

NFPA®

33

Standard for
Spray Application
Using Flammable or
Combustible Materials

2021



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NFPA® 33

Standard for

Spray Application Using Flammable or Combustible Materials

2021 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 October 5, 2020, with an effective date of October 25, 2020, and supersedes all previous editions.

This edition of NFPA 33 was approved as an American National Standard on October 25, 2020.

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*).

The following major changes were adopted in the 2003 edition:

- (1) Chapters were rearranged to align the standard with the NFPA *Manual of Style*. For example, all the references within the mandatory text are now listed in Chapter 2 and all the definitions are now in Chapter 3.
- (2) Chapter 6 (formerly Chapter 4) was extensively revised to recognize the Zone concept of area classification. Changes included the addition of the appropriate definitions and revision of the figures to illustrate the area classifications in and around spray areas, spray booths, spray rooms, and equipment.
- (3) Chapter 9 (formerly Chapter 7) was extensively revised to more effectively and clearly present the requirements for fire protection in spray areas.
- (4) Section 10.5 was added to provide more specific guidance on the handling of waste materials, Section 10.7 was revised to allow for the use of any suitable solvent to clean spray equipment, and Section 10.8 was added to address the hazards of solvent distillation units.
- (5) 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.
- (2) In Section 5.5, the allowable materials for vision and observation panels were expanded.
- (3) Section 7.7 was revised to allow for the use of fire-retardant combustible materials for ducts connected to powder coating booths.
- (4) 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*.
- (5) In Chapters 11, 12, and 15, subsections 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 for surface conductivity.

The following major changes were adopted in the 2011 edition:

- (1) The document scope was amended to exempt certain small quantity operations and a decision tree was added to Annex A to assist the user.
- (2) The definition of *spray area* was amended.
- (3) Chapter 6 was revised to recognize the Zone 21 and Zone 22 hazardous (classified) area classifications for combustible dusts.
- (4) Section 7.7 was amended to allow concrete as a material of construction for spray area exhaust plenums and ducts.

- (5) Section 8.2 was revised to recognize the concept of maximum allowable quantities (MAQs) and establish quantity limits based on MAQs.
- (6) Section 13.2 was revised to provide clarification for spray areas used for drying or curing at a temperature above that of the area where the spray application takes place.
- (7) Section 13.5 was added to address installations where the spray booth or spray room is directly connected to the drying/curing oven by an enclosed vestibule.
- (8) 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.
- (9) Subsection 17.5.2 was amended to replace the requirement for Division 1/Zone 1 electrical equipment with the requirement for Division 2/Zone 2.

The following major changes were adopted in the 2016 edition:

- (1) Chapter 1 was revised to include indoor and outdoor spray application processes and operations within temporary membrane enclosures.
- (2) Chapter 9 was revised to allow for the use of water mist systems and to clarify the sprinkler design area requirement.
- (3) The figure in Chapter 14 was revised to improve consistency and to clarify the electrical classification requirements in the document.
- (4) Chapter 15 was revised to incorporate the requirements for combustible dusts that are present in operations.
- (5) Chapter 18 was added to address the use of temporary membrane enclosures

The following major changes were adopted in the 2018 edition:

- (1) In Chapter 3, new or revised definitions were added for *automated spray application operations*, *basement*, *control area*, *dry particulate scrubber spray booth*, and *workstation*.
- (2) Chapter 5 was revised to address the confusion between spray rooms and spray booths.
- (3) The figures in Chapter 6 were revised to improve consistency and to clarify electrical classification requirements in the document.
- (4) Chapter 7 was revised to provide clarification on the heating of recirculated air and the manifolding of exhaust ducts.

