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NFPA 505 Powered Industrial Trucks Including Type, Areas of Use, Maintenance, and Operation 1992 Edition

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Policy Adopted by NFPA Board of Directors on December 3, 1982

The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

Statement on NFPA Procedures

This material has been developed under the published procedures of the National Fire Protection Association, which are designed to assure the appointment of technically competent Committees having balanced representation. While these procedures assure the highest degree of care, neither the National Fire Protection Association, its members, nor those participating in its activities accept 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.

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NFPA 505

Fire Safety Standard for

Powered Industrial Trucks Including Type Designations, Areas of Use, Maintenance, and Operation

1992 Edition

This edition of NFPA 505, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Maintenance, and Operation*, was prepared by the Technical Committee on Industrial Trucks and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 18-21, 1992 in New Orleans, LA. It was issued by the Standards Council on July 17, 1992, with an effective date of August 14, 1992, and supersedes all previous editions.

The 1992 edition of this document has been approved by the American National Standards Institute.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

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 the NFPA under the designation NFPA 505B and 505C, respectively. 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 this edition, Group F was added to the list of classified locations to correlate with the *National Electrical Code*®.

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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.

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.

Contents

NFPA 505

Fire Safety Standard for

Powered Industrial Trucks

Including Type Designations, Areas of Use, Maintenance, and Operation

1992 Edition

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

Information on referenced publications can be found in Chapter 6 and Appendix B.

Chapter 1 Type Designations and Areas of Use

1-1 Scope. This standard applies 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 does not apply to compressed air or nonflammable compressed gas-operated industrial trucks, farm vehicles, or automotive vehicles for highway use.

1-2 General.

1-2.1 Design and installation of the LP-Gas fuel systems on LP-Gas- and dual-fuel-powered industrial trucks shall be in accordance with the applicable provisions of NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gas.*

1-2.2 Approved powered industrial trucks as used in this standard are those trucks listed by a testing laboratory for the use intended. Trucks shall be tested and labeled in accordance with ANSI/UL 558, *Safety Standard for Internal-Combustion-Engine-Powered Industrial Trucks*, or ANSI/UL 583, *Safety Standard for Electric-Battery-Powered Industrial Trucks.*

1-3* Definitions.

Approved. Acceptable to the "authority having jurisdiction."

NOTE: 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 or 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 concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: 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, 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 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."

Labeled. Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization 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 or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The "authority having jurisdiction" should utilize the system employed by the listing organization to identify a listed product.

Type Designation. A system for identifying types of powered industrial trucks for operation in nonclassified and classified areas [*see following paragraphs (a) through (m)*].

(a) The *Type D* units are diesel-powered units having minimal acceptable safeguards against inherent fire hazards.

(b) The *Type DS* units are diesel-powered units that, in addition to all the requirements for the Type D units, are provided with additional safeguards to the exhaust, fuel, and electrical systems.

(c) The *Type DY* units are diesel-powered units that have all the safeguards of the Type DS units and, in addition, do not have any electrical equipment, including ignition. They are equipped with temperature limitation features.

(d) The *Type E* units are electrically powered units having minimum acceptable safeguards against inherent fire and electrical shock hazards.

(e) The *Type ES* units are electrically powered units that, in addition to all of the requirements for the Type E units, are provided with additional safeguards to the electrical system to prevent emission of hazardous sparks and to limit surface temperatures.

(f) The *Type EE* units are electrically powered units that have, in addition to all of the requirements for the Types E

and ES units, the electric motors and all other electrical equipment completely enclosed.

(g) The *Type EX* units are electrically powered units that differ from the Types E, ES, or EE units in that the electrical fittings and equipment are so designed, constructed, and assembled that the units may be used in atmospheres containing specifically named flammable vapors, dusts, and, under certain conditions, fibers. Type EX units are specifically tested and classified for use in Class I, Group D or for Class II, Group F or G locations as defined in NFPA 70, *National Electrical Code®*.

(h) The *Type G* units are gasoline-powered units having minimum acceptable safeguards against inherent fire hazards.

(i) The *Type GS* units are gasoline-powered units that, in addition to all the requirements for the Type G units, are provided with additional safeguards to the exhaust, fuel, and electrical systems.

(j) The *Type LP* units are liquefied-petroleum-gas-powered units having minimum acceptable safeguards against inherent fire hazards.

(k) The *Type LPS* units are liquefied-petroleum-gas-powered units that, in addition to the requirements for the Type LP units, are provided with additional safeguards to the exhaust, fuel, and electrical systems.

(l) The *Type G/LP* units operate on either gasoline or liquefied petroleum gas having minimum acceptable safeguards against inherent fire hazards.

(m) The *Type GS/LPS* units operate on either gasoline or liquefied petroleum gas and, in addition to all requirements for the Type G/LP units, are provided with additional safeguards to the exhaust, fuel, and electrical systems.

1-4 Hazard Classification.

