

# NFPA<sup>®</sup>

# 33

---

Standard for  
Spray Application  
Using Flammable or  
Combustible Materials

---

## 2021



Copyright © 2020 National Fire Protection Association®. All Rights Reserved.

## 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.



## Technical Committee on Finishing Processes

**Geoffrey A. Raifsnider**, *Secretary*  
Global Finishing Solutions, WI [M]

**Shane A. Adams**, Rancho Cucamonga Fire Protection District, CA [E]

Rep. International Fire Marshals Association

**William C. Anderson**, Approved Protection Systems, LLC, MI [IM]  
Rep. National Association of Fire Equipment Distributors

**Donald W. Ankele**, UL LLC, IL [RT]

**Jeffrey R. Bennett**, New-Tech Coating Automation, Inc., IN [SE]

**Mark A. Bowman**, Global Asset Protection Services, LLC, OH [I]

**Benjamin Bushaw**, Intertek, NY [RT]

**Seung-Ho Choi**, Korean Fire Protection Association (KFPA), South Korea [SE]

**Mark Dubbin**, Las Cruces Fire Department, NM [E]

**Luc Durand**, Saskatoon Fire Department, Canada [E]

**Ruby Evans**, FM Global, MA [I]

**Robert J. Feldkamp**, Nordson Corporation, OH [M]

**Paul B. Gentry**, Zurich Services Corporation, TN [I]

**Thomas B. George**, Tokio Marine America, Inc., OH [I]

**James S. Gustin**, Travelers Insurance Company, NC [I]

**Laura Jacobsen**, The Boeing Company, CA [U]

**Bryant C. Jeffrey**, Axalta Coating Systems, DE [M]

**Anton Jensen, Jr.**, Liberty Mutual Insurance Company, GA [I]

**Steven D. Jensen**, 3M Company, MN [U]

**Donald R. Kirkham**, Molded Fiberglass Companies, SD [U]

Rep. American Composites Manufacturers Association

**Martin J. Korecky**, AkzoNobel Powder Coatings, FL [M]

**John McKnight**, National Marine Manufacturers Association, DC [U]

Rep. Plastics Industry Association (Plastics)

