses volatile flammable solvents
(6) Portions of cleaning and dyeing plants where hazardous liquids are used
(7) Gas generator rooms and other portions of gas-manufacturing plants where flammable gas can escape
(8) Inadequately ventilated pump rooms for flammable gas or for volatile flammable liquids
(9) Interiors of refrigerators and freezers in which volatile flammable materials are stored in open, lightly stoppered, or easily ruptured containers
(10) All other locations where hazardous concentrations of flammable vapors or gases are likely to occur in the course of normal operations

1-6.3 Class I, Division 2, Group D.

1-6.3.1 Approved power-operated industrial trucks designated as Type DX, Type DY, Type EE, or Type EX (classified for Class I, Group D locations) shall be used in locations where volatile flammable liquids or flammable gases are handled, processed, or used under the following conditions:

(1) Where confined within closed containers or closed systems from which they can escape only in the event of the accidental rupture or breakdown of such containers or systems, or in the event of abnormal operation of equipment
(2) In locations in which ignitible concentrations of gases or vapors are normally prevented by positive mechanical ventilation but where such concentrations can become hazardous through failure or abnormal operation of the ventilating equipment
(3) In locations adjacent to Class I, Division 1 locations and to which ignitible concentrations of gases or vapors can occasionally be communicated

Exception to (3): This requirement shall not apply where such communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

Table 1-6 Summary Table on Use of Powered Industrial Trucks

Locations	CNG-Powered		Diesel-Powered				Electric-Powered				Gasoline-Powered		LP-Gas-Powered		Dual Fuel–Powered				Text Reference
	CN	CNS	D	DS	DY	DX	E	ES	EE	EX	G	GS	LP	LPS	G/CN	GS/CNS	G/LP	GS/LPS	
Class I, Division 1																			
Group A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1-6.1
Group B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1-6.1
Group C	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1-6.1
Group D	NA	NA	NA	NA	NA	A	NA	NA	NA	A	NA	NA	NA	NA	NA	NA	NA	NA	1-6.2
Class I, Division 2																			
Group A	NA	NA	NA	NA	K	K	NA	NA	K	K	NA	NA	NA	NA	NA	NA	NA	NA	1-6.10
Group B	NA	K	NA	K	K	K	NA	K	K	K	NA	K	NA	K	NA	K	NA	K	1-6.10
Group C	NA	K	NA	K	K	K	NA	K	K	K	NA	K	NA	K	NA	K	NA	K	1-6.10
Group D	NA	J	NA	J	A	A	NA	J	A	A	NA	J	NA	J	NA	J	NA	J	1-6.3
Class II, Division 1																			
Group E	NA	NA	NA	NA	NA	J	NA	NA	NA	J	NA	NA	NA	NA	NA	NA	NA	NA	1-6.4
Group F	NA	NA	NA	NA	NA	A[1]	NA	NA	NA	A[1]	NA	NA	NA	NA	NA	NA	NA	NA	1-6.5
Group G	NA	NA	NA	NA	NA	A	NA	NA	NA	A	NA	NA	NA	NA	NA	NA	NA	NA	1-6.6
Class II, Division 2																			
Group F[2]	NA	J	NA	J	A	A	NA	J	A	A	NA	J	NA	J	NA	J	NA	J	1-6.7
Group G	NA	J	NA	J	A	A	NA	J	A	A	NA	J	NA	J	NA	J	NA	J	1-6.7
Class III, Division 1	NA	J	NA	J	A	A	NA	J	A	A	NA	J	NA	J	NA	J	NA	J	1-6.8
Class III, Division 2	NA	A	NA	A	A	A	J	A	A	A	NA	A	NA	A	NA	A	NA	A	1-6.9
Ordinary (Unclassified)	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	1-5.1

[1]Where dust has resistivity of 10^5 ohm-cm, use J.
[2]Where dust has resistivity of 10^5 ohm-cm or greater.
A = Type truck authorized for location described
J = Type truck authorized for location described with approval of the authority having jurisdiction
K = Type truck authorized to be determined by the authority having jurisdiction
NA = Type truck not authorized in location described

1-6.3.2 In locations used for the storage of flammable liquids in sealed containers or liquefied or compressed flammable gases in containers, approved power-operated industrial trucks designated as Types CNS, DS, ES, GS, LPS, GS/CNS, and GS/LPS shall be permitted to be used where approved by the authority having jurisdiction.

1-6.3.3 Class I, Division 2, Group D areas shall include locations where volatile flammable liquids or flammable gases or vapors are used and that, in the judgment of the authority having jurisdiction, can become hazardous only in the event of an accident or an unusual operating condition. The quantity of flammable material that can escape during an accident, the

adequacy of ventilating equipment, the total area involved, and the record of the industry or business with respect to explosions or fires are factors that shall be considered in determining whether a particular type of truck possesses sufficient safeguards for the location.

1-6.4 Class II, Division 1, Groups E and F.

1-6.4.1 Power-operated industrial trucks shall not be used in locations that contain hazardous concentrations of metal dust, including aluminum and magnesium and their commercial alloys, or other dusts with similarly hazardous characteristics having resistivity of less than 10^2 ohm-cm.

