NFPA®

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Standard on Explosion Prevention Systems

2019

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NFPA® 69

Standard on

Explosion Prevention Systems

2019 Edition

This edition of NFPA 69, *Standard on Explosion Prevention Systems*, was prepared by the Technical Committee on Explosion Protection Systems. It was issued by the Standards Council on November 5, 2018, with an effective date of November 25, 2018, and supersedes all previous editions.

This edition of NFPA 69 was approved as an American National Standard on November 25, 2018.

Origin and Development of NFPA 69

In 1965, an NFPA Committee was appointed to develop standards for explosion protection systems. These standards included information on inerting to prevent explosions and on venting to minimize damage from an explosion.

A tentative draft on explosion prevention systems was presented at the NFPA Annual Meeting in New York City in May 1969. This tentative document was officially adopted in May 1970. NFPA 69 was revised in 1973 and reconfirmed in 1978.

In 1982, the Committee on Explosion Protection Systems began a thorough review of NFPA 69, including the development of a chapter on the technique of deflagration pressure containment. The results of that effort became the 1986 edition.

The 1992 edition of NFPA 69 incorporated a new chapter on deflagration isolation systems. Partial amendments were made to refine definitions, improve descriptions of oxidant concentration reduction techniques, improve material on deflagration suppression, and fine-tune deflagration pressure containment material.

The 1997 edition of this standard included some reorganization and updating of the technical material to improve its usability. New material was added on enrichment to operate above the upper flammable limit as a means of explosion protection with minimum oxidant concentrations for preventing explosions. Material was added for provisions on reliability of explosion protection control systems and deflagration suppression systems for consistency with other NFPA standards.

The 2002 edition of NFPA 69 included new information on spark detection and extinguishment system design. A reorganization of the protection methods reflected a hierarchy based on the degree of explosion prevention. The limiting oxidant concentration (LOC) values for gases and vapors in Annex C were updated based on recent research. The standard was revised to reflect the requirements of the *Manual of Style for NFPA Technical Committee Documents*.

The 2008 edition incorporated a comprehensive revision to the standard that included a performance-based option in addition to the existing specification methods for explosion prevention. This revision included new requirements for detection and ignition control, suppression, and active and passive isolation. The committee also added a chapter on passive suppression using expanded metal mesh or polymer foams. A new chapter on installation, inspection, and maintenance addressed the concept of safety integrity and reliability. New definitions supporting the expanded requirements were added and existing definitions were updated to conform to the *NFPA Glossary of Terms*.

The 2014 edition was revised and updated to improve the overall clarity and use of the document. Design requirements for flow-actuated flap valves and a new annex, Deflagration Containment Calculation Method for Two Interconnected Vessels, were incorporated. The operating safety margins for oxidant concentration control were also modified in order to remove discontinuity. In addition, the use of the term *commissioning* was updated throughout the document for compatibility with the 2012 edition of NFPA 3, *Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems*.

In the 2019 edition, the adjustment for LOC values obtained in flammability tubes has been revised, reconfirming the change made by a Tentative Interim Amendment (TIA) to the 2014 edition. Requirements have been added to consider the concentration variation with time and location within the protected enclosure, and all foreseeable variations in operating conditions and material loadings, when using the combustible concentration reduction method of explosion prevention. A new section on safety instrumented systems (SIS) has been added with the requirement that explosion prevention system controls installed after November 5, 2021, be implemented as an SIS. New annex material has been added to provide example calculations on how to estimate the LOC for a fuel or a fuel mixture.

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This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the 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 explosion protection systems for all types of equipment and for buildings, except pressure venting devices designed to protect against overpressure of vessels such as those containing flammable liquids, liquefied gases, and compressed gases under fire exposure conditions, as now covered in existing NFPA standards.

Contents

NFPA 69

Standard on

Explosion Prevention Systems

2019 Edition

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

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex H. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex H.

Chapter 1 Administration

1.1 Scope. This standard applies to the design, installation, operation, maintenance, and testing of systems for the prevention of explosions by means of the following methods:

(1) Control of oxidant concentration
(2) Control of combustible concentration
(3) Predeflagration detection and control of ignition sources
(4) Explosion suppression
(5) Active isolation
(6) Passive isolation
(7) Deflagration pressure containment
(8) Passive explosion suppression

1.2 Purpose.

1.2.1 This standard shall cover the minimum requirements for installing systems for the prevention of explosions in enclosures that contain flammable concentrations of flammable gases, vapors, mists, dusts, or hybrid mixtures.

1.2.2 This standard shall provide basic information for design engineers, operating personnel, and authorities having jurisdiction.

1.2.3* To meet a minimum level of reliability, explosion prevention and control systems provided in accordance with the requirements of this standard shall include, but not be limited to, the following:

(1) Design system verification through testing
(2) Design documentation
(3) System acceptance
(4) Management of change
(5) Regular testing and maintenance

1.3* Application. This standard shall apply to methods for preventing and controlling explosions where the need for such methods has been established.

