



Lake Havasu City Fire Department

Fire Prevention Bureau

2330 McCulloch Blvd. N.

Lake Havasu City, AZ 86403

Phone: (928) 855-1141 www.lhcaz.gov

FD Specification #09

2018 IFC, Ch. 24, 30 & 57

Rev. 9/01/2021

Flammable Finishes - Installation & Operation of Spray Booths

Page 1 of 11

OVERVIEW

Installation of open and closed spray booths used for the application of flammable finish materials requires approval of both the Lake Havasu City Fire Department (LHCFD) and the Development Services Department/Building Division (LHCDS).

PURPOSE

This fire department specification is intended to provide the necessary information to obtain a fire department construction permit to design or install any spray booth within the city limits, for the spray application of flammable and combustible materials. Where unusual industrial processes are involved, the LHCFD is permitted to require additional safeguards or modifications provided equivalent safety is achieved. Nothing in this specification is intended to be less restrictive than the applicable provisions of the International Fire Code (IFC). Where conflicts occur between provisions of this specification and IFC, the provisions of the IFC will apply.

SCOPE

This specification applies to locations or areas where the following activities are conducted:

1. The application of flammable or combustible paint, varnish, lacquer, stain, fiberglass resins, organic coatings, powder coating materials, or other flammable or combustible liquid materials that create flammable dusts or vapor conditions that are applied by means of spray apparatus in a continuous or intermittent process.
2. Use of open faced and closed spray booths is acceptable, as are dry filter and water wash air filtration systems.

DEFINITIONS

1. **Combustible liquid** is any liquid having a flash point at or above, 100° F.; a Class II or III liquid. **NOTE:** Any combustible liquid used above its flash point shall be considered a flammable liquid.
2. **Electrostatic application** applies to any equipment using electrostatically charged elements for the atomization, charging and/or precipitation of hazardous materials for coatings on articles or for other similar purposes in which the charging or atomizing device is attached to a mechanical support. Electrostatic apparatus and devices used in connection with paint spraying and paint-detearing operations must be of an *approved* type and be in compliance with IFC § 2407 *Electrostatic Apparatus*.
3. **Flammable liquid** is any liquid having a flash point below 100°F., and having a vapor pressure not exceeding 40 lbs. per square inch; a Class I liquid.

4. **Limited spraying space** is an area in which spraying operations for touch-up or spot painting of a surface area of 9 square feet or less are conducted **and not of a continuous nature**.
5. **Resin application area** is an area where reinforced plastics, polyester resins, or gel coats are used to manufacture products by hand lay-up or spray-fabrication methods.
6. **Spray booth** is a mechanically ventilated appliance of varying dimensions and construction provided to enclose or accommodate a spraying operation and to confine and limit the escape of spray vapor and residue and to exhaust it safely.
7. **Spraying room** is designed to accommodate spraying operations, must comply with building code requirements, and separated from the remainder of the building by a minimum one-hour fire barrier.
8. **Spraying space** is an area in which dangerous quantities of flammable vapors or combustible residues, dusts or deposits are present due to the operation of the spraying process. The fire code official is authorized to define the limits of any spray space.

PERMITS

1. **A Building Permit** (*Application for Building/Driveway/Fire Permits/Water Service & Land Use*) is required for both open and closed designs and *Automotive Spray Booth Electrical Submittal Requirements* information sheets are available through the Lake Havasu Development Services Department. For permit information, call (928) 453-4148.
2. **A Fire Department Construction Permit** is required to install, erect or modify a spray room, dip tank or spray booth. To obtain a spray booth permit from the Lake Havasu City Fire Department, the following items are required to be submitted for review and approval:
 - a. Floor plan to scale (minimum ¼":12"), showing the location of each spray booth located inside the building.
 - b. Indicate the duct size, diameter, and termination point of the exhaust.
 - c. Show the location of electrical controls and air supply for spraying apparatus.
 - d. Provide a single line drawing of the automatic fire sprinkler heads, pipe size, valves, and connection to the existing fire sprinkler system or an alternate extinguishing system as approved by the *International Fire Code*.
 - e. Provide all detailed manufacturer's data sheets on the spray booth construction, installation, or equipment.
3. **Other Agencies** - may require you to obtain permits and/or impose other operating standards for spray booth installation and/or operation.
 - a. **Arizona Department of Environmental Quality (ADEQ)** – for air pollution control and hazardous waste management.

