

NFPA® 33

**Standard for
Spray Application
Using Flammable or
Combustible Materials**

2018



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NFPA® 33

Standard for

Spray Application Using Flammable or Combustible Materials

2018 Edition

This edition of NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials*, was prepared by the Technical Committee on Finishing Processes. It was issued by the Standards Council on November 10, 2017, with an effective date of November 30, 2017, and supersedes all previous editions.

This edition of NFPA 33 was approved as an American National Standard on November 30, 2017.

Origin and Development of NFPA 33

NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials*, originally titled *Standard on Paint Spraying and Spray Booths*, was initiated in 1921. The first edition was published in 1922 as part of the *Standard on Dip Tanks* (now NFPA 34, *Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids*). Revised editions were published in 1926, 1928, 1935, 1937, 1941, 1946, 1950, 1953, 1954, 1955, 1957, 1959, 1960, 1961, 1963, 1966, 1969, 1973, 1977, 1982, 1985, 1987, 1989, 1995, 2000, 2003, 2006, and 2010.

The following major changes were incorporated into the 2003 edition:

- (1) The arrangement of the text was modified to comply with the *Manual of Style for NFPA Technical Committee Documents*, including relocation of Chapter 17, Referenced Publications, to a new Chapter 2 and the addition of a new Chapter 3, Definitions, which incorporated all the definitions previously located in Chapter 1.
- (2) Chapter 6 (formerly Chapter 4), Electrical and Other Sources of Ignition, was extensively revised to recognize the Zone concept of area classification. Changes included the addition of appropriate definitions and revisions of the figures illustrating the area classifications in and around spray areas, spray booths, spray rooms, and equipment.
- (3) Chapter 9 (formerly Chapter 7), Protection, was extensively revised to more effectively and more clearly present the requirements for fire protection in spray areas. In addition, the requirements for interlocking were clarified and requirements for automated electrostatic spray systems were modified to reflect current operational practices, including extending these concepts to powder application systems.
- (4) A new chapter was added that included several changes: Section 10.5 (formerly Section 8.5), Waste Containers, was to provide more specific guidance on the handling of waste materials. Section 10.7 (formerly Section 8.7), Cleaning Operations, was revised to allow the use of any suitable solvent for cleaning of spray equipment, provided it is used safely. The requirements were also applied to spray apparatus cleaning systems. Finally, a new Section 10.8 was added to address the hazards of solvent distillation units.
- (5) The fire protection requirements formerly located in Section 9.5, Exception No. 2, of the 2000 edition, were incorporated into Section 9.7 and Section 9.8.
- (6) Subsection 14.3.5 (formerly 12.3.5) was revised to incorporate the Zone concept of area classification for use with limited finishing workstations.

The following major changes were adopted in the 2007 edition:

- (1) In Chapter 3, the definition of *spray area* was revised to more clearly define the extent of the spray area and to identify those parts of the process that are not considered part of the spray area.
- (2) In Section 5.5, the allowable materials for vision and observation panels were expanded to include laminated glass and other listed assemblies. Also, vision and observation panels for powder spray booths are now allowed to be of fire retardant combustible materials.
- (3) Chapter 6 was amended with text extracted from *NFPA 70®*, *National Electrical Code®*, to reflect changes in *NFPA 70* to hazardous locations.

- (4) Definitions were extracted from *NFPA 70, National Electrical Code*, and added to Chapter 6 to recognize Class II, Zones 20, 21, and 22 hazardous (classified) locations.
- (5) Section 7.7 was revised to allow fire retardant combustible materials for ducts connected to powder coating booths.
- (6) In Chapter 8, the maximum quantities of flammable and combustible liquids were changed to correlate with changes to *NFPA 30, Flammable and Combustible Liquids Code*.
- (7) In Chapter 9, the requirements for protection of spray area exhaust ducts were revised, expanded, and clarified.
- (8) In Chapters 11, 12, and 15, 11.3.6, 12.5.4, and 15.13.4 were added to designate certain highly resistive workpieces as grounded, if they meet certain criteria of surface conductivity.
- (9) In Chapter 13, more restrictive requirements for high temperature limit switches and interlocks were added for spray booths and spray rooms that are also used for drying and curing operations.
- (10) In Chapter 14, more definitive requirements were added for drying, curing, and fusion apparatus used in limited finishing workstations.

The following major changes were adopted in the 2011 edition:

- (1) In Section 1.1, the scope was amended to exempt certain small quantity operations, and a decision tree was added to Annex A (A.1.1.1) to assist the user in determining whether NFPA 33 is applicable to a particular spray application process.
- (2) The definition of *spray area* in 3.3.1.3 was amended to more clearly identify which parts of the spray system are not considered to be part of the spray area.
- (3) Chapter 6 was revised to recognize the Zone 21 and Zone 22 hazardous (classified) area classifications for combustible dusts. This correlated with *NFPA 70, National Electrical Code*, with respect to the latter's recognition of Zones 21 and 22 for electrical systems.
- (4) Section 7.7 was amended to allow concrete as a material of construction for spray area exhaust plenums and ducts, thus allowing a formed concrete exhaust plenum in the floor beneath a spray booth or room.
- (5) Section 8.2 was completely revised to recognize the concept of maximum allowable quantities (MAQs) of flammable and combustible liquids and to establish quantity limits based on MAQs. This correlated with *NFPA 30, Flammable and Combustible Liquids Code*.
- (6) Section 13.2 was revised to clarify that, if a spray area is used for drying or curing at a temperature above that at which the spray application takes place, the provisions of Section 13.3 must be followed. In addition, *ambient* was defined in Chapter 3 as the temperature range in the spray booth or room at which the spray application process takes place.
- (7) A new paragraph, 13.3.1.9, was added to exempt spray booths and spray rooms that are also used for drying and curing from the requirement for explosion relief venting, if certain conditions are met.
- (8) Subsection 13.3.2 was replaced with a new Section 13.5, which addressed installations where the spray booth or spray room is directly connected to the drying/curing oven by an enclosed vestibule.
- (9) Subsection 15.8.1 was amended to require that the concentration of combustible powder in the exhaust from a powder coating booth be based on the actual minimum explosive concentration of the powder being used.
- (10) Section 17.3 was amended by replacing the requirement for an automatic sprinkler system with a requirement that resin application areas be protected in accordance with Chapter 9, thus allowing other types of fire protection systems.
- (11) Subsection 17.5.2 was amended to replace the requirement for Division 1/Zone 1 electrical equipment with Division 2/Zone 2.

In the 2016 edition, terms and definitions were modified to be consistent with other NFPA documents and to mirror terms and definitions used in NFPA 34. Exceptions and vague and unenforceable language were removed from the document to comply with *Manual of Style for NFPA Technical Committee Documents*. The 2016 edition also contained the following changes:

- (1) Chapter 1 was revised to indicate that the standard now applies to spray application processes and operations that are conducted indoors or outdoors within temporary membrane enclosures.
- (2) Definitions of various types of spray booths and membrane enclosures were added to coordinate with changes made in other chapters of the document.
- (3) Chapter 4 was revised to address egress and accessibility concerns for spray operations that occur in basement.
- (4) The figures in Chapter 6 were revised to improve consistency and to clarify electrical classification requirements in the document.
- (5) Clarifications to mixing room requirements were made in Chapter 8.
- (6) Chapter 9 was revised to allow the use of water mist systems and to clarify the sprinkler design area requirement. Annex material was added to provide guidance in determining the water supply requirements for sprinklers likely to open in a fire incident. Duct protection requirements were revised to indicate that a sprinkler head should be located at the top of a vertical duct.

