POWDER COATING OPERATIONS
Answers To The Ten Most Common Safety And Regulatory Questions

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Today, finishers face a host of challenges and issues including regulatory activity, rising insurance rates, worker safety, and increasing manufacturing and materials costs. Managers of paint operations that apply electrostatic powder coatings often find themselves in the middle of one or more of these issues.

This paper is designed to provide people in the finishing industry with a quick overview and reference guide to some of the most commonly asked questions regarding electrostatic powder paint shop compliance and efficiency. The paper will focus primarily on Occupational Safety and Health Administration (OSHA), American National Standards Institute (ANSI), and National Fire Protection Association (NFPA) standards as they relate to the operation of a powder coating system, and is not intended to be a substitute for actual OSHA, ANSI/NFPA and Uniform Fire Code (UFC) texts as well as state and local fire codes.

1. As it relates to our paint shop and equipment, whom should we listen to with regard to standards and compliance?

There are a number of agencies whose standards may affect your operation. These include federal, state and local agencies, all of which have the responsibility to enforce the regulations that have the force of law. Violations can result in legal actions.

Agencies

Governmental agencies issuing regulations affecting powder painting operations in the United States include the following:

OSHA, The Occupational Safety and Health Administration

OSHA's purpose is to encourage reduction of workplace hazards, research ways to deal with safety and health problems, establish rights and responsibilities for employers and employees, maintain reporting and recording systems, establish training programs, develop mandatory standards and enforcement, and to oversee state programs.

OSHA specifically states that “Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees.”

EPA, The Environmental Protection Agency

The primary federal agency in environmental law is the U.S. Environmental Protection Agency. Environmental laws and regulations are issued by the federal government, individual states, and counties, municipalities and special districts, such as sewer districts, river basin authorities and air pollution control districts. Generally, the U.S. EPA establishes regulations for water pollution, air pollution, solid wastes, and special hazards.

Local Fire Marshal and Industrial Safety Department

It is likely that your state, county or city has a Fire Marshal and/or Industrial Safety Department. Typically, these organizations are responsible for developing, adapting and/or enforcing local regulations related to fire and workplace safety.

Consensus Standards

Consensus standards are used to supplement federal, state and local regulations. Consensus standards must provide for equal or greater employee protection than federal laws/regulations. Powder painting operations are affected by the following standards:

ANSI, The American National Standards Institute

ANSI is a self-regulating, private-sector standards-developing organization in the United States. ANSI’s role is to coordinate over 250 U.S. professional and technical societies and trade associations.

NFPA, The National Fire Protection Association

NFPA codes and standards are developed by more than 225 NFPA technical committees, each representing a full balance of affected interests. All interests are afforded an equal opportunity to participate in a system that is not dominated by any particular interest, thus evolving full and complete consensus on technical issues. More than 5,000 individuals serve on NFPA committees, all on a voluntary, unpaid basis. Committees operate according to a detailed Regulations Governing Committee, and projects are administered by a Standards Council that reports to the NFPA’s Board of Directors.

UFC, The Uniform Fire Code

The Uniform Fire Code is a model fire prevention code developed by the International Fire Code Institute (IFCI) and is published by the International Conference of Building Officials (ICBO). The Uniform Fire Code is intended to maintain a safe environment in and around a building that is constructed to the standards found in the Uniform Building Code.
Although ANSI/NFPA and ICBO are not enforcement bodies, OSHA, Fire Marshals and Industrial Safety Departments look to ANSI/NFPA and UFC standards for information and guidance in development of their own standards.

2. Aren’t all of these standards essentially the same?
No, but they are similar, since most states use the Uniform Fire Code (UFC) or National Fire Protection Association (NFPA) standards as a guide. Also, many federal regulations are derived from one or both of these standards. For instance, the OSHA federal standard CFR 1910.107 related to approved electrostatic spray equipment was abstracted from NFPA 33, Standard for Spray Application Using Flammable or Combustible Materials. States and cities typically adopt the most recent edition of the UFC or NFPA 33 for their regulations.