- b. **Lake Havasu City Wastewater Division** – for wastewater disposal from industrial/commercial wastewater producing operations (e.g., wastewater from water wash air filtration systems, parts washing and cleaning).
4. **Inspections** - Spray booth installations require inspections for structural, mechanical, electrical, plumbing and fire systems, and will be included on the Building Permit returned to you with the approved plans. Inspections can be arranged by calling the Development Services Department and/or the Fire Department, as appropriate.

LOCATION OF SPRAY-FINISH OPERATIONS

1. Spray finishing operations conducted in buildings used for assembly, educational, institutional, and residential must be located in a spray room protected with an approved automatic fire sprinkler system and separated vertically and horizontally from other areas in accordance with the *International Building Code*. In other occupancies, spray-finishing operations must be conducted in a spray room, spray booth, or spraying space where permitted.

Exceptions:

- a. Automobile undercoating spray operations and spray-on automotive lining operations may be conducted in areas with approved natural or mechanical ventilation when utilizing class IIIA or III-B combustible liquids.
- b. Resin application of reinforced plastics with the use of chopper guns.

SPRAY BOOTH CONSTRUCTION AND INSTALLATION

1. **Booth Construction** – must be constructed of non-combustible materials other than aluminum. Sheet metal used in booth construction must be a minimum of 18-gauge for single wall structures and 20-gauge for double walled structures. Sections of the booth are allowed to be sealed with latex-based sealants and/or caulks, provided the sealant will not react with the sprayed materials.
2. **Interior Surfaces** – must be smooth to allow the free-flow of air through the booth, to prevent pocketing of residual overspray, and to facilitate cleaning of residues that build up on interior surfaces.
3. **Floors** – must be constructed of a non-combustible surface. Combustible coverings including, but not limited to, thin paper or plastic and strippable coatings may be used to facilitate cleaning operations.
4. **Exit Doors** – from pre-manufactured spray booths must not be less than 30 inches in width and 80 inches in height.
5. **Clear Space** – Clearance of at least 3 feet must be maintained on all exterior sides of a spray booth to allow for cleaning, maintenance, and inspection. Lesser distances may be allowed if the surrounding wall/partition has a fire resistance rating of at least one hour and the booth can be adequately cleaned, maintained, and inspected. In all cases, the clearance area must not be used for storage and must be kept free of combustible construction.

6. **Spray Booth Size** – The aggregate area of spray booths in a building must not exceed 10% of the floor area for the building or the basic area allowed for a Group H-2 Occupancy without area increases, as set by the IBC. The area of an individual spray booth must not exceed 1,500 square feet. An exception is allowed for one spray booth of 500 square feet as long as the other installation requirements can be met (spacing, clearances, ventilation, and ductwork, etc.)
7. **Illumination** – Glass panels used in booth lighting must be made of heat resistant, fire rated glass, and must be sealed to prevent introduction of flammable vapors, dusts, or other residues behind the glass where they may be exposed to elevated temperatures or electrical appurtenances. Surface temperature of panels must not exceed 200° F at any time.
8. **Exterior Luminaries** – Luminaries attached to the walls or ceilings of a flammable vapor area but outside of any classified area and separated from the flammable vapor areas by vapor-tight glass panels, and must be suitable for use in ordinary hazard locations. Such luminaries must be serviced from outside the flammable vapor area.
9. **Integral Luminaries** – Luminaries that are an integral part of the walls or ceiling of a flammable vapor area are allowed to be separated from the flammable vapor area by glass panels that are a part of the luminary. Such luminaries must be listed for use in Class I Division 2 or Class II Division 2 locations.
10. **Open-face Spray Booths** - must be equipped with a deflector plate extending at least 4½ inches down over the top edge of the booth opening to prevent escape of airborne vapors/overspray.

