

A Guide to ICC Spray Booth Codes

The following is a discussion of the 2003 ICC codes and standards adopted in 48 of 50 states. The first section deals with **Fire and Life Safety**, the second section deals with **Ventilation**. This limited discussion is by no means complete but offers and cross-references the major rules and regulations. This guide is intended to assist all code consultants, plan reviewers, and authorities having jurisdiction in determining the applicability of the new codes and standards. It is imperative that code enforcement be consistent and fair in all jurisdictions. Help us refine this guide; modifications will be posted to our website: www.boothandburner.com . We appreciate any and all feedback.

WA Adopted Codes and Standards

On July 1, 2004, WA enacted RCW 19.27 and WAC 51-52, adopting the International Building, Mechanical, Fire, and Fuel Gas Codes as published by the International Code Council. RCW 19.28.031 adopts the "national electrical code". WAC 296-46B-010 further defines that as the 2002 National Electrical Code (NFPA 70).

The International Fire Code 102.6 adopts by reference all the ICC Codes and a number of NFPA standards, notably:

NFPA 30 (Flammable and Combustible Liquids Code)
NFPA 33 (Spray Application Using Flammable or Combustible Materials)
NFPA 86-99 (Ovens and Furnaces)
NFPA 101-00 (Life Safety Code)

The International Mechanical Code 102.8 adopts by reference all the ICC Codes and a number of NFPA standards, notably:

NFPA 91 (Exhaust Systems for Air Conveying of Vapors, Gases, Mists)
Note:The series of Uniform Building Codes, specifically the Uniform Fire Code (NFPA 1), are no longer adopted in WA.

Fire and Life Safety

Applicable Provisions of the International Building Code

306.1 defines assembly, disassembly, fabrication, finishing, manufacturing, and repair operations to be Factory Industrial Group F occupancy. 306.2 further defines automobiles to be a **Factory Industrial F-1 occupancy**. 307.4 defines Class I, II, or IIIA flammable liquids used or stored in closed containers or systems pressurized at more than 15 psi, (paint spraying), to be **High-Hazard Group H-2**. 307.5 defines Class I, II, or IIIA flammable liquids used or stored in

closed containers or systems pressurized at less than 15 psi, (paint mixing and storage), be High-Hazard Group **H-3**.

Auto Body Repair Shops are an F-1 occupancy with allowed H-2 and H-3 areas within that, per 307.9.3, must comply with Section 416 (Application of Flammable Finishes), and the International Fire Code.

Table 302.3.2. requires the H-2 areas to be separated from F-1 areas by 2 hour walls, and H-3 areas by one hour walls.

415.3 requires mix rooms larger than 500 square feet to be located on an outside wall. However NFPA 33, 6.3.2 and IMC, 502.8.1.1 limit **mixing rooms** to a maximum 150 square feet. Spray paint booths are excepted from being located on outside walls.

415.3.1.2. If the combined H-2 and H-3 areas in the F-1 building exceed 1,000 square feet, all building walls must be set back from property lines at least 30 feet.

416.3 requires spraying spaces, spraying areas not in spray rooms or booths to be enclosed by curtains. 416.4 requires fire protection in all spray and storage rooms.

1033.1.9 and 1008.1.9 require personnel doors in H-2 and H-3 areas to be (cross-bar or push-pad type) panic hardware opened, if the door has to have a latch or lock. Brixon style latches are no longer allowed on personnel doors. NFPA 101, 7-2.1.8.1 specifies that a door normally required to be kept closed shall be self-closing or automatic-closing. Drive-through doors that are not required personnel egresses may still have slide bolts and Brixon style latches. 1008.1.6 limits personnel door threshold heights to ½ inch.

Table 1018.1 specifies a minimum of 2 exits but Table 1018.2 allows H-2 and H-3 areas to have one exit if there is a maximum travel distance of 25 feet to any exit. Note: the International Fire Code 1015.1 specifies that the travel distance be “measured from the most remote point” “to an exit along the natural and unobstructed path of egress travel”. The 25 foot rule must consider walking around an automobile. This requires nearly all spray booths to have two exit doors. NFPA 101, 7.11.4 (1) requires two means of egress from any hazardous area over 200 square feet. NFPA 101, 40.2.4.1.1 requires two means of egress from every section of an industrial occupancy. So, spray booths less than 200 square feet in non-industrial occupancies could have only one personnel door.