The following major changes have been adopted in the 2021 edition of the standard:

- (1) The Origin and Development for previous editions of NFPA 33 has been updated to better act as a brief summary of the historical changes to the standard.
- (2) Several editorial revisions have been made, including updates to extracted material. Some of these updated extracts from NFPA 30 have led to revised language concerning the classification of liquids and their associated definitions. In the annex material for Chapter 6, direction has been added to the applicable sections of *NFPA 70®*, *National Electrical Code®*, for the construction and installation of flexible power cords.
- (3) Several clarifications have been introduced to this new edition of the standard. Examples of this include requirements for the recirculation of heated air that does not apply to spray booths used for curing, language explaining why plastic bags should not be used to cover sprinklers, and how automatic fire protection is not required in small spray booths. Additionally, Chapter 9 has been reorganized to provide a better flow of information.

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2021 Edition

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Information on referenced and extracted 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 the spray application of water-borne, water-based, and water-reducible materials that

contain ignitable (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 ignitable (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 indoors or 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*, 2021 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 2019 edition.

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2019 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2021 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2021 edition.

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

NFPA 69, *Standard on Explosion Prevention Systems*, 2019 edition.

NFPA 70®, *National Electrical Code*®, 2020 edition.

NFPA 72®, *National Fire Alarm and Signaling Code*®, 2019 edition.

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

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids*, 2020 edition.

NFPA 101®, *Life Safety Code*®, 2021 edition.

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

NFPA 400, *Hazardous Materials Code*, 2019 edition.

NFPA 496, *Standard for Purged and Pressurized Enclosures for Electrical Equipment*, 2021 edition.

NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*, 2019 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2019 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2021 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2021 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, 2019.

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*, 2019.

ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester*, 2016a.

ASTM D93, *Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester*, 2018.

ASTM D3278, *Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus*, 1996 (reapproved 2011).

ASTM D3828, *Standard Test Methods for Flash Point by Small Scale Closed Cup Tester*, 2016a.

ASTM D4359, *Standard Test Method for Determining Whether a Material is a Liquid or a Solid*, 1990 (reapproved 2019).

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2019b.

ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C*, 2019.

ASTM E2652, *Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*, 2018.

ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter*, 2017.

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

UL 340, *Tests for Comparative Flammability of Liquids*, 2017.

UL 723, *Test for Surface Burning Characteristics of Building Materials*, 2018.

UL 900, *Air Filter Units*, 2015.

UL 2208, *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*, 2021 edition.

NFPA 56, *Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems*, 2020 edition.

NFPA 69, *Standard on Explosion Prevention Systems*, 2019 edition.

NFPA 70®, *National Electrical Code®*, 2020 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2021 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 3.3.2.3.2.

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, 2021]

3.3.5 Boiling Point (BP). The temperature at which the vapor pressure of a liquid equals the surrounding atmospheric pressure. [30, 2021]

3.3.6 Chopper Gun. A device that feeds glass fiber through a cutting unit and injects the cut glass fibers into a stream of catalyzed liquid resin that is then sprayed onto a surface.

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

3.3.8 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, 2020]

3.3.9* 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). (BLD-IND) [5000, 2021]

N 3.3.10 Flash Point (FP). The minimum temperature of a liquid at which sufficient vapor is given off to form an ignitable mixture with the air, near the surface of the liquid or within the vessel used, as determined by the appropriate test procedure and apparatus specified in Section 4.7. [30, 2021]

3.3.11 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.

3.3.11.1 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.

3.3.12 Inerting. A technique by which a combustible mixture is rendered nonignitable by adding an inert gas or a noncombustible dust. [69, 2019]

3.3.13 Limited Combustible. See Section 4.6.

3.3.14 Liquid (Physical State). Any material that (1) has a fluidity greater than that of 300 penetration asphalt when tested in accordance with ASTM D5/D5M, *Standard Test Method 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, 2021]

Δ 3.3.14.1 Combustible Liquid. An ignitable liquid that is classified as a Class II or Class III liquid. (See 4.6.2 and 4.6.3). [30, 2021]

Δ 3.3.14.2 Flammable Liquid. An ignitable liquid that is classified as a Class I liquid. (See 4.6.1). [30, 2021]

N 3.3.14.3* Ignitable Liquid. Any liquid or liquid mixture that has a measurable fire point. [30, 2021]

N 3.3.14.4 Liquid Class. A uniform system of classifying ignitable liquids. (See Chapter 4.) [30, 2021]

3.3.15 Material.

3.3.15.1 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 3.3.14.1), a flammable liquid (see 3.3.14.2), or a combustible powder (see 3.3.7).