Exception: An approved power-operated industrial truck designated as Type DX or Type EX shall be permitted to be used in such locations, subject to special investigation of the truck and the specific area of use by the authority having jurisdiction.

1-6.4.2 In atmospheres where the dust of magnesium, aluminum, or aluminum bronze can be present, truck fuses, switches, motor controllers, and circuit breakers shall have enclosures that are specifically approved for such locations.

1-6.5 Class II, Division 1, Group F.

1-6.5.1 Power-operated industrial trucks shall not be used in locations that contain hazardous concentrations of electrically conductive Group F dusts that have a resistivity of less than 10^5 ohm-cm.

Exception: An approved power-operated industrial truck designated as Type DX or Type EX shall be permitted to be used in such locations, subject to special investigation of the truck and the specific area of use by the authority having jurisdiction.

1-6.5.2 Approved power-operated industrial trucks designated as Type DX or Type EX (classified for Class II, Group F locations) shall be used in locations where electrically nonconductive Group F dust having a resistivity greater than 10^5 ohm-cm but less than 10^8 ohm-cm is in suspension or can be in suspension under normal operating conditions in quantities sufficient to produce explosive or ignitible mixtures or where mechanical failure or abnormal operation of machinery or equipment can cause such mixtures to be produced.

1-6.5.3* Class II, Division 1, Group F areas shall include locations that contain carbon black, charcoal, coal, and coke dusts that have more than 8 percent total volatile material (coal and coke dust in accordance with ASTM D 3175, *Standard Test Method for Volatile Matter in the Analysis Sample of Coal and Coke*) or atmospheres containing such dusts that are sensitized by other materials so that they present an explosion hazard.

1-6.6 Class II, Division 1, Group G.

1-6.6.1 Approved power-operated industrial trucks designated as Type DX or Type EX (classified for Class II, Division 1, Group G locations) shall be used in locations where combustible dust having a resistivity of 10^8 ohm-cm or greater is in suspension or can be in suspension under normal operating conditions in quantities sufficient to produce explosive or ignitible mixtures; or where mechanical failure or abnormal operation of machinery or equipment can cause such mixtures to be produced.

1-6.6.2 Class II, Division 1, Group G areas shall include locations such as the following:

(1) Working areas of grain-handling and storage plants
(2) Rooms containing the following:
   a. Grinders or pulverizers
   b. Cleaners
   c. Graders
   d. Scalpers
   e. Open conveyors or spouts
   f. Open bins or hoppers
   g. Mixers or blenders
   h. Automatic or hopper scales
   i. Packing machinery
   j. Elevator heads and boots
   k. Stock distributors
   l. Dust and stock collectors (except all-metal collectors vented to the outside)
(3) All similar dust-producing machinery and equipment in the following:
   a. Grain-processing plants
   b. Starch plants
   c. Sugar-pulverizing plants
   d. Malting plants
   e. Wood flour plants
   f. Hay-grinding plants
   g. Other occupancies of similar nature where combustible dust having a resistivity of 10^8 ohm-cm or greater can, under normal operating conditions, be present in the air in quantities sufficient to produce explosive or ignitible mixtures

1-6.7 Class II, Division 2, Groups F and G.

1-6.7.1 Approved power-operated industrial trucks designated as Type DX, Type DY, Type EE, or Type EX (classified for Class II, Group F or G locations, as appropriate) shall be permitted to be used in locations where combustible dust having a resistivity of 10^5 ohm-cm or greater is not normally in suspension in the air, or is unlikely to be thrown into suspension by the normal operation of equipment or apparatus in quantities sufficient to produce explosive or ignitible mixtures, but where deposits or accumulations of such dust can be ignited by arcs or sparks originating in the truck.

1-6.7.2 In locations where dangerous concentrations of suspended dust having a resistivity of 10^5 ohm-cm or greater is unlikely, approved power-operated industrial trucks designated as Type CNS, Type DS, Type ES, Type GS, Type LPS, Type GS/CNS, or Type GS/LPS shall be permitted to be used if approved for such locations by the authority having jurisdiction. Such locations include rooms and areas that contain only closed spouting and conveyors, closed bins or hoppers, or machines and equipment from which appreciable quantities of dust can escape only under abnormal operating conditions; rooms or areas into which explosive or ignitible concentrations of suspended dust can be communicated only under abnormal operating conditions; rooms or areas where the formation of explosive or ignitible concentrations of suspended dust is prevented by the operation of effective dust-control equipment; warehouses and shipping rooms where dust-producing materials are stored or handled only in bags or containers; and other similar locations.

1-6.8 Class III, Division 1.

1-6.8.1* Approved power-operated industrial trucks designated as Type DX, Type DY, Type EE, or Type EX shall be permitted to be used in locations where easily ignitible fibers or materials producing combustible flyings exist but in which such fibers or flyings are unlikely to be in suspension in the air in quantities sufficient to produce ignitible mixtures.