1-4.1 The authority having jurisdiction shall determine the hazard classification of any particular location. The location shall have been classified prior to the consideration of industrial trucks being used therein, and the type of industrial truck required shall be as provided in Section 1-5 of this standard for such location.

1-4.2 Several areas of any one plant or building may have different hazard classifications. The authority having jurisdiction shall limit the use of industrial trucks in classified areas in a plant or building in accordance with the hazard classification of such areas. The responsibility for enforcement of restricted use in such areas shall rest with management.

1-4.3 The industrial trucks specified in Section 1-5 are the minimum types required. Industrial trucks having greater safeguards may be used if desired.

1-5 Specific Areas of Use.

NOTE: Table 1-5 provides a summary of industrial truck types for specific areas of use and was developed from information contained in this section.

References in parentheses in the following subsection headings in this section are to the corresponding classification as used in NFPA 70, *National Electrical Code*, for the convenience of people familiar with those classifications.

1-5.1* Areas Containing Certain Flammable Gases or Vapors Where Power-Operated Industrial Trucks Shall Not Be Used (Class I, Groups A, B, and C, Division 1). Power-operated industrial trucks shall not be used in these locations.

NOTE: For examples of chemicals of which mixtures of their vapors in air are classified as Class I, Group A, B, and C, see Section 500-3 of NFPA 70, *National Electrical Code*, and A-1-5.1 of this standard.

1-5.2 Areas Where Vapors of Flammable Liquids and Some Gases Exist under Normal Operating Conditions (Class I, Group D, Division 1).

1-5.2.1* Approved power-operated industrial trucks designated as Type EX and classified for Class I, Group D chemicals shall be used in these locations containing gases or vapors.

NOTE: For examples of chemicals of which mixtures of their vapors in air are classified as Class I, Group D, see Section 500-3 of NFPA 70, *National Electrical Code*, and A-1-5.2.1 of this standard.

1-5.2.2 Class I, Group D, Division 1 includes locations where volatile flammable liquids or liquefied flammable gases are transferred from one container to another; interiors of spray booths and areas in the vicinity of spraying and painting operations where volatile flammable solvents are used; locations containing open tanks or vats of volatile flammable liquids; drying rooms or compartments for the evaporation of flammable solvents; locations containing fat and oil extraction apparatus using volatile flammable solvents; portions of cleaning and dyeing plants where hazardous liquids are used; gas generator rooms and other portions of gas manufacturing plants where flammable gas may escape; inadequately ventilated pump rooms for flammable gas or for volatile flammable liquids; the interiors of refrigerators and freezers in which volatile flammable materials are stored in open, lightly stoppered, or easily ruptured containers; and all other locations where hazardous concentrations of flammable vapors or gases are likely to occur in the course of normal operations.

1-5.3 Areas Where Volatile Flammable Liquids and Their Vapors or Flammable Gases Are Normally Confined (Class I, Group D, Division 2).

1-5.3.1 Approved power-operated industrial trucks designated as Types DY, EE, or 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, but in which these liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems, or in case of abnormal operation of equipment; also in locations in which ignitible concentrations of gases or vapors are normally prevented by positive mechanical ventilation but that might become hazardous through failure or abnormal operation of the ventilating equipment; or in locations adjacent to Class I, Division 1 locations, and to which ignitible concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

Table 1-5 Summary Table on Use of Powered Industrial Truck as Described in Chapter 1 of This Standard

	Diesel-Powered			Electric-Powered				Gasoline-Powered		LP-Gas-Powered		Dual-Fuel		Text Par.
Locations	**D**	**DS**	**DY**	**E**	**ES**	**EE**	**EX**	**G**	**GS**	**LP**	**LPS**	**G/LP**	**GS/LPS**	**Reference**
Class I														
Division 1														
Group A														1-5.1
Group B														1-5.1
Group C														1-5.1
Group D							A							1-5.2
Class I														
Division 2														
Group A		X	X		X	X	X	X		X		X	X	1-5.10
Group B		X	X		X	X	X		X		X		X	1-5.10
Group C		X	X		X	X	X		X		X		X	1-5.10
Group D		*	A		*	A	A		*		*		*	1-5.3
Class II														
Division 1														
Group E							*							1-5.4
Group F							A**							1-5.5
Group G							A							1-5.6
Class II														
Division 2														
Group F#		*	A		*	A	A		*		*		*	1-5.7
Group G		*	AZ		*	A	A		*		*		*	1-5.7
Class III														
Division 1		*	A		*	A	A		*		*		*	1-5.8
Class III														
Division 2		A	A	*	A	A	A		A		A		A	1-5.9

Key To Table Symbols

A = Type truck authorized in location described.
* = Type truck authorized in location described with approval of the authority having jurisdiction.
** = If resistivity of dust 10^5 ohm-cm see *.
# = If dust has resistivity of 10^5 ohm-cm or greater.
X = Type truck authorized to be determined by the authority having jurisdication.
Blank spaces = Type truck not authorized in location described.