3.3.15.2 Limited-Combustible Material. See Section 4.6.

3.3.15.3 Noncombustible Material. See Section 4.5.

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

3.3.17 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.

3.3.18* 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.

3.3.19* 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.

3.3.19.1 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.

3.3.19.2 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.

3.3.19.3 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.

3.3.19.4 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.

3.3.19.5 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.

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

Δ 3.3.21 Utilization Equipment. Equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes. [70:100]

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

3.3.23 Workstation.

3.3.23.1* 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.

3.3.23.2 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.

Δ 4.3* Basements.

N 4.3.1 Spray booths, rooms, and areas in a basement shall meet the requirements of 5.1.4.

N 4.3.2 Spray booths, rooms, and areas in a basement shall have an access means provided for emergency response personnel that is acceptable to the authority having jurisdiction.

N 4.4 Fueled Vehicles. Air makeup systems and spray area exhaust systems shall remain functioning when a liquefied-petroleum-gas, compressed-natural-gas, or hydrogen-fueled vehicle is present in the spray booth or spray room.

4.5 Noncombustible Material.

4.5.1 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 Assessing Combustibility of Materials Using 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 Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*. [5000:7.1.4.1.1]

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

Δ 4.6 Limited-Combustible Material. A material shall be considered a limited-combustible material where one of the following is met:

- (1) The conditions of 4.6.1 and 4.6.2, and the conditions of either 4.6.3 or 4.6.4, shall be met
- (2) The conditions of 4.6.5 shall be met [5000:7.1.4.2]

4.6.1 The material does not comply with the requirements for a noncombustible material in accordance with Section 4.5. [5000:7.1.4.2.1]

4.6.2 The material, in the form in which it is used, exhibits a potential heat value not exceeding 8141 kJ/kg (3500 Btu/lb) when tested in accordance with NFPA 259. [5000:7.1.4.2.2]

Δ 4.6.3 The material shall have a structural base of 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, *Test for Surface Burning Characteristics of Building Materials*. [5000:7.1.4.2.3]

Δ 4.6.4 The material shall be composed of materials that in the form and thickness used neither exhibit a flame spread index greater than 25 nor exhibit evidence of continued progressive combustion when tested in accordance with ASTM E84 or UL 723 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 exhibit evidence of continued progressive combustion when tested in accordance with ASTM E84 or UL 723. [5000:7.1.4.2.4]

N 4.6.5 Materials shall be considered limited-combustible materials where tested in accordance with ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter*, at an incident heat flux of 75 kW/m² for a 20-minute exposure, and both the following conditions are met:

- (1) The peak heat release rate shall not exceed 150 kW/m² for longer than 10 seconds.
- (2) The total heat released shall not exceed 8 MJ/m². [5000:7.1.4.2.5]

4.6.6 Where the term limited-combustible is used in this standard, it shall also include the term *noncombustible*. [5000:7.1.4.2.6]

Δ 4.7 Classification Scheme.

N 4.7.1 Class I Liquids.

N 4.7.1.1 A liquid with a closed-cup flash point below 37.8°C (100°F) shall be designated as a Class I liquid (i.e., flammable liquid), 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 40 psi (276 kPa) at 37.8°C (100°F) as determined by ASTM D323, *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)*. [30:4.2.1.1]

▲ **4.7.1.2** Class I liquids shall be further subclassified in accordance with the following:

- (1) Class IA Liquid. A 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. A 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. A liquid that has a flash point at or above 22.8°C (73°F), but below 37.8°C (100°F). [30:4.2.1.2]

●

■ **4.7.2 Class II Liquids.** A liquid with a closed-cup flash point at or above 37.8°C (100°F) but below 60°C (140°F) shall be designated as a Class II liquid (i.e., combustible liquid), as determined by the test procedures and apparatus set forth in Section 4.7. [30:4.2.2]