1-6.8.2 Locations where easily ignitible fibers or flyings are found usually include some portions of rayon, cotton, and other textile mills; combustible fiber manufacturing and processing plants; cotton gins and cottonseed mills; flax-processing plants; clothing-manufacturing plants; woodworking plants (except wood flour plants); and establishments and industries involving similar processes or conditions.

A wood flour plant shall be considered to be a Class II, Division 1, Group G location as defined in 1-6.6.2.

Easily ignitible fibers and flyings shall include rayon, cotton (including cotton linters and cotton waste), sisal or henequen, istle, jute, hemp, tow, cocoa fiber, oakum, baled waste kapok, Spanish moss, excelsior, sawdust, wood chips, and other similar materials.

1-6.9 Class III, Division 2. Approved power-operated industrial trucks designated as Type CNS, Type DS, Type DX, Type DY, Type ES, Type EE, Type EX, Type GS, Type LPS, Type GS/CNS, or Type GS/LPS shall be used in locations where easily ignitible fibers are stored or handled, including outside storage, but where such fibers are not processed or manufactured. Industrial trucks designated as Type E that have been used previously in such locations shall be permitted to be continued in use with the approval of the authority having jurisdiction.

Exception: In process of manufacture.

1-6.10 Hazardous Areas Not Otherwise Classified. The authority having jurisdiction shall determine which types of approved power-operated industrial trucks, if any, shall be used following an engineering survey of the property and an evaluation of the fire and explosion hazards.

1-6.11 Piers and Wharves.

1-6.11.1 Where it is determined that the location on piers and wharves used for handling general cargo is not hazardous, any approved power-operated industrial truck designated as Type CN, Type D, Type E, Type G, Type LP, Type G/CN, or Type G/LP shall be permitted to be used, or trucks that conform to the requirements for these types shall be permitted to be used.

1-6.11.2 Where an area of a pier or wharf is determined to be hazardous, only approved power-operated industrial trucks as specified for such locations in 1-6.1 through 1-6.9 shall be permitted to be used.

1-6.12 General Inside and Outside Storage.

1-6.12.1 Where it is determined that the location for general storage in warehouses or general outside storage is not hazardous, any approved power-operated industrial truck designated as Type CN, Type D, Type E, Type G, Type LP, Type G/CN, or Type G/LP shall be permitted to be used, or trucks that conform to the requirements for the specified types shall be permitted to be used.

1-6.12.2 Where the location for general storage in warehouses or general outside storage is determined to be hazardous, only approved power-operated industrial trucks as specified for such a location in 1-6.1 through 1-6.9 shall be permitted to be used.

1-6.13 General Industrial or Commercial Properties.

1-6.13.1 Where it is determined that the location on a general industrial or commercial property used for handling or processing materials (with storage being incidental to handling and processing), or for both, is not hazardous, any approved power-operated industrial truck designated as Type CN, Type D, Type E, Type G, Type LP, Type G/CN, or Type G/LP shall be permitted to be used, or trucks that conform to the requirements for the specified types shall be permitted to be used.

1-6.13.2 Where the location on a general industrial or commercial property used for handling or processing materials, or both, is determined to be hazardous, only approved power-operated industrial trucks as specified for such a location in 1-6.1 through 1-6.9 shall be permitted to be used.

1-6.14 Converted Industrial Trucks.

1-6.14.1 Power-operated industrial trucks for ordinary (nonhazardous) locations that previously have been approved for, or that conform to, the requirements for a particular type of fuel shall be permitted to be converted to an alternate fuel in accordance with the requirements in Chapter 3.

1-6.14.2 The conversion of trucks approved for, or that conform to, the requirements for hazardous locations shall be in accordance with the requirements of UL 558, *Standard for Safety Industrial Trucks, Internal Combustion Engine-Powered*, and shall be certified by a nationally recognized testing laboratory (NRTL).

1-6.14.3 Power-operated industrial trucks that previously have been approved for, or that conform to, the requirements for Type CN, Type G, Type LP, Type G/CN, or Type G/LP shall not be converted to a type designation for use in hazardous (classified) locations, such as conversion of LP to LPS, G to GS, and CN to CNS.

Chapter 2 Dual-Fuel Trucks

2-1 General. A dual-fuel truck shall be a truck that is equipped to be operated using either gasoline or LP-Gas or to be operated using either gasoline or CNG without further modification.

2-2 Requirements.

2-2.1 Fuel system parts that come into contact with gasoline shall meet the requirements for liquid fuel in UL 558, *Standard for Safety Industrial Trucks, Internal Combustion Engine-Powered.*

2-2.2 Fuel system parts that come into contact with CNG fuel shall meet the requirements for CNG fuel in NFPA 52, *Compressed Natural Gas (CNG) Vehicular Fuel Systems Code.*

2-2.3 Fuel system parts that come into contact with LPG fuel shall meet the requirements for LPG fuel in UL 558, *Standard for Safety Industrial Trucks, Internal Combustion Engine-Powered.*

2-2.4 Fuel system parts that come into contact with gasoline and LPG fuel or with gasoline and CNG fuel shall be compatible, respectively, with both fuels.

2-2.5* Fuel Changeover. Where switching from CNG or LPG to liquid fuel, care shall be taken to ensure that there is no spillage of liquid fuel.

