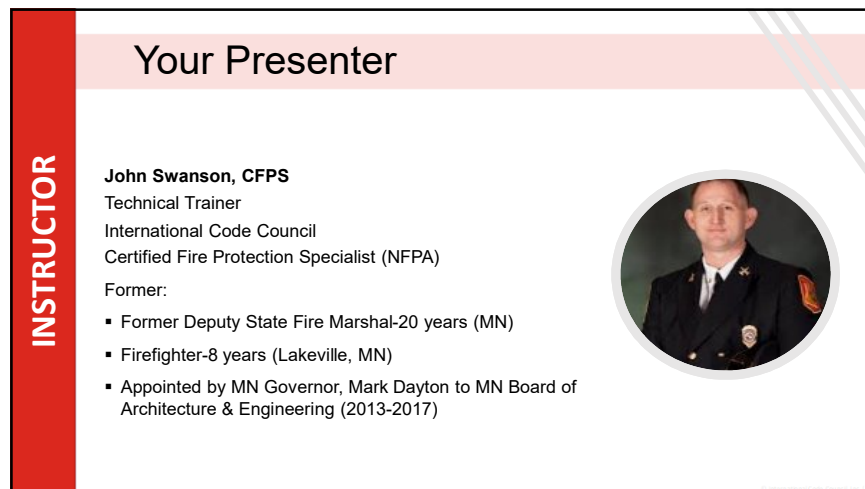




1



2



3



4

Course Schedule

5

GOAL & OBJECTIVES

Goal:

Enhance code official, design professional, contractor and other interested persons' 2024 *International Fire Code*® comprehension



6

GOAL & OBJECTIVES

2024 IFC Essentials Objectives

After this class:

- 1) Recall the 2024 IFC scope and purpose
- 2) Provide examples of common fire hazards and describe how the 2024 IFC addresses correction, mitigation or elimination



7

GOAL & OBJECTIVES

2024 IFC Essentials Objectives (cont'd)

- 3) Summarize how the 2024 IFC addresses life safety and fire protection in building design and construction
- 4) Discuss how the 2024 IFC applies to building and facility maintenance for fire and life safety
- 5) Generalize how the 2024 IFC addresses hazardous material controls



8

COURSE OUTLINE

- Part I - Code Administration and Enforcement
- Part II - General Safety Provisions
- Part III - Site and Building Services
- Part IV – Fire and Life Safety Systems and Features
- Part V - Special Processes and Building Uses
- Part VI – Hazardous Materials
- Part VII - Referenced Standards
- Part VIII - Appendices



9

Code Administration and Enforcement

PART I



10

INTRODUCTION TO BUILDING AND FIRE CODES



11

IFC Purpose

- Minimum requirements for
 - Reasonable level of life safety and property protection
 - New and existing buildings, structures, premises
 - First responder safety during emergencies

12

The IFC and every chapter opens with a “scoping statement” that describes the chapter’s purpose and what it regulates.

13

IFC Scope

[A] 101.2 Scope. This code establishes regulations affecting or relating to structures, processes, premises and safeguards regarding all of the following:

1. The hazard of fire and explosion arising from the storage, handling or use of structures, materials or devices.
2. Conditions hazardous to life, property or public welfare in the occupancy of structures or premises.
3. Fire hazards in the structure or on the premises from occupancy or operation.
4. Matters related to the construction, extension, repair, *alteration* or removal of fire protection systems.
5. Conditions affecting the safety of firefighters and emergency responders during emergency operations.

14

Chapter References

- Scoping statement may refer to other chapters

3201.1 Scope. *High-piled combustible storage* shall be in accordance with this chapter. In addition to the requirements of this chapter, the following material-specific requirements shall apply:

1. Aerosols shall be in accordance with Chapter 51.
2. *Flammable and combustible liquids* shall be in accordance with Chapter 57.
3. Hazardous materials shall be in accordance with Chapter 50.
4. Storage of combustible paper records shall be in accordance with NFPA 13.
5. Storage of *combustible fibers* shall be in accordance with Chapter 37.
6. General storage of combustible material shall be in accordance with Chapter 3.

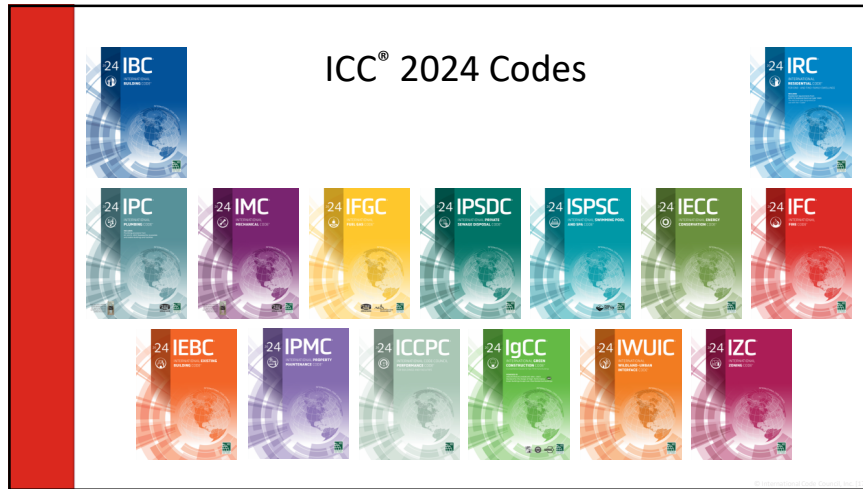
15

Compatibility

- All model I-Codes intended to work together
 - Not all jurisdictions use all I-Codes
 - Mechanical, fuel gas, plumbing
- IFC includes references to IBC, IMC, IPC
- IFC application to *International Residential Code*
 - Construction: Access, water supplies, addressing
 - Operational and maintenance: All



16



17

Code Development Correlation

SECTION 101—SCOPE AND GENERAL REQUIREMENTS

[A] 101.1 Title. These regulations shall be known as the *Fire Code* of [NAME OF JURISDICTION], hereinafter referred to as "this code."

[A] 101.2 Scope. This code establishes regulations affecting or relating to structures, processes, premises and safeguards regarding all of the following:

SECTION 202—GENERAL DEFINITIONS

[BG] 24-HOUR BASIS. The actual time that a person is an occupant within a facility for the purpose of receiving care. It shall not include a facility that is open for 24 hours and is capable of providing care to someone visiting the facility during any segment of the 24 hours.

3D PRINTER. A machine used in the *additive manufacturing* process for fabricating objects through the deposition of a material using a print head, nozzle or other printer technology.

[M] ACCESS (TO). That which enables a device, appliance or equipment to be reached by *ready access* or by a means that first requires the removal or movement of a panel or similar obstruction [see also "*Ready access (to)*"].

[BE] ACCESSIBLE MEANS OF EGRESS. A continuous and unobstructed way of egress travel from any *accessible* point in a building or facility to a *public way*.

18

Codes and Standards

- "Codes" legally adopted by jurisdiction
 - Minimum requirements to achieve life safety and property protection
 - "Mandatory" language stating what must be done
- "Standards" referenced by codes
 - "Mandatory" language stating how to do it
- Chapter 80 - IFC referenced standards

"The building shall have an automatic fire sprinkler system"

"The fire sprinkler system shall be installed in accordance with NFPA 13"

19

Hierarchy

- Code takes preference over standards
 - Mandatory reference standards
- Specific over general
 - In specific case, most restrictive

20

2024 QR Codes for Marginal Markings



SECTION 104—DUTIES AND POWERS OF THE FIRE CODE OFFICIAL

[A] 104.1 **General.** The fire code official is hereby authorized to enforce the provisions of this code.

[A] 104.2 **Determination of compliance.** The fire code official shall have the authority to determine compliance with this code, to render interpretations of this code and to adopt policies and procedures in order to clarify the application of its provisions. Such interpretations, policies and procedures:

1. Shall be in compliance with the intent and purpose of this code.
2. Shall not have the effect of waiving requirements specifically provided for in this code.

[A] 104.2.1 **Listed compliance.** Where this code or a referenced standard requires equipment, materials, products or services to be listed and a listing standard is specified, the listing shall be based on the specified standard. Where a listing standard is not specified, the listing shall be based on an approved listing criteria. Listings shall be germane to the provision requiring the listing. Installation shall be in accordance with the listing and the manufacturer's instructions, and where required to verify compliance, the listing standard and manufacturer's instructions shall be made available to the fire code official.

Changes can be accessed by entering the 7-digit code beneath the QR code
At the end of the following URL: LINK: qr.iccsafe.org/
(in the above example, "qr.iccsafe.org/3844374").

21

21

Definitions

SECTION 502—DEFINITIONS

502.1 Definitions. The following terms are defined in Chapter 2:

AGENCY.

FIRE APPARATUS ACCESS ROAD.

FIRE COMMAND CENTER.

FIRE DEPARTMENT MASTER KEY.

FIRE LANE.

KEY BOX.

TRAFFIC CALMING DEVICES.

- Definitions for each Chapter follow the scoping statement
- Refer to Chapter 2, Definitions

22

202 Definitions

- Italicized – Refer to Chapter 2

▪ *Approved* – Acceptable to the fire code official

▪ *Container* – A vessel of 60 gallons or less used for transporting or storing hazardous materials

- “Ordinarily accepted meaning”

▪ Merriam Webster’s Collegiate Dictionary, 11th Edition

..

23

Lists

- “And/or” conditions

403.3.1.1.1 Fire safety plan. A copy of the fire safety plan shall be maintained at the facility at all times. The plan shall include all of the following in addition to the requirements of Section 404:

1. Locations of care recipients who are rendered incapable of self-preservation.
2. Maximum number of care recipients rendered incapable of self-preservation.
3. Area and extent of each ambulatory care facility.
4. Location of any special locking arrangements.