■ **4.7.3 Class III Liquids.**

■ **4.7.3.1** A liquid with a closed-cup flash point at or above 60°C (140°F) shall be designated as a Class III liquid (i.e., combustible liquid), as determined by the test procedures and apparatus set forth in Section 4.8. [30:4.2.3.1]

■ **4.7.3.2** Class III liquids shall be further subclassified in accordance with the following:

- (1) *Class IIIA Liquid.* A liquid that has a flash point at or above 60°C (140°F), but below 93°C (200°F).
- (2) *Class IIIB Liquid.* A liquid that has a flash point at or above 93°C (200°F). [30:4.2.3.1]

4.8 Determination of Flash Point (FP). The flash point of a liquid shall be determined according to the methods specified in 4.8.1 through 4.8.4. [30:4.4]

4.8.1 Except as specified in 4.8.1.1, 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]

▲ **4.8.1.1** 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. [30:4.4.1.1]

■ **4.8.1.2** Such liquids as stated in 4.7.1.1 shall be tested in accordance with 4.8.2 [30:4.4.1.2]

4.8.2 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]

4.8.3 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]

4.8.4 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 both of the following:

- (1) Constructed of noncombustible or limited-combustible materials or assemblies
- (2) Securely and rigidly mounted or fastened

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.

▲ **5.1.1.2** Air intake filters that are a part of a wall or ceiling assembly shall be listed in accordance with UL 900, *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.

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

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

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.

5.3 Spray Booths.

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

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.).

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

▲ 5.3.4 Powder Coating.

■ **5.3.4.1** Spray booths that are used exclusively for powder coating shall meet the requirements of Chapter 15.

■ **5.3.4.2** Spray booths that are used exclusively for powder coating shall be permitted to be constructed of fire-retardant combustible materials where approved by the authority having jurisdiction.

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

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.

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.

N 5.5.1 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.

N 5.5.2 Multiple connected spray booths shall not be considered as “other operations” except as provided for in Section 13.3.

N 5.5.3 Multiple spray booths connected by openings for moving the workpiece or that share a common wall shall not be considered as “other operations.”

N 5.5.4 For spray booths adjacent to rooms or equipment used for drying, curing or fusing, the separation requirements of Section 13.7 shall apply.

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

5.5.6 A clear space of not less than 915 mm (3 ft) shall be both of the following:

- (1) Maintained on all sides and above the spray booth
- (2) Kept free of any storage or combustible construction

5.5.6.1 The requirement in 5.5.6 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.

5.5.6.2 The requirement in 5.5.6 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 shall be separated from the luminaire to prevent the surface temperature of the panel from exceeding 105°C (221°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.

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 10.10.)

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.

6.2.1.1 Powered vehicles shall meet the requirements of Section 6.10.

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 Zone 0 location.
- (2) A Class I, Division 1 location shall be permitted to be alternatively classified as a Zone 1 location.
- (3) A Class I, Division 2 location shall be permitted to be alternatively classified as a 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, Zone 2 locations shall be permitted to abut, but not overlap, Class I, Division 2 locations. 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 Class I liquid [FP < 37.8°C (100°F)] 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 the case of an 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.

Δ 6.3.1.3* Zone 0 Locations. As defined in 505.5(B)(1) of *NFPA 70*, a 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.

Δ 6.3.1.4* Zone 1 Locations. As defined in 505.5(B)(2) of *NFPA 70*, a 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 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.

Δ 6.3.1.5 Zone 2 Locations. As defined in 505.5(B)(3) of *NFPA 70*, a 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, it will only exist for a short period of time.
- (2) A flammable gas or a Class I liquid [FP < 37.8°C (100°F)] 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 the case of an accidental rupture or breakdown of the container or system or in the 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 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.

Δ 6.4.1 The spray area as defined in 3.3.2.3 shall be Class I, Division 1; Zone 1; Class II, Division 1; or Zone 21, whichever is applicable.