2-3 Nameplate Visibility. The truck type designation *(see definition in Section 1-4)*, as shown on the nameplate and the type marker *(see 5-4.2)*, shall not be covered over with paint so that the identification information is obscured.

Chapter 3 Conversion of Trucks

3-1* Conversion Requirements.

3-1.1 A truck designated as Type G, Type LP, or Type G/LP that is converted to another of these designations shall conform to the requirements for the new designation in accordance with UL 558, *Standard for Safety Industrial Trucks, Internal Combustion Engine-Powered.*

3-1.2 Conversion kits for use on trucks designated as Type G, Type LP, or Type G/LP shall conform to the requirements for the type designation in accordance with UL 558, *Standard for Safety Industrial Trucks, Internal Combustion Engine-Powered*, and shall be approved by a testing laboratory.

3-1.3 Conversion kits for use on trucks designated as Type CN, Type G, Type LP, Type G/CN, or Type G/LP shall include the items specified in 3-1.4. The installation of the kit shall be in accordance with 3-1.4. Where a listed conversion kit is used, a copy of the report shall be supplied to the authority having jurisdiction upon request.

3-1.4 Kits for the conversion of Types CN, G, LP, G/CN, and G/LP trucks shall include the following:

(1) Step-by-step installation instructions with illustrations, if necessary
(2) All parts necessary to complete the installation, including the following:
    a. Functional components
    b. Mounting brackets and hardware
    c. Connecting wires, hose, and fittings
    d. Sealants, if required
(3) A durable, corrosion-resistant plate, indicating the converted type designation of the truck, for permanent mounting adjacent to the manufacturer's nameplate on the truck
(4) A metal nameplate attached to the LPG-tank mounting that identifies the fuel container assembly to be used in situations where the conversion is to LPG and a removable fuel tank is to be used
(5) A gasoline fuel tank with necessary mounting and connection hardware and installation instructions, in situations where the conversion is from CNG or LPG to gasoline or a dual fuel
(6) Instructions for removal or deactivation of the existing components, including the gasoline tank(s), where the conversion is from gasoline or a dual fuel to CNG or LPG
(7) A tank or tanks, as appropriate, with the necessary mounting and connection hardware and installation instructions in situations where the conversion is from LPG to CNG or a dual fuel, or where conversion is from gasoline to CNG or a dual fuel and the truck is not equipped with a CNG or gasoline fuel tank, or both
(8) Instructions covering checks and tests to be performed after the conversion and prior to putting the truck into service

3-1.5 When a conversion kit is installed, all original identification of approval or listing and type designation shall be removed, and the plate specified in 3-1.4(3) shall be installed in lieu thereof.

Chapter 4 Maintenance of Industrial Trucks

4-1 General. The fire safety built into power-operated industrial trucks shall be maintained in accordance with the instructions and training material provided by the manufacturer. Any power-operated industrial truck that is not in safe operating condition shall be removed from service.

4-2 Precautions.

4-2.1 Repairs shall not be made in Class I, Class II, and Class III locations.

4-2.2 Repairs to the fuel and ignition systems of industrial trucks that involve fire hazards shall be conducted only in locations designated for such repairs.

4-2.3 Repairs to the electric system of battery-powered industrial trucks shall be performed only after the battery has been disconnected.

4-3 Replacement Parts. All parts of any industrial truck, particularly trucks approved for use in classified hazardous locations, that need replacement shall be replaced only with parts that provide the same degree of fire safety as those used in the original design.

4-4 Mufflers. Water mufflers shall be filled daily or as frequently as is necessary to prevent depletion of the supply of water below 75 percent of filled capacity. Vehicles with mufflers having screens or other parts that can become clogged shall not be operated while such screens or parts are clogged. Any vehicle that emits hazardous sparks or flames from the exhaust system shall be removed from service immediately and shall not be returned to service until the cause for the emission of such sparks and flames has been eliminated.

4-5 Operating Temperature. Where the temperature of any part of any truck is found to be in excess of its normal operating temperature and creates a hazardous condition, the vehicle shall be removed from service and shall not be returned to service until the cause for such overheating has been eliminated.

4-6 Fire Prevention. Industrial trucks shall be kept clean and reasonably free of lint, excess oil, and grease. Noncombustible agents are preferred for cleaning trucks. Flammable liquids [those having flash points below 100°F (37.8°C)] shall not be used. Combustible liquids [those having flash points at or above 100°F (37.8°C)] shall be permitted to be used. Precautions regarding toxicity, ventilation, and fire hazard shall be appropriate for the agent or solvent used.

4-7 Antifreeze. Where antifreeze is used in the engine-cooling system, only glycol-based material shall be used.

4-8 Nameplate Visibility. The truck type designations *(see definition in Section 1-4)*, as shown on the nameplate and the type marker *(see 5-4.2)*, shall not be covered over with paint so that the identification information is obscured.

Chapter 5 Fuel Recharging, Marking, and Operation of Industrial Trucks

5-1 Fuel Handling and Storage.

5-1.1 Liquid Fuels (Such as Gasoline and Diesel Fuel).