NFPA 33 is one of the primary standards for liquid and powder finishing operations. The publication establishes standards on finishing processes covering the following areas:
- Location of Spray Application Devices
- Construction and Design of Spray Areas, Spray Rooms, and Spray Booths
- Electrical and Other Sources of Ignition
- Ventilation
- Storage, Handling, and Distribution of Flammable and Combustible Liquids
- Protection
- Operations and Maintenance
- Automated Electrostatic Spray Equipment
- Hand-Held Electrostatic Spray Equipment
- Drying, Curing, or Fusion Process

3. What are the key factors in achieving compliance for my powder coating system?
Most of the standards specific to powder coating operations cover a variety of areas, including electrostatic spray equipment, fire detection and fire extinguishing systems, design and construction of spray areas, booth ventilation, curing systems, and operation and maintenance. This paper is intended only to answer some of the most often asked questions related to powder spray equipment and powder spray booths. Consult your local safety officials for specific compliance information.

4. Many of the regulations and standards require electrostatic spray equipment that is listed. What does “listed” mean?
Listed means that an approved, nationally recognized testing laboratory such as Factory Mutual (FM) Corporation has inspected and approved the device. The device meets safety requirements established by the laboratory, bears the laboratory’s mark and is included in the list of devices that have passed their tests. These “listed” products receive manufacturing and quality audits by the agencies on a regular basis. There are several testing laboratories in the United States.

Below are selected standards and regulations for electrostatic spray devices:

OSHA
CFR 1910.107 (h)(2): “Type approval. Electrostatic apparatus and devices used in connection with coating operations shall be of approved types.”
CFR 1910.7 (a)(8): “Approved. Shall mean approved and listed by a nationally recognized testing laboratory. Refer to 1910.7 for definition of nationally recognized laboratory.”
CFR 1910.107 (i)(3): “Equipment approval and specifications. Electrostatic hand spray apparatus and devices used in conjunction with coating operations shall be of approved types. The high voltage circuits shall be designed so as to not produce a spark of sufficient intensity to ignite any vapor-air mixtures nor result in appreciable shock hazard upon coming in contact with a grounded object under all normal operating conditions. The electrostatically charged exposed elements of the handgun shall be capable of being energized only by a switch which also controls the coating material supply.”
NFPA 33, Standard for Spray Application Using Flammable or Combustible Materials.
Chapter 9 Automated Electrostatic Spray Equipment
9-5.1 Spray equipment shall be listed.
9-5.2 Spray equipment installed after December 1997 shall be listed.

Exception No. 1: This requirement shall not apply to replacement components installed on or before December 31st, 1997.

Exception No. 2: This requirement shall not apply to automatic electrostatic spray equipment where all of the following additional fire protection is provided:
(a) The flame detection system shall use optical flame detectors. In addition to the requirements in paragraphs 7-1.1 and 7-6(b), the optical flame detection system shall also activate an open head deluge system designed to discharge a minimum density of 0.6 gpm/sq. ft. (24.4 mm/min) over each affected automated zone.
(b) Manual deluge activation stations shall be installed at each personnel entrance to an automated electrostatic spray zone. These devices shall activate the open head deluge system for the affected automated zone and accomplish the requirements in paragraphs 7-1.1 and 7-6(b).
(c) A wet pipe sprinkler system shall also be provided throughout the spray booth. This system shall meet all the applicable requirements of NFPA 13, Standard for the Installation of Sprinkler Systems, for Extra Hazard (Group 2) occupancies.
(d) The automated zone open head deluge systems and spray booth wet pipe sprinkler system shall be supplied by separate or dual fed water supply piping.

(e) Automatic electrostatic equipment enclosures containing paint delivery systems shall be protected with an approved automatic fire suppression system. Activation of this system shall automatically accomplish the requirements of paragraphs 7-1.1 and 7-6(b).