Δ 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; Zone 1;

Class II, Division 1; or Zone 21 locations, whichever is applicable.

Δ 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; 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.

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

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

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

Δ 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; Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable, as shown in Figure 6.5.4.
- (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:
 - (a) 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; Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable.
 - (b) 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.

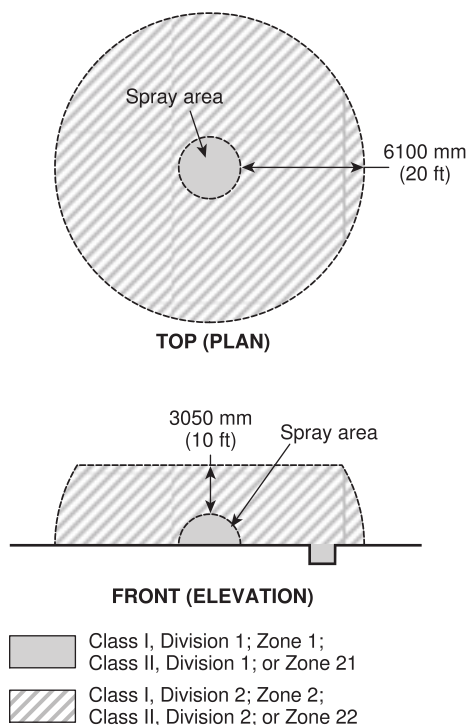


FIGURE 6.5.1 Electrical Area Classification for Unenclosed Spray Areas.

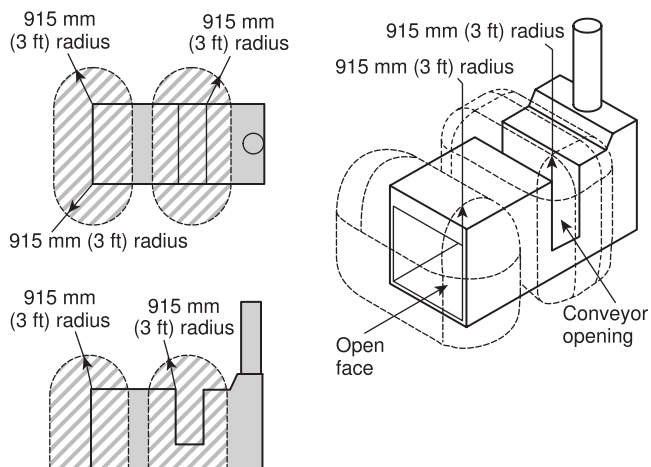


FIGURE 6.5.2(a) Class I, Division 2; Zone 2; Class II, Division 2; or Zone 22 Locations Adjacent to an Open-Face or Open-Front Spray Booth or Spray Room.