5-1.1.1 The storage and handling of liquid fuels shall be in accordance with NFPA 30, *Flammable and Combustible Liquids*

Code, or NFPA 30A, *Automotive and Marine Service Station Code*, as applicable.

5-1.1.2* Trucks using liquid fuels shall be refueled only at locations designated for such purpose and shall be refueled from approved dispensing pumps.

5-1.1.3 The engine shall be stopped, and the operator shall not be on or inside the truck during refueling.

5-1.1.4 Emergency refueling shall be from approved safety cans. Safety cans shall be inspected regularly for leaks and for damage to closures. Faulty cans shall be replaced.

5-1.1.5 Spillage of fuel or overfilling of the vehicle fuel tank shall be avoided.

5-1.1.6 Smoking or open flames shall be prohibited in the refueling area.

5-1.2 Liquefied Petroleum Gas Fuel.

5-1.2.1 The storage and handling of liquefied petroleum gas (LP-Gas) shall be in accordance with NFPA 58, *Liquefied Petroleum Gas Code*.

5-1.2.2 Fuel containers that are permanently mounted on trucks and removable DOT-type LP-Gas containers shall be filled at locations designated for such purpose and in accordance with NFPA 58, *Liquefied Petroleum Gas Code*.

5-1.2.3 LP-Gas containers shall not be dropped, thrown, rolled, or dragged.

5-1.2.4 LP-Gas containers shall not be overfilled.

5-1.2.5 The engine shall be stopped, and the operator shall not be on or inside the truck during refueling.

5-1.2.6 Trained and designated personnel shall refill or exchange LP-Gas containers.

5-1.2.7 A soap solution shall be used to check for leaks. A match or open flame shall not be used.

5-1.2.8 Removable LP-Gas containers shall not be exchanged near, and LP-Gas-powered vehicles shall not be parked near, sources of heat or open flame or similar sources of ignition or near open pits, underground entrances, elevator shafts, or other similar areas.

Exception: This requirement shall not apply to open pits, underground entrances, elevator shafts, or similar areas that are adequately ventilated to prevent accumulations of LP-Gas.

5-1.2.9 Trucks equipped with permanently mounted LP-Gas containers shall be refueled outdoors.

5-1.2.10* Means shall be provided in the fuel system to minimize the escape of fuel when the containers are exchanged. This shall be accomplished as follows:

(a) The valve on the LP-Gas container shall be closed.

(b) An approved, automatic quick-closing coupling (a type that closes in both directions when uncoupled) shall be used in the fuel line. Where such an automatic quick-closing coupling is not used, the fuel line shall be emptied by allowing the engine to run until the fuel in the line is consumed.

5-1.2.11 Removable LP-Gas containers shall be mounted securely to prevent them from jarring loose, slipping, or rotating and shall be positioned so that the safety pressure relief valve opening is always in contact with the vapor space (top) of the container. Proper mounting shall be accomplished by using a substantial positioning pin that engages the cylinder, or an equivalent means, and a container clamp(s) that positions the container where the container is properly installed. A container and its fittings shall not extend beyond the plan form of the industrial truck.

5-1.2.12 All reserve LP-Gas containers shall be stored and transported with the service valve closed. Safety relief valves shall have direct communication with the vapor space of the container at all times.

5-1.2.13 All LP-Gas containers shall be examined before refilling for the following defects or damage:

(1) Dents, scrapes, and gouges of the pressure vessel
(2) Damage to the various valves and liquid level gauge
(3) Debris in the relief valve
(4) Damage to or loss of the relief valve cap
(5) Indications of leakage at the valves or threaded connections
(6) Deterioration, damage, or loss of flexible seals in the filling or servicing connections

Where examination reveals physical damage, such as dents, scrapes, or gouges *[see 5-1.2.13(1)]*, that materially weaken the structure of the LP-Gas container and render it unsafe for use, it shall be removed from service.

Where examination reveals damage as specified in 5-1.2.13(2) through (6), other than physical damage to the container, appropriate repairs shall be made before the container is refilled.

5-1.2.14 Smoking shall be prohibited in the container refilling area for either portable or permanently mounted containers and in the exchange area during the exchange of LP-Gas containers.

5-1.2.15 The service valve of the fuel container shall be closed whenever vehicles are parked overnight or stored indoors for a protracted time.

5-1.3 Compressed Natural Gas Fuel.

5-1.3.1 The compression, storage, handling, and dispensing of CNG shall be located and conducted in accordance with NFPA 52, *Compressed Natural Gas (CNG) Vehicular Fuel Systems Code*.

5-1.3.2 The engine shall be stopped, and the operator shall not be on or inside the truck during refueling.

5-1.3.3 Smoking and open flames shall be prohibited in the refueling area.

5-1.3.4 Each fuel supply container shall be mounted in a location that minimizes damage from collision. A container and its fittings shall not extend beyond the plan form of the industrial truck. Containers, valves, and hose and fittings shall be protected from physical damage using the vehicle structure, valve protectors, or suitable guards in accordance with NFPA 52, *Compressed Natural Gas (CNG) Vehicular Fuel Systems Code*.