Chapter 10 Hand-Held Electrostatic Spray Equipment

10-3 Hand-Held Apparatus

Hand-held electrostatic spray apparatus and devices shall be listed. The high voltage circuits shall be designed so as not to produce a spark of sufficient intensity to ignite the most hazardous of those vapor-air mixtures or powder-air mixtures likely to be encountered, nor to result in appreciable shock hazard upon coming in contact with a grounded object under all normal operating conditions.

Exception: This requirement shall not apply to replacement components of systems installed on or before December of 1997.

5. What is the difference between “listed” and “approved” equipment?

Listed, as described above, means the device has passed tests established by an approved, nationally recognized testing laboratory, such as Factory Mutual.

Only Factory Mutual Research Corporation (FM) has a procedure for testing electrostatics. FM refers to their procedure as an approval process. Successful completion of this process results in the product being “listed.”

NFPA defines “approved” as “acceptable to the authority having jurisdiction,” such as your local Fire Marshal and OSHA. The term “approved,” as used by NFPA, is not synonymous with the FM approval process. Be certain to check with local authorities to ensure the compliance of your equipment.

6. Do I need sprinklers and/or fire-detection equipment in a powder booth?

Yes. OSHA requires automatic sprinklers. NFPA, as well as many states and cities require automatic sprinklers as well as listed flame-detection equipment.

Even non-flammable powder coatings in an atomized state (powder and air mixture) can support a fire if exposed to an ignition source. However, if a fire is detected and the supply of fuel (atomized powder) is interrupted, the fire from the guns will stop.

Standards are in place to help powder coaters minimize and control powder booth fires:

OSHA

CFR 1910.107 (h) (12): “Fire Protection. All areas used for spraying, including the interior of the booth, shall be protected by automatic sprinklers where this protection is available. Where this protection is not available, other approved automatic extinguishing equipment shall be provided.”

NFPA 33, Standard for Spray Application Using Flammable or Combustible Materials.

Chapter 7 Protection

7.1 General

Spray area and mixing and storage rooms shall be protected with an approved automatic fire extinguishing system.

7.5 Protection for Automated Powder Application Equipment

Automated Powder application shall be protected further by the installation of an approved, supervised flame detection apparatus that shall, in the event of ignition, react to the presence of flame within one-half (0.5) second and shall accomplish all of the following:

(a) Shut down all energy supplies (electrical and compressed air) to conveyor, ventilation, application, transfer, and powder application equipment.

(b) Close segregation dampers in associated ductwork to interrupt airflow from application equipment to powder collector.

(c) Activate an alarm.
7. What typically causes fires in powder spray booths?
The most frequent ignition source is improperly grounded parts on the paint line, which can lead to a fire under the right conditions. NFPA has established standards to minimize potential arcing caused by ungrounded or improperly grounded parts.

NFPA 33, Standard for Spray Application Using Flammable or Combustible Materials.

13-6 Electrical and Other Sources of Ignition
13-6.2 When the object or material being coated is preheated in an oven, the controls shall be set so that the surface temperature of the object or material does not come within 50°F (10°C) of the autoignition temperature of the powder used.

13-6.3 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 10⁶ ohms (1 megohm), as measured with an instrument that applies at least 500 volts to the circuit being evaluated. This requirement shall also apply to personnel that might be in the area.

8. Are explosions possible in powder coating spray booths?
Yes, depending on the type of system. Although powder coating systems are in general far safer than comparable liquid systems, there is a potential for explosion in closed collection systems such as cyclone spray booths. As a result, these spray booths require explosion venting to an area outside the plant. Also, cyclone systems that use ductwork to transport oversprayed powder to a collector must meet certain ventilation (minimum explosive concentration or MEC) requirements listed in NFPA standards.

Cartridge spray systems are not closed collection systems, so the explosion venting and MEC requirements do not apply.

A third type of spray booth, the Nordson Cyclo-Kinetic® (CK) spray booth, is a closed collection system, so explosion venting is required. However, ductwork is not used to transport oversprayed powder to a collector, so the MEC requirements do not apply.