ELECTRICAL WIRING AND EQUIPMENT

1. **Electrical Wiring and Equipment in Flammable Areas** – All must be protected from flammable vapors or contact with flammable residues and be of an explosion-proof type approved for use in hazardous locations. Such areas must be considered to be Class I Division I or Class II Division I hazardous locations in accordance with the *National Electric Code (NEC)*.
2. **Areas Adjacent to Spray Booths** - Electrical wiring and equipment located outside of, but within 3 feet of the openings in a spray booth or spray room must be approved for Class I Division II or Class II Division II hazardous locations, whichever is applicable.
3. **Areas Subject to Overspray or Residues** – Electrical equipment in flammable vapor areas located that such deposits of combustible residue could accumulate must be approved for locations containing deposits in accordance with the *NEC*.
4. **Electrical Wiring and Equipment Not Subject to Deposits of Combustible Residues** located in a spraying area must be of an explosion-proof type approved for use in a Class I, Division 1 hazardous location in accordance with the *NEC*. Where portable infrared drying apparatuses are used, electrical wiring and portable drying equipment located within 18" of the floor level must be approved for Class I Division 2 hazardous locations.
5. **Metallic Parts of Drying Apparatus** - must be electrically bonded and grounded.

6. **Portable electric lamps** - used during cleaning or repairing operations must be of a type approved for hazardous locations.
7. **Portable Electric Heating/Drying Equipment** - where used in a booth, must be integrated into the interlock system so that spraying cannot be performed when the heating/drying equipment is in use, the ventilation system is operational during the drying process, and heating/drying equipment will shut down if the booth's interior temperature rises above 200°F.
8. **Metal Parts of Spray Booths, Exhaust Ducts, and Piping Systems** - conveying Class I or II liquids, ventilation system components, lighting fixtures, spray application equipment and/or systems, material containers, work pieces, and work stands must be electrically grounded in accordance with the *NEC*.

CONTROL OF SOURCES OF IGNITION

1. **Open Flames and Sparks** – Open flames and spark producing devices must not be located in a flammable vapor area and must not be located within 20 feet of such area unless separated by a permanent partition.
2. **Heated Surfaces** - having a temperature sufficient to ignite vapors must not be located in vapor areas. Space heating appliances, steam pipes, or hot surfaces must be located such that they are not subject to deposits of residues.
3. **Smoking is Strictly Prohibited** – in flammable vapor areas and within 20 feet of a hazardous area. **"NO SMOKING"** signs are to be conspicuously posted.
4. **Welding/Hot Work** – is strictly prohibited in spray booths, spray areas, and in areas adjacent to spraying operations that can contain flammable vapors (a minimum separation distance of 20 feet is suggested). **"NO WELDING"** signs must be conspicuously posted in the area, and signs prohibiting welding/hot work must be posted with the following warning:

NO WELDING

The use of welding or cutting equipment in or near this area is dangerous because of fire or explosion hazards. Welding and cutting shall only be done under the supervision of the person in charge.

VENTILATION SYSTEM(S) CONSTRUCTION AND INSTALLATION

1. **Mechanical Ventilation** – of flammable vapor areas must be provided in accordance with sections 502 and 510 of the *International Mechanical Code*. Mechanical ventilation must be kept in operation at all times while spraying operations are being conducted and for a sufficient time thereafter to allow vapors from drying articles to be exhausted. Spraying equipment must be interlocked with the ventilation so that spraying operations cannot be conducted unless the ventilation system is in operation.
2. **Interlocks** - must be provided that link all the following components of the spraying system and will prevent booth operation if any are inoperable:
 - a. Ventilation System