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

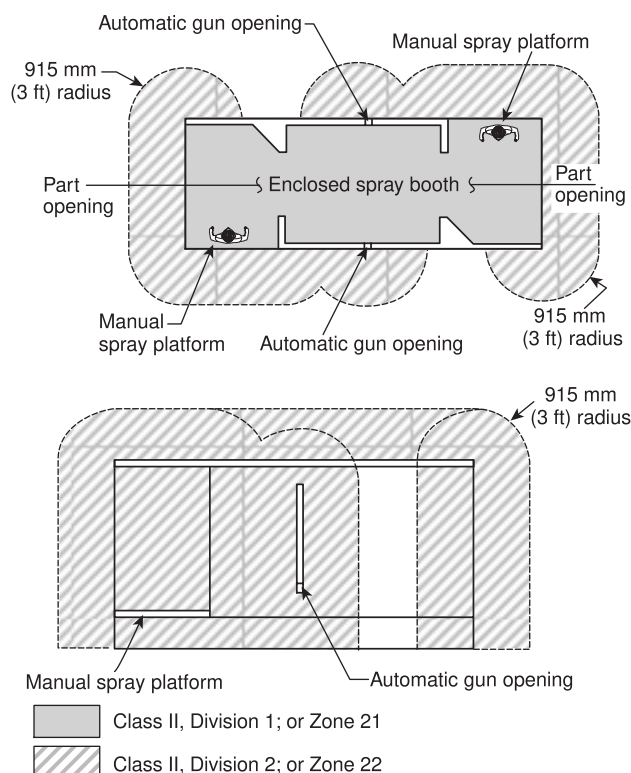


FIGURE 6.5.2(b) Class II, Division 1; or Zone 21 Locations Inside Powder Coating Booth and On the Manual Spray Platforms. Class II, Division 2; or Zone 22 Locations Adjacent to Automatic Gun Openings and Outer Edge of the Manual Spray Platform for Powder Coating Booth.

- (2) The area extending 610 mm (2 ft) beyond the Division 1 or Zone 1 location shall be classified as Class I, Division 2 or 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 Zone 2, whichever is applicable.
- (4) The area inside any tank or container shall be classified as Class I, Division 1 or 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 — Outside Classified Areas.

6.6.1.1 Luminaires, like that shown in Figure 6.6.1.1, 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 not be required to be listed for use in hazardous (classified) locations.

6.6.1.2 Such luminaires as stated in 6.6.1.1 shall be capable of being serviced from outside the spray area.

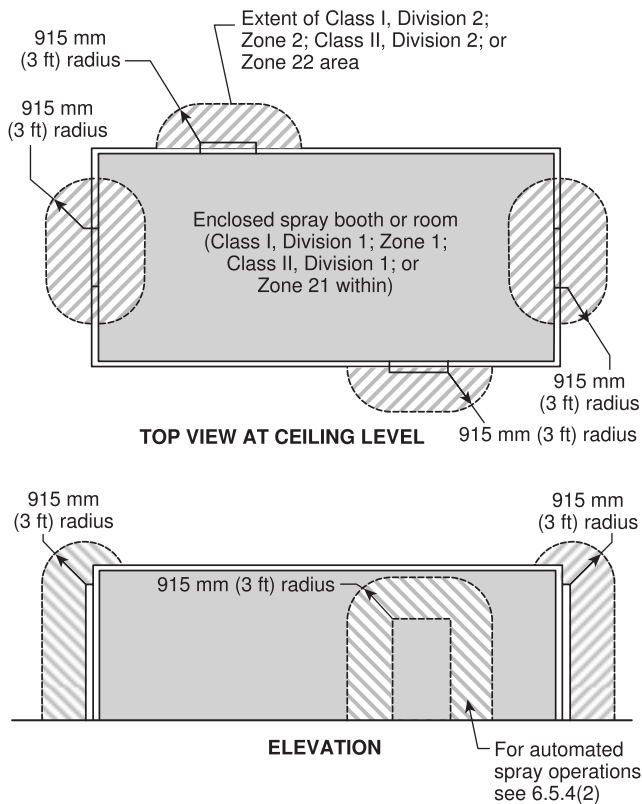


FIGURE 6.5.4 Class I, Division 2; Zone 2; Class II, Division 2; or Zone 22 Locations Adjacent to an Enclosed Spray Booth or Spray Room.

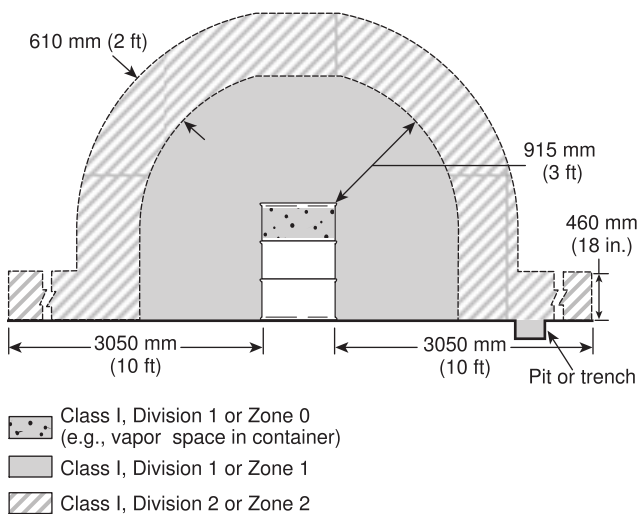


FIGURE 6.5.5.2 Electrical Area Classification for Class I Liquid Operations Around Open Containers, Supply Containers, Waste Containers, Spray Gun Cleaners, and Solvent Distillation Units.