Applicable Provisions of the International Fire Code (IFC)

105.6.17 (2.) An operational permit is required to store, handle or use Class I liquids in excess of 5 gallons.

105.7.7 and 105.7.10 require permits for all spray rooms, booths and ovens.

906 requires minimum 4-A fire extinguishers with a maximum travel distance of 75 feet, located in “conspicuous locations” not “obstructed or obscured from view”. The extinguishers cannot exceed 40 pounds and be at least 4 inches above and not over 5 feet from the floor.

Chapter 15 defines Limited Spraying Space, Spray Booth, and Spray Room.

1504 specifies that Spray Booths be non-combustible, 18 gage single-skin, 20 gage double-skin, smooth interior surfaces, and personnel doors to be a minimum 30 inches wide and 80 inches high. Spray booths are to have a clear space of 3 feet around. Spray Booths may be closer to or directly against noncombustible outside walls or one hour rated interior walls.

The aggregate area of Spray Booths may not exceed 10% of the building’s area and no individual Spray Booth may exceed 1,500 square feet. In very small buildings, Spray Booths 500 square feet or less may exceed the 10% rule.

1504.1.4 and IMC, 502.7.2, a **Limited Spraying Space** is used for non-continuous touch-up or spot painting of a surface area of **9 square feet or less**. No fire protection or explosion venting is required. All wiring 20 feet beyond the space and within 10 feet of the floor has to be Class 1, Division 2.

1504.2.6 and IMC, 502.7.3.6 and 511.2 require exhaust ducts conveying flammable vapors (defined in the IBC, Section 415, as concentrations exceeding 10% of the solvent’s LFL), fumes, or dusts to terminate 30 feet from any property line and 6 feet above the roof. Exhaust ducts carrying only filtered sanding dust to be 10 feet from the property line and 3 feet above the roof. Environmental air (no dust, and flammable vapors concentrations less than 10% of the solvent’s LFL) may exhaust three feet from property lines, no height rule. Environmental air ducts are not defined in the ICC codes. However, for reference, the Uniform Mechanical Code, 1997, section 502, states: *Environmental Air Duct is ducting used for conveying air ... to and or from occupied areas ... through other than heating or air conditioning, such as ventilation for human usage...* The environmental air duct setbacks have been improperly used for sanding exhaust box exhausts.

1504.5.3 allows listed inside-access lights to be listed as Class I, Division 2.

1504.6 requires fire protection throughout all spraying areas, exhaust plenums (including pits), exhaust ducts, and both sides of dry filters.

1504.7.2.1 requires interlocks to shut off spraying air during bake cycles, 3 minute minimum purge cycle before baking, and a maximum 200 degrees F. on the high temperature limit switch.

2103.4 and NFPA 86, 3-1.4.2, and 3-4.3.13 require roofs and floors near bake booths and hot ducts to be insulated and ventilated to prevent surface temperatures of combustible surfaces from exceeding 160 degrees F.

Applicable Provisions of NFPA 33

1.6 defines Limited Finishing Workstation, Preparation Workstation, Spray Booth, and Spray Room.

4.2.1 classifies all spray areas to be Class I, Division I locations. 4.3 classifies specified adjacent areas to be Class I, Division 2.

4.5 requires all electrically conductive parts of the spray booth, exhaust ducts, and spray equipment to be electrically bonded and grounded. NFPA 86, 3-2.14, and 4-1.2 require the metal frames of ovens to be grounded. NFPA 91, 5-2.1 specifies bonding and grounding with a resistance less than 1.0×10^{-6} ohms to ground.

5.2.1 requires all overspray filters to have visible gauges.

6.3.2 and IMC, 502.8.1.1 limit mixing rooms to a maximum 150 square feet and to be designed to contain a spill of the contents of the room. Fire protection is required and all wiring and electrical devices to be Class I, Division 1. IMC,

502.8.1.1(5.) Exhaust shall be taken from a point within 12 inches of the floor.

6.3.5 limits mixing room's flammable liquid quantities to 2 gallons per square foot and spray areas to a maximum of 60 gallons. Quantities exceeding these limits must meet the requirements of NFPA 30.

11.3 Spray booths used as ovens must comply with NFPA 86, for Class A Ovens.

12.2 Preparation Workstations must comply with the requirements of an unenclosed spray area if they exceed the limitations of a Limited Finishing Workstation.

12.3 Limited Finishing Workstations must have curtains or partitions, fire protection, and spray a maximum one gallon of paint per 8 hours.