- b. Booth Doors – must be closed for booth to operate. (Not applicable to approved open-faced booths); AND
 - c. Interior Spray Booth Temperature –not in excess of 200°F or flash point of material being sprayed.
3. **Exhaust Filters** - are required to capture overspray. Discarded filter pads must be immediately removed to a safe, detached location or placed in a non-combustible container with a tight fitting lid and disposed of properly.
 4. **Vapor Pick-Up** - The mechanical ventilation systems must pick up flammable vapors within 6 inches of the floor.
 5. **Air Recirculation Systems** - are prohibited unless the system can be proven to reduce the flammable vapor concentration below 25% of the sprayed material's lower flammability limit at all times, and the system is alarmed to shut-down operations when the vapor concentration exceeds 25% of the sprayed material's lower flammability limit
 6. **Dry Ventilation/Filtration Systems** - must be compatible with the material(s) being sprayed. They are not allowed where spray residue would be susceptible to spontaneous ignition or heating, either by reaction with the filter media itself, reaction with other spray materials, or reaction with the residue of a different type of material.
 7. **Access Ports** - Ventilation systems must be equipped with access ports to allow for inspection and maintenance, including inspection and maintenance of baffles, deflectors, fan assemblies, and fire suppression system components.
 8. **Ventilation System Protection** - Ventilation systems must be equipped with automatic sprinkler systems or other approved fire suppression systems.
 9. **Ducts** – Each spray booth and spray room shall have in independent duct system discharging to the outside unless approved by the Fire Code Official.
 10. **Duct Termination Points** - Exhaust ducts discharging explosive or flammable vapors, fumes or dusts to the atmosphere shall be not less than 30 ft. from the lot line; 10 ft. from openings into a building; 6 ft. from exterior walls and roofs; 30 ft. from combustible walls or openings into the building that are in the direction of the exhaust discharge; and 10 ft. above adjoining grade.
 11. **Air Velocity** – Ventilation systems must be designed, installed, and maintained such that the flammable contaminants are diluted in non-contaminated air to maintain concentrations in the exhaust airflow below 25% of the contaminant's lower flammable limit (LFL). In addition, the spray booth shall be provided with mechanical ventilation so that the average air velocity through openings.
 12. **Open-face or open-front spray booth.** For spray application operations conducted in an open-face or open-front spray booth, the ventilation system shall be designed, installed and maintained so that the average air velocity into the spray booth through all openings is not less than 100 feet per minute. **Exception:** For fixed or automated electrostatic spray application equipment, the average air velocity into the spray booth through all openings shall be not less than 50 feet per minute.

13. **Enclosed spray booth or spray room with openings for product conveyance.** For spray application operations conducted in an enclosed spray booth or spray room with openings for product conveyance, see **IFC § 2404.7.3.2.**
14. **Maintaining Air Velocity** – Visible gauges, alarms or pressure-activated devices shall be installed to indicate or ensure that the required air velocity is maintained.
15. **Multiple Spray Booths** - may be allowed to have a common ventilation system provided all the following conditions are met and approved:
 - a. The same types of material, or compatible materials, are being used in each booth.
 - b. Each booth's exhaust duct is manifolded prior to commingling of vapors.
 - c. Each booth's exhaust duct, and the common ductwork, are all protected by separate automatic fire suppression system fittings (sprinkler heads or discharge nozzles).
 - d. Ventilation airflow within each booth meets or exceeds the airflow requirements when all booths are in operation.
 - e. When the booths' exhausts are connected to a treatment device used for air pollution control purposes.
2. **Exhaust Fans, Motors & Belts** – Electrical motors driving exhaust fans must not be placed inside booths or ducts. Fan rotating elements must be nonferrous or non-sparking or the casing shall consist of, or be lined with, such material. Belts must not enter the duct or booth unless the belt and pulley within the duct is tightly enclosed.

FIRE PROTECTION

Approved Automatic Extinguishing Systems - Spray booths and spray rooms must be protected by an approved automatic fire extinguishing system including booths with water wash air filtration systems. Protection must extend to exhaust plenums, exhaust ducts and both sides of dry filters when such filters are used.