1-5.3.2 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 DS, ES, GS, LPS, or GS/LPS may be used if permitted for such locations by the authority having jurisdiction.

1-5.3.3 The classification Class I, Group D, Division 2 includes locations where volatile flammable liquids or flammable gases or vapors are used, but that, in the judgment of the authority having jurisdiction, would become hazardous only in case of an accident or of some unusual operating condition. The quantity of flammable material that might escape in case of 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 all factors that should receive consideration in determining whether or not the Type DS, DY, ES, EE, GS, LPS, or GS/LPS truck possesses sufficient safeguards for the location.

1-5.4 Areas Containing Combustible Metal Dusts and Other Combustible Dusts Having Resistivity of Less than 10^2 ohm-cm (Class II, Groups E and F, Division 1).

1-5.4.1 Power-operated industrial trucks shall not be used in locations containing hazardous concentrations of metal dust, including aluminum, magnesium, and their commercial alloys, or other dusts of similarly hazardous characteristics having resistivity of less than 10^2 ohm-cm.

Exception: Approved power-operated industrial trucks designated as Type EX may be used in such locations, subject to special investigation of both the truck and specific area of use by the authority having jurisdiction.

1-5.4.2 In atmospheres where dust of magnesium, aluminum, or aluminum bronze might be present, fuses, switches, motor controllers, and circuit breakers of trucks shall have enclosures specifically approved for such locations.

1-5.5 Areas Containing Combustible Dusts in Suspension Having Resistivity of 10^2 ohm-cm or Greater and Less than 10^8 ohm-cm (Class II, Group F, Division 1).

1-5.5.1 Power-operated industrial trucks shall not be used in locations containing hazardous concentrations of electrically conductive Group F dusts having a resistivity less than 10^5 ohm-cm.

Exception: Approved power-operated industrial trucks designated as Type EX may be used in such locations, subject to special investigation of both the truck and specific area of use by the authority having jurisdiction.

1-5.5.2 Approved power-operated industrial trucks designated as Type EX (classified for Class II, Group F locations) shall be used in locations in which electrically nonconductive Group F dust having a resistivity of 10^5 ohm-cm or greater but less than 10^8 ohm-cm is or may 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 might cause such mixtures to be produced.

1-5.5.3 Classification of Class II, Group F, Division 1 includes areas containing carbon black, charcoal, coal, and coke dusts that have more than 8 percent total volatile material (coal and coke dust per ASTM D-3175, *Standard Test Method for Volatile Matter in the Analysis Sample of Coal and Coke*) or atmospheres containing those dusts sensitized by other materials so that they present an explosion hazard.

NOTE: Most Group F dusts are electrically nonconductive and have resistivities in the range of 10^5 to 10^8 ohm-cm. However, some western (Wyoming) coals may have resistivties less than 10^5 ohm-cm.

1-5.6 Areas Containing Combustible Dusts in Suspension Having Resistivity of 10^8 ohm-cm or Greater (Class II, Group G, Division 1).

1-5.6.1 Approved power-operated industrial trucks designated as Type EX (classified for Class II, Group G locations) shall be used in locations in which combustible dust having resistivity of 10^8 ohm-cm or greater is or may 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 might cause such mixtures to be produced.

1-5.6.2 The classification Class II, Group G, Division 1 includes the working areas of grain-handling and storage plants, and rooms containing grinders or pulverizers, cleaners, graders, scalpers, open conveyors or spouts, open bins or hoppers, mixers or blenders, automatic or hopper scales, packing machinery, elevator heads and boots, stock distributors, dust and stock collectors (except all-metal collectors vented to the outside), and all similar dust-producing machinery and equipment in grain-processing plants, starch plants, sugar-pulverizing plants, malting plants, wood flour plants, hay-grinding plants, and other occupancies of similar nature where combustible dust having resistivity of 10^8 ohm-cm or greater might, under normal operating conditions, be present in the air in quantities sufficient to produce explosive or ignitible mixtures.

1-5.7 Areas Where Combustible Dusts Having Resistivity of 10^5 ohm-cm or Greater are Present but Not Normally in Suspension in the Atmosphere (Class II, Groups F and G, Division 2).

1-5.7.1 Approved power-operated industrial trucks designated as Type DY, EE, or EX (classified for Class II, Group F or G locations, as appropriate) shall be used in locations in which combustible dust having resistivity of 10^5 ohm-cm or greater is not normally in suspension in the air or is not likely 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 might be ignited by arcs or sparks originating in the truck.

1-5.7.2 In locations where dangerous concentrations of suspended dust having resistivity of 10^5 ohm-cm or greater would not be likely, approved power-operated industrial trucks designated as Type DS, ES, GS, LPS, or GS/LPS may be used if permitted for such location by the authority having jurisdiction. These locations would include rooms and areas containing only closed spouting and conveyors, closed bins or hoppers, or machines and equipment from which appreciable quantities of dust would escape only under abnormal operating conditions; rooms or areas into which explosive or ignitible concentrations of suspended dust might 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.