Selected NFPA texts related to ventilation follow:
NFPA 33, Standard for Spray Application Using Flammable or Combustible Materials.
13-7 Ventilation

13-7.2 Where powder overspray is collected at the spray area by a recovery system that is part of the spray system, the requirements of 13.7-1 shall not apply.

13-7.3 Recirculation of air:
Air exhausted from the recovery system of a powder operation shall not be recirculated unless the particulate composition of the exhaust air has been returned to an acceptable safe level and suitable equipment continuously monitors the filtration system to signal the operator and to automatically shut down the operation in the event the filtration system fails to maintain the air in this condition.

13-7.4 Deflagration venting:
Any enclosures of a powder coating operation (booth, recovery enclosure, etc.) that are effectively “tight” enclosures shall be provided with adequate deflagration venting to safely relieve internal pressure in case of mixture ignition. (See NFPA 68, Guide for Venting of Deflagrations.)

13-9 Operation and Maintenance:
The area surrounding the spray area, including horizontal surfaces such as ledges, beams, pipes, hoods and booth floors shall be maintained to prevent the accumulation of powder.

13.9.2 Surfaces shall be cleaned in such a manner as to avoid scattering powder or creating powder clouds. No scrap metal or spark producing material shall be introduced into the powders being applied. No smoking shall be permitted. Vacuum sweeping equipment, where used, shall be of a type approved for use in hazardous locations.

NFPA 68, Guide for Venting of Deflagrations
Chapter 5 Protection

5-4 Effects of Vent Discharge Ducts.

5-4.1 The vented material discharged from an enclosure during the deflagration should be directed to a safe location to avoid injury to personnel and to minimize property damage. (Example 6) (See Section 5-5.)

5-4.2 If it is necessary to locate enclosures that require deflagration venting inside buildings, the vents must not discharge within the building. Flames and pressure waves discharging from the enclosure during venting represent a threat to personnel and could damage other equipment. Therefore, vent ducts should be used to direct vented material from the enclosure to the outdoors. (Example 7)

5-4.3 If a vented enclosure is located within buildings, it should be placed close to exterior walls so that the vent ducts will be as short as possible, preferably not more than 3m (10 ft) long.

5-5 Exposure from the Venting Process:

Flames and pressure waves emerging from an enclosure during the venting process can injure personnel, ignite other combustibles in the vicinity, cause ensuing fires or secondary explosions, and cause pressure damage to adjacent buildings or equipment.

9. What is the minimum air velocity for a powder spray booth?
NFPA has no established minimum velocity level, although it must be high enough to keep the powder cloud restricted inside the booth. History has shown that an average face velocity of about 100 feet per minute (fpm) is adequate. Some powder spray booths may require higher air flows due to the location of the collector in relation to the booth openings, hot parts and the surrounding environment.

It is important to note that high air velocity can reduce first-pass transfer efficiency. It is suggested that you maintain the air velocity no higher than what is necessary to contain the powder cloud within the booth.

10. Are there environmental regulations specific to powder coating that I should be aware of?
Although there are a variety of environmental regulations that cover various areas of your operation, there are some regulations you will need to meet that are specific to powder coating:

EPA
Clean Air Act (CAA) requirements including permits to operate for BTU emissions generated during the product baking process in powder operations.

Superfund Amendment and Reauthorization Act (SARA) requirements including community right-to-know inventory reporting for powder materials.
Resource Conservation and Recovery Act (RCRA) requirements including profile of waste powder and spent filters with the local waste haulers.

For specific information on compliance issues related to your powder coating operation, consult your local agencies governing fire, plant safety and environmental requirements. You may also wish to reference the following publications:

**NFPA 33**
Standard for Spray Application Using Flammable or Combustible Materials

**NFPA 68**
Guide for Venting of Deflagrations

**NFPA 69**
Explosion Prevention Systems

**ANSI Z9.3**

**U.F.C.** Part V Article 45.

Nordson Corporation is committed to helping powder coaters meet safety and compliance issues in addition to providing the highest quality powder coating systems. For information about Nordson equipment, call 800-626-8303. Or visit us on the Internet at www.nordson.com.