- (7) Chapter 9 also was revised to include fire protection for newer technology spray booths and scrubbers.
- (8) The figure in Chapter 14 was revised to improve consistency and to clarify the electrical classification requirements in the document.
- (9) Chapter 15 was completely revised to incorporate requirements for combustible dusts that are present in operations such as bag dump stations, pneumatic conveying systems, and other operations that generate dust.
- (10) The Committee added a new Chapter 18 on the use of temporary membrane enclosures for spraying workpieces that cannot be sprayed in traditional spray booths or rooms.
- (11) Table C.2.1 in Annex C was updated with current test data.

The following changes have been made for the 2018 edition:

- (1) Chapter 1, Administration, added clarification to document application. For example, Chapter 14 shall apply only to miscellaneous spray operations, and Chapter 18 shall apply only to spray application processes or operations that are conducted in temporary membrane enclosures both inside and outside buildings and structures.
- (2) Chapter 3, Definitions, was modified to include application definitions as well as to be consistent with other NFPA documents. New or revised definitions for applications including *automated spray application operations*, *basement*, *control area*, *dry particulate scrubber spray booth*, and *workstation* are provided. In addition, definition changes made to liquids and materials are consistent with other NFPA documents placing noncombustible material, limited-combustible material, and classification of liquids and determination of flash points in a General Requirements section. Changes to definitions are consistent with NFPA 1, NFPA 30, and *NFPA 5000*.
- (3) Chapter 4, General Requirements, is applicable to all spray operations. It has been revised to clarify definitions and spraying location, making them consistent with Chapter 5 requirements.
- (4) Chapter 5, Construction and Design of Spray Areas, Spray Rooms, and Spray Booths, has been revised to address the confusion between spray rooms and spray booths. It provides requirements for each type of spray location.
- (5) Chapter 6, Electrical and Other Sources of Ignition, has been revised. In addition, the figures in Chapter 6 were revised to improve consistency and to clarify electrical classification requirements in the document. The movement power vehicles in spray areas has also been clarified.
- (6) Chapter 7, Ventilation, has been revised to provide clarification of the heating of recirculated air and the manifolding of exhaust ducts.

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Committee Scope: This Committee shall have primary responsibility for documents on safeguarding against the fire and explosion hazards associated with spray application processes, dipping processes, coating processes, and other similar processes, including glass fiber/resin fabrication processes and printing processes, except for certain dipping processes that are within the scope of the Committee on Ovens and Furnaces.

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NFPA 33

Standard for

Spray Application Using Flammable or Combustible Materials

2018 Edition

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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 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 E. 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 E.

Chapter 1 Administration

1.1* Scope.

1.1.1* This standard shall apply to the spray application of flammable or combustible materials, as herein defined, either continuously or intermittently by any of the following methods:

- (1) Compressed air atomization
- (2) Airless or hydraulic atomization
- (3) Electrostatic application methods
- (4) Other means of atomized application

1.1.2 This standard shall also apply to the application of flammable or combustible materials, as herein defined, either continuously or intermittently by any of the following methods:

- (1) Fluidized bed application methods
- (2) Electrostatic fluidized bed application methods

(3) Other means of fluidized application

1.1.3 This standard shall also apply to spray application of water-borne, water-based, and water-reducible materials that contain flammable or combustible liquids or that produce combustible deposits or residues.

1.1.4* This standard shall not apply to spray operations that use less than 1 L (33.8 fl oz) of flammable or combustible liquid in any 8-hour period.

1.1.5 This standard shall apply to spray application processes or operations that are conducted both indoors and outdoors within temporary membrane enclosures.

1.1.6* This standard shall not apply to spray application processes or operations that are conducted outdoors.

1.1.7* This standard shall not apply to the use of portable spraying equipment that is not used repeatedly in the same location.

1.1.8 This standard shall not apply to the use of aerosol products in containers up to and including 1 L (33.8 oz) capacity that are not used repeatedly in the same location. (See A.1.1.7.)

1.1.9 This standard shall not apply to the spray application of noncombustible materials.

1.1.10 This standard shall not apply to the hazards of toxicity or to industrial health and hygiene. (See 1.2.2.)

1.2 Purpose.

1.2.1 The purpose of this standard shall be to provide requirements for fire safety for spray application of flammable or combustible materials. This standard anticipates conditions of average use. Where unusual industrial processes are involved, the authority having jurisdiction shall be permitted to require additional safeguards or modifications to the requirements of this standard, provided equivalent safety is achieved.

1.2.2* The purpose of this standard shall be to address only the fire and explosion hazards of spray application processes and operations. This standard shall not address toxicity and shall not address industrial health and hygiene. From the standpoint of personnel safety, it shall be recognized that the materials used in these processes could be present in concentrations that present a health hazard, even though these concentrations do not present a fire or explosion hazard.

1.3 Application. Chapter 4 through Chapter 10 and Chapter 19 shall apply to all spray application processes within the scope of this standard. Chapter 11 and Chapter 12 shall apply only to electrostatic spray application processes. Chapter 13 shall apply only to drying, curing, and fusion processes and operations. Chapter 14 shall apply **only** to miscellaneous spray operations. Chapter 15 shall apply only to powder coating application processes and operations. Chapter 16 and Chapter 17 shall apply only to multicomponent coating systems and to processes that involve the use of catalysts, such as organic peroxide formulations. Chapter 18 shall apply only to spray application processes or operations that are conducted in temporary membrane enclosures **both inside and outside** buildings and structures.

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 this 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.

1.6 Units and Formulas. The units of measurement used in this standard shall be the International System of Units, otherwise known as "SI" and "Modernized Metric System." English customary units are given in parentheses following SI units, but shall be considered to be approximate conversions.

1.7 Enforcement. (Reserved)

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.

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

NFPA 10, *Standard for Portable Fire Extinguishers*, 2018 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 2018 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2016 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 2016 edition.

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2015 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2017 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2018 edition.

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

NFPA 69, *Standard on Explosion Prevention Systems*, 2014 edition.

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

NFPA 72®, *National Fire Alarm and Signaling Code*, 2016 edition.

NFPA 86, *Standard for Ovens and Furnaces*, 2015 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids*, 2015 edition.

NFPA 101®, *Life Safety Code®*, 2018 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, 2018 edition.

NFPA 400, *Hazardous Materials Code*, 2016 edition.

NFPA 496, *Standard for Purged and Pressurized Enclosures for Electrical Equipment*, 2017 edition.

NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*, 2015 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2015 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2018 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2018 edition.

2.3 Other Publications.

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

Boiler and Pressure Vessel Code, Section VIII, 2015.

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

ASTM D5/D5M, *Standard Test Method for Penetration of Bituminous Materials*, 2013.

ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester*, 2010.

ASTM D93, *Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester*, 2015a.

ASTM D323, *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)*, 2015a.

ASTM D3278, *Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus*, 2011.

ASTM D3828, *Standard Test Methods for Flash Point by Small Scale Closed Cup Tester*, 2012a.

ASTM D4359, *Standard Test Method for Determining Whether a Material is a Liquid or a Solid*, 2012.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2015b.

ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, 2016.

ASTM E2652, *Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*, 2015.

2.3.3 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 340, *Standard for Tests for Comparative Flammability of Liquids*, 2009, revised 2014.

ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, 2008.

ANSI/UL 900, *Standard for Air Filter Units*, 2004, revised 2015.

ANSI/UL 2208, *Standard for Solvent Distillation Units*, 2010, revised 2015.

2.3.4 Additional Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 30, *Flammable and Combustible Liquids Code*, 2018 edition.

NFPA 56, *Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems*, 2017 edition.

NFPA 69, *Standard on Explosion Prevention Systems*, 2014 edition.

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

NFPA 5000®, *Building Construction and Safety Code®*, 2018 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 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.

3.2.4* 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.

3.2.5 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and that is in a form generally suitable

for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase “standards development process” or “standards development activities,” the term “standards” includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1* Ambient. For the purposes of this standard, the temperature range of the air in the spray area at which a spray application process takes place.

3.3.2 Area.

3.3.2.1 Flash-Off Area. An open or enclosed area after a spray application process where vapors are released due to exposure to ambient air or a heated atmosphere.

3.3.2.2 Resin Application Area. Any area in which polyester resins or gelcoats are spray applied.

3.3.2.3* Spray Area. Any fully enclosed, partly enclosed, or unenclosed area in which flammable or combustible vapors, mists, residues, dusts, or deposits are present due to the operation of spray processes, including (1) any area in the direct path of a spray application process; (2) the interior of a spray booth, spray room, or limited finishing workstation, as herein defined; (3) the interior of any exhaust plenum, eliminator section, or scrubber section; (4) the interior of any exhaust duct or exhaust stack leading from a spray application process; (5) the interior of any air recirculation path up to and including recirculation particulate filters; (6) any solvent concentrator (pollution abatement) unit or solvent recovery (distillation) unit; and (7) the inside of a membrane enclosure. The following are not part of the spray area: (1) fresh air make-up units; (2) air supply ducts and air supply plenums; (3) recirculation air supply ducts downstream of recirculation particulate filters; and (4) exhaust ducts from solvent concentrator (pollution abatement) units.

3.3.2.3.1 Outdoor Spray Area. A spray area that is outside the confines of a building or that has a canopy or roof that does not limit the dissipation of the heat of a fire or dispersion of flammable vapors and does not restrict fire-fighting access and control. For the purpose of this standard, an outdoor spray area can be treated as an unenclosed spray area, as defined in 3.3.3.3.2.

3.3.2.3.2 Unenclosed Spray Area. Any spray area that is not confined by a limited finishing workstation, spray booth, or spray room, as herein defined.

3.3.3 Automated Spray Application Operations. Operations where the spray application operation is performed by mechanical or electronic devices that take the place of human labor.

3.3.4 Basement. For the purposes of this standard, a story of a building or structure having one-half or more of its height below ground level and to which access for fire-fighting purposes is restricted. [30, 2018]

3.3.5 Chopper Gun. A device that feeds glass fiber roving through a cutting unit and injects the cut glass fibers into a

stream of catalyzed liquid resin that is then sprayed onto a surface.

3.3.6 Combustible Powder. Any finely divided solid coating material that is capable of being ignited.

3.3.7 Competent Person. One who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. [56, 2017]

N 3.3.8* Control Area. A building or portion of a building within which hazardous materials are allowed to be stored, dispensed, used, or handled in quantities not exceeding the maximum allowable quantities (MAQ). [5000, 2018]

3.3.9 [Electrical] Utilization Equipment. Equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes. [70, 2017]

3.3.10 Fluidized Bed. A chamber holding powder coating material that is aerated from below to form an air-supported, expanded cloud of the powder. The object or material being coated is preheated, then immersed into the cloud.

3.3.10.1 Electrostatic Fluidized Bed. A chamber holding powder coating material that is aerated from below to form an air-supported, expanded cloud of the powder. The powder is electrically charged with a charge opposite to that of the object or material being coated.

3.3.11 Inerting. A technique by which a combustible mixture is rendered nonignitable by adding an inert gas or a noncombustible dust. [69, 2014]

Δ 3.3.12 Limited Combustible. See Section 4.5.

3.3.13 Liquid. Any material that (1) has a fluidity greater than that of 300 penetration asphalt when tested in accordance with ASTM D5/D5M, *Standard Method of Test for Penetration of Bituminous Materials*, or (2) is a viscous substance for which a specific melting point cannot be determined but that is determined to be a liquid in accordance with ASTM D4359, *Standard Test Method for Determining Whether a Material is a Liquid or a Solid*. [30, 2018]

Δ 3.3.13.1 Combustible Liquid. Any liquid that has a closed-cup flash point at or above 37.8°C (100°F), as determined by the test procedures and apparatus set forth in Section 4.7. Combustible liquids are classified according to Section 4.6. [30, 2018]

3.3.13.2 Flammable Liquid. Any liquid that has a closed-cup flash point below 37.8°C (100°F), as determined by the test procedures and apparatus set forth in Section 4.7, and a Reid vapor pressure that does not exceed an absolute pressure of 276 kPa (40 psi) at 37.8°C (100°F), as determined by ASTM D323, *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)*. Flammable liquids are classified according to Section 4.6. [30, 2018]

3.3.14 Material.

3.3.14.1 Flammable or Combustible Material. Any material, including its residue, that is used in the spray application process and also meets the definition of a combustible liquid (see 3.3.13.1), a flammable liquid (see 3.3.13.2), or a combustible powder (see 3.3.6).

N 3.3.14.2 Limited-Combustible Material. See Section 4.5.

Δ 3.3.14.3 Noncombustible Material. See Section 4.4.

3.3.15 Overspray. Any sprayed material that is not deposited on the intended object.

3.3.16 Readily Accessible. For the purposes of this standard, capable of being removed or exposed without damaging the equipment or system or the building structure or finish, or not permanently enclosed.

3.3.17* Recirculation Particulate Filter. A filter, or series of filters, capable of removing more than 95 percent of particles 0.3 to 10 μ in size from the airstream.

3.3.18* Spray Booth. A power-ventilated enclosure for a spray application operation or process that confines and limits the escape of the material being sprayed, including vapors, mists, dusts, and residues that are produced by the spraying operation and conducts or directs these materials to an exhaust system.

3.3.18.1 Dry Particulate Scrubber Spray Booth. A spray booth that is equipped with a dry filtration system that uses a dry, noncombustible particulate medium to remove paint overspray particulate from the spray booth exhaust airstream.

3.3.18.2 Dry-Type Spray Booth. A spray booth that is not equipped with a water-washing system to remove overspray from the exhaust airstream and is equipped with one or more of the following: (1) distribution or baffle plates to promote an even flow of air through the booth or to reduce the overspray before it is pulled into the exhaust system; (2) dry media filters, either fixed or on rolls, to remove overspray from the exhaust airstream; (3) powder collection systems that capture powder overspray.

3.3.18.3 Electrostatic Precipitator Spray Booth. A spray booth that removes the paint particles from the exhaust air by directing the exhaust air through an electrostatic field and capturing the paint particles on grounded elements.

3.3.18.4 High-Capacity Dry Paint Arrestor Booth. A spray booth equipped with a dry media paint particulate overspray filtration system that utilizes discrete filtration elements having a paint holding capacity of greater than or equal to 22.7 kg (50 lb)/ filter element.

3.3.18.5 Water-Wash Spray Booth. A spray booth that is equipped with a water-washing system designed to minimize the concentrations of dusts or residues entering exhaust ducts and to permit the collection of the dusts or residues.

