

Chapter 2

Protection of Operations

Introduction

IFC Section 1503 contains the minimum requirements for the protection of operations involved in the application of flammable finishes, including requirements that address sources of ignition; the storage, use, and handling of flammable and combustible liquids; and the operation and maintenance of flammable finishing activities. IFC Section 1503 is applicable to all the activities regulated in IFC Sections 1504 through 1510.

IFC Section 1503.2 sets forth requirements for controlling sources of ignition, including the use of the appropriate electrical equipment or powered industrial trucks within hazardous (classified) locations, the specification and installation of electrical equipment that may be subject to deposits from overspray, heated surfaces such as paint heaters and open flame sources.

IFC Section 1503.3 contains minimum requirements that expand upon those contained in IFC Chapter 34 for the storage, use, and handling of flammable and combustible liquids. The requirements in this section are germane to manufacturing processes that transfer flammable liquids in either batch quantities or by pumping the liquids to the spray space. They also address the cleaning of spray finishing equipment. While the section title includes the word “storage,” all of the requirements in IFC Section 1503.3 address the use and handling of liquids.

IFC Section 1503.4 regulates the operations and maintenance of areas and equipment used for the application of flammable finishes. Its requirements focus on the use of proper tools for cleaning flammable finishing equipment, the proper disposal of wastes and any residues, and the recycling of solvents that may have been used during the application of flammable finishes or the cleaning of the equipment.

Electrical Sources of Ignition

IFC Section 1503.2.1 sets forth requirements for the control of electrical sources of ignition. For operations involving the application of flammable liquids, heated flammable or combustible liquids or combustible dusts, the focus of the requirements is to ensure electrical equipment does not constitute a source of ignition. For flammable liquids or heated flammable and combustible liquids, a release of these liquids can create a large volume of vapor that could be ignited by arcing or sparking components inside of electrical equipment, which can occur during the operation of switches or relays.



Photo courtesy of Safety Kleen, Plano, TX

Definitions

SOLVENT DISTILLATION UNIT. An appliance that receives contaminated flammable or combustible liquids and which distills the contents to remove contaminants and recover the solvents.

Key Concept

The requirements in IFC Section 1503 apply to all flammable finishing operations regulated in the IFC.

Spray rooms or spaces illuminated by electrical lamps are another potential source for ignition and fire. During spray finishing, overspray from the guns or nozzles can accumulate on the glazing protecting the electric lamps. If a sufficient depth of residue is accumulated, this material can be heated by the luminaires and ignite. If ignition occurs during the application of flammable or combustible liquids, it could result in a flash fire or deflagration.

Combustible dusts used in powder coating can also be ignited when excessive amounts of powder accumulate on hot surfaces. The concern with combustible dusts is the thickness or depth of a dust layer on electrical equipment. The dust can insulate the electrical equipment, which captures and collects additional heat. This heating can begin the pyrolysis of the combustible dusts that can result in the ignition and burning of the dust layer. If this occurs in an enclosed environment, such as the interior of a powder-coating booth, the potential for a deflagration exists, especially if the volume of combustible dust suspended in air is at or above the MEC.

Section 1502.1 defines “Flammable vapor areas” as:

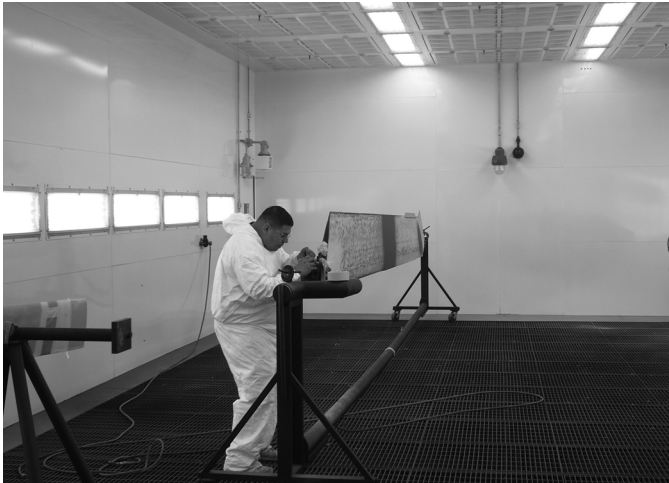


Figure 2-1:
Spraying space

FLAMMABLE VAPOR AREA. An area in which the concentration of flammable constituents (vapor, gas, fume, mist or dust) in air exceeds 25 percent of their lower flammable limit (LFL) because of the flammable finish processes operation. It shall include:

1. The interior of spray booths.
2. The interior of ducts exhausting from spraying processes.
3. Any area in the direct path of spray or any area containing dangerous quantities of air-suspended powder, combustible residue, dust, deposits, vapor or mists as a result of spraying operations.
4. The area in the vicinity of dip tanks, drain boards or associated drying, conveying or other equipment during operation or shutdown periods.