Δ **1.3.1** Where provided, explosion prevention shall be achieved by one or more of the following methods as required to mitigate damage, prevent transport of an ignition source, and prevent deflagration:

(1) Using the methods in Chapter 7 or 8 to control the environment within the protected enclosure so that a deflagration cannot occur
(2) Using the methods in Chapter 11 or 12 to prevent the propagation of a deflagration
(3) Using the methods in Chapters 10, 13, or 14 or in NFPA 68 to mitigate the effects of the deflagration so that the protected enclosure will not be uncontrollably breached

1.3.1.1 It shall be permitted to use the methods in Chapters 4 and 5 in lieu of the methods in Chapters 7 through 14.

1.3.1.2 This standard shall apply to methods for predeflagration detection or control of an ignition. When desired by the owner or operator, or required by the authority having jurisdiction, or when required by other standards, predeflagration detection or control of an ignition shall be achieved by methods described in Chapter 9.

1.3.1.2.1 These methods shall be permitted to be used independently to reduce the frequency of deflagrations where explosion prevention is not required.

1.3.1.2.2 These methods shall be permitted to be used as an additional detector for a method of Chapter 10, 11, 12, or 13.

1.3.1.2.3 These methods shall not interfere with the operation of the validated system.

1.3.1.2.4 These methods shall not be permitted to be used as the sole detector for a method of Chapter 10, 11, 12, or 13.

1.3.1.3* When another standard requires explosion prevention or control in accordance with NFPA 69 for an enclosure and that enclosure is interconnected to other enclosures by a line containing combustible dust, gas, mist, or hybrid mixtures that could transmit flame or pressure from the original enclosure, explosion prevention or control shall be provided for interconnected enclosures by one of the following methods:

(1) Deflagration isolation as discussed in Chapters 11 and 12

(2) Explosion venting of the interconnected enclosures within the limitations specified in Section 8.10 of NFPA 68
(3) Containment as discussed in Chapter 13
(4) Expanded metal mesh or polymer foam as discussed in Chapter 14

1.3.1.4 It shall be permitted to eliminate deflagration isolation protection for interconnected enclosures based on a documented risk analysis acceptable to the authority having jurisdiction, unless isolation protection is specifically required for such enclosure by other standards.

1.3.2 This standard shall not apply to the following conditions:

(1) Devices or systems designed to protect against detonations
(2)* Design, construction, and installation of deflagration vents
(3) Protection against overpressure due to phenomena other than internal deflagrations
(4) Chemical reactions other than combustion processes
(5) Unconfined deflagrations, such as open-air or vapor cloud explosions
(6) Rock dusting of coal mines, as covered by 30 CFR 75
(7) General use of inert gas for fire extinguishment
(8)* Preparation of tanks, piping, or other enclosures for hot work, such as cutting and welding
(9) Ovens or furnaces handling flammable or combustible atmospheres, as covered by NFPA 86
(10) Marine vapor control systems regulated by 33 CFR 154
(11) Marine vessel tanks regulated by 46 CFR 30, 46 CFR 32, 46 CFR 35, and 46 CFR 39

1.4 Retroactivity. The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

1.4.1 Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.

1.4.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this standard deemed appropriate.

1.4.3 The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction, and only where it is clearly evident that a reasonable degree of safety is provided.

1.5 Equivalency. Nothing in the standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

1.5.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.5.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

Δ **2.2 NFPA Publications.** National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 61, *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities,* 2017 edition.

NFPA 68, *Standard on Explosion Protection by Deflagration Venting,* 2018 edition.

NFPA 70®, National Electrical Code®, 2017 edition.

NFPA 72®, National Fire Alarm Code, 2019 edition.

NFPA 86, *Standard for Ovens and Furnaces,* 2019 edition.

NFPA 326, *Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair,* 2015 edition.

NFPA 484, *Standard for Combustible Metals,* 2019 edition.

NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids,* 2017 edition.

2.3 Other Publications.

Δ **2.3.1 API Publications.** American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.

API 510, *Pressure Vessel Inspection Code: In-Service Inspection, Rating, Repair, and Alteration,* 2014.

Δ **2.3.2 ASME Publications.** American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ASME B31.3, *Process Piping,* 2016.

Boiler and Pressure Vessel Code, 2015.

2.3.3 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D257, *Standard Test Methods for DC Resistance or Conductance of Insulating Materials,* 2014.

ASTM D3574, *Standard Test Methods for Flexible Cellular Materials — Slab, Bonded, and Molded Urethane Foams,* 2016.

ASTM E1354, *Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter,* 2017.

ASTM E2079, *Standard Test Method for Limiting Oxygen (Oxidant) Concentration in Gases and Vapors,* 2007 (reapproved 2013).

2.3.4 ISO Publications. International Organization for Standardization, ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland.

ISO 16852, *Flame arresters — Performance requirements, test methods and limits for use,* 2016.

2.3.5 Military Specifications. Department of Defense Single Stock Point, Document Automation and Production Service, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-DTL-83054C, *Baffle and Inerting Material, Aircraft Fuel Tank,* 2003.