5-1.3.5 The refueling receptacle on a truck shall be supported firmly and shall incorporate a means to prevent the entry of dust, water, and other foreign material. Where the means used seals the system pressure, it shall be capable of being depressurized before removal.

5-1.3.6 A CNG cylinder shall not be charged in excess of its maximum allowable working pressure at the normal temperature for the cylinder.

5-1.3.7 The transfer of CNG into the fuel supply container of a truck shall be performed by a person who has performed the transfer operation for at least three full cycles under supervi-

sion and who has competence in initiating emergency procedures. The individual shall be responsible for verifying the working pressure and for ensuring that the container is retested according to the required schedule.

5-1.3.8 A match or open flame shall not be used to check for leaks in CNG fuel systems.

5-1.3.9 Containers.

5-1.3.9.1 Containers and their appurtenances, piping systems, compression equipment, controls, devices, and pressure relief valves shall be maintained in proper operating condition.

5-1.3.9.2 Pressure relief devices shall be maintained in reliable operating condition by using care in the handling and storing of compressed natural gas containers to avoid damage. Care also shall be exercised to avoid plugging caused by paint or other dirt accumulation in pressure relief device channels or other parts of the container that can interfere with the functioning of the device. Only qualified personnel shall be permitted to service pressure relief devices.

5-1.3.9.3 Only assemblies or original manufacturer's parts shall be used in the repair of pressure relief devices.

Exception: Assemblies or parts that have been proved by suitable testing shall be permitted to be used.

5-1.3.10 CNG–powered vehicles shall not be parked near sources of heat or open flame or similar sources of ignition.

5-1.3.11 The service valve of the fuel container shall be closed whenever vehicles are parked overnight or stored indoors for a protracted time.

5-2 Dual Fuel.

5-2.1* Where operating a dual-fuel truck on CNG or LP-Gas, the gasoline level in the liquid fuel tank shall be checked daily. The truck shall not be operated unless the gasoline fuel tank is at least one-quarter full.

5-2.2 Where operating a dual-fuel truck on CNG fuel, the provisions of 5-1.3 shall apply.

5-2.3 Where operating a dual-fuel truck on LP-Gas, the provisions of 5-1.2 shall apply.

5-2.4 Where operating a dual-fuel truck on liquid fuels, the provisions of 5-1.1 shall apply.

5-3 Changing and Charging Storage Batteries.

5-3.1* Section 5-3 shall apply to batteries used on electric trucks.

5-3.2 Battery-charging installations shall be located in areas designated for such purpose. The areas shall be kept free of extraneous combustible materials. Facilities shall be provided for the following:

(1) Flushing spilled electrolyte
(2) Fire protection
(3) Protection of charging apparatus against damage by trucks
(4) Adequate ventilation for dispersal of fumes from gassing batteries

Where onboard chargers are used, charging shall be accomplished at locations designated for such purpose, taking into account the electrical requirements of the charger and facilities for fire protection.

Exception: Flushing facilities shall not be required if charging is accomplished without removing the battery from the vehicle.

5-3.3 Where handling acid concentrates that contain greater than 50 percent acid (above 1.400 specific gravity), an eyewash fountain shall be provided.

5-3.4 A conveyor, an overhead hoist, or equivalent material-handling equipment shall be provided for handling batteries.

5-3.5 Chain hoists shall be equipped with load-chain containers. Where a hand hoist is used, uncovered batteries shall be covered with a sheet of plywood or other nonconducting material to prevent the hand chain from shorting on cell connectors or terminals. A properly insulated spreader bar shall be used with any overhead hoist.

5-3.6 Reinstalled batteries or new batteries shall be equivalent to or shall be rated higher than the battery type marked on the truck. Reinstalled batteries shall be positioned properly and secured in the truck.

5-3.7 A carboy tilter or siphon shall be provided where acid in carboys is used. Where diluting concentrated sulfuric acid to make up electrolyte, the acid shall ALWAYS be added to the water. Water shall NEVER be added to acid. Battery maintenance personnel shall wear protective clothing such as eye protection, long sleeves, and gloves.

Exception: Removal and replacement of batteries shall not require the use of protective clothing.

5-3.8 Electric installations shall be in accordance with NFPA 70, *National Electrical Code*, and any local ordinances.

5-3.9 Trained and authorized personnel shall change or charge batteries.

5-3.10 Trucks shall be positioned properly and brakes shall be applied before attempting to change or charge batteries.

5-3.11 Where charging batteries, the vent caps shall be kept in place to avoid electrolyte spray. Care shall be taken to ensure that vent caps are functioning. The battery or compartment cover(s) shall be open to dissipate heat and gas.

5-3.12 Smoking shall be prohibited in the charging area.

5-3.13 Precautions shall be taken to prevent open flames, sparks, or electric arcs in battery-charging areas.

5-3.14 Tools and other metal objects shall be kept away from the tops of uncovered batteries.

5-4 Use of Trucks in Classified Areas.

5-4.1 Industrial trucks shall not be used in classified areas.