**Jarod M. Moseley**, Toyota Engineering & Manufacturing, KY [U]

**Jim Pakkala**, Durr Systems, Inc., MI [M]

**Mark W. Roeber**, Infinity Precision Systems, LLC, MN [M]

**James M. Sute**, General Motors Company, MI [U]

Rep. NFPA Industrial Fire Protection Section

**Mike Thies**, GEMA USA, Inc., IN [M]

**Barry Thomas**, BECCA Inc., GA [M]

**Brent W. Thor**, Thor and Associates, Inc., TX [M]

Rep. Mobile Environmental Solutions

**Jared R. Van Gammeren**, Midwestern Mechanical, SD [IM]

Rep. American Fire Sprinkler Association

**Nan Wei**, John Deere, IL [U]

**Derek P. Wester**, Amerex Corporation, AL [M]

Rep. Fire Equipment Manufacturers' Association

**Kevin J. Wolf**, Intertek Testing Services, NY [RT]

### Alternates

**Dale S. Bonn**, Travelers Insurance Companies, CT [I]  
(Alt. to James S. Gustin)

**Dean Doherty**, General Motors Company, MI [U]  
(Alt. to James M. Sute)

**Skip Donnell**, Liberty Mutual Insurance Company, IN [I]  
(Alt. to Anton Jensen, Jr.)

**Matthew M. Euson**, 3S Incorporated, IN [IM]  
(Voting Alt.)

**Thomas Flannery**, AkzoNobel Powder Coatings, IN [M]  
(Alt. to Martin J. Korecky)

**Richard J. Hild**, Axalta Coating Systems, MD [M]  
(Alt. to Bryant C. Jeffrey)

**Eli Horden**, The Boeing Company, WA [U]  
(Alt. to Laura Jacobsen)

**Edward L. Jones**, Nordson Corporation, OH [M]  
(Alt. to Robert J. Feldkamp)

**John S. Jurasic**, Spray Tech Enclosures, CA [M]  
(Alt. to Barry Thomas)

**John A. LeBlanc**, FM Global, MA [I]  
(Alt. to Ruby Evans)

**Mark C. Rascio**, Tokio Marine America, Inc., NC [I]  
(Alt. to Thomas B. George)

**Brian P. Schadrie**, Global Finishing Solutions, WI [M]  
(Alt. to Geoffrey A. Raifsnider)

**John Schweitzer**, American Composites Manufacturers Association, VA [U]  
(Alt. to Donald R. Kirkham)

**Michael A. Slowinske**, UL LLC, IL [RT]  
(Alt. to Donald W. Ankele)

**Jeffrey A. Spiesz**, Global Asset Protection Services, LLC, OH [I]  
(Alt. to Mark A. Bowman)

**Dawn Svenkeson**, Graco, MN [M]  
(Alt. to Mike Thies)

**James W. Taylor**, Zurich Services Corporation, TN [I]  
(Alt. to Paul B. Gentry)

**William Vegso**, Buckeye Fire Equipment Company, NC [M]  
(Alt. to Derek P. Wester)

### Nonvoting

**William R. Hamilton**, US Department of Labor, DC [E]

**Guy R. Colonna**, NFPA Staff Liaison

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

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

**Committee Scope:** This Committee shall have primary responsibility for documents on 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.