2006.11.5 Notification of the fire department. The fire department shall be notified of any fuel spill that is considered a hazard to people or property or which meets one or more of the following criteria:

1. Any dimension of the spill is greater than 10 feet (3048 mm).
2. The spill area is greater than 50 square feet (4.65 m²).
3. The fuel flow is continuous in nature.

24

Tables

- Condense code requirements
 - Often include notes

TABLE 906.3(1)—FIRE EXTINGUISHERS FOR CLASS A FIRE HAZARDS			
	LIGHT (Low) HAZARD OCCUPANCY	ORDINARY (Moderate) HAZARD OCCUPANCY	EXTRA (High) HAZARD OCCUPANCY
Minimum-rated single extinguisher	2-A ^a	2-A	4-A ^a
Maximum floor area per unit of A	3,000 square feet	1,500 square feet	1,000 square feet
Maximum floor area for extinguisher ^b	11,250 square feet	11,250 square feet	11,250 square feet
Maximum distance of travel to extinguisher	75 feet	75 feet	75 feet

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 gallon = 3.785 L.
 a. Two 2½-gallon water-type extinguishers shall be deemed the equivalent of one 4-A rated extinguisher.
 b. Annex E.3.3 of NFPA 10 provides more details concerning application of the maximum floor area criteria.
 c. Two water-type extinguishers, each with a 1-A rating, shall be deemed the equivalent of one 2-A rated extinguisher for Light (Low) Hazard Occupancies.

25

Exceptions and Notes

- Eliminate, modify, supplement or mitigate code requirements

907.5.2.3.1 Public use areas and common use areas. Visible alarm notification appliances shall be provided in *public use areas and common use areas*.

Exception: Where employee work areas have audible alarm coverage, the notification appliance circuits serving the employee work areas shall be initially designed with not less than 20-percent spare capacity to account for the potential of adding visible notification appliances in the future to accommodate hearing-impaired employee(s).

For SI: 1 pound = 0.454 kg, 1 gallon = 3.785 L, 1 cubic foot = 0.02832 m³.
 a. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2.
 b. The aggregate quantities in storage and use shall not exceed the maximum allowable quantity for storage, including applicable increases.
 c. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials allowed in outdoor storage per single property under the same ownership or control used for retail or wholesale sales is allowed to exceed the maximum allowable quantity per control area where such storage is in accordance with Section 5003.11.
 d. Quantities in parentheses indicate quantity units in parentheses at the head of each column.
 e. "High BV" Category 1B flammable gas has a burning velocity greater than 3.9 in/s (10 cm/s). "Low BV" Category 1B flammable gas has a burning velocity of 3.9 in/s or less.

26

101.2.1 Appendices - Examples

- Regulatory or advisory
 - Must be legally adopted

Appendix	Title	Purpose
A	Board of Appeals	Advisory
B	Fire-flow for Buildings	Regulatory
E	Hazard Categories	Advisory
F	Hazard Ranking	Regulatory
I	Non-Compliant Fire Protection Systems	Regulatory
N	Indoor Trade Shows and Exhibitions	Regulatory
O	Valet Trash and Recycling Collection	Regulatory

27

LEGAL ASPECTS, PERMIT AND INSPECTIONS



© International Code Council, Inc. (201)

28

102.1 Applicability - Construction

- Construction requirements apply to:
 - New structures, facilities and conditions
 - Existing facilities and conditions
 - not legally in existence when code is adopted,
 - as required by Chapter 11, Existing Buildings,
 - are distinct hazard to life or property, or
 - if adopted, Appendix K (ambulatory care) and Appendix M (high rise sprinklers)

29

102.2 Operations and Maintenance

- Administrative, operational and maintenance requirements apply to:
 - Conditions and operations arising after adoption
 - Existing conditions and operations

30

102.3 Use or Occupancy Change



- Certificate of occupancy sets building's use and occupancy
- Occupancy may **not** change unless IFC and *International Existing Building Code*-compliant
 - Fire code official may approve changes that reduce hazard

31

102.6 Historic Buildings

- IFC not applicable
 - State- or locally-designated historic building
 - Are not distinct property or life hazard
- Approved fire protection plan
 - NFPA 914, *Code for the Protection of Historic Structures*



32

104.2 Determination of Compliance

[A] 104.2 Determination of compliance The fire code official shall have the authority to determine compliance with this code, to render interpretations of this code and to adopt policies and procedures in order to clarify the application of its provisions. Such interpretations, policies and procedures:

1. Shall be in compliance with the intent and purpose of this code.
2. Shall not have the effect of waiving requirements specifically provided for in this code.

- Aids include listed compliance, technical assistance, alternative methods and modifications

33

104.2.1 Listed Compliance



- Equipment, materials, products or services
- Listing based on specified standard
 - ASHRAE 15, *Safety Standard for Refrigeration Systems*
 - ANSI/CGA P-18, *Standard for Bulk Inert Gas Systems*
 - ISO 8115, *Cotton Bales – Dimensions and Density*

34

104.2.2 Technical Assistance

[A] 104.2.2 Technical assistance. To determine compliance with this code, the *fire code official* is authorized to require the *owner* or *owner's* authorized agent to provide a technical opinion and report.

- Cost
- Qualifications
- Content
- Tests

35

104.2.3 Alternative Materials, Design

- Matches other I-Codes
- Review and approval process
- Code equivalency intended requirements
 - Must meet quality, strength, effectiveness, fire resistance, durability and safety
 - ICC Evaluation Service (ICC-ES)



36

Discussion



37

37

104.2.4 Modifications

- Individual cases
- Natural disasters



38

38

Discussion



39

39

104.4 Right of Entry

- Property owner can refuse government entry into a building or onto a site
- Entry is by permission
 - U.S. Supreme Court: *See v. the City of Seattle* (1967)
- Identification protocols
- Administrative warrants

40

105 Permits

- Operational and construction
 - Allow regulated hazardous operations
 - Construct or alter fire protection systems
 - Install equipment for hazardous material storage, handling or use
- 105.4 Revocation procedures

41

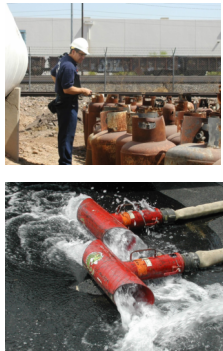
106 Construction Documents



- Drawings and specifications
- Shop drawings and calculations
- Manufacturer's installation instructions
- Registered design professional where required by law
- Recordkeeping schedules
 - Confirm with state or local law

42

109 Inspections



- "As deemed necessary"
- Verify construction compliance
 - Approved design documents
 - Permit conditions
 - Approved changes
 - Codes and standards
- Witness acceptance tests
- Verify operational compliance
- Concealed work

43

112 Appeals



- Creates Board of Appeals
 - Reviews code official orders, decisions and determinations
 - Compares against code application and intent
 - Provides decision on code application or interpretation
 - May only "modify or reverse" code official's decision
 - May **not** "waive" code requirements
- Refer to Appendix A for procedures

44

113 Violations



- Abatement or correction by owner or agent
- Violation notice procedures
 - Written notice
 - Service
 - Compliance
 - Prosecution

45

114 Stop Work Order

- May be issued for work:
 - Performed without permits
 - Dangerous or non-compliant
 - Concealed before inspection and approval
- Penalty for non-compliance



46

115 Unsafe Structures or Equipment

- Criteria for “unsafe conditions”
 - Structural hazards reported to building code official
 - Unsecured vacant buildings
- Evacuation and re-entry criteria
 - Emergency operations
- Notification and service procedures



47

203 Occupancy Classification and Use

- Building classified into one or more occupancy groups
- Multiple uses to meet all occupancy requirements
 - Comply with IBC 508
- Occupiable roofs
 - Comply with IBC 503.1.4



48

General Safety Provisions

PART II



49

GENERAL PRECAUTIONS AGAINST FIRE



50

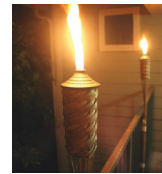
Combustible Waste Material Control

- Orderly storage maintenance
- Away from ignition sources
- Separation from means of egress
- Dumpsters located $\geq 5'$ from combustible construction, wall openings and combustible roof eaves
- Valet trash only if approved by AHJ



51

Open Flames and Smoking



- Separation from combustible materials
- Unwanted fires
- Open flames can be used for:
 - Theatrical performances
 - Religious ceremonies
 - Paint removal
 - Food preparation
 - Decoration
- Smoking prohibition

52

311 Vacant Premises

- Safeguarding vacant buildings
 - Openings secured
 - Hazardous materials removed
 - Placards
 - Fire protection systems in service
- Placard warnings
- Vacant mall building spaces
- IFC 115 Unsafe Structure consideration



Normal conditions



Hazards Exist –
Use extreme caution



Exterior FF only
Entry only for known life hazard

53

314.4 Indoor Vehicle Display

- Addresses newer alternative fuels and power systems
- EV: only ignition batteries need be disconnected
 - Not propulsion batteries
- Fuel limits clarified and expanded

Fuel Type	Limit
Class I, II & III liquid fuel	Lesser of ¼ tank or 5 gallons
LP-gas	Lesser of ¼ tank or 6.6 gallons
CNG	Lesser of ¼ tank or 630 cubic feet
Hydrogen	Lesser of ¼ tank or 2000 cubic feet



54

315 Outdoor Pallet Storage (Excerpt)

- Table 315.7.6(1) Distance between **Wood Pallets** and **Buildings**

WALL CONSTRUCTION	OPENING TYPE	WOOD PALLET SEPARATION (FT)		
		≤ 50 Pallets	51-200 Pallets	> 200 Pallets
Masonry	None	2	2	2
	Fire-rated glazing with open sprinklers	2	5	20
	Plain glass with open sprinklers	5	10	20
Noncombustible	None	5	10	20
Wood	None	15	30	90