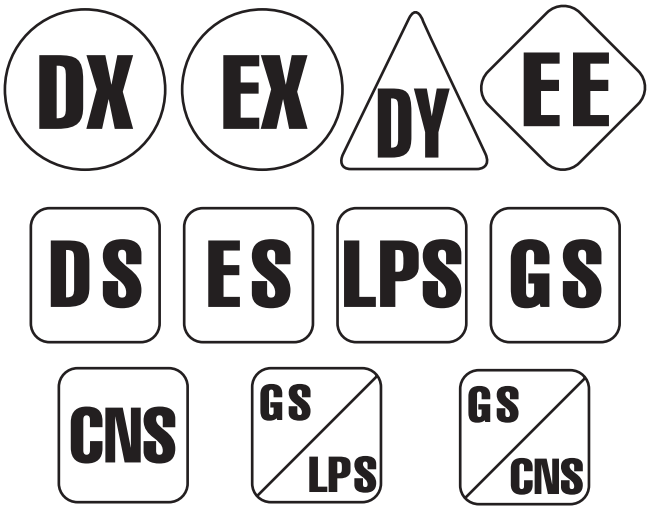
Exception: Industrial trucks shall be permitted to be used where specified in Chapter 1.

5-4.2 Types CNS, DS, DY, DX, ES, EE, EX, GS, LPS, GS/CNS, and GS/LPS Industrial Trucks and their Areas of Use.

5-4.2.1 Proper equipment shall be used in classified areas for the safety and protection of employees and property. Approved trucks that are listed by a testing laboratory for use in such areas shall be clearly identified. To facilitate identification by operators and supervisory personnel, a uniform system of marking as described in 5-4.2.2 and 5-4.2.3 shall be used.

5-4.2.2 Durable markers indicating the type designation of trucks used in classified areas shall be applied to each side of the vehicle in a visible but protected location. The markers shall be distinctive in shape as shown in Figure 5-4.2.2. The markers for Types LPS, GS, DS, ES, CNS, GS/LPS, and GS/CNS shall be 4-in. (102-mm) squares. The width of markers for other type designations shall be 5 in. (127 mm). The markers shall consist of black borders and lettering on a yellow background.

Figure 5-4.2.2 Markers used to identify type of industrial truck.



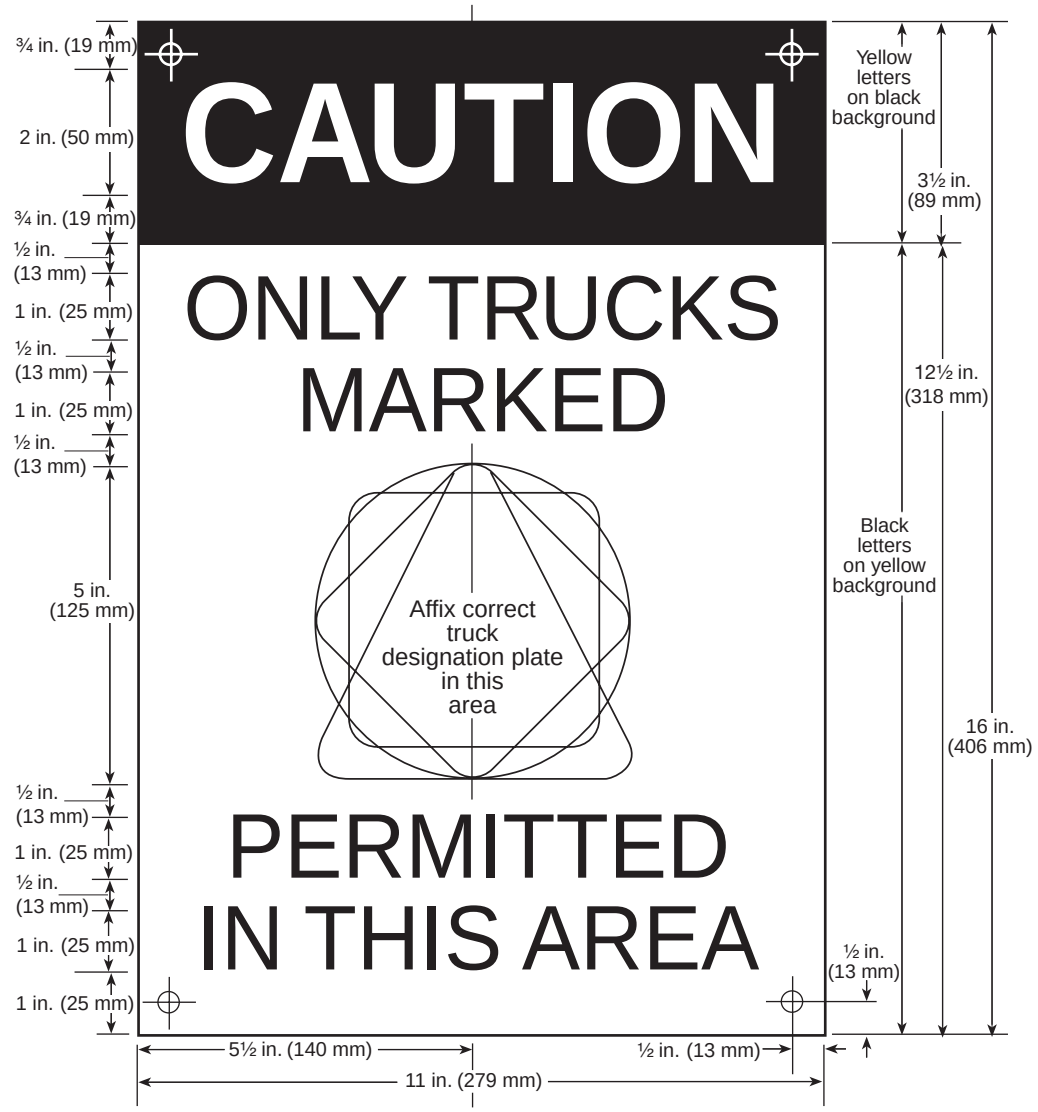
5-4.2.3 Entrances to classified areas where industrial trucks are to be used shall be posted with durable markers as shown in Figure 5-4.2.3. The minimum width of the sign shall be 11 in. (279 mm). The minimum height of the sign shall be 16 in. (406 mm). The word *caution* shall be printed on the sign in yellow letters on a black background. The body of the sign shall consist of black letters on a yellow background. A marker(s) identical to that used on the side of the truck shall be installed on the sign. *(See Figure 5-4.2.2.)*