3.3.19* Spray Room. A power-ventilated fully enclosed room with a specified fire resistance rating used for spraying of flammable or combustible materials.

3.3.20 Ventilation. The changing of air within a compartment by natural or mechanical means.

3.3.21 Workstation.

Δ 3.3.21.1* Limited Finishing Workstation. A power-ventilated apparatus that is capable of confining the vapors, mists, residues, dusts, or deposits that are generated by a limited spray application process. A limited finishing workstation is not a spray booth or spray room, as herein defined.

3.3.21.2 Preparation Workstation. A power-ventilated apparatus that is used to control the dusts and residues generated by surface preparation operations. A preparation workstation is not a limited finishing workstation, spray booth, or spray room, as herein defined.

Chapter 4 General Requirements

4.1* Location of Spray Application Operations. Spray application operations and processes shall be located in industrial occupancies as defined by *NFPA 5000* and shall be confined to spray booths, spray rooms, spray areas, or in temporary membrane enclosures as defined in this standard.

4.1.1* Locations in Other Occupancies. Spray application operations and processes shall not be conducted in any building that is classified as an assembly, an educational, a day care, a health care, an ambulatory health care, a detention/correctional, a residential, a mercantile, a business, or a storage occupancy, unless the following requirements are met:

- (1) The spraying is located in a room that is separated both vertically and horizontally from all surrounding areas by construction having a fire resistance rating of not less than 2 hours or in a spray room (see Section 5.2).
- (2) The room is protected by an approved automatic sprinkler system designed and installed in accordance with NFPA 13.

4.2* Separation. Spray application operations shall be separated from other operations, materials, or occupancies by location, fire barrier walls, and horizontal assemblies in accordance with *NFPA 5000*, or other means acceptable to the authority having jurisdiction.

4.3* Basements. Spray booths, rooms, and areas shall not be located in a basement unless all the following requirements are met:

- (1) A means of egress is provided that meets the requirements of 5.1.4.
- (2) An access means is provided for emergency response personnel.

4.4 Noncombustible Material.

4.4.1 A material that complies with any one of the following shall be considered a noncombustible material:

- (1)* The material, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.
- (2) The material is reported as passing ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*.
- (3) The material is reported as complying with the pass/fail criteria of ASTM E136 when tested in accordance with the test method and procedure in ASTM E2652, *Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*.

[5000:7.1.4.1.1]

4.4.2 Where the term *limited-combustible* is used in this standard, it shall also include the term *noncombustible*. [5000:7.1.4.1.2]

4.5 Limited-Combustible Material. A material shall be considered a limited-combustible material where both of the follow-

ing conditions of 4.5.1 and 4.5.2, and the conditions of either 4.5.3 or 4.5.4, are met. [5000:7.1.4.2]

4.5.1 The material does not comply with the requirements for a noncombustible material in accordance with Section 4.4. [5000:7.1.4.2(1)]

4.5.2 The material, in the form in which it is used, exhibits a potential heat value not exceeding 8141 kJ/kg (3500 Btu/lb) where tested in accordance with NFPA 259. [5000:7.1.4.2(2)]

4.5.3 The material has a structural base of a noncombustible material with a surfacing not exceeding a thickness of 3.2 mm (1/8 in.) where the surfacing exhibits a flame spread index not greater than 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*. [5000:7.1.4.2.1]

4.5.4 The material is composed of materials which, in the form and thickness used, neither exhibit a flame spread index greater than 25 nor evidence of continued progressive combustion when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, and are of such composition that all surfaces that would be exposed by cutting through the material on any plane would neither exhibit a flame spread index greater than 25 nor evidence of continued progressive combustion when tested in accordance with ASTM E84 or UL 723. [5000:7.1.4.2.2]

4.5.5 Where the term *limited-combustible* is used in this standard, it shall also include the term *noncombustible*. [5000:7.1.4.2.3]

4.6 Classification of Liquids. Any liquid within the scope of this standard and subject to the requirements of this standard shall be classified in accordance with this section. [30:4.3]

4.6.1 Flammable liquids, as defined in 3.3.13.2, shall be classified as Class I liquids and shall be further subclassified in accordance with the following:

- (1) Class IA Liquid — Any liquid that has a flash point below 22.8°C (73°F) and a boiling point below 37.8°C (100°F)
- (2) Class IB Liquid — Any liquid that has a flash point below 22.8°C (73°F) and a boiling point at or above 37.8°C (100°F)
- (3) Class IC Liquid — Any liquid that has a flash point at or above 22.8°C (73°F), but below 37.8°C (100°F) [30:4.3.1]

4.6.2 Combustible liquids, as defined in 3.3.13.1, shall be classified in accordance with the following:

- (1) Class II Liquid — Any liquid that has a flash point at or above 37.8°C (100°F) and below 60°C (140°F)
- (2) Class III Liquid — Any liquid that has a flash point at or above 60°C (140°F)
 - (a) Class IIIA Liquid — Any liquid that has a flash point at or above 60°C (140°F), but below 93°C (200°F)
 - (b) Class IIIB Liquid — Any liquid that has a flash point at or above 93°C (200°F)

[30:4.3.2]

N 4.7 Determination of Flash Point. The flash point of a liquid shall be determined according to the methods specified in 4.7.1 through 4.7.4. [30:4.4]

N 4.7.1 Except as specified in 4.7.1.1, the flash point of a liquid having a viscosity below 5.5 centiStokes at 40°C (104°F) or below 9.5 centiStokes at 25°C (77°F) shall be determined in accordance with ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester*. [30:4.4.1]

N 4.7.1.1 Cut-back asphalts, liquids that tend to form a surface film, and liquids that contain suspended solids shall not be tested in accordance with ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester*, even if they otherwise meet the viscosity criteria. Such liquids shall be tested in accordance with 4.7.2. [30:4.4.1.1]

N 4.7.2 The flash point of a liquid having a viscosity of 5.5 centiStokes or more at 104°F (40°C) or 9.5 centiStokes or more at 25°C (77°F) or a flash point of 93.4°C (200°F) or higher shall be determined in accordance with ASTM D93, *Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester*. [30:4.4.2]

N 4.7.3 As an alternative, ASTM D3278, *Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus*, shall be permitted to be used for paints, enamels, lacquers, varnishes, and related products and their components that have flash points between 0°C (32°F) and 110°C (230°F) and viscosities below 150 Stokes at 25°C (77°F). [30:4.4.3]

N 4.7.4 As an alternative, ASTM D3828, *Standard Test Methods for Flash Point by Small Scale Closed Cup Tester*, shall be permitted to be used for materials other than those for which ASTM D3278, *Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus*, is specifically required. [30:4.4.4]

Chapter 5 Construction and Design of Spray Areas, Spray Rooms, and Spray Booths

5.1* Spray Areas.

5.1.1 Walls, doors, and ceilings that intersect or enclose a spray area shall be constructed of noncombustible or limited-combustible materials or assemblies and shall be securely and rigidly mounted or fastened. The interior surfaces of the spray area shall be smooth, designed and installed to prevent pockets that can trap residues, and designed to facilitate ventilation and cleaning.

N 5.1.1.1 The interior surfaces of the spray area shall be smooth, designed and installed to prevent pockets that can trap residues, and designed to facilitate ventilation and cleaning.

N 5.1.1.2 Air intake filters that are a part of a wall or ceiling assembly shall be listed in accordance with ANSI/UL 900, *Standard for Air Filter Units*.