A.7.2.4 recommends that fire sprinklers in ceilings over spray booths be rated at 286 degrees F. Fire sprinklers inside spray booths and rooms should be no more than four feet from sidewalls, extra hazard, group 2 design, 90 square feet max. spacing, max. 12 feet apart including all ductwork, and controlled by a separate control valve.

Applicable Provisions of NFPA 86 - Ovens and Furnaces

3-2.14 specifies: "The metal frames of furnaces shall be electrically grounded." This is rarely ever done. With the high air flow, static charges build up and can ignite flammable vapors.

4-2.2.1 specifies: "The fuel-burning system design shall provide for an adequate supply of clean combustion air for proper burner operation." Burner air ducting is often not done by installers on indirect-fire burners that use "flame guns" such as all Power Flame burners. The burner fans then intake dusty shop air and plug up.

5-7.2.1 specifies: "Each main and pilot fuel gas burner system shall be separately equipped with two safety shutoff valves piped in series." This is an old IRI rule that is now adopted by code. The gas modulating are allowed to be one of the safety shutoff valves if listed to do so.

5-8.1 specifies: "A low (fuel) pressure switch shall be provided and shall be interlocked with the combustion safety circuitry." Many heaters are supplied with a high fuel pressure switch only.

Applicable Provisions of NFPA 91 – Exhaust Systems

2-3.1 requires exhaust ducts subject to particulate build-up to have access doors at all elbows, junctions, and vertical ducts, and door spacing shall not exceed 12 feet.

2-6.1 and IMC, 510.8.2 require exhaust ducts handling flammable vapors and/or combustible material, with fire protection, to maintain 6 inches clearance from combustibles unless protection specified in Table 2-6.1 is used.

2-6.2 specifies that exhaust ducts operating at temperatures above 140 degrees F. shall have clearances from combustibles of not less than 18 inches, no exceptions listed. Non-recirculating bake booths would have to comply with this rule for any exhaust ducts used for bake exhaust.

6-1 and IMC, 510.7 allow no fire protection for exhaust ducts of 10" or less dia.

Application of the International Fuel Gas Code

The International Mechanical Code, 101.2 and 301.3 states: “.....fuel gas-fired appliancesshall be in accordance with the *International Fuel Gas Code*.” *International Fire Code* (IFC), Section 1504, Spray Finishing, 1504.1.2 Spray booths. “The design and construction of spray booths shall be in accordance with, and NFPA 33.”

NFPA 33, A.11.3, “When a spray booth or spray room is used for drying or curing at elevated temperatures in accordance with Section 11.3, it is considered a “Class A” oven or furnace”

IFC, Section 1504, Spray Finishing, 1504.7.2 Drying apparatus. “Fixed drying apparatus shall comply with this chapter and the applicable provisions of Chapter 21. (Industrial Ovens)

IFC, Chapter 21, Industrial Ovens, Section 2101, 2101.1, Scope. (Industrial ovens shall comply withthe *International Fuel Gas Code*.....” 2102.1 Definitions. Furnace Class A. “An oven or furnace that has heat utilization equipment wherein there is a potential explosion or fire hazard that could be occasioned by the presence of flammable volatiles or combustible materials processed or heated in the furnace.” “Note: Such flammable volatiles or combustible materials can, for instance, originate from the following: 1. Paints from finishing processes, such assprayed and impregnated materials.”
WA Administrative Code 51-52-0101 states: “The installation offuel-gas fired appliances.....shall be regulated by the *International Fuel Gas Code*.” (IFGC)

These codes establish that a spray booth with a heater, whether for spraying or baking, is a Class A oven, and must comply with the *International Fuel Gas Code*.

Applicable Provisions of the International Fuel Gas Code

101.2 Scope. “This code shall apply to the installation offuel-gas utilization equipment and related accessories.....”

101.2.3 Gas utilization equipment. “Requirements for gas utilization equipment and related accessories shall include installation, combustion and ventilation air and venting and connections to piping systems.”

301.3 Listed and Labeled. “Appliances regulated by this code shall be listed and labeled unless otherwise approved in accordance with Section 105.” Section 105 variously states: “.....the code authority shall have the authority to grant

modifications for individual cases, provided the code official shall first find that special individual reason makes the strict letter of this code impractical and that such modificationdoes not lessen health, life, and safety requirements.”

The listed/unlisted issue is not a “strict letter” technicality-type issue. The listed requirement is fundamental and important enough to be the first regulation of the *International Fuel Gas Code*.