1. The sprinkler system for each spray area must be controlled by a separate listed indicating valve.
2. The water supply must be sufficient to supply all sprinklers likely to open in a fire incident without depleting the water source. The fire sprinkler system must be designed for an extra hazard Group II or in resin application areas the system must be designed for a minimum of an Ordinary Hazard Group II.
3. **Protection of Sprinklers** – Automatic sprinklers installed in spray areas must be protected from the accumulation of residue. Bags used as protective coverings must be .076mm polyethylene or cellophane or must be thin paper. Automatic sprinklers contaminated by overspray particles must be replaced with new automatic sprinklers of the same type and temperature.
4. **Portable Fire Extinguishers** – must be located in conspicuous locations along normal paths of travel and where special hazards exist. A minimum of one (1) 40-BC extinguisher with a travel distance of thirty feet (30') or an 80-BC extinguisher with a fifty-foot (50') travel

distance is required for spraying areas. Extinguishers having a gross weight not exceeding forty (40) pounds must be installed so that the top is not more than five (5) feet above the floor. For extinguishers exceeding forty (40) pounds the top must be installed not more than 3' 6" above the floor.

FLAMMABLE/COMBUSTIBLE MATERIALS HANDLING

1. **General storage, use, and handling** - of flammable or combustible liquids used in the spraying operation must be in accordance with *IFC Chapter 57, Flammable, and Combustible Liquids*. The more common requirements covering flammable/ combustible materials used in spray coatings operations (solvents, paints, coating materials) are as follows:
2. **Flammable/Combustible Liquids** - in quantities over 10 gallons (aggregate) must be stored in a flammable liquids cabinet, or in a room designed for storage of flammable/combustible liquids, such as paint storage locker or paint mixing room.
3. **Containers** - supplying flammable/combustible finishing materials to spray nozzles must be kept closed at all times except when adding or removing material. Containers must be supported or resting on the floor of the spray area, not handheld. Gravity feed systems must have a maximum container capacity of 10 gallons.
4. **Solvents** - used for cleaning of spray finishing equipment must be contained in a cleaning machine approved for such purpose, or within a spray booth. When solvent cleaning is performed inside a spray booth, either on spray coating equipment or the booth itself, the booth's ventilation system must be operating for the duration of cleaning operations.
5. **Storage** - Flammable/combustible finishing materials exceeding the amounts shown in IFC Table 5003.1.1(1) require storage in a flammable liquids cabinet or in an acceptable alternative storage facility such as a paint locker or paint room:

IFC Table 5003.1.1(1) MAQ per Control Area of
Hazardous Materials Posing a Physical Hazard Used in an Open System

Class 1A Fl. Liquid	10 gallons
Class 1B & 1C Fl. Liquid	30 gallons
Class II Comb. Liquid	30 gallons
Class III Comb. Liquid	80 gallons
Class III Comb. Liquid	3,300 gallons*

MAQ may be increased 100% in buildings equipped throughout with an approved automatic sprinkler system in accordance with IFC [§ 903.3.1.1](#), except where noted.

*Quantities shall not be limited in a building equipped throughout with an approved automatic sprinkler system in accordance with [Section 903.3.1.1](#).

6. **Waste Containers** - (cans or drums) must be available to contain any hazardous materials or hazardous wastes removed from the booth. These include paints and other coatings,

solvents, residues, waste filters, rags, paper, or plastic sheeting, and solvents. Containers must be kept closed when not in use and must be labeled with their contents.

7. **Valves** - must be provided at both ends of a system delivering flammable/combustible finishing material. If the material is pumped using a positive displacement pump, the delivery system must be provided with a pressure relief valve that feeds back to the input/suction line or to a safe location.
8. **Grounding** - All parts of flammable finish transfer and/or application systems must be grounded. Separate parts of the system must be grounded to each other to reduce the potential for static discharge.
9. **Storage of Hazardous Materials** - at a facility in excess of 55 gallons of liquid, 500 lbs. of a solid, or 200 ft³ of a gas (compressed or cryogenic), requires completion and submittal of a Hazardous Materials Inventory Statement (HMIS) to the LHCDF Fire Prevention Bureau.

ADDITIONAL REQUIREMENTS FOR POWDER COATING SYSTEMS

In addition to meeting, the requirements contained in ***IFC Sections 2406 and 2407***, powder-coating systems must comply with the standards of Sections 1 - 6 of this LHCDF Specification for general flammable finish spray application operations.