5.1.2 The floor of the spray area shall be constructed of noncombustible material, limited-combustible material, or combustible material that is completely covered by noncombustible material.

5.1.3 Aluminum shall not be used for structural support members, walls, or ceilings that enclose a spray area or for ventilation ductwork to or from an enclosed spray area unless otherwise permitted by 5.1.3.1.

N 5.1.3.1 Aluminum shall be permitted to be used for interior components, such as platforms, spray apparatus components, and other ancillary devices.

Δ 5.1.4 Enclosed spray areas shall be provided with means of egress that meet the applicable requirements of Chapter 40 of NFPA 101.

N 5.2 Spray Rooms. In addition to the requirements of Section 5.1, spray rooms shall be constructed of and separated vertically and horizontally from all surrounding areas by construction assemblies that have a fire resistance rating of not less than 2 hours.

N 5.3 Spray Booths.

N 5.3.1 Spray booths shall meet the requirements of Sections 5.1 and 5.3.

N 5.3.2 If walls or ceiling assemblies are constructed of sheet metal, single-skin assemblies shall be no thinner than 1.2 mm (0.0478 in.), and each sheet of double-skin assemblies shall be no thinner than 0.9 mm (0.0359 in.).

N 5.3.3 Structural sections of spray booths shall be permitted to be sealed with a caulk or sealant to minimize air leakage.

N 5.3.4 Spray booths that are used exclusively for powder coating shall meet the requirements of Chapter 15 and shall be permitted to be constructed of fire-retardant combustible materials where approved by the authority having jurisdiction.

N 5.3.4.1 Listed spray booth assemblies that are constructed of other materials shall be permitted.

N 5.3.5 Spray application operations and processes that involve the use of finishing materials containing nitrocellulose shall be confined to water-wash spray booths as defined in this standard unless otherwise specified in 5.3.5.1.

N 5.3.5.1 Spray application of finishing materials containing nitrocellulose shall be permitted in a dry-type spray booth provided that residue is removed from all baffle plates at least daily and all filters are changed at least daily.

5.4 Conveyor Openings. Conveyor openings that are necessary for transporting or moving work into and out of the spray area shall be as small as practical.

5.5* Separation from Other Operations. Spray booths shall be separated from other operations by a minimum distance of 915 mm (3 ft) or by a partition, wall, or floor/ceiling assembly having a minimum fire resistance rating of 1 hour; multiple connected spray booths shall not be considered as "other operations" except as provided for in Section 13.3.

5.5.1 Spray booths shall be installed so that all parts of the booth are readily accessible for cleaning.

5.5.2 A clear space of not less than 915 mm (3 ft) shall be maintained on all sides and above the spray booth, and shall be kept free of any storage or combustible construction.

5.5.2.1 The requirement in 5.5.2 shall not prohibit locating a spray booth closer than 915 mm (3 ft) to or directly against an interior partition, wall, or floor/ceiling assembly that has a fire resistance rating of not less than 1 hour, provided the spray booth can be maintained and cleaned.

5.5.2.2 The requirement in 5.5.2 shall not prohibit locating a spray booth closer than 915 mm (3 ft) to an exterior wall or a

roof assembly, provided the wall or roof is constructed of noncombustible material and provided the spray booth can be maintained and cleaned.

5.6 Illumination and Observation Panels.

5.6.1 Panels for luminaires or observation shall be of heat-treated glass, laminated glass, wired glass, or hammered-wired glass and shall be sealed to confine vapors, mists, residues, dusts, and deposits to the spray area.

5.6.1.1 Listed spray booth assemblies that have observation panels constructed of other materials shall be permitted.

5.6.2 Panels for luminaires shall be separated from the fixture to prevent the surface temperature of the panel from exceeding 93°C (200°F).

5.6.3 The panel frame and method of attachment shall be designed to not fail under fire exposure before the observation panel fails.

5.6.4 Observation panels for spray booths that are used exclusively for powder coating processes shall be permitted to be constructed of fire-resistant combustible materials.

Δ 5.7 Ventilation. Spray areas that are equipped with ventilation distribution, baffle plates, or dry overspray collection filters shall meet the requirements of 5.7.1 through 5.7.5.

5.7.1 Distribution plates or baffles shall be constructed of noncombustible materials and shall be readily removable or accessible for cleaning on both sides.

5.7.2 Filters shall not be used when applying materials known to be highly susceptible to spontaneous heating or spontaneous ignition.

5.7.3 Supports and holders for filters shall be constructed of noncombustible materials.

5.7.4 Overspray collection filters shall be readily removable or accessible for cleaning or replacement.

5.7.5 Filters shall not be alternately used for different types of coating materials if the combination of the materials might result in spontaneous heating or ignition. (See also Section 10.9.)

Chapter 6 Electrical and Other Sources of Ignition

6.1 Scope. This chapter shall apply to electrical wiring and electrical utilization equipment that is used in the spray area or in the vicinity of the spray area. This chapter shall also apply to other sources of ignition.

6.2* General.

6.2.1 Electrical wiring and utilization equipment shall meet all applicable requirements of Articles 500, 501, 502, 505, and 516 of *NFPA 70* and all applicable requirements of this chapter.

N 6.2.1.1 Powered vehicles shall meet the requirements of Section 6.10.

N 6.2.1.2 Resin application operations shall meet the requirements of Chapter 17.

6.2.2* For the purposes of this standard, the Zone system of electrical area classification shall be applied as follows:

- (1) The inside of open or closed containers or vessels shall be considered a Class I, Zone 0 location.
- (2) A Class I, Division 1 location shall be permitted to be alternatively classified as a Class I, Zone 1 location.
- (3) A Class I, Division 2 location shall be permitted to be alternatively classified as a Class I, Zone 2 location.
- (4) A Class II, Division 1 location shall be permitted to be alternatively classified as a Zone 21 location.
- (5) A Class II, Division 2 location shall be permitted to be alternatively classified as a Zone 22 location.

6.2.3 For the purposes of electrical area classification, the Division system and the Zone system shall not be intermixed for any given source of release.

6.2.4 In instances of areas within the same facility classified separately, Class I, Zone 2 locations shall be permitted to abut, but not overlap, Class I, Division 2 locations. Class I, Zone 0 or Zone 1 locations shall not abut Class I, Division 1 or Division 2 locations. [70:505.7(B)]

6.2.5* Open flames, spark-producing equipment or processes, and equipment whose exposed surfaces exceed the autoignition temperature of the material being sprayed shall not be located in a spray area or in any surrounding area that is classified as Division 2, Zone 2, or Zone 22.

6.2.5.1 This requirement shall not apply to drying, curing, or fusing apparatus covered by Chapter 13.

6.2.6* Any utilization equipment or apparatus that is capable of producing sparks or particles of hot metal and that is located above or adjacent to either the spray area or the surrounding Division 2, Zone 2, or Zone 22 areas shall be of the totally enclosed type or shall be constructed to prevent the escape of sparks or particles of hot metal.

6.3 Electrical Area Classification.

6.3.1* Class I Locations. A Class I location shall be any location where a flammable gas or vapor is present or might be present in the air in quantities sufficient to produce an explosive or ignitable mixture.