1-5.8 Areas Where Easily Ignitible Fibers or Materials Producing Combustible Flyings Are Handled, Manufactured, or Used (Class III, Division 1).

1-5.8.1 Approved power-operated industrial trucks designated as Type DY, EE, or EX shall be used in locations that are classified because of the presence of easily ignitible fibers or materials producing combustible flyings but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitible mixtures.

NOTE: Where these materials are either in enclosed systems or flyings in air are minimized through use of ventilation controls, then the use of Types DS, ES, GS, LPS, or GS/LPS trucks may be considered.

1-5.8.2 Locations where easily ignitible fibers or flyings are found usually include some parts 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.

Wood flour plants shall be considered as being in the type of locations defined in 1-5.6.2.

Easily ignitible fibers and flyings 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 materials of similar nature.

1-5.9 Areas Where Easily Ignitible Fibers Are Stored or Handled (Class III, Division 2).

Exception: In process of manufacture.

1-5.9.1 Approved power-operated industrial trucks designated as Type DS, DY, ES, EE, EX, GS, LPS, or GS/LPS shall be used in locations where easily ignitible fibers are

stored or handled, including outside storage, but are not being processed or manufactured. Industrial trucks designated as Type E, which have been previously used in these locations, may be continued in use with the approval of the authority having jurisdiction.

1-5.10 Hazardous Areas Not Otherwise Classified. The authority having jurisdiction shall determine what types of approved power-operated industrial trucks, if any, shall be used on an engineering survey of the property and an evaluation of the fire and explosion hazards.

1-5.11 Piers and Wharves.

1-5.11.1 Where it is determined that the location on piers and wharves for handling general cargo is not hazardous, any approved power-operated industrial truck designated as Type D, E, G, LP, or G/LP may be used, or trucks that conform to the requirements for these types may be used.

1-5.11.2 Where an area of a pier or wharf is determined to be hazardous, only approved power-operated industrial trucks specified for such locations in the preceding subsections shall be used.

1-5.12 General Inside and Outside Storage.

1-5.12.1 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 D, E, G, LP, or G/LP may be used, or trucks that conform to the requirements for these types may be used.

1-5.12.2 Where the location for general storage in warehouses or general outside storage is determined to be hazardous, only approved power-operated industrial trucks specified for such locations in the preceding subsections shall be used.

1-5.13 General Industrial or Commercial Properties.

1-5.13.1 Where it is determined that the locations on general industrial or commercial properties for handling or processing materials (storage being incidental to handling and processing), or both, is not hazardous, any approved power-operated industrial truck designated as Type D, E, G, LP, or G/LP may be used, or trucks that conform to the requirements for these types may be used.

1-5.13.2 Where the location on general industrial, or commercial properties for handling or processing materials, or both, is determined to be hazardous, only approved power-operated industrial trucks specified for such locations in the preceding subsections shall be used.

1-5.14 Converted Industrial Trucks.

1-5.14.1 Power-operated industrial trucks that have originally been approved for or that conform to the requirements for Type G for the use of gasoline for fuel, when converted to the use of liquefied petroleum gas fuel in accordance with Chapter 3, may be used in those locations where G- or LP-type trucks have been specified in the preceding subsections.

1-5.14.2 Power-operated industrial trucks that have originally been approved for or that conform to the requirements for Type G for the use of gasoline for fuel, when converted to the use of dual fuels in accordance with Chapter 3, may be used in those locations where G- or LP-type trucks have been specified in the preceding subsections.

1-5.14.3 Power-operated industrial trucks that have originally been approved, or that conform to the requirements for Type LP for the use of liquefied petroleum gas for fuel, when converted to the use of dual fuels in accordance with Chapter 3, may be used in those locations where G- or LP-type trucks have been specified in the preceding subsections.

1-5.14.4 Power-operated industrial trucks that have originally been approved, or that conform to the requirements for Type LP for the use of liquefied petroleum gas for fuel, when converted to the use of gasoline for fuel in accordance with Chapter 3, may be used in those locations where G-type trucks have been specified in the preceding subsections.

1-5.14.5 Power-operated industrial trucks that have originally been approved, or that conform to the requirements for Type G/LP for the use of dual fuels, when converted to the use solely of gasoline for fuel in accordance with Chapter 3, may be used in those locations where G-type trucks have been specified in the preceding subsections.

1-5.14.6 Power-operated industrial trucks that have originally been approved, or that conform to the requirements for Type G/LP for the use of dual fuels, when converted to the use solely of liquefied petroleum gas for fuel in accordance with Chapter 3, may be used in those locations where LP-type trucks have been specified in the preceding subsections.