- Table 315.7.6(2) Distance between **Plastic Pallets** and **Buildings**
- Table 315.7.6(3) Distance between **Wood Pallets** and **On-site Storage/Pallets**
- Table 315.7.6(4) Distance between **Plastic Pallets** and **On-site Storage/Pallets**
- Pallet piles – maximum 400 sq.ft and 20' high

55

317.2 Vegetative and Landscaped Roofs

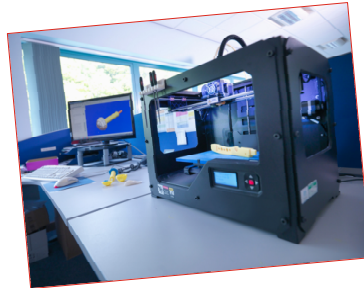


- IBC covers design and construction
 - Design standard
 - ANSI/SPRI VF-1 *External Fire Design for Vegetative Roofs*
- IFC covers maintenance
 - Maintenance plan
 - Dead material removal
- Landscaped Roof vs. Vegetative Roof

56

319 Additive Manufacturing (3D Printing)

- Industrial additive manufacturing
 - Production scale
 - Combustible powders/metals
 - Inert gases
 - Combustible dust collection
 - Exterior hazardous (classified) zone
 - Group F manufacturing facilities only
- Non-industrial additive manufacturing
 - Small-scale, desktop
 - Inherent safety features
 - Allowed in all occupancies



57

57

320 Lithium-ion/Lithium Metal Batteries

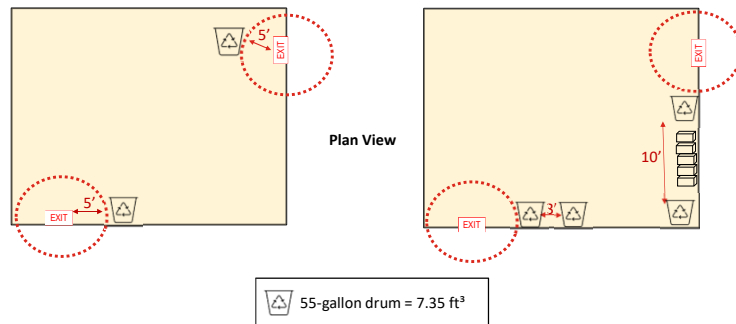
- Storage requirements address thermal runaway fire hazard
 - Permits
 - Technical report and opinion
 - Quantity limits
 - Two-hour separation & explosion control
 - Fire detection and protection systems
 - Fire safety and evacuation plan (§ 403.10.6)
- Three storage conditions
 - Limited indoor storage
 - Indoor storage
 - Outdoor storage



58

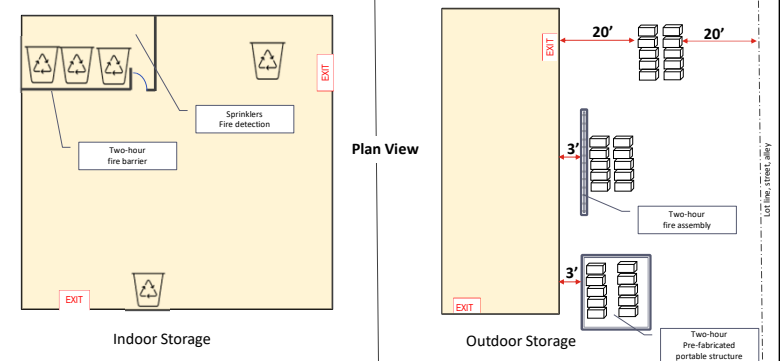
58

320.4.1 Limited Indoor Storage - Containers



59

Indoor and Outdoor Storage



60

322 Powered Micromobility Devices

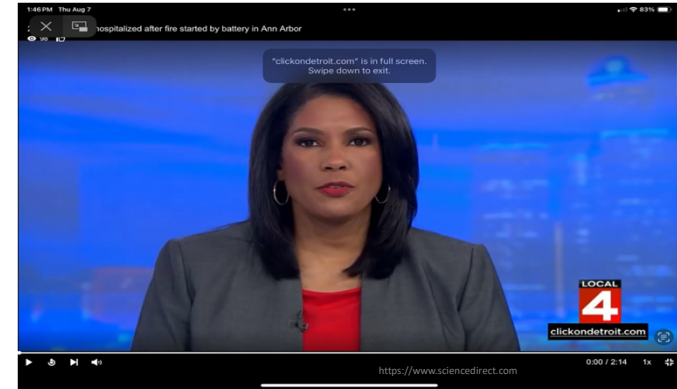
- Prohibited use locations
 - Exceptions for residential
- Battery chargers and equipment
- Listing – UL 2272 or UL 2849
- Battery charging areas
 - Receptacles
 - Distance between batteries/device
- Fire safety plan
 - Thermal runaway mitigation measures



61

61

322 Powered Micromobility Devices



62

62

Discussion



63

63

EMERGENCY PLANNING AND PREPAREDNESS



© International Code Council, Inc. (ICC)

64

Chapter 4 – Emergency Planning

- Fire reporting and notification
- Occupancy-based requirements
 - Emergency planning and preparedness
 - Indoor/outdoor events
 - Fire safety, evacuation and lockdown plans
 - Fire watch/crowd managers
- Public Safety Plans



65

Chapter 4 – Emergency Planning



- Emergency evacuation drills
 - Frequency based on occupancy type
 - Participants – staff, occupants, employees
- Employee training
 - Fire prevention and safety
 - Evacuation and lockdown
- Hazard communication – 2024 code clarifies when requirements apply
 - Haz. Mat. Inventory Statement
 - Haz. Mat. Management Plan
 - Safety Data Sheets
 - Facility closure plan

66

Site and Building Services

PART III



67

FIRE SERVICE FEATURES



68

503 Fire Apparatus Access Roads



Courtesy: Vigilant Hose Company 6 - Emmitsburg, MD

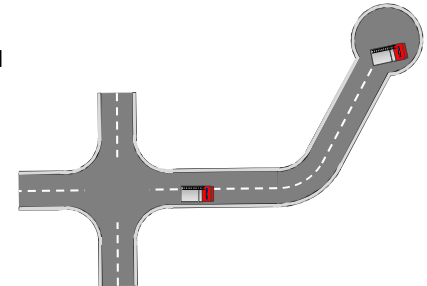


- Road from fire station to target property
- Minimum 20 feet wide, 13' 6" clear height
- Typically applied to private property
 - Public road constructions specifications
 - Public Works or Transportation Engineering department

69

Dead-ends and Bridges

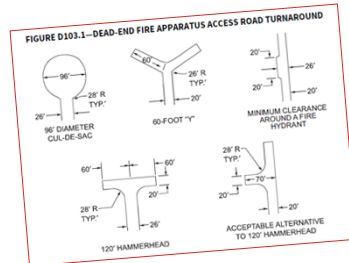
- Approved turnaround required
 - Dead-end more than 150 feet
- Bridges and elevated surfaces
 - AASHTO HB-17, *Standard Specifications for Highway Bridges*
- Appendix D Fire Apparatus Access Roads



70

Appendix D – Fire Apparatus Access Roads

- Minimum load-bearing 75,000 lbs.
- Aerial apparatus access
- Optional dead-end designs
- Gates
- Signs
- Multiple-access points
- Turning radii, breakover and departure angles



71

504 Building Access

- Required exterior doors or openings
 - Access walkway
- Equipment room identification
- Key box
- Roof stairway to roof



72

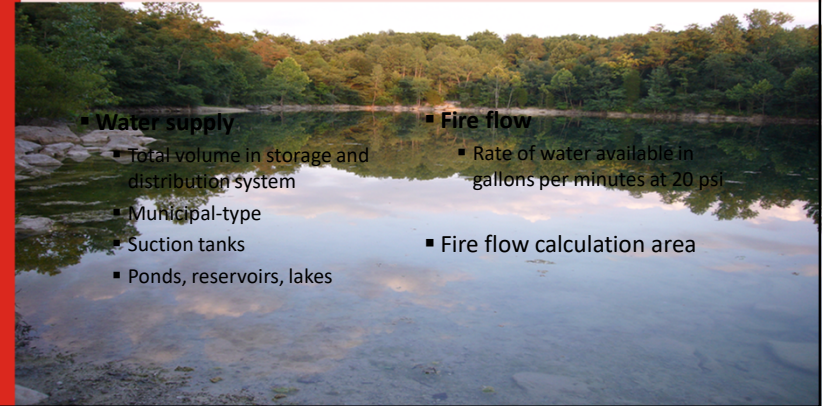
507 Fire Protection Water Supplies



- Fixed system to meet **manual** fire-fighting fire flow demand
- Fire flow methods
 - Appendix B, Fire Flow Requirements for Buildings
 - *International Wildland Urban Interface Code*
 - NFPA 1142, *Water Supplies for Suburban and Rural Fire Fighting*
 - Iowa State University
 - National Fire Academy
 - Verisk ISO

73

Water Supply vs. Fire Flow



- **Water supply**
 - Total volume in storage and distribution system
 - Municipal-type
 - Suction tanks
 - Ponds, reservoirs, lakes
- **Fire flow**
 - Rate of water available in gallons per minutes at 20 psi
 - Fire flow calculation area

74

Water Supply and Fire Sprinklers



- Fire flow reductions for sprinklered buildings
 - Appendix B105.3
- Water supply provides greater of
 - Sprinkler system demand plus hose streams, or
 - Required fire flow