6.3.1.1* Class I, Division 1 Locations. As defined in 500.5(B) (1) of *NFPA 70*, a Class I, Division 1 location shall be any location where one of the following conditions exists:

- (1) An ignitable concentration of flammable gas or vapor can exist under normal operating conditions.
- (2) An ignitable concentration of flammable gas or vapor can exist frequently because of repair or maintenance operations or because of leakage.
- (3) Breakdown or faulty operation of equipment or processes might release an ignitable concentration of flammable gas or vapor and might also cause simultaneous failure of electrical equipment in such a way as to directly cause the electrical equipment to become a source of ignition.

6.3.1.2* Class I, Division 2 Locations. As defined in 500.5(B) (2) of *NFPA 70*, a Class I, Division 2 location shall be any location where one of the following conditions exists:

- (1) A flammable gas or a volatile flammable liquid is handled, processed, or used, but any flammable gas, vapor, or liquid is confined within a closed container or a closed system from which it can escape only in case of accidental rupture or breakdown of the container or

system or in case of abnormal operation of the equipment.

- (2) An ignitable concentration of flammable gas or vapor is normally prevented by positive mechanical ventilation but might exist because of failure or abnormal operation of the ventilating equipment.
- (3) An ignitable concentration of flammable gas or vapor might occasionally be transmitted from an adjacent Class I, Division 1 location, unless such transmission is prevented by positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

6.3.1.3* Class I, Zone 0 Locations. As defined in 505.5(B)(1) of *NFPA 70*, a Class I, Zone 0 location shall be any location where an ignitable concentration of flammable gas or vapor is present either continuously or for long periods of time.

6.3.1.4* Class I, Zone 1 Locations. As defined in 505.5(B)(2) of *NFPA 70*, a Class I, Zone 1 location shall be any location where one of the following conditions exists:

- (1) An ignitable concentration of flammable gas or vapor is likely to exist under normal operating conditions.
- (2) An ignitable concentration of flammable gas or vapor might exist frequently because of repair or maintenance operations or because of leakage.
- (3) Breakdown or faulty operation of equipment or processes might release an ignitable concentration of flammable gas or vapor and might also cause simultaneous failure of electrical equipment in such a way as to directly cause the electrical equipment to become a source of ignition.
- (4) An ignitable concentration of flammable gas or vapor might occasionally be transmitted from an adjacent Class I, Zone 0 location, unless such transmission is prevented by positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

6.3.1.5 Class I, Zone 2 Locations. As defined in 505.5(B)(3) of *NFPA 70*, a Class I, Zone 2 location shall be any location where one of the following conditions exists:

- (1) An ignitable concentration of a flammable gas or vapor is not likely to exist under normal operating conditions, and if an ignitable concentration does exist, will exist only for a short period of time.
- (2) A flammable gas or a volatile flammable liquid is handled, processed, or used, but any flammable gas, vapor, or liquid is confined within a closed container or a closed system from which it can escape only in case of accidental rupture or breakdown of the container or system or in case of abnormal operation of the equipment.
- (3) An ignitable concentration of flammable gas or vapor is normally prevented by positive mechanical ventilation but might exist because of failure or abnormal operation of the ventilating equipment.
- (4) An ignitable concentration of flammable gas or vapor might occasionally be transmitted from an adjacent Class I, Zone 1 location, unless such transmission is prevented by positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided. (See also A.6.3.1.2.)

6.3.2 Class II Locations. A Class II location shall be any location that might be hazardous because of the presence of a combustible dust.

6.3.2.1* Class II, Division 1 Locations. As defined in 500.5(C)(1) of *NFPA 70*, a Class II, Division 1 location shall be any location where one of the following conditions exists:

- (1) Combustible dust is in the air in quantities sufficient to produce explosive or ignitable mixtures under normal operating conditions.
- (2) Mechanical failure or abnormal operation of machinery or equipment might cause an explosive or ignitable mixture of combustible dust in air and might also provide a source of ignition through simultaneous failure of electrical equipment, operation of protection devices, or from other causes.
- (3) Group E combustible dusts might be present in quantities sufficient to be hazardous.

6.3.2.2* Class II, Division 2 Locations. As defined in 500.5(C)(2) of *NFPA 70*, a Class II, Division 2 location shall be a location in which one of the following conditions exists:

- (1) Combustible dust due to abnormal operations might be present in the air in quantities sufficient to produce explosive or ignitable mixtures.
- (2) Combustible dust accumulations are present but are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus, but could as a result of infrequent malfunctioning of handling or processing equipment become suspended in the air.
- (3) Combustible dust accumulations on, in, or in the vicinity of the electrical equipment could be sufficient to interfere with the safe dissipation of heat from electrical equipment, or could be ignitable by abnormal operation or failure of electrical equipment.

6.3.2.3* Zone 20. As defined in 506.5(B)(1) of *NFPA 70*, a Zone 20 location shall be any location where one of the following conditions exists:

- (1) An ignitable concentration of combustible dust is present continuously.
- (2) An ignitable concentration of combustible dust is present for long periods of time.

6.3.2.4* Zone 21. As defined in 506.5(B)(2) of *NFPA 70*, a Zone 21 location shall be any location where one of the following conditions exists:

- (1) An ignitable concentration of combustible dust is likely to exist occasionally under normal operating conditions.
- (2) An ignitable concentration of combustible dust might exist frequently because of repair or maintenance operations or because of leakage.
- (3) Equipment is operated or processes are carried on of such a nature that equipment breakdown or faulty operations could result in the release of an ignitable concentration of combustible dust and also cause simultaneous failure of electrical equipment in a mode to cause the electrical equipment to become a source of ignition.
- (4) An ignitable concentration of combustible dust could be communicated from an adjacent Zone 20 location, unless communication is prevented by adequate positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

6.3.2.5* Zone 22. As defined in 506.5(B)(3) of *NFPA 70*, a Zone 22 location shall be any location where one of the following conditions exists:

- (1) An ignitable concentration of combustible dust is not likely to occur in normal operation, and if it does occur, will only persist for a short period.
- (2) A combustible dust is handled, processed, or used, but the dust is normally confined within closed containers or closed systems from which it can escape only as a result of the abnormal operation of the equipment with which the dust is handled, processed, or used.
- (3) An ignitable concentration of combustible dust could be communicated from an adjacent Zone 21 location, unless communication is prevented by adequate positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

6.4 Electrical Devices in Spray Areas.

6.4.1 The spray area as defined in 3.3.3.3 shall be Class I, Division 1; Class I, Zone 1; Class II, Division 1; or Zone 21, whichever is applicable.

6.4.2 Electrical wiring and utilization equipment that is located in the spray area and is not subject to deposits of combustible residues shall be suitable for Class I, Division 1; Class I, Zone 1; Class II, Division 1; or Zone 21 locations, whichever is applicable.

6.4.3* Electrical wiring and utilization equipment that is located in the spray area and is subject to deposits of combustible residues shall be listed for such exposure and shall be suitable for Class I, Division 1; Class I, Zone 1; Class II, Division 1; or Zone 21 locations, whichever is applicable.

6.5 Electrical Devices in Areas Adjacent to or Connected to Spray Areas. Electrical wiring and utilization equipment located in areas adjacent to or connected to the spray area, including but not limited to vestibules and tunnels, shall be classified in accordance with 6.5.1 through 6.5.5.

6.5.1 Electrical wiring and utilization equipment located outside, but within 6100 mm (20 ft) horizontally and 3050 mm (10 ft) vertically, of an unenclosed spray area and not separated from the spray area by partitions extending to the boundaries of the area designated as Division 2, Zone 2; or Zone 22 in Figure 6.5.1 shall be suitable for Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable.