1-5.14.7 Power-operated industrial trucks originally designated Type GS, LPS, or GS/LPS shall not be converted to the use of other fuels.

1-5.14.8 Power-operated industrial trucks originally approved or that conform to the requirements for Type G, LP, or G/LP shall not be converted to Type GS, LPS, or GS/LPS.

Chapter 2 Dual-Fuel Trucks

2-1 General. A dual-fuel truck is defined as a truck equipped to be operated on either gasoline or LPG without further modification.

2-2 Requirements.

2-2.1 Those parts of the fuel system that come into contact with gasoline shall meet the requirements for liquid fuel — ANSI/UL 558, *Standard for Internal-Combustion-Engine-Powered Industrial Trucks*. (*See Appendix A.*)

2-2.2 Those parts of the fuel system that come into contact with LPG fuel shall meet the requirements for LPG fuel — ANSI/UL 558, *Standard for Internal-Combustion-Engine-Powered Industrial Trucks*, or NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases*. (*See A-3-1.*)

2-2.3 Those parts of the fuel system that come into contact with both gasoline and LPG fuel shall be compatible with both types of fuel.

2-2.4* Fuel Changeover. When switching from LPG to liquid fuel, care shall be taken to ascertain there is no spillage of liquid fuel.

2-3 Nameplate Visibility. The truck designations (*see Section 1-3*) as shown on the nameplate and the type markers (*see Figure 5-4.2.2*) shall not be painted over so as to obscure their content.

Chapter 3 Converted Trucks

3-1* Conversion of Trucks. Industrial trucks originally approved and classified by type designation (*see 1-5.1.4*) shall be permitted to be converted to another type provided that the conversion results in a truck that embodies the features specified for the particular fuel to be used in accordance with Table 3-1.

Table 3-1 Permissible Truck Fuel Conversions

Original Approval and Classification	New Approval and Classification
Gasoline	LP-Gas
Gasoline or LP-Gas	Dual Fuels
LP-Gas or Dual Fuels	Gasoline
Dual Fuels	LP-Gas

3-2 Conversion Requirements.

3-2.1 A truck designated Type G, LP, or G/LP that is converted to another of these designations shall conform to the requirements for the new designation selected in accordance with ANSI/UL 558, *Standard for Internal-Combustion-Engine-Powered Industrial Trucks.*

3-2.2 Conversion kits for use on trucks designated Type G, LP, or G/LP shall conform to the requirements for the type designation selected in accordance with ANSI/UL 558, *Standard for Internal-Combustion-Engine-Powered Industrial Trucks*, and may be approved by a testing laboratory.

(a) The content of the kit shall be as set forth in 3-2.3.

(b) The installation of the kit shall conform to the features set forth in 3-2.3.

When a conversion kit approved by a testing laboratory is used, a copy of the report shall be supplied to the authority having jurisdiction, upon request.

3-2.3 Kits for conversion of Types G, LP, and G/LP trucks shall include:

(a) Step-by-step installation instructions with pictorial illustration (if necessary) for clarity.

(b) All parts required to complete the installation, including:

1. Functional components;
2. Mounting brackets and hardware;
3. Connecting wires, hoses, and fittings; and
4. Sealants, if required.

(c) A durable, corrosion-resistant plate indicating the type designation of the converted truck, for permanent mounting on the truck.

(d) A metal nameplate attached to the LP-tank mounting identifying the fuel container assembly to be used.

(e) A gasoline fuel tank, along with necessary mounting and connection hardware and installation instructions if the conversion is from LP-Gas to gasoline or dual fuels.

(f) If the conversion is from gasoline to LP, instructions for removal or deactivation of the present components including gasoline tank(s).

(g) Instructions covering checks and tests to be performed after the conversion and prior to putting the truck into service.

3-2.4 When a conversion kit is installed, all original identification of approval and type designation shall be removed or obliterated, and the plate specified in 3-2.3(c) shall be installed in lieu thereof.

Chapter 4 Maintenance of Industrial Trucks

4-1 General. It is essential that the fire safety built into power-operated industrial trucks be maintained; any power-operated industrial truck not in safe operating condition shall be removed from service.

4-2 Precautions.

4-2.1 Repairs shall not be made in Class I, II, and 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 electrical 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, and particularly trucks approved for use in classified hazardous locations, requiring replacement shall be replaced only with parts providing 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 the filled capacity. Vehicles with mufflers having screens or other parts that may 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 immediately be removed from service and not returned to service until the cause for the emission of such sparks and flames has been eliminated.

4-5 Operating Temperature. When 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 not returned to service until the cause for such overheating has been eliminated.

4-6 Fire Prevention. Industrial trucks shall be kept in a clean condition, 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)] may be used. Precautions regarding toxicity, ventilation, and fire hazard shall be consonant with the agent or solvent used.

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

4-8 Nameplate Visibility. The truck designations (*see Section 1-3*) as shown on the nameplate and the type markers (*see 5-4.2*) shall not be painted over so as to obscure their content.