75

Appendix B – Residential Fire Flow

Table B105.1(1) One- and Two-Family Dwellings, Groups R-3, R-4 and Townhouses

FIRE-FLOW CALCULATION AREA (sq. ft.)	AUTOMATIC SPRINKLER (Design Standard)	MINIMUM FIRE-FLOW (gallons per minute)	FLOW DURATION (hours)
0- 3,600	No sprinklers	1,000	1
3,601 and greater	No sprinklers	Table B105.1(2) value	Table B105.1(2) value at flow rate
0-3,600	IFC 903.3.1.3 (NFPA 13D) or IRC P2904	500	One-half
3,601 and greater	IFC 903.3.1.3 (NFPA 13D) or IRC P2904	One-half Table B105.1(2) value	1

76

Residential (Example)



- Type VB
- 3,800 sq. ft. no sprinklers
 - Fire flow from B105.1(2)
 - 1,750 gpm for two hours
- With sprinklers (13D or P2904)
 - 875 gpm for one hour

77

Appendix B – Fire Flow for Buildings (Excerpt)

- Table B105.1(2) All others
- Building construction, fire flow calculation area, fire sprinklers

FIRE-FLOW CALCULATION AREA (square feet)					FIRE FLOW (gpm)	DURATION (hours)
Types IA-IB	Types IIA-IIIA	Types IV-IA	Types IIB-IIIB	Type V-B		
38,701 - 48,300	21,801 - 24,200	12,901 - 17,400	9,801 - 12,600	6,201 - 7,700	2,250	2
70,901 - 83,700	39,701-47,100	25,501 - 30,100	18,401 - 21,800	11,301 - 13,400	3,000	3
128,701-145,900	72,401-82,100	46,401-52,500	33,501-379	20,601-23,300	4,000	4

- IA-IB construction
 - Three largest successive floors
 - Open parking garage largest floor
- Fire walls without openings

78

Appendix B – 75% Sprinkler Credit

- Sprinklers
 - IFC 903.3.1.1 (NFPA 13)
 - IFC 903.3.1.2 (NFPA 13R)

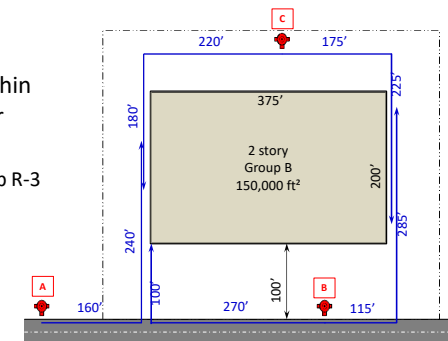


- Type VA
- 108,000 sq. ft.
- From Table B105.1(2)
 - Fire flow = 6,000 gpm for four hours
 - 75% reduction for IFC 903.3.1.2 (NFPA 13R) sprinkler system
 - Net fire flow required = 1,500 gpm for two hours

79

507.5.1 Hydrant Distance

- Hydrant/tank connection within 400' of the first-floor exterior walls
 - Sprinklered buildings, Group R-3 and U ≤ 600'
 - Add hydrants
 - Appendix C

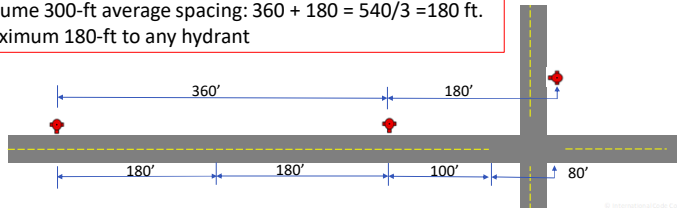


80

Appendix C – Hydrant Locations and Spacing (Excerpt)

FIRE-FLOW REQUIREMENT (gpm)	MINIMUM NUMBER OF HYDRANTS	AVERAGE SPACING BETWEEN HYDRANTS (feet)	MAXIMUM DISTANCE FROM ON STREET OR ROAD FRONTAGE TO A HYDRANT (feet)
2,251 – 2,750	3	450	225
4,001 – 5,000	5	300	180
6,001 – 7,000	7	250	150

- Assume 300-ft average spacing: $360 + 180 = 540/3 = 180$ ft.
- Maximum 180-ft to any hydrant



81

507.5.2 Inspection, Testing, Maintenance

- NFPA 25, *Water-based Fire Protection Systems*
 - Private system
 - Hydrants: Annual flow test and maintenance
 - Water mains flow test every 5 years
 - Water main strainers: inspection and maintenance after use
- Minimum 3' clearance around hydrants
- Impact protection



82

202 Emergency Responder Communications Enhancement System (ERCES).

An infrastructure solution installed within a building to enhance the communications capabilities for first responders that utilizes solutions such as a signal booster, voting receiver, base station or other technology capable of enhancing the radio frequency (RF) to ensure effective public safety communications.

- Replaces "Emergency Response Radio Communications System (ERRCS)"
- Revised to include all methods of communications
 - Native
 - Enhanced radio signal
 - Firefighter phones

83

83

510 – Emergency Communications

- Required in all new buildings
 - Exceptions
 - Wired communication system as alternate
 - When not required by fire code official
 - Where system could affect business operations
 - One-story buildings $\leq 12,000$ sq. ft.
- Equipment must be listed to UL 2524, *In-building 2-Way Emergency Radio Communication Enhancement Systems*.

Emergency Responder
Radio Communication
System (ERRCS)

NFPA 1221



Now: Emergency
Responder
Communication
Enhancement System
(ERCES)
NFPA 1225

84

84

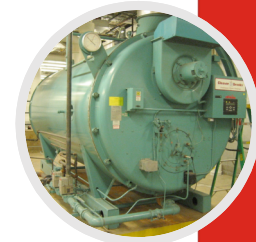
ERCES Systems



- Construction and operational permits
- Radio-frequency signal types
 - Narrowband analog,
 - Digital or wideband long-term evolution (LTE) signals, or
 - Equivalent Bit Error Rate (BER) or Signal-to-Interference-Plus-Noise Ratio (SINR)
- Fire alarm system supervision option

85

BUILDING SYSTEMS



© International Code Council, Inc. [96]

86

603 Electrical Wiring and Equipment



- Equipment, wiring, installation, use
 - Listed, labeled
 - NFPA 70, *National Electrical Code*
 - NFPA 99, I-2 and ambulatory care
 - Hazardous condition be abated
- Working space and clearances
- Room/connection markings
- Relocatable power taps listing
- Extension cords use safety

87

604 Elevators

- Emergency operations
- Manual transfer for standby power
- Elevator keys – kept in approved location
- Emergency sign at elevator – updated
- Car and machine room storage limits



88

605 Fuel-Fire Appliances

- Nonportable appliances and systems using fuel gas or fuel oil
- Equipment must be installed and operated in accordance with manufacturer's instructions
- Modifications must meet manufacturer's requirements
- Maintenance of access, unsafe conditions and clearances
- Fuel oil storage tank quantity limitations



Waste-oil Burners

PHOTO COURTESY OF CLEAN BURN ENERGY SYSTEMS, LANSING, MI

89

606 Commercial Cooking



- Local exhaust ventilation system to remove heat, vapors, steam, smoke and odors
 - IMC Chapter 5
 - Type I hoods remove grease-laden vapors and smoke
 - Require fire extinguishing system
 - Type II hoods remove heat, steam and odors
- System cleaning
- Hood inspection frequencies

90

Table 606.3.3.1 Commercial Hood Maintenance

COOKING OPERATION	INSPECTION FREQUENCY
High-volume cooking operations such as 24-hour cooking, charbroiling, or wok cooking	3 months
Low-volume cooking operations such as places of religious worship, seasonal businesses, and senior centers	12 months
Cooking operations utilizing solid-fuel-burning cooking appliances	1 month
All other cooking operations	6 months



COURTESY OF FINE STEAM, INC., CALVERT CITY, MD



91

608 Mechanical Refrigeration

- Cross-reference IMC® Chapter 11
- Ammonia – new IIAR compliances
 - Now in *International Institute of Ammonia Refrigeration* standards IIAR 2, IIAR 6, IIAR 7, IIAR 8 and IIAR 9
 - Standards address
 - Refrigerant detection
 - Labeling
 - Ventilation
 - Discharge, and
 - Treatment, if any



92

608.9 Refrigeration Detection



- Machinery room refrigerant detector with audible and visible alarm inside and outside of room
- Detector at an approved location where a leak is expected
- Detection exceeding upper detection limit or 25% of LFL stops refrigerant equipment

93

93

608.18 A2L/B2L Refrigerants

<https://neps.org/blog/leaking-concerns-about-refrigerant-flammability>

Higher Flammability	A3 Fluorocarbon Blends	B3 Methoxy Chloride	Increasing Flammability	
Flammable	A2 Methoxy Fluoride	B2 Methoxy Chloride		
Lower Flammability	A2L R-454B	B2L Ammonia		
No Flame Propagation at 60° C	A1 R-310A	B1 Sulfur Dioxide		
	Lower Toxicity (IDLH of 400 ppm or greater)	Higher Toxicity (IDLH of less than 400 ppm)		Increasing Toxicity

ASHRAE Standard 34 Safety Classes

- Machinery rooms meet IMC 1106.4
 - No permanent open flame devices > 1290° F
 - Refrigerant detection
 - Alarm
 - Ventilation system

94

94

1203 Emergency/Standby Power Systems

- Sources
 - Battery (see IFC 1207)
 - NFPA 111, *Stored Electrical Energy Emergency and Standby Power*
- Generator
 - Minimum two-hour load duration
 - UL 2200, *Stationary Engine Generator Assemblies*
 - NFPA 110, *Emergency and Standby Power Systems*
 - Automatic transfer switch operation
 - 10 seconds-primary; 60 seconds - secondary