6.5.2 If spray application operations are conducted within a closed-top, open-face or open-front booth or room, as shown in Figure 6.5.2(a) or Figure 6.5.2(b), any electrical wiring or utilization equipment located outside the booth or room but within 915 mm (3 ft) of any opening shall be suitable for Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable.

6.5.3 If spray application operations are conducted within an open-top booth, any electrical wiring or utilization equipment located within the space 915 mm (3 ft) vertically from the top of the booth shall be suitable for Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable. In addition, any electrical wiring or utilization equipment located within 915 mm (3 ft) in all directions of openings other than the open top also shall be suitable for

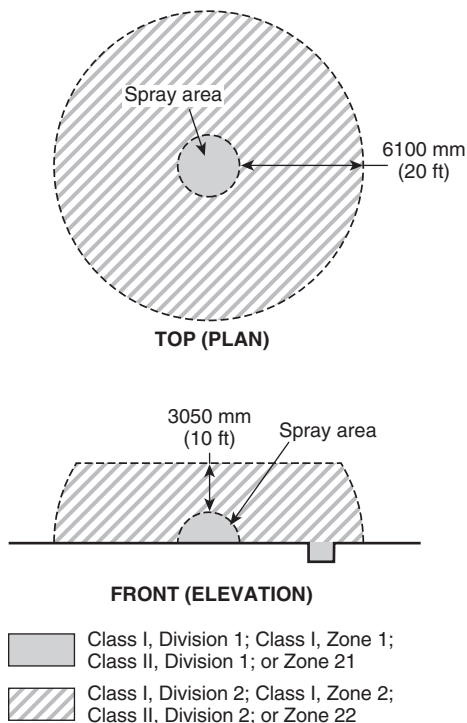


FIGURE 6.5.1 Electrical Area Classification for Unenclosed Spray Areas.

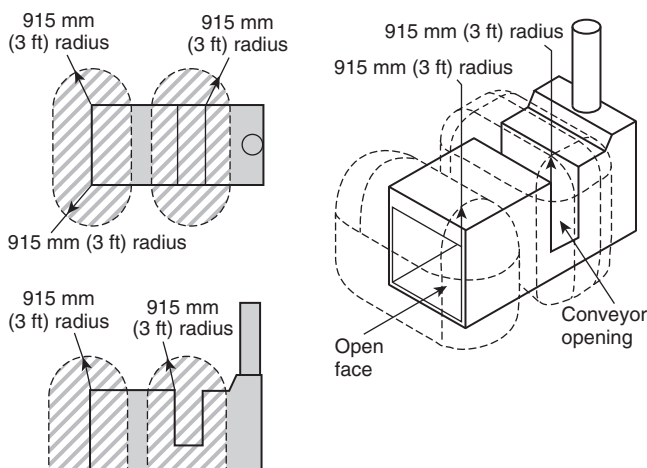


FIGURE 6.5.2(a) Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 Locations Adjacent to an Open-Face or Open-Front Spray Booth or Spray Room.

Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable.

6.5.4 If spray application operations are confined to an enclosed spray booth or room, electrical area classification shall be as follows:

- (1) The area within 915 mm (3 ft) of any opening shall be classified as Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable, as shown in Figure 6.5.4.

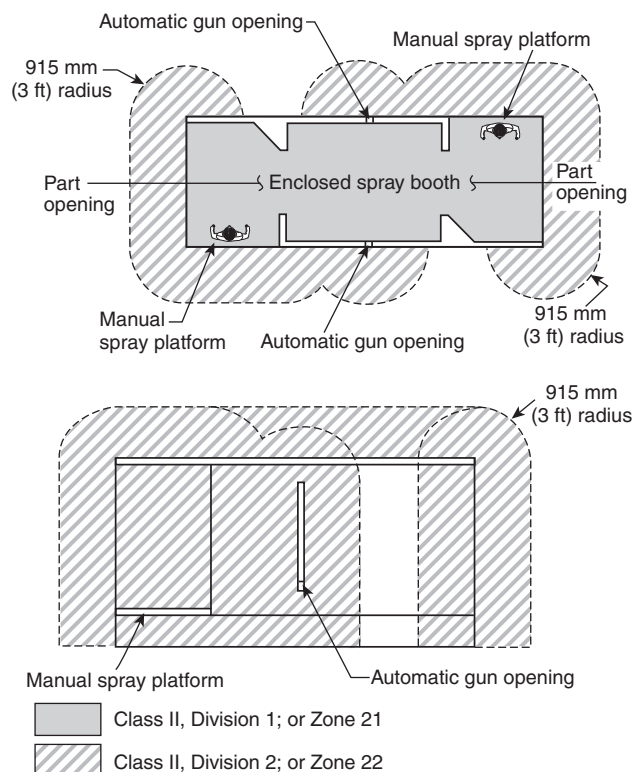


FIGURE 6.5.2(b) Class II, Division 1; or Zone 21 Locations Inside Powder Coating Booth and On the Manual Spray Platforms. Class II, Division 2; or Zone 22 Locations Adjacent to Automatic Gun Openings and Outer Edge of the Manual Spray Platform for Powder Coating Booth.

- (2)* Where automated spray application equipment is used, the area outside the access doors shall be unclassified provided the door interlock prevents the spray application operations when the door is open.
- (3) Where exhaust air is recirculated and all requirements of Section 7.5 are met, both of the following shall apply:
- The interior of any recirculation path downstream of the recirculation particulate filter up to and including the air supply plenum shall be classified as Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable.
 - The interior of fresh air supply ducts shall be unclassified.
- (4) Where exhaust air is not recirculated, the interior of fresh air supply ducts and fresh air supply plenums shall be unclassified.

6.5.5* Open containers, supply containers, waste containers, spray gun cleaners, and solvent distillation units that contain Class I liquids shall be located in areas ventilated in accordance with applicable requirements of Chapter 7.

6.5.5.1 Electrical area classification shall be as follows:

- (1) The area within 915 mm (3 ft) in all directions from any such container or equipment and extending to the floor

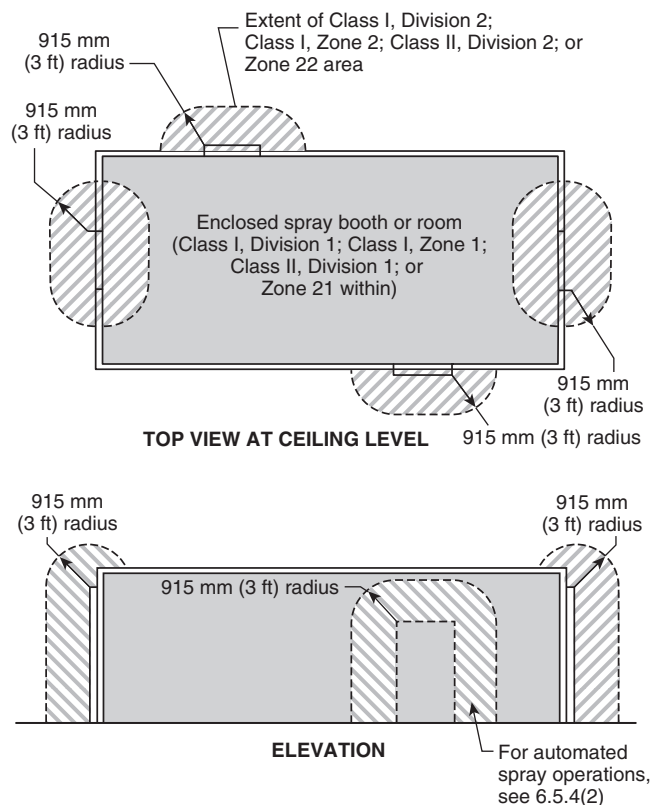


FIGURE 6.5.4 Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 Locations Adjacent to an Enclosed Spray Booth or Spray Room.