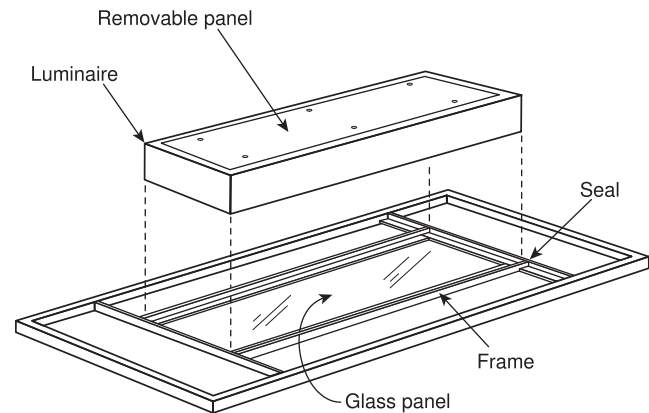


FIGURE 6.6.1.1 Example of a Luminaire Mounted Outside the Spray Area and Serviced from Outside the Spray Area.

6.6.2 Luminaires — Location.

6.6.2.1 Luminaires, like that shown in Figure 6.6.1.1, 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 Zone 2; a Class II, Division 2; or a Zone 22 location shall be listed for such locations.

6.6.2.2 Such luminaires as stated in 6.6.2.1 shall be serviced from outside the spray area.

6.6.3 Luminaires — Walls or Ceilings.

6.6.3.1 Luminaires, like that shown in Figure 6.6.3.1, 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 luminaire.

6.6.3.2 Such luminaires as stated in 6.6.3.1 shall be listed for the following:

- (1) Use in Class I, Division 2; Zone 2; Class II, Division 2; or Zone 22 locations, whichever is applicable
- (2) Accumulations of deposits of combustible residues

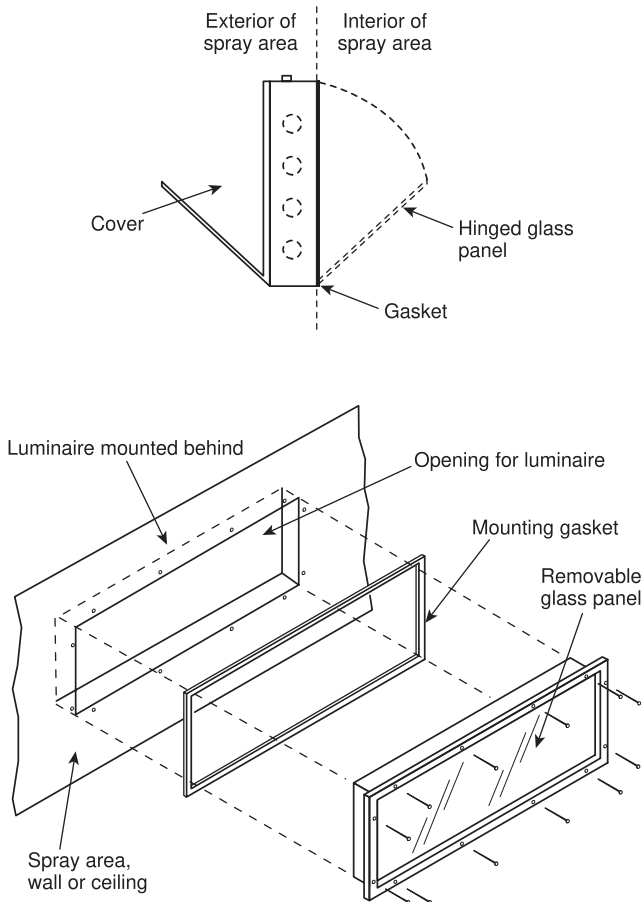
6.6.3.3 Such luminaires as stated in 6.6.3.1 shall be permitted to be serviced from inside the spray area.