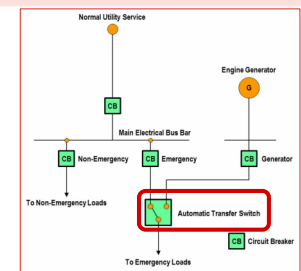


• • • •

95

1203 Emergency/Standby Power (cont'd)

- Maintenance
 - Operate transfer switch
 - Run generator under load
 - Use generator for load sharing
- Circuit protection
 - UL 2196 listed 1-hour fire-resistive cable
 - 1-hour rated construction


 Parallel Thermal Management
 Houston, TX

96

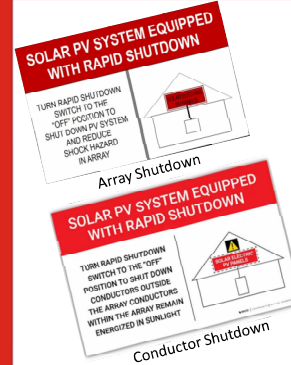
1205 Solar Photovoltaic



- On-building and ground-mounted
 - Installation permit
 - Compliance with IFC, IBC, and
 - NFPA 70, *National Electrical Code*®
- Individual array size:
 - Maximum 22,500 ft²
 - Maximum dimension of 150'
- Pathways to ridge
 - 3' wide for residential
 - 6' wide for commercial

97

1205.4 Rapid Shutdown Warnings



- IFC prescribes sign types where rapid shutdown installed
 - Array energy or conductor shutdown
- NEC® requires rapid shut down on new solar PV systems
 - Reduces array energy 80 volts within 30 seconds
 - Rapid shutdown switch within 3' of service disconnect
- Pre-2014 systems **may not** have rapid shutdown

98

1207.1 - Energy Storage Systems Scoping

- Stationary or mobile energy storage systems
- ESS under electric utility exclusive control
 - IFC Chapter 12, Energy Systems applies
 - NFPA 855, *Installation of Stationary Energy Storage Systems*
- Not applicable to generation, transmission, distribution



99

Table 1207.1.3 ESS Threshold Quantities (Excerpt)

Technology	Energy Capacity ^a
Flow batteries ^b	20 kWh
Lead-acid batteries, all types	70 kWh ^c
Lithium-ion batteries	20 kWh
New: Nickel cadmium (Ni-Cd), nickel metal hydride (Ni-MH) and nickel-zinc batteries (Ni-Zn)	70 kWh
New: Nonelectrochemical ESS ^d	
Other battery technologies	10 kWh
New: Sodium nickel chloride batteries	70 kWh
New: Zinc manganese dioxide batteries (Zn-MnO ₂)	

100

100

Table 1207.5 ESS Protection Thresholds - Excerpt

- Rooms, areas or walk-in unit fire area maximum allowable quantities

Technology	Energy Capacity ^a
Flow batteries ^b	600 kWh
Lead-acid batteries, all types	Unlimited
Lithium-ion batteries	600 kWh
New: Nickel cadmium (Ni-Cd), nickel metal hydride (Ni-MH) and nickel-zinc batteries (Ni-Zn)	Unlimited
Other battery technologies	200 kWh
New: Sodium nickel chloride batteries	600 kWh
New: Zinc manganese dioxide batteries (Zn-MnO ₂)	Unlimited

101

101

Chapter 7 - Fire-resistant Construction



- IBC establishes passive fire protection system requirements
 - Fire-resistant construction, fire-rated assemblies, opening protectives
- IFC regulates inspection and maintenance
- 701.6.1 Recordkeeping

102

701.6 Owner's Responsibility

- Maintain inventory of all required fire resistance-rated construction
- Visual inspection annually
 - Except inaccessible concealed spaces
- Damaged areas must be repaired, restored or replaced



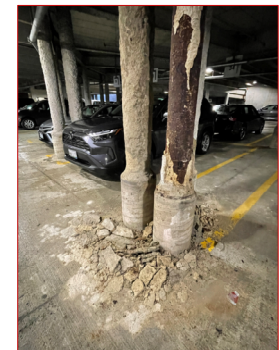
Photo courtesy of the American Wood Council

103

103

708.1 Sprayed Fire-Resistant Materials

- Inspection and maintenance
 - Intumescent and spray-applied fire-resistant materials
 - Records maintained for inspection



104

104

INTERIOR FINISH AND DECORATIVE MATERIALS



105

Chapter 8 Interior Finish and Decorative Materials

- Significant fire and life issue
- Flame spread and smoke development
- New buildings meet IBC 803
- Existing buildings meet IFC 804 - 807



106

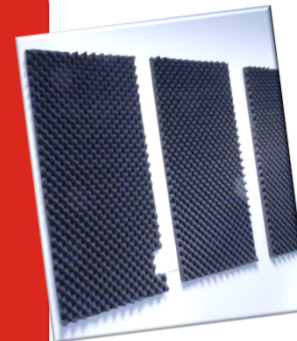
Table 803.3 – (Excerpt)

GROUP	SPRINKLERED ¹			NONSPRINKLERED		
	Interior exit stairways and ramps and exit passageways ^{a,b}	Corridors and enclosure for exit access stairways and ramps	Rooms and enclosed spaces ^c	Interior exit stairways and ramps and exit passageways ^{a,b}	Corridors and enclosure for exit access stairways and ramps	Rooms and enclosed spaces ^c
A-1 and A-2	B	B	C	A	A ^d	B ^e
B, E, M, R-1, R-4	B	C ^m	C	A	B ^m	C
I-1	B	C	C	A	B	B
R-2	C	C	C	B	B	C

Refer to Table 803.3 Notes for additional details.

107

803.11.1 Foam Plastics



- Exposed and textile or vinyl covered
- Allowed as interior finish where materials meet IBC 2603.9 test standards
 - NFPA 286 *Wall and Ceiling Finish Contribution to Room Fire (Corner Test)*
 - FM 4880 *Insulated Building Panel and Interior Finish Fire Performance*
 - UL 1040 *Insulated Wall Construction, or*
 - UL 1715 *Interior Finish Material*

108

108

Fire and Life Safety Systems and Features

Part IV



109

REQUIREMENTS FOR ALL FIRE PROTECTION SYSTEMS



110

Fire and Life Safety System Thresholds

CONDITION	EXAMPLE
Building occupancy	All Group R and H Occupancies
Fire area size	Groups M, F-1 and S-1 > 12,000 sq. ft.
Occupant load	Group A-3 more than 300 persons
Occupant location	Assemblies above or below level of exit discharge
Building height	Mid-rise more than 55 feet above fire apparatus access
Building area	IBC allowable or unlimited area
Hazardous materials	Increase maximum allowable quantity (MAQ)
Hazardous operations	Spray areas, commercial cooking, high-piled storage
Occupant alerting	Smoke and carbon monoxide alarms, gas detection

.....

111

901.2 Documents and Testing

- Construction documents
 - Plans, specifications, calculations, product literature
 - Compliance statement
- Acceptance testing
- Inspection, testing and maintenance (ITM)
- Reference standards

112

901.7 Impairment Protocols

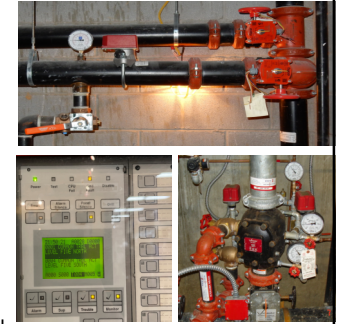


- Notifications
 - Scheduled impairment
 - Unscheduled impairment
- Code official can require
 - Building evacuation, or
 - Fire watch
- Impairment coordinator responsibilities

113

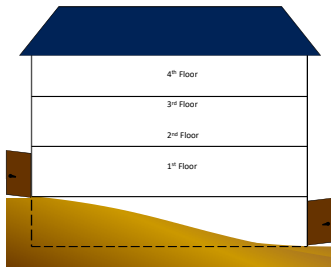
903.4, 907.6.6 System Supervision

- Sprinkler system monitoring
 - Main control valves
 - Floor control valves
 - Water flow
 - Trouble
- Fire alarm system monitoring
 - Alarm activation
 - Trouble
- Service cancellation
 - Supervising company must notify code official



114

Level of Exit Discharge



- “Story at the point at which an exit terminates and an exit discharge begins”
 - Sprinkler requirements based on levels above or below level of exit discharge

115

Fire Area

Table 707.3.10
FIRE SEPARATIONS BETWEEN FIRE AREAS

- “Aggregate floor area enclosed and bounded by fire walls, fire barriers, exterior walls or horizontal assemblies of a building.”
 - Fire sprinkler thresholds based on fire areas

OCCUPANCY GROUP	FIRE-RESISTANCE RATING (hours)
H-1, H-2	4
F-1, H-3, S-1	3
A, B, E, F-2, H-4, H-5, I, M, R, S-2	2
U	1

116

AUTOMATIC SPRINKLER SYSTEMS



117

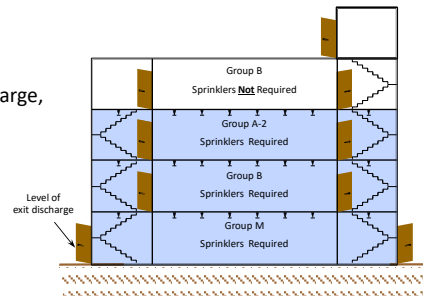
Sprinkler Design and Installation Standards