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*.

5-1.1.2 Trucks using liquid fuels shall be refueled only at locations designated for that purpose and from approved dispensing pumps. Safe outdoor locations are preferable to those indoors. NFPA 30, *Flammable and Combustible Liquids Code*, includes requirements for arranging indoor fueling facilities.

5-1.1.3 Engines shall be stopped and the operator shall be off the truck during refueling.

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

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

5-1.1.6 Smoking 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, *Standard for the Storage and Handling of Liquefied Petroleum Gases*.

5-1.2.2 Filling of fuel containers that are permanently mounted on trucks and filling of removable DOT-type LP-Gas containers shall be done at locations designated for that purpose and in accordance with NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases*.

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 be off 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 and LP-Gas-powered vehicles shall not be parked near sources of heat, open flames, or similar sources of ignition or near open pits, underground entrances, elevator shafts, or other similar areas unless such areas 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 The exchange of removable LP-Gas containers is preferably done outdoors, but may be done indoors. Means shall be provided in the fuel system to minimize the escape of fuel when the containers are exchanged. This shall be accomplished by:

(a) Closing the valve on the LP-Gas container, and

(b) Using an approved automatic quick-closing coupling (a type that closes in both directions, when uncoupled) 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 securely mounted to prevent jarring loose, slipping, or rotating and shall be so positioned that the safety pressure relief valve opening is always in contact with the vapor space (top) of the container. This shall be accomplished by means of a substantial positioning pin engaging the cylinder or an equivalent means and container clamp(s) that, when the container is properly installed, positions the container. 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:

(a) Dents, scrapes, and gouges of the pressure vessel;

(b) Damage to the various valves and liquid level gage;

(c) Debris in the relief valve;

(d) Damage to or loss of relief valve cap;

(e) Indications of leakage at valves or threaded connections; and

(f) Deterioration damage or loss of flexible seals in the filling or servicing connections.

Where examination reveals physical damage such as dents, scrapes, or gouges [item (a)] that materially weaken the structure of the LP-Gas container, rendering it unsafe for use, it shall be removed from service.

Where examination reveals damages listed above other than physical damage [items (b) through (f)] 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 when exchanging LP-Gas containers.

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

5-2 Dual Fuel.

5-2.1* When operating a dual-fuel truck on 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 1/4 full.

5-2.2 When operating a dual-fuel truck on LP-Gas, the provisions of 5-1.2 shall be followed.

5-2.3 When operating a dual-fuel truck on liquid fuel, the provisions of 5-1.1 shall be followed.

5-3 Changing and Charging Storage Batteries.

5-3.1 This section shall apply to batteries used on electric trucks. The two types of batteries in common use are (a) lead and (b) nickel-iron. They contain corrosive chemical solutions, either acid or alkali, and therefore present a chemical hazard. On charge, they give off hydrogen and oxygen, which, in certain concentrations, are explosive.

5-3.2 Battery-charging installations shall be located in areas designated for that purpose; such areas shall be kept free of extraneous combustible materials. Facilities shall be provided for: flushing spilled electrolyte; fire protection; protecting charging apparatus from damage by trucks; and adequate ventilation for dispersal of fumes from gassing batteries. Where on-board chargers are used, charging shall be accomplished at locations designated for that purpose, taking into account the electrical requirements of the charger and facilities for fire protection.

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

5-3.3 When handling acid concentrates greater than 50 percent acid (above 1.400 specific gravity), an eye wash fountain shall be provided.

5-3.4 A conveyor, 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. When 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 shall be positioned properly and secured in the truck.

5-3.7 A carboy tilter or siphon shall be provided when acid in carboys is used. When diluting concentrated sulfuric acid to make up electrolyte, ALWAYS add the acid to the water and not the water to the acid. Battery maintenance personnel shall wear protective clothing such as eye protection, long sleeves, and gloves.

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

5-3.8 Electrical installations shall conform to 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 properly positioned and brake applied before attempting to change or charge batteries.

5-3.11 When 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 metallic 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 except as specified in Chapter 1 of this standard.

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

5-4.2.1 The use of proper equipment in classified areas is essential for the safety and protection of employees and property. Approved trucks, listed by a testing laboratory for use in such areas, shall be clearly identified. To facili-

tate identification both by operators and supervisory personnel, a uniform system of marking has been developed as described herein.

5-4.2.2 Durable markers indicating the designation of the type of truck for use in classified areas shall be applied to each side of the vehicle in a visible but protected location. These markers shall be distinctive in shape as indicated in Figure 5-4.2.2.

5-4.2.3 Entrances to classified areas where industrial trucks are intended to be used shall be posted with durable markers as shown in Figure 5-4.2.3.