5-5 Safe Operating Rules.

5-5.1 Powered industrial truck operation shall be in accordance with applicable sections of ASME/ANSI B56.1, *Safety Standard for Low Lift and High Lift Trucks.*

5-5.2 Prior to each shift of operations, the operator of an industrial truck shall perform an inspection for safe operation, including a visual check of the general condition of the truck and a check for the presence of easily ignited combustible materials such as accumulated debris and oily rags.

Figure 5-4.2.3 Building signs for posting at entrance to hazardous areas.



5-6 Operating Procedures and Training.

5-6.1 There shall be a written operating procedure plan and operator training.

5-6.2 The procedure shall include, as a minimum, the following:

(1) Operation limited to trained personnel
(2) Cautions where checking or filling tank
(3) Action for suspected leak
(4) Refueling instructions
(5) Emergency items
   a. Shutoff fuel valve
   b. Ensure battery correct type and position

Chapter 6 Portable Fire Extinguishers

6-1* General Requirements. Where the authority having jurisdiction or end user requires an industrial truck to be equipped with a portable extinguisher, the location of the extinguisher on the truck shall be in accordance with the truck manufacturer's recommendations.

6-1.1 Industrial trucks shall be equipped with portable extinguishers only if truck operators have been trained in the safe operation and use of portable extinguishers.

6-1.2 The type of extinguisher used on a truck shall be in accordance with the hazard classification guidance provided in NFPA 10, *Standard for Portable Fire Extinguishers.*

6-2 Maintenance.

6-2.1 Extinguishers shall be maintained in accordance with Chapter 4 of NFPA 10, *Standard for Portable Fire Extinguishers,* and records shall be kept in accordance with such requirements.

6-2.2 Recharging procedures shall follow the requirements of Chapter 4 of NFPA 10, *Standard for Portable Fire Extinguishers.*

6-2.3 Extinguishers that are out of service for maintenance or recharge shall be replaced with extinguishers that have the same agent, rating, and operating procedure.

6-3 Hydrostatic Testing. Extinguisher shells and appurtenant devices, such as nozzles, hose, and pressure cartridges, shall be hydrostatically tested in accordance with Chapter 5 of NFPA 10, *Standard for Portable Fire Extinguishers.*

Chapter 7 Referenced Publications

7-1 The following documents or portions thereof are referenced within this standard as mandatory requirements and shall be considered part of the requirements of this standard. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this standard. Some of these mandatory documents might also be referenced in this standard for specific informational purposes and, therefore, are also listed in Appendix B.

7-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 10, *Standard for Portable Fire Extinguishers,* 1998 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 1996 edition.

NFPA 30A, *Automotive and Marine Service Station Code,* 1996 edition.

NFPA 52, *Compressed Natural Gas (CNG) Vehicular Fuel Systems Code,* 1998 edition.

NFPA 58, *Liquefied Petroleum Gas Code,* 1998 edition.

NFPA 70, *National Electrical Code®,* 1999 edition.

7-1.2 Other Publications.

7-1.2.1 ASME Publication. American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.

ASME/ANSI B56.1, *Safety Standard for Low Lift and High Lift Trucks,* 1993.

7-1.2.2 ASTM Publication. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 3175, *Standard Test Method for Volatile Matter in the Analysis Sample of Coal and Coke,* 1989.

7-1.2.3 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

UL 558, *Standard for Safety Industrial Trucks, Internal Combustion Engine-Powered,* 1991.

UL 583, *Standard for Safety Electric-Battery-Powered Industrial Trucks,* 1991.

Appendix A Explanatory Material

Appendix A is not a part of the requirements of this NFPA document but is included for informational purposes only. This appendix contains explanatory material, numbered to correspond with the applicable text paragraphs.

A-1-4 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A-1-4 Authority Having Jurisdiction. The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.