DESIGN	SPRINKLER STANDARD		
	903.3.1.1 (NFPA 13)	903.3.3.2 (NFPA 13R)	903.3.3.3 (NFPA 13D or IRC P2904)
Coverage	Throughout entire building	Occupied spaces	Occupied spaces
Design Intent	Life safety and property protection	Life safety	Life safety
Applicability	All occupancies	Group R ≤ 4 stories up to 60 feet	1- and 2-family dwellings and townhomes ≤ 3 stories
Design Methods	- Pipe schedule - Control mode – density/design area - Control mode – specific application - Suppression mode	4 sprinklers in hydraulic remote compartment	IRC §P2904 – Prescriptive NFPA 13D – 2 sprinklers in hydraulic remote compartment
Sprinklers	All listed and approved sprinklers	Listed residential sprinklers	Listed residential sprinklers
Minimum Water Supply Duration	30 to 120 minutes depending on the hazard and design	30 minutes	7 to 10 minutes depending on dwelling size and stories

118

903.2.1 Group A

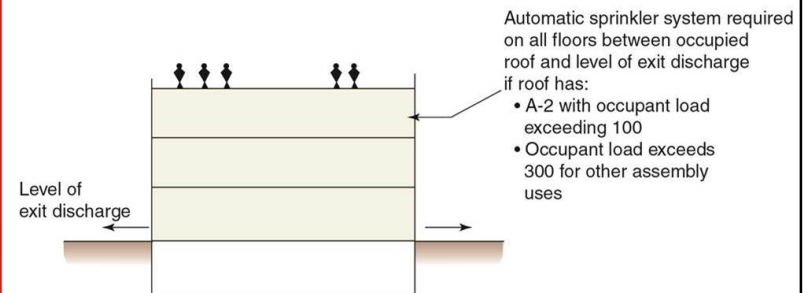
- Groups A-1, A-3 and A-4
 - Fire area >12,000 ft²,
 - Occupant load ≥300,
 - Floor other than level of exit discharge, or
 - Multi-theater
- Group A-2
 - Fire area >5,000 ft²,
 - Occupant load ≥100,
 - Floor other than the level of exit discharge



119

903.2.1.6 Group A

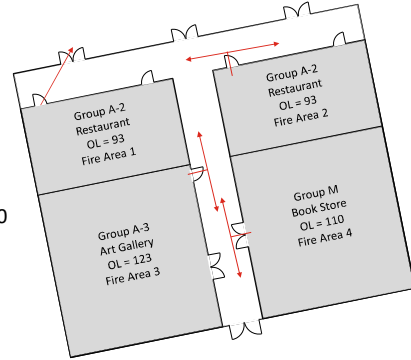
- Rooftop assembly – install sprinklers to level of exit discharge



120

903.2.1.7 Group A – Shared Egress

- Multiple Group A fire areas
 - A-1, A-2, A-3, A-4
 - Aggregate occupant load ≥ 300



121

903.2.2 Group B



- Ambulatory health care facilities
- Lithium ion or lithium metal battery research and development
- Occupant load ≥ 30 on a floor $\geq 55'$ above lowest level of fire apparatus access (903.2.11.3)

122

903.2.3 Group E

- Group E
 - Fire area $>12,000$ ft², or
 - All portions below level of exit discharge
 - Except where each classroom has at least one exterior exit door at ground level



123

Groups F-1, M and S-1

- Groups F-1, M and S-1
 - Fire area $>12,000$ ft²
 - Aggregate fire area $>24,000$ ft²
 - Above the 3rd story



124

Groups F-1, M and S-1 (cont'd)



- Special hazards
 - Woodworking >2,500 ft²
 - Upholstered furniture or mattresses
 - Manufacture or storage >2,500 ft²
 - Retail sale >5,000 ft²
 - High-piled storage
 - Distilled spirits

125

Groups H, I and R



- Any Group H occupancy
- Throughout buildings housing
 - Groups I and R
 - Some Group I-4 (day care) exceptions

126

903.3.1.1.1 "Equipped Throughout"

- Systems installed in accordance with their design standard provide protection "throughout"
 - NFPA 13 series and IRC P2904 allow omissions

127

912 Fire Department Connection



128

904 Alternative Automatic Systems



- Special hazard protection
 - Spray booths, commercial cooking, dip tanks, server rooms, hyperbaric chambers, etc.
- May **not** be used for sprinkler exceptions or reductions
 - One-hour rated corridors
- System interlock
 - Fuel shutoffs, ventilation controls, door closers, etc.
- NFPA design and installation standards

129

905 Standpipe Systems



- Installation requirements
 - Height and occupancy
- Hose outlet locations
- Design standard: NFPA 14, *Standpipe and Hose Systems*

SYSTEM CLASS	APPLICATIONS	HOSE CONNECTION SIZE (in.)	MINIMUM FLOW AND PRESSURE (gpm @ psi)
I	Fire department use	2 ½	500 gpm @ 150 psi
II	Occupant use	1 ½	100 gpm @ 65 psi
III	Combined features	2 ½ and 1 ½	500 gpm @ 150 psi

130

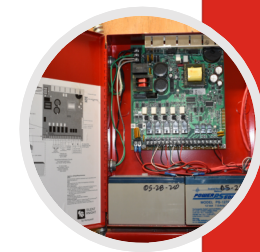
906 Portable Fire Extinguishers

- Occupancy requirements
 - Special locations and hazards
 - Additional requirements Table 906.1
- Extinguisher capacities
 - Fire classes (A, B, C, D, K)
 - Size ratings
- Mounting instructions/travel distances
- Inspection, testing and maintenance



131

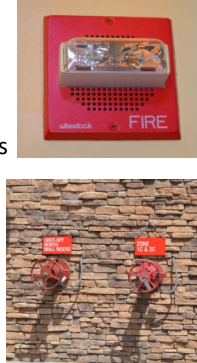
FIRE ALARM AND DETECTION SYSTEMS



132

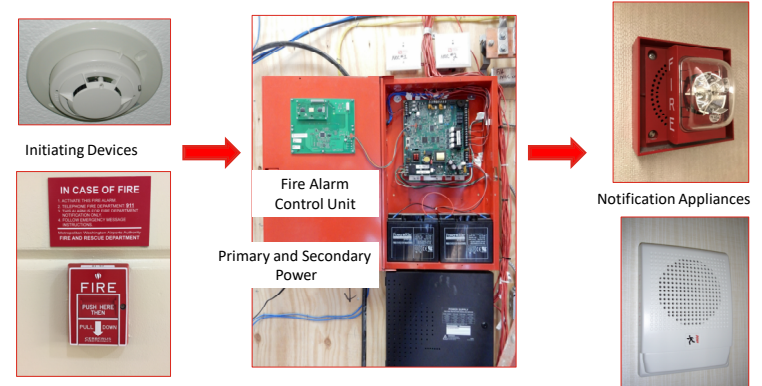
907 Fire Detection and Alarm

- Occupancy-based
- Design, construction and maintenance requirements
 - NFPA 72, *National Fire Alarm and Signaling Code*
 - NFPA 70, *National Electrical Code*
- Detect, alert, report and control fire



133

Fire Alarm Components



134

Occupancy-based Requirements

OCCUPANCY GROUP	CONDITIONS	ALARM TYPE
Group A	≥ 300 persons	Manual alarm
	≥ 1,000 persons	Emergency voice/alarm communication
Groups B and M	High-rise	Manual
	Ambulatory care	
	≥ 500 persons	
	≥ 100 persons on floor other than level of exit discharge	
Groups F, M, S	Lithium-ion battery storage or manufacture	Air-aspirating or flame sensing

135

Occupancy-based Requirements (cont'd)



- Group E
 - > 50 persons
 - If occupant load >100
 - must have emergency alarm/voice communication system



- Group I
 - All subgroups
 - Private mode signaling
 - Corridor smoke detection in Groups I-1 and I-2

136

Occupancy-based Requirements (cont'd)

GROUP	CONDITION	ALARM TYPE
R-1	Exceptions - Two-story all exterior exit - Sprinklered with waterflow alarm	Manual alarm, smoke alarms and corridor smoke detection
R-2	Sleeping spaces 3 or more stories above exit discharge, - More than one story below highest exit discharge, or > 16 dwelling or sleeping units	Manual alarm, smoke alarms
R-2 higher education dormitory	Common areas, laundries, interior corridors	Smoke detection
R-3, R-4, I-1	Sleeping spaces	Smoke alarms

.....

137

915.1, 1103.9 Carbon Monoxide Detection

- CO detection required in **all new and existing** occupancies containing carbon monoxide source.
- Exceptions: Group F, S and U not normally occupied

138

916 Gas Detection Systems

- Gas detection required by other sections
 - Compressed gases
 - Group H-5
- Detection thresholds
 - 25% Lower Explosive Limit (LEL)
 - 50% Immediately Dangerous to Life and Health (IDLH)



139

MEANS OF EGRESS

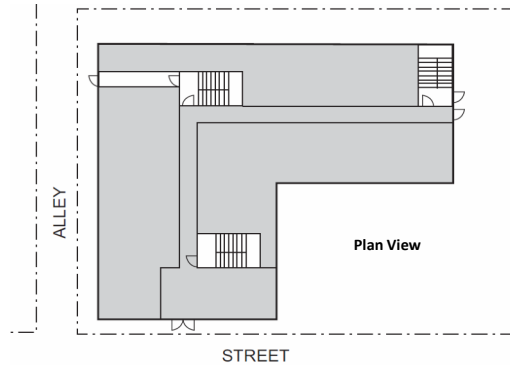


© International Code Council, Inc. (IAC)