5-5 Safe Operating Rules. Powered industrial truck operation shall be in accordance with ANSI B56.1, *Safety Standard for Low Lift and High Lift Trucks.*

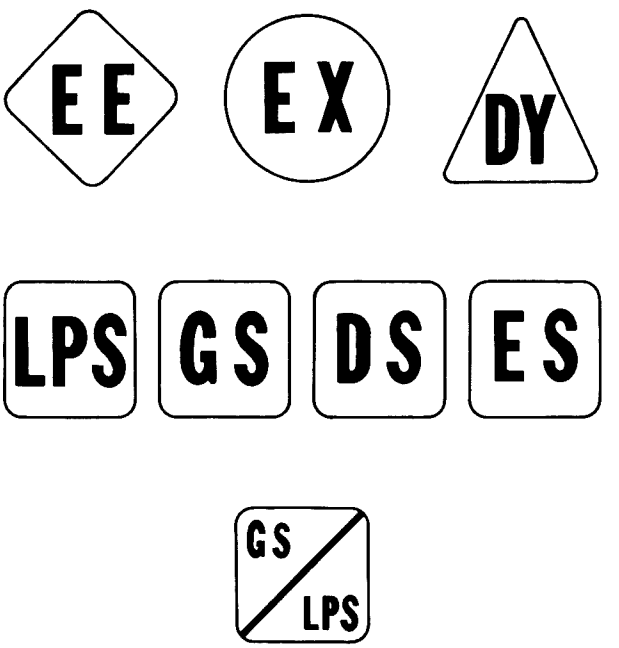

Figure 5-4.2.2. Markers to identify type of industrial truck. The markers for LPS, GS, DS, ES, and GS/LPS are 4 in. (102 mm) square. The width of the others is 5 in. (127 mm). The signs shall have black borders and lettering on a yellow background.

For SI Units: 1 in. = 25.4 mm.

Figure 5-4.2.3. Building signs for posting at entrance to hazardous areas. The minimum width of the sign is 11 in. (279 mm); the minimum height of the sign is 16 in. (406 mm). The sign shall have the word "Caution" in yellow letters on a black background. The body of the sign shall have black letters on a yellow background. A marker(s) identical to the one(s) used on the side of the truck shall be installed on the sign as indicated (*see Figure 5-4.2.2*).

Chapter 6 Referenced Publications

6-1 The following documents or portions thereof are referenced within this standard and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

6-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 30, *Flammable and Combustible Liquids Code*, 1990 edition

NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases*, 1992 edition

NFPA 70, *National Electrical Code*, 1993 edition.

6-1.2 Other Publications.

6-1.2.1 ASME Publication. American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.

ANSI/ASME B56.1-88, *Safety Standard for Low Lift and High Lift Trucks.*

6-1.2.2 ASTM Publication. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D3175-89, *Standard Test Method for Volatile Matter in the Analysis Sample of Coal and Coke.*

6-1.2.3 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

ANSI/UL 558-91, *Safety Standard for Internal-Combustion-Engine-Powered Industrial Trucks*

ANSI/UL 583-91, *Safety Standard for Electric-Battery-Powered Industrial Trucks.*

Appendix A

This Appendix is not a part of the requirements of this NFPA document, but is included for information purposes only.

A-1-3 Specific standards covering the types of industrial trucks detailed in Section 1-3 have been published by Underwriters Laboratories Inc., and are identified as *Standard for Internal-Combustion-Engine-Powered Industrial Trucks*, ANSI/UL 558, and *Standard for Electric-Battery-Powered Industrial Trucks*, ANSI/UL 583. UL 558 covers Types D, DS, DY, G, GS, LP, LPS, G/LP and GS/LPS; UL 583 covers Types E, EE, ES, and EX.

Underwriters Laboratories Inc.'s examination of powered industrial trucks relates to fire hazards only for Types D, DS, DY, G, GS, LP, LPS, G/LP, and GS/LPS internal-combustion-engine-powered industrial trucks; to fire and electrical shock hazard only for Types E, ES, and EE battery-powered industrial trucks; and to the fire, electric shock, and explosion hazard for Type EX trucks, suitable either for use in Class I, Group D or Class II, Group G hazardous locations. Trucks that have been examined and classified as meeting the respective Underwriters Laboratories Standards for the particular area of use are listed in their *Automotive Equipment Directory*, except for Type EX trucks, which are listed in their *Hazardous Location Equipment Directory*.