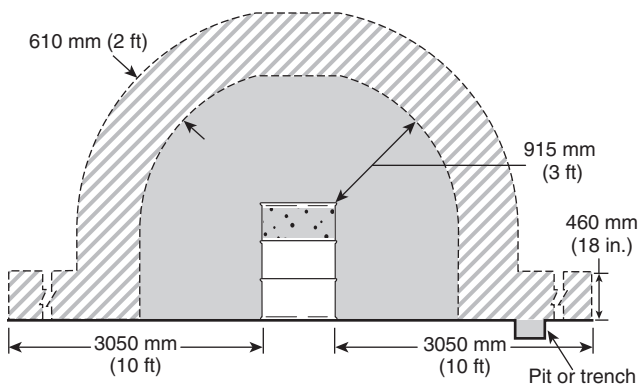
or grade level shall be classified as Class I, Division 1 or Class I, Zone 1, whichever is applicable.

- (2) The area extending 610 mm (2 ft) beyond the Division 1 or Zone 1 location shall be classified as Class I, Division 2 or Class I, Zone 2, whichever is applicable.
- (3) The area extending 1525 mm (5 ft) horizontally beyond the area described in 6.5.5.1(2) up to a height of 460 mm (18 in.) above the floor or grade level shall be classified as Class I, Division 2 or Class I, Zone 2, whichever is applicable.
- (4) The area inside any tank or container shall be classified as Class I, Division 1 or Class I, Zone 0, whichever is applicable.

6.5.5.2 Electrical wiring and utilization equipment installed in these areas shall be suitable for the location, as shown in Figure 6.5.5.2.

6.6 Illumination.

6.6.1 Luminaires, like that shown in Figure 6.6.1, that are attached to the walls or ceiling of a spray area but that are outside any classified area and are separated from the spray area by glass panels that meet the requirements of Section 5.6 shall be suitable for use in unclassified locations. Such fixtures shall be serviced from outside the spray area.



- Class I, Division 1 or Zone 0
 (e.g., vapor space in container)
- Class I, Division 1 or Zone 1
- Class I, Division 2 or Zone 2

FIGURE 6.5.2 Electrical Area Classification for Class I Liquid Operations Around Open Containers, Supply Containers, Waste Containers, Spray Gun Cleaners, and Solvent Distillation Units.

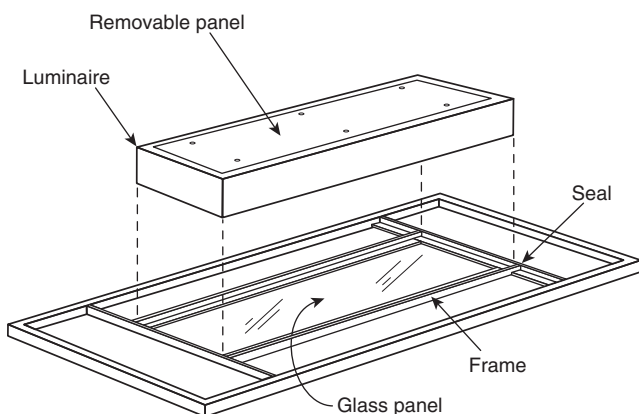


FIGURE 6.6.1 Example of a Luminaire Mounted Outside the Spray Area and Serviced from Outside the Spray Area.

6.6.2 Luminaires, like that shown in Figure 6.6.1, that are attached to the walls or ceiling of a spray area; that are separated from the spray area by glass panels that meet the requirements of Section 5.6; and that are located within a Class I, Division 2; a Class I, Zone 2; a Class II, Division 2; or a Zone 22 location shall be suitable for such location. Such fixtures shall be serviced from outside the spray area.

6.6.3 Luminaires, like that shown in Figure 6.6.3, that are an integral part of the walls or ceiling of a spray area shall be permitted to be separated from the spray area by glass panels that are an integral part of the fixture. Such fixtures shall be listed for use in Class I, Division 2; Class I, Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable, and also shall be listed for accumulations of deposits of combustible residues. Such fixtures shall be permitted to be serviced from inside the spray area.

6.6.4 Luminaires that are located inside the spray area shall meet the requirements of Section 6.4 and Section 6.7.

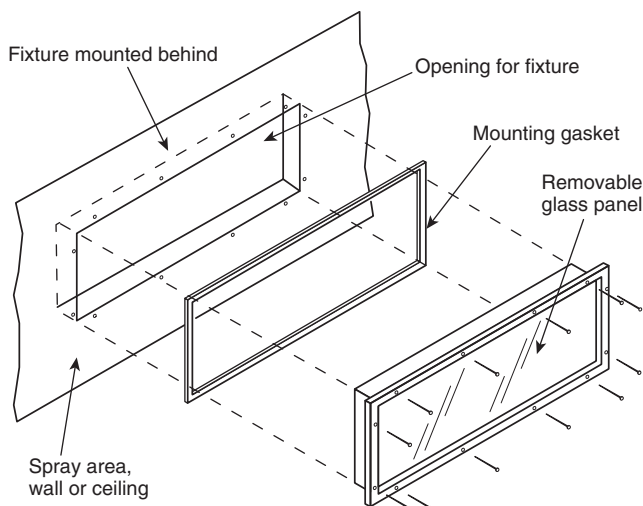
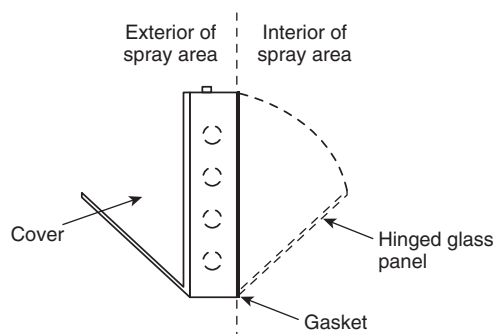


FIGURE 6.6.3 Examples of Luminaires That Are Integral Parts of the Spray Area and That Are Serviced from Inside the Spray Area.

6.7* Static Electricity. All electrically conductive objects in the spray area, except those objects required by the process to be at high voltage, shall be electrically connected to ground with a resistance of not more than 10^6 ohms (1 megohm). This requirement shall apply to containers of coating material, wash cans, guards, hose connectors, brackets, and any other electrically conductive objects or devices in the area. This requirement shall also apply to any personnel who enter the spray area.

6.8 Flexible Power Cords. For automated equipment and robotic equipment, flexible power cords shall be permitted to be used in hazardous (classified) locations and shall be permitted to be connected to the fixed part of the electrical circuit, provided they meet all of the following conditions:

- (1) They are approved for extra-hard usage.
- (2) They are equipped with a grounding conductor that meets the requirements of Section 400.2 of *NFPA 70*.
- (3) They are connected to terminals or conductors in an approved manner.
- (4) They are supported by a positive mechanical clamp in such a manner that permits the cord to be readily replaced and prevents strain at the cord connections within the terminal enclosure.