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

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 to be connected to the fixed part of an electrical circuit provided they meet all of the following conditions:

- (1) They are listed for extra-hard usage.
- (2) They are equipped with a grounding conductor that meets the requirements of Section 400.2 of *NFPA 70*.



▲ FIGURE 6.6.3.1 Examples of Luminaires That Are Integral Parts of the Spray Area and That Are Serviced from Inside the Spray Area.

- (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 enables a cord to be readily replaced and prevents strain at the cord connections within the terminal enclosure.
- (5)* They are provided with explosionproof seals for liquid applications or dusttight seals for powder applications where cords enter junction boxes, fittings, or enclosures.
- (6) They are listed for deposits of combustible residue.

6.9 Portable Electric Luminaires. Portable electric luminaires used in spray areas shall meet the requirements of 6.4.3.

6.10 Movement of Powered Vehicles. Powered vehicles shall be listed for the electrical area classification in which they are used, and unlisted powered vehicles shall not be moved into or out of a spray area or operated in a spray area unless the spray application operation or process is stopped and the ventilation system is maintained in operation.

Chapter 7 Ventilation

7.1 General. Ventilating and exhaust systems shall be designed and installed in accordance with the applicable requirements of NFPA 91 except as amended by the requirements of this chapter.

7.2 Performance Requirements. Each spray area shall be provided with mechanical ventilation that is capable of confining and removing vapors and mists to a safe location and is capable of confining and controlling combustible residues, dusts, and deposits. The concentration of the vapors and mists in the exhaust stream of the ventilation system shall not exceed 25 percent of the lower flammable limit. (See Annex B for additional guidance on determining the lower flammable limit.)

7.2.1* Spray areas equipped with overspray collection filters shall have an effective means to ensure that the performance requirements of Section 7.2 are met.

7.2.2 Powder Coating Systems. Powder coating systems also shall meet the requirements of Section 15.8.

7.2.3 Mechanical ventilation shall be kept in operation at all times while spray operations are being conducted and for a sufficient time thereafter to allow the vapors from drying coated objects or material and residues to be exhausted. Where spray operations are conducted automatically without an attendant constantly on duty, the operating controls of the spray apparatus shall be arranged so that the spray apparatus cannot function unless the exhaust fans are operating.

7.2.4 In confined spaces, where ventilation is not capable of meeting the requirements of Section 7.2, an inerting procedure shall be permitted to be used. Such procedures shall meet the applicable requirements of NFPA 69 and shall be acceptable to the authority having jurisdiction.

7.3* Make-Up Air. Clean make-up air shall be provided to compensate for the air exhausted from spray operations. The intake for this make-up air shall be located so that the air exhausted from spray operations is not recirculated.

7.4 Routing of Exhaust Ducts. Air exhausted from liquid spray operations shall be conducted by ducts directly to the outside of the building. Exhaust ducts shall follow the shortest route to the point of discharge and shall meet the following conditions:

- (1) Exhaust ducts shall not penetrate a fire wall or fire barrier wall.
- (2) Exhaust discharge shall be directed away from any air intakes.
- (3) Exhaust discharge point shall be at least 1830 mm (6 ft) from any exterior wall or roof.
- (4) Exhaust discharge point shall be at least 3048 mm (10 ft) from openings into the building.
- (5) Exhaust discharge point shall be at least 3048 mm (10 ft) above adjoining grade.
- (6) Exhaust duct shall not discharge in the direction of any combustible construction that is within 7625 mm (25 ft) of the exhaust duct discharge point.
- (7) Exhaust duct shall not discharge in the direction of any unprotected opening in any noncombustible or limited-combustible construction that is within 7625 mm (25 ft) of the exhaust duct discharge point.