A-1-5.1 The following are some examples of Class I, Group A, B, and C chemicals:

acetaldehyde
acetylene
acrolein (inhibited)
allyl alcohol
arsine
butadiene
n-butyraldehyde
carbon monoxide
crotonaldehyde
cyclopropane
diethyl ether
diethylamine
epichlorohydrin
ethyl mercaptan
ethyl sulfide
ethylene
ethylene oxide
ethylenimine
hydrogen
hydrogen cyanide
hydrogen sulfide
manufactured gases containing more than 30% hydrogen (by volume)
morpholine
2-nitropropane
propylene oxide
propylnitrate
tetrahydrofuran
unsymmetrical dimethyl hydrazine (UDMH 1, 1-dimethyl hydrazine)

A-1-5.2.1 The following are some examples of Class I, Group D chemicals:

acetic acid (glacial)
acetone
acrylonitrile
ammonia
benzene
butane
1-butanol
2-butanol (secondary utyl alcohol)
n-butyl acetate
isobutyl acetate
sec-butyl alcohol
di-isobutylene
ethane
methane (natural gas)
methanol (methyl alcohol)
3-methyl-1-butanol (isoamyl alcohol)
methyl ethyl ketone
methyl isobutyl ketone
2-methyl-1-propanol (isobutyl alcohol)
2-methyl-2-propanol (tertiary butyl alcohol)
petroleum naphtha
pyridine
octanes
ethanol (ethyl alcohol)
ethyl acetate
ethyl acrylate
ethylene diamine (anhydrous)
ethylene dichloride
ethylene glycol monomethyl ether
gasoline
heptanes
hexanes
isoprene
isopropyl ether
mesityl oxide
pentanes
1-pentanol (amyl alcohol)
propane
1-propanol (propyl alcohol)
2-propanol (isopropyl alcohol)
propylene
styrene
toluene
vinyl acetate
vinyl chloride
xylenes

A-2-2.4 The purpose of this requirement is to ensure the carburetor float system is functioning properly after a period of disuse.

A-3-1 Section 3-1 provides that acceptance of an industrial truck that has been converted:

(a) from the use of gasoline as a fuel to liquefied petroleum gas as a fuel;

(b) from the use of either gasoline or liquefied petroleum gas as a fuel to dual-fuel;

(c) from the use of liquefied petroleum gas or dual-fuel to gasoline as a fuel; or

(d) from the use of dual-fuel to liquefied petroleum gas as a fuel

rests entirely with the inspection authority having jurisdiction. The responsibility of determining whether or not a truck has been properly converted is placed with the authority having jurisdiction because it is impractical to ship each converted truck back to the testing laboratory to be reexamined or retested, and it is also impractical for the laboratory to send a representative into the field to examine or test every converted truck.

It is recognized that the various authorities having jurisdiction may not be expert in determining what constitutes a proper conversion. Installation directions furnished with conversion equipment, "Listed by Report," specify in detail how the conversion is to be made so that it will be in accordance with NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases*. These detailed instructions supply the authority having jurisdiction with all the necessary information to determine whether or not a truck has been properly converted.

A-5-2.1 The purpose in requiring the maintenance of at least 1/4-full tank of gasoline is to provide a sufficient amount of liquid fuel to maintain a vapor saturation in the tank above the normally explosive level. The amount of fuel in the tank may be determined using the normal fuel gage provided on the vehicle.

Appendix B Referenced Publications

B-1 The following documents or portions thereof are referenced within this standard for informational purposes only and thus are not considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

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

NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases*, 1992 edition

NFPA 70, *National Electrical Code*, 1993 edition.

B-1.2 Other Publications.

B-1.2.1 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

Automotive Equipment Directory

Hazardous Location Equipment Directory.

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FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Mail to: Secretary, Standards Council
National Fire Protection Association, 1 Batterymarch Park, Quincy, Massachusetts 02269-9101
Fax No. 617-770-3500

Note: All proposals must be received by 5:00 p.m. EST/EDST on the published proposal-closing date.

If you need further information on the standards-making process, please contact the Standards Administration Department at 617-984-7249.

Date 9/18/93 **Name** John B. Smith **Tel. No.** 617-555-1212

Company _____

Street Address 9 Seattle St., Seattle, WA 02255

Please Indicate Organization Represented (if any) Fire Marshals Assn. of North America

1. a) NFPA Document Title National Fire Alarm Code **NFPA No. & Year** NFPA 72, 1993 ed.

b) Section/Paragraph 1-5.8.1 (Exception No.1)

2. Proposal recommends: (Check one)
- ☐ **new text**
- ☐ **revised text**
- ☒ **deleted text**

FOR OFFICE USE ONLY
Log # _____
Date Rec'd _____

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):

Delete exception.

4. Statement of Problem and Substantiation for Proposal: (Note: State the problem that will be resolved by your recommendation; give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a "trouble" signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

5. ☒ This Proposal is original material. (Note: Original material is considered to be the submitter's own idea based on or as a result of his/her own experience, thought, or research and, to the best of his/her knowledge, is not copied from another source.)

☐ **This Proposal is not original material; its source (if known) is as follows:** _____

Note 1: Type or print legibly in black ink.
Note 2: If supplementary material (photographs. diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

I hereby grant NFPA the non-exclusive, royalty-free rights, including non-exclusive, royalty-free rights in copyright, in this proposal and I understand that I acquire no rights in any publication of NFPA in which this proposal in this or another similar or analogous form is used.

John B. Smith
Signature (Required)

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