## Contents

<b>Chapter 1 Administration</b> .....	33- 7	<b>Chapter 8 Storage, Handling, and Distribution of Flammable and Combustible Liquids</b> .....	33- 19
1.1 Scope. ....	33- 7	8.1 General. ....	33- 19
1.2 Purpose. ....	33- 7	8.2 Storage in Process Areas. ....	33- 19
1.3 Application. ....	33- 7	8.3 Handling and Use. ....	33- 20
1.4 Retroactivity. ....	33- 7	8.4 Distribution Systems — Piping. ....	33- 20
1.5 Equivalency. ....	33- 8	8.5 Distribution Systems — General. ....	33- 21
1.6 Units and Formulas. ....	33- 8	<b>Chapter 9 Protection</b> .....	33- 22
1.7 Enforcement. (Reserved) .....	33- 8	9.1 General. ....	33- 22
<b>Chapter 2 Referenced Publications</b> .....	33- 8	9.2 Ventilation Systems. ....	33- 22
2.1 General. ....	33- 8	9.3 Coating Material Delivery Systems. ....	33- 22
2.2 NFPA Publications. ....	33- 8	9.4 Conveyors. ....	33- 22
2.3 Other Publications. ....	33- 8	9.5 Protection Systems. ....	33- 22
2.4 References for Extracts in Mandatory Sections. ..	33- 9	9.6 Specific Process Protection. ....	33- 23
<b>Chapter 3 Definitions</b> .....	33- 9	9.7 Protection for Electrostatic Precipitator Scrubber. ....	33- 24
3.1 General. ....	33- 9	9.8 Protection for High-Capacity Dry Paint Arrestor. .	33- 24
3.2 NFPA Official Definitions. ....	33- 9	<b>Chapter 10 Operations and Maintenance</b> .....	33- 24
3.3 General Definitions. ....	33- 9	10.1 General. ....	33- 24
<b>Chapter 4 General Requirements</b> .....	33- 11	10.2 Inspection, Testing, and Maintenance. ....	33- 24
4.1 Location of Spray Application Operations. ....	33- 11	10.3 Combustible Deposits. ....	33- 24
4.2 Separation. ....	33- 11	10.4 High-Pressure Hose Lines. ....	33- 25
4.3 Basements. ....	33- 11	10.5 Maintenance Procedures. ....	33- 25
4.4 Fueled Vehicles. ....	33- 11	10.6 Waste Containers. ....	33- 25
4.5 Noncombustible Material. ....	33- 11	10.7 Clothing. ....	33- 25
4.6 Limited-Combustible Material. ....	33- 11	10.8 Cleaning Operations. ....	33- 25
4.7 Classification Scheme. ....	33- 11	10.9 Solvent Distillation Units (Solvent Recyclers). ....	33- 25
4.8 Determination of Flash Point (FP). ....	33- 12	10.10 Spontaneous Ignition Hazards. ....	33- 25
<b>Chapter 5 Construction and Design of Spray Areas, Spray Rooms, and Spray Booths</b> .....	33- 12	10.11 Chlorinated Solvents. ....	33- 26
5.1 Spray Areas. ....	33- 12	10.12 Smoking. ....	33- 26
5.2 Spray Rooms. ....	33- 12	10.13 Hot Work. ....	33- 26
5.3 Spray Booths. ....	33- 12	<b>Chapter 11 Automated Electrostatic Spray Equipment</b> ...	33- 26
5.4 Conveyor Openings. ....	33- 13	11.1 Scope. ....	33- 26
5.5 Separation from Other Operations. ....	33- 13	11.2 General. ....	33- 26
5.6 Illumination and Observation Panels. ....	33- 13	11.3 Automated Electrostatic Systems. ....	33- 26
5.7 Ventilation. ....	33- 13	11.4 Incendive Equipment. ....	33- 26
<b>Chapter 6 Electrical and Other Sources of Ignition</b> ....	33- 13	11.5 Listing and Approval of Equipment. ....	33- 27
6.1 Scope. ....	33- 13	<b>Chapter 12 Handheld Electrostatic Spray Equipment</b> ....	33- 27
6.2 General. ....	33- 13	12.1 Scope. ....	33- 27
6.3 Electrical Area Classification. ....	33- 14	12.2 General. ....	33- 27
6.4 Electrical Devices in Spray Areas. ....	33- 15	12.3 Handheld Apparatus. ....	33- 27
6.5 Electrical Devices in Areas Adjacent to or Connected to Spray Areas. ....	33- 15	12.4 Electrical Components. ....	33- 27
6.6 Illumination. ....	33- 16	12.5 Grounding. ....	33- 27
6.7 Static Electricity. ....	33- 17	<b>Chapter 13 Drying, Curing, and Fusion Processes</b> .....	33- 27
6.8 Flexible Power Cords. ....	33- 17	13.1 General. ....	33- 27
6.9 Portable Electric Luminaires. ....	33- 18	13.2 Spray Booths and Spray Rooms Used for Ambient Air Drying. ....	33- 27
6.10 Movement of Powered Vehicles. ....	33- 18	13.3 Spray Booths and Spray Rooms Used for Drying at Elevated Temperatures. ....	33- 27
<b>Chapter 7 Ventilation</b> .....	33- 18	13.4 Liquefied-Petroleum-Gas, Compressed-Natural- Gas, or Hydrogen-Fueled Vehicles. ....	33- 28
7.1 General. ....	33- 18	13.5 Radiant Drying Apparatus. ....	33- 28
7.2 Performance Requirements. ....	33- 18	13.6 Flash-Off Areas. ....	33- 28
7.3 Make-Up Air. ....	33- 18	13.7 Spray Booths or Spray Rooms Adjacent to or Connected to Rooms or Equipment Used for Drying, Curing, or Fusing. ....	33- 29
7.4 Routing of Exhaust Ducts. ....	33- 18	13.8 Ventilation. ....	33- 29
7.5 Recirculation of Exhaust. ....	33- 19	13.9 Warning Signs. ....	33- 29
7.6 Heating of Recirculated Air. ....	33- 19	<b>Chapter 14 Miscellaneous Spray Operations</b> .....	33- 29
7.7 Manifolding of Exhaust Ducts. ....	33- 19	14.1 Vehicle Undercoating and Body Lining. ....	33- 29
7.8 Materials of Construction. ....	33- 19		
7.9 Support of Exhaust Ducts. ....	33- 19		
7.10 Exhaust Duct Access Openings. ....	33- 19		
7.11 Exhaust Fans and Drives. ....	33- 19		
7.12 Drying Areas. ....	33- 19		