140

Exit Access

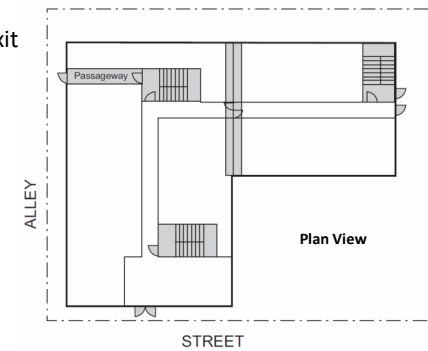
- From an occupied space to an exit



141

Exit

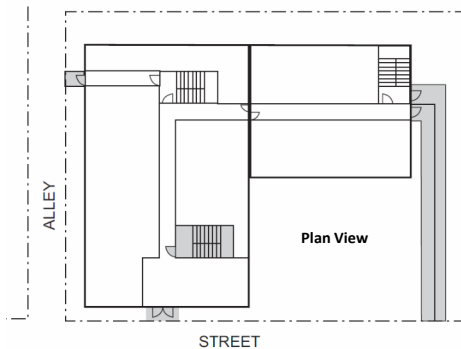
- Between occupied space and exit discharge
 - Exterior exit doors
 - Interior exit stairways
 - Interior exit ramps
 - Exit passageways
 - Exterior exit stairways
 - Exterior exit ramps
 - Horizontal exits



142

Exit Discharge

- Between end of exit and public way



143

Egress Elements

EGRESS FEATURE	CODE REQUIREMENTS
Occupant load-based use and size	Egress design based on occupant count
Width to accommodate occupant load	Doors, corridors, stairs and ramps minimum widths
Travel distance to protected path	Common path of travel, exit access travel distance
Exit pathway protection	One- or two-hour enclosures with opening protectives
Elevation changes	Stair, ramp, elevator and escalator controls
Egress identification	"EXIT" signs where two or more exits required
Egress illumination	Minimum normal and emergency lighting standards

144

1004 Occupant Load

- Egress requirements based on design occupant load
 - **Gross floor area** : Entire floor area within the exterior walls, exclusive of vent shafts and courts
 - **Net floor area**: Normally occupied area within the exterior walls
 - Excludes unoccupied accessory uses including corridors, stairways, toilets, mechanical rooms and closets
 - **Fixed seating**: count seats
 - **Bench seating**: measure length
 - 18"/person
 - Booths: 24"/person

.....

145

Table 1004.5 Excerpt

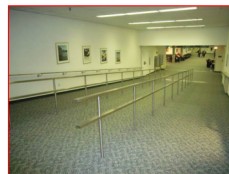
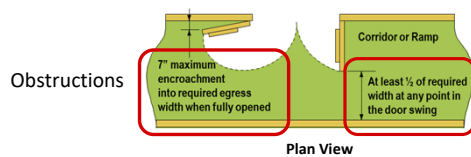
FUNCTION OF SPACE	OCCUPANT LOAD FACTOR (sq. ft./person)
Airport terminal (Concourse)	100 gross
Assembly (Gaming floors)	11 gross
Assembly without fixed seats	
Chairs only	7 net
Tables and chairs	15 net
Business areas	100 gross
Exercise rooms	50 gross
Parking garages	200 gross
Warehouses	500 gross



146

1005 Egress Width

EGRESS ELEMENT	BASIC VALUE	SPRINKLERS AND EMERGENCY VOICE COMMAND SYSTEMS
Stairways	0.3" per person	0.2" per person
Level area or ramps	0.2" per person	0.15" per person



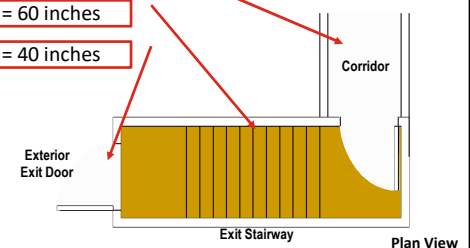
..

147

Given: Egress system serves 200 occupants in a nonsprinklered Group B building.

What is the minimum egress width for the:

- 1) Corridor Table 1020.3 = 44 inches
- 2) Stairs $200 \times 0.3 = 60$ inches
- 3) Door openings $200 \times 0.2 = 40$ inches



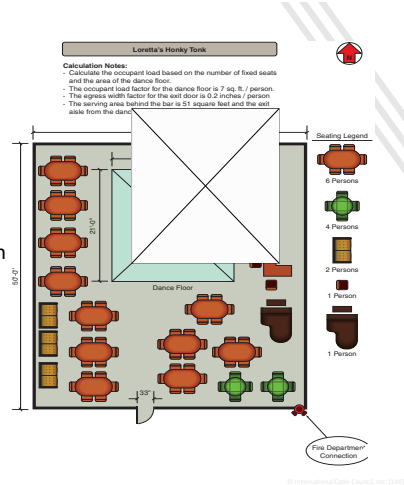
148

Loretta's Honkytonk

- Existing building with new business
- Group A-2
- 2,250 sq. ft.
- Fire sprinkler system
 - No emergency voice/alarm system
- Determine occupant load
 - Fixed seats
 - Dance floor
 - Bar service area

Determine required exit width

* * * *



149

149

SEATING	NUMBER	OCCUPANTS
Tables for six persons	11	66
Tables for four persons	2	8
Tables for two persons	3	6
Individual chairs/stools	10	10
TOTAL SEATING		90

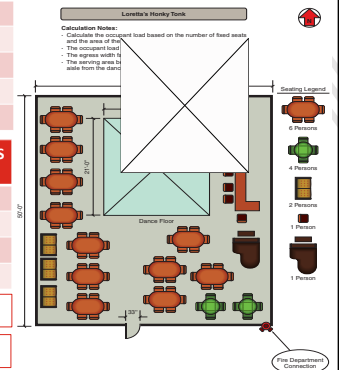
FUNCTION	AREA (sq. ft.)	FACTOR (sq. ft./person)	OCCUPANTS
Dance floor	420	7	60
Bar service	41	200	1
TOTAL FUNCTIONAL AREA			61
GRAND TOTAL			151

151 X 0.2" = 30.2" required exit width

Available exit width = 33"

Second exit required by Table 1006.2.1

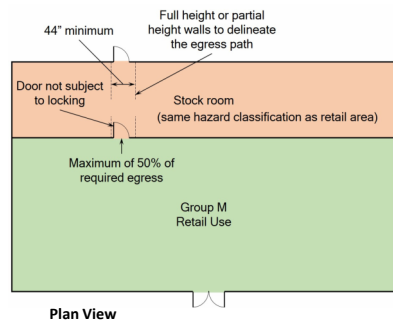
* * * *



150

150

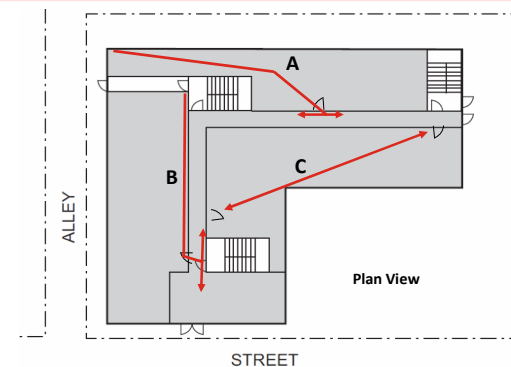
1016 Exit Access – Intervening Spaces



- Egress allowed through adjacent area or room where the rooms are accessory to each other
- May not pass through closets, storage rooms or kitchens
- Exceptions for Group M stockrooms

151

1006.2.1 Common Path of Egress Travel



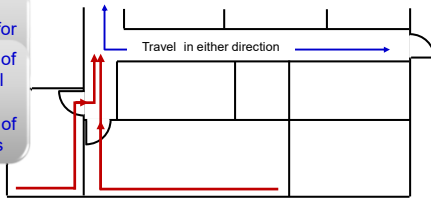
152

Common Path of Egress Travel

§1006.2.1

INSTRUCTOR

Is that the measurement for Common Path of Egress Travel ends where there is choice of two directions



153

153

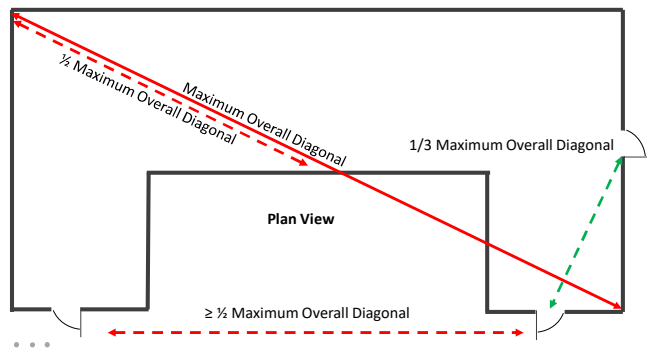
1017.2 Exit Access Travel Distance

- Exit access travel distance is measured to:
 - Exterior exit door
 - Door to
 - vertical exit enclosure
 - exterior exit ramp or stairway
 - Exit passageway
 - Horizontal exit
- Common path of travel is part of travel distance

OCCUPANCY	WITHOUT SPRINKLER SYSTEM (FEET)	WITH SPRINKLER SYSTEM (FEET)
A, E, F-1, M, R, S-1	200	250 ^{b,e}
I-1	Not Permitted	250 ^c
B	200	300 ^c
F-2, S-2, U	300	400 ^c
H-1	Not Permitted	75 ^d
H-2	Not Permitted	100 ^d
I-2, I-3	Not Permitted	200 ^c
I-4	150	200 ^c

154

1007 Exit/Exit Access Configuration



155

1008 Illumination



- Ambient exit and exit access illumination required, except:
 - Group U
 - Self-service storage units ≤ 400 sqft w/direct access
 - Aisles in Group A
 - Dwelling and sleeping units in Groups I, R-1, R-2 & R-3
- When ≥ 2 exits or exit access doors required, emergency power is required for egress path illumination
 - 90-minute duration
 - 10 footcandles at floor
- Exit discharge illumination exceptions

156

1008.3 Illumination

- Rooms, spaces and buildings with ≥ 2 exits, **illuminated by emergency electrical system:**
 - Aisles
 - Corridors
 - Interior/Exterior stairways and ramps
 - Exit passageways
 - Exit discharge vestibules
 - Exterior landings for exit doorways leading to discharge
 - Electrical equipment rooms
 - Fire command centers
 - Fire pump rooms
 - Generator rooms
 - Public restrooms with an area greater than 300 square feet