Additional requirements for are as follows:

1. **Ventilation Systems** - for powder coating booths must be sufficient to maintain coating booth atmosphere below 1/2 the minimum explosive concentration of the material being applied.
2. **Flame Detection Systems** - Powder coating operations must be equipped with a supervised flame detection system that will react to flame detection within 0.5 seconds. The detection system must cause the shutting down of energy supplies to any conveyor systems running through the booth, ventilation systems, powder application equipment (conveying, application and powder collection equipment), closing of dampers that connect the coating operations to the powder collection equipment (if they are separate systems), activation of the fire suppression system, and activation of an alarm system.
3. **Parts Preheating Systems** - must be adjustable so that the temperature of the parts being preheated, or the temperature of the system, if in close proximity to the spray booth, can be kept at a temperature below the ignition temperature of the powder coating material to be applied to the heated parts.
4. **Drying, Curing, Fusion Ovens** - and other equipment shall comply with *IFC Chapter 21, Industrial Ovens*.
5. **Curing Ovens** - must be equipped with interlocks to shutdown the oven should any part of the ventilation system fail (intake or exhaust air in either the burner or processing sections of the oven systems).

INDOOR MANUFACTURING OF REINFORCED PLASTICS (USE OF RESIN)

Indoor manufacturing processes involving spray or hand application of reinforced plastics and using more than 5 gallons of resin in a 24-hour period shall be in accordance with IFC §§ 2409.2 through 2409.6.1.

2409.2 Resin application equipment. Equipment used for spray application of resin shall be installed and used in accordance with IFC § 2408 and §§ 2409.3 - 2409.6.1.

2409.3 Fire protection. Resin application areas shall be protected by an *automatic sprinkler system*. The sprinkler system design shall be not less than that required for Ordinary Hazard, Group 2, with a minimum design area of 3,000 square feet. Where the materials or storage arrangements are required by other regulations to be provided with a higher level of sprinkler system protection, the higher level of sprinkler system protection shall be provided.

2409.4.1 Handling of excess catalyzed resin. A noncombustible, open-top container shall be provided for disposal of excess catalyzed resin. Excess catalyzed resin shall be drained into the container while still in the liquid state. Enough water shall be provided in the container to maintain a minimum 2-inch water layer over the contained resin.

2409.4.2 Control of overchop. In areas where chopper guns are used, exposed wall and floor surfaces shall be covered with paper, polyethylene film or other *approved* material to allow for removal of overchop. Overchop shall be allowed to cure for not less than 4 hours prior to removal.

2409.4.2.1 Disposal. Following removal, used wall and floor covering materials required by § 2409.4.2 shall be placed in a noncombustible container and removed from the facility.

2409.4.3 Storage and use of hazardous materials. Storage and use of organic peroxides shall be in accordance with Section 2408 and Chapter 62. Storage and use of flammable and *combustible liquids* shall be in accordance with Chapter 57. Storage and use of unstable (reactive) materials shall be in accordance with Chapter 66.

2409.5 Sources of ignition in resin application areas. Sources of ignition in resin application areas shall comply with Section 2403.2.

2409.6 Ventilation. Mechanical ventilation shall be provided throughout resin application areas in accordance with § 2404.7. The ventilation rate shall be adequate to maintain the concentration of flammable vapors in the resin application area at or below 25 percent of the LFL. [Mechanical ventilation of flammable vapor areas shall be provided in accordance with § 502.7 of the **International Mechanical Code.**]

Exception: Mechanical ventilation is not required for buildings that have 75 percent of the perimeter unenclosed.

2409.6.1 Local ventilation. Local ventilation shall be provided inside of workpieces where personnel will be under or inside of the workpiece.

This specification is intended to be used as a guide. For details that may not be contained in this specification, please refer to the listed references.

REFERENCES

2018 IFC Ch. 24, *Flammable Finishes*

2018 IFC Ch. 30, *Industrial Ovens*

2018 IFC Ch. 57, *Flammable and Combustible Liquids*

Note: This FD Specification is intended to be a guide only. For full installation, fire-flow, location, distribution, and maintenance requirements, refer to the references above. Where conflicts exist between this document and the applicable codes and standards, the above references must supersede.

APPROVED:  _____
Scott Hartman, Fire Marshal

DATE: 9/1/2021