The *fire code official* is authorized to determine the extent of the flammable vapor area, taking into consideration the material characteristics of the flammable materials, the degree of sustained ventilation and the nature of the operations.

This definition states that the interior of a spray booth, the interior of mechanical exhaust ducts connected to the spraying area, or any area that is in the direct path of spray in which the atmosphere exceeds 25 percent of the LFL in air constitutes a flammable vapor area. The area in the vicinity of dip tanks, drain boards or material-handling equipment is included within the requirements of the definition (see Figure 2-1).

A question commonly posed by fire code officials is; “How do I determine the boundary of a flammable vapor area?” The answer comes from the fact that all of the flammable finishing processes addressed in this application guide require a mechanical ventilation system. The area served by such a system is considered as the boundary of the flammable vapor area. If the process being evaluated does

not have mechanical ventilation that complies with the requirements in Chapter 15 and the IMC, then one must assume that “dangerous quantities” of flammable vapor or combustible dusts are present. In such a case the code official should stop the activities until the hazard has been removed using the requirements in IFC Section 111.1. As an alternative, information in the form of a technical report and opinion should be prepared, with acceptance by the code official required in accordance with the provisions in IFC Section 104.7.2.

Item 3 in the definition of a flammable vapor area uses the term “containing dangerous quantities of air-suspended powder, combustible residue, dust, deposits, vapor or mists.” This phrase is unique because the term “dangerous” is not defined in the IFC or International Building Code® (IBC®). However, it is a well-accepted requirement in the IFC that controls for ignition sources are required in atmospheres that can exceed 25 percent of flammable vapor in air. Therefore this value should be used as the basis for determining if an area or atmosphere satisfies the definition of a “Flammable vapor area.” The fire code official is authorized to establish the boundaries of the flammable vapor area.

IFC Section 1503.2.1.1 specifies the minimum requirements for electrical equipment located inside of flammable vapor areas:

Electrical wiring and equipment in flammable vapor areas shall be of an explosion-proof type approved for use in such hazardous locations. Such areas shall be considered to be Class I, Division 1 or Class II, Division 1 hazardous locations in accordance with the NFPA 70.

Article 500 of the NEC contains the requirements for the classification and installation of hazardous (classified) location electrical equipment. The requirements for electrical equipment installed in hazardous (classified) locations serving spray application, dipping, and coating operations are found in NEC Article 516. The Division 1 and 2 boundaries for spray finishing and powder coating are found in NFPA 33, and the same boundaries for dip tanks are located in NFPA 34.

Determining and establishing the boundary of flammable vapor areas can require considerable skill and judgment of variables such as the adequacy of the mechanical ventilation system, the quantity of the release, and the temperature and pressure at the time of release. Additional information and guidance is contained in NFPA 497, *Recommended Practice for the Classification of Flammable Liquids, Gases or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*, and NFPA 499, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*.

The NEC divides hazardous (classified) locations into three broad categories for the purpose of determining the potential of fire or deflagrations for processes operating at atmospheric pressure. A properly identified hazardous (classified) location is assigned three designations:

- Class
- Division
- Group

The class designation is assigned based on the type of material. Class I materials are flammable liquids, gases or vapors. Class II materials are combustible dusts that are formulated from metals, organic materials, or carbon-formulated dusts such as charcoal or coal dusts. Class III materials are combustible flyings and flock-

Key Concept

Electrical equipment in the flammable vapor area must be listed for use in hazardous (classified) locations. Spraying spaces for flammable and combustible liquids require equipment listed for Class I, Division I locations in accordance with the NEC. Class II, Division I equipment is required in spraying spaces used for powder coating.