14.2	Preparation Workstations. ....	33– 29			
14.3	Limited Finishing Workstations. ....	33– 29			
<b>Chapter 15</b>	<b>Powder Coating</b> .....	33– 30	<b>Chapter 17</b>	<b>Styrene Cross-Linked Composites Manufacturing (Glass Fiber-Reinforced Plastics)</b> .....	33– 34
15.1	Scope. ....	33– 30	17.1	Scope. ....	33– 34
15.2	General. ....	33– 30	17.2	Resin Application Equipment. ....	33– 34
15.3	Applicability. ....	33– 30	17.3	Fire Protection. ....	33– 34
15.4	Location. ....	33– 30	17.4	Resin Storage. ....	33– 34
15.5	Protection. ....	33– 30	17.5	Electrical and Other Hazards. ....	33– 34
15.6	Enclosures. ....	33– 31	17.6	Ventilation. ....	33– 34
15.7	Electrical and Other Sources of Ignition. ....	33– 31	17.7	Use and Handling. ....	33– 34
15.8	Ventilation, Dust Collection, and Explosion Protection. ....	33– 32	<b>Chapter 18</b>	<b>Spray Application Operations in Membrane Enclosures</b> .....	33– 34
15.9	Drying, Curing, and Fusing Equipment. ....	33– 32	18.1	Scope. ....	33– 34
15.10	Operation and Maintenance. ....	33– 32	18.2	Limitations. ....	33– 34
15.11	Automated Electrostatic Powder Spraying Equipment. ....	33– 32	18.3	Membrane Material. ....	33– 35
15.12	Handheld Electrostatic Powder Spraying Equipment. ....	33– 32	18.4	Protection. ....	33– 35
15.13	Electrostatic Fluid Beds. ....	33– 32	18.5	Personnel Inside the Enclosure. ....	33– 35
15.14	Hot Flocking. ....	33– 33	18.6	Electrical and Other Sources of Ignition. ....	33– 35
15.15	Fluid Bed Coating. ....	33– 33	18.7	Ventilation. ....	33– 36
15.16	Powder Coating Delivery and Circulation. ....	33– 33	18.8	Recordkeeping. ....	33– 37
15.17	Powder Unloading, Bag Dumping Stations, and Pneumatic Conveying Systems. ....	33– 33	18.9	Storage and Handling of Ignitable (Flammable and Combustible) Liquids. ....	33– 37
15.18	Screening or Sieving Operations. ....	33– 33	18.10	Facilities Compliance Permitting. ....	33– 37
15.19	Storage and Handling. ....	33– 33	<b>Chapter 19</b>	<b>Training</b> .....	33– 38
<b>Chapter 16</b>	<b>Organic Peroxides and Plural Component Coatings</b> .....	33– 33	19.1	General. ....	33– 38
16.1	Scope. ....	33– 33	<b>Annex A</b>	<b>Explanatory Material</b> .....	33– 38
16.2	General. ....	33– 33	<b>Annex B</b>	<b>Determining Lower Flammable Limits</b> .....	33– 54
16.3	Prevention of Contamination. ....	33– 33	<b>Annex C</b>	<b>Determining Ventilation Airflow for Powder Application Systems</b> .....	33– 55
16.4	Storage of Organic Peroxides. ....	33– 33	<b>Annex D</b>	<b>Fire Record</b> .....	33– 56
16.5	Handling of Organic Peroxides. ....	33– 34	<b>Annex E</b>	<b>Informational References</b> .....	33– 57
16.6	Mixing of Organic Peroxides with Promoters. ....	33– 34	<b>Index</b>	.....	33– 59
16.7	Smoking. ....	33– 34			
16.8	Trained Personnel. ....	33– 34			
16.9	Material Safety Data Sheets. ....	33– 34			