Modification, by waiving the listing, requires that there be a “special individual reason making the strict letter of the code impractical”. With dozens of listed spray booths with heaters for sale, the “special individual reason” has to be that the buyer chose not to pay extra for a listed spray booth with heater. The buyer’s purchasing choice made the requirement for listing “impractical”, to the buyer only.

301.3 further states: “The approval of unlisted appliances in accordance with Section 105 shall be based upon approved engineering evaluation.” showing that modification of the requirement for a listed spray booth with heater “does not lessen health, life, and fire safety requirements.” (105.1) The burden of code compliance proof and costs for an “engineering evaluation” is the buyers, having chosen an unlisted spray booth with heater.

WA RCW 18.43.020 Definitions (5) “Practice of engineering:such professional services as.....evaluation.....for the purpose of assuring compliance with specifications and design in connection with anyequipment.....” “A person shall be construed to practiceengineering.....represents himself or herself to be a professional engineer.” (2) “.....as attested by his or her legal registration as a professional engineer.” We add this as a booth manufacturer publishes a letter, trying to avoid the requirement for listing, that is signed by their “engineer/technician”.

Ventilation

IFC 1504.2.3 and IMC, 502.7.3.3 require a minimum **average** air velocity of 100 feet per minute across the direction of air flow of all spraying operations. All Limited Finishing Workstations, Preparation Workstations, Spray Booths, and Spray Rooms:

NFPA 33, 1.6.29 and 5.2 and NFPA 91, 2-1.3 and IMC, 510.3 require enough ventilation to maintain a maximum concentration of flammable vapors to 25% of the LFL.

NFPA 33, 6.3.2 and IMC, 502.8.1.1 require mixing room ventilation to be “in operation at all times” and to be a minimum 150 cfm.

IMC, 503.2 requires all exhaust fan parts that come in contact with flammable vapors, fumes, or dusts shall be of nonferrous or non-sparking materials and that the fan bearings shall not be within the airstream. This **outlaws squirrel-cage fans as exhaust fans.**

Note: the following rules pertain to all uncontained spraying operations. For full cabin, contained air, Spray Booths, see above.

IFC 1504.1.4.3 and IMC, 502.7.2, Limited Spraying Space ventilation is required at 6 air changes per hour.

NFPA 33, 12.2 Preparation Workstations must comply with the requirements of an unenclosed spray area if they exceed the limitations of a Limited Finishing Workstation.

NFPA33,12.3 Limited Finishing Workstations must have a dedicated make-up air supply and plenum, and a dedicated mechanical exhaust and filtration.

NFPA33,A.5.3 ***Make-up Air***. All spray areas require make-up air (See IMC 510.5.5) Natural infiltration ventilation is allowed, but additional make-up air should be provided if the volume of the building is not at least 20 times the volumetric capacity of the exhaust fans (that are capable of three air changes per hour in the spray area and per IFC 1504.2.3 and IMC, 502.7.3.3: an average air velocity of 100 feet per minute across the direction of air flow.). *Example: 10,000 cfm (exhaust fan) x 20 = 200,000 cubic foot building, if the roof height were 15 feet, the minimum floor area for natural ventilation would be 13,334 square feet. A smaller building requires mechanical make-up air ventilation.* Also, it is recommended that all intake and exhaust filters be baffled to prevent more than 200 feet per minute velocity through any filter. *Note: these appendix "shoulds" can be "shalls" at the prerogative of the code official and should be presumed to be required unless specifically allowed by the code official.*

IMC, 508.1.1 Makeup air temperature. The temperature differential between makeup air and the air in the conditioned space shall not exceed 10° F. *Note: this rule pertains to Commercial Kitchen Makeup Air, however as no other specific rule pertains to spraying operations, it may be applied by the code official by authority of IMC 102.9: Requirements not covered. This rule requires a heated air makeup unit except where "makeup air does not decrease the comfort conditions of the occupied space".*

NFPA 33, 6.3.2 and IMC, 502.8.1.1 require mixing room ventilation to be "in operation at all times" and to be a minimum 150 cfm.

IMC, 501.3 specifies that where mechanical exhaust is required that the ventilated space "shall be maintained with a neutral or negative pressure". *This*

requires that make-up air sizing be such that ex-filtration of dust or fumes does not occur into adjoining areas.

NFPA 91 – Exhaust Systems, Table A-2-1.5 suggests exhaust duct diameter sizing to allow 1,000-2,000 feet per minute velocity.