157

1010.2.4 - Locks and Latches

- Reformats and adds Table 1010.2.4 for locks and applications
- Clarifies existing "main door" exception
 - Primary building or tenant space door
- Night latch, dead bolt or security chain permitted where dwelling/sleeping units allowed single exit
 - Eliminates occupant load limit of 10



158

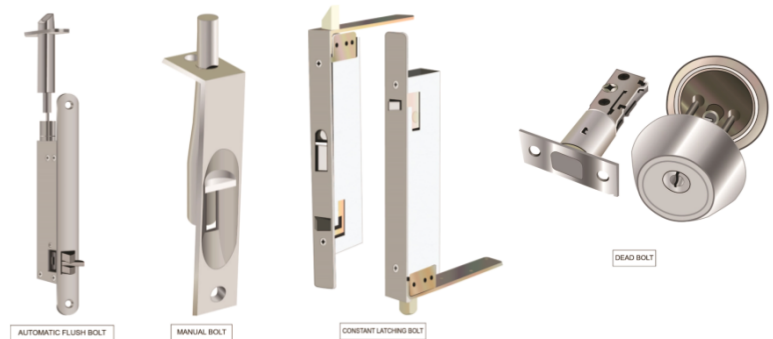
Table 1010.2.4 – Door Bolts on Door Pairs (Excerpt)

ACTIVE AND INACTIVE LEAF DOORS	IBC 716 DOOR PAIR COMPLIANCE	INACTIVE LEAF PERMITTED USES		
		Surface or Flush	Automatic Flush	Constant Latching
B, F, S occupant load < 50	No	P	P	P
	Yes	NP	NP ^b	P
I-2 patient care and sleeping	No	NP	NP ^b	P
	Yes	NP	NP ^b	P
Storage or equipment rooms	No	P ^a	P	P
	Yes	P ^a	P	P

159

159

202 Egress Controls – Locking Devices

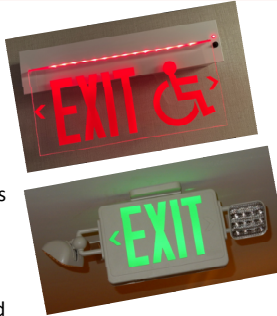


160

160

1013 Exit Signs

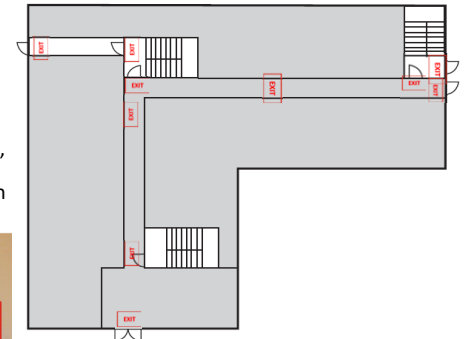
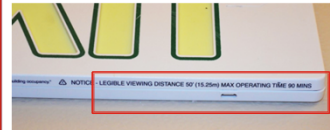
- At all exit and exit access doors, **except**:
 - Rooms or areas with one exit or exit access
 - Main exterior exit doors clearly identifiable as exits when building code official-approved
 - Group U occupancies
 - Individual sleeping units or dwelling units in Groups R-1, R-2 or R-3
 - Dayrooms, sleeping rooms or dormitories in Group I-3
 - On the seating side of vomitories in Groups A-4 and A-5



161

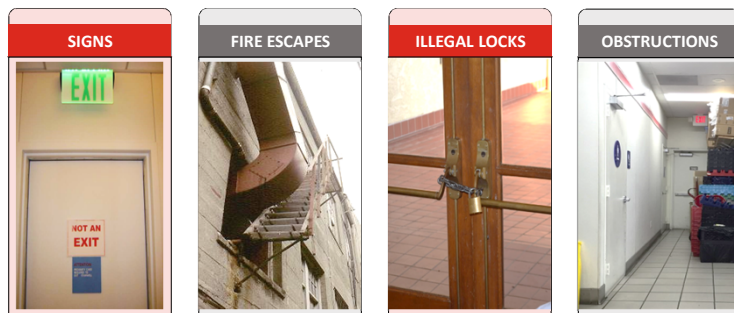
1013 Sign Criteria

- Internally or externally illuminated
- Signs located at changes in direction
- Indicate direction to exit
- All doors into corridors must have visible exit sign within 100'
- Signs spaced in accordance with their listing



162

1032 Egress Maintenance



163

Chapter 11 Existing Buildings

- Buildings that do not comply with current IBC
- Table 1103.1 based on occupancy
 - Egress
 - Doors, corridors, fire escapes
 - Elevators
 - Vertical openings
 - Stairs, escalators, shafts
 - Waste and linen chutes
 - Fire protection and life safety systems



164

1107.1 - Existing Li-ion Energy Storage Systems

- Pre-2018 code installations exceeding Table 1207.1.1 values
 - Provide "Failure Mode and Effects Analysis," or
 - Approved hazard mitigation analysis
- Corrective action plan where required
- Early thermal runaway detection evaluation of installed protection systems

165

165

Special Processes and Building Uses

PART V



© International Code Council, Inc. (166)

166

MOTOR FUEL-DISPENSING FACILITIES AND REPAIR GARAGES



© International Code Council, Inc. (167)

167

Motor Fuel-dispensing Facilities

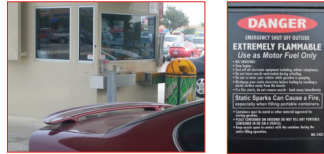
- Regulation based on fuel type

FUEL	APPLICABLE IFC SECTIONS	NFPA STANDARDS
Gasoline, Diesel Fuel, Gasoline/Ethanol mixtures	2306; Chapter 57	NFPA 30; NFPA 30A
Hydrogen – Compressed	2309; 5303	NFPA 55
Hydrogen – Liquefied	2309; 5806	NFPA 55
Liquefied Petroleum Gas	2307; Chapters 53 & 61	NFPA 58
Natural Gas – Compressed	2308; Chapter 53	NFPA 52
Natural Gas – Liquefied	Chapter 58	NFPA 55; NFPA 57; NFPA 59A

168

2304 Dispensing (All Fuels)

- Dispensing operation
 - Attended
 - Attendant's responsibilities
 - Unattended
 - Owner's responsibilities
- Dispenser location
 - 10' from lot line & buildings
 - 20' from ignition sources
 - Fully extended nozzle not reach within 5' of building openings



• •

169

2305 Dispensing Operations



- Emergency fuel disconnect switch
- Separation from exposures
 - Vehicles delivering, receiving fuel and dispensing equipment must be on same property
- Tank filling must be on same property
- Portable fire extinguishers

170

2306 Liquid Fuel Dispensing Facilities

FUEL	CLASSIFICATION
Gasoline	Class IB (flammable)
Alcohol-blended gasoline	
#2 Fuel oil (Diesel)	Class II (combustible)
Biodiesel	Class IIIB (combustible)



- Separation requirements for above-ground fuel tanks
- Storage, use and dispensing of fuel

171

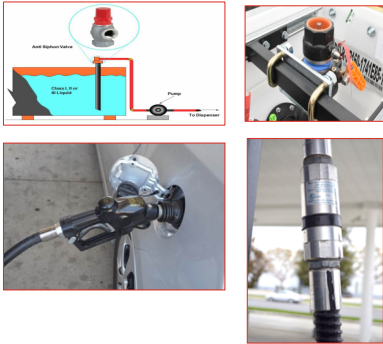
2306 Liquid Fuel Dispensing Facilities

STORAGE TANKS	CONDITIONS
Underground (UST)	• UL 58 (steel) or 94 (fiberglass) • All liquid classes
Aboveground (AST)	• Class II and III liquids only • UL 142 • Maximum 12,000 gallons each • Maximum 48,000 gallons aggregate
Protected Aboveground Tank (PAST)	• All liquid classes • UL 2085 • Maximum 12,000 gallons each or 48,000 gallons aggregate
Aboveground tank in vault	• All liquid classes • UL 142 • 15,000 gallons per vault, above- or below ground



172

Liquid Fuel Transfer Equipment



- All openings through tank top
- Listed components
- Dispenser emergency shutoff valve
 - At base of dispenser
- Emergency dispenser breakaway device
- Fuel delivery nozzle

173

Alcohol-blended Fuels

- E10 = 10% ethanol and 90% unleaded gasoline
- E85 = 85% ethanol and 15% unleaded gasoline

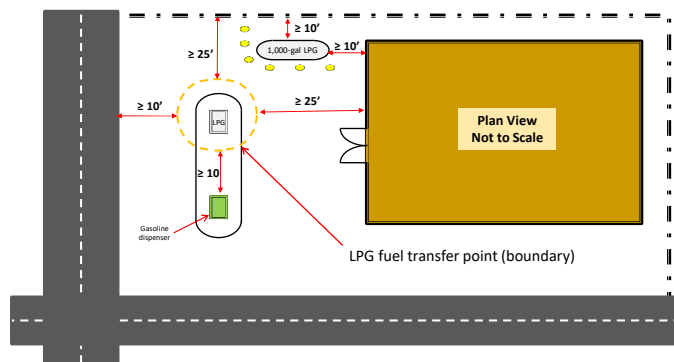
Fuel	Lower flammable limit (percent volume in air)	Upper flammable limit (percent volume in air)
Unleaded gasoline	1.4%	7.6%
E85 alcohol-blended fuel	1.4%	19.0%



- Components must be listed and compatible
 - Ethanol potentially increases corrosion
 - This can create a concern when an existing motor fuel-dispensing facility changes from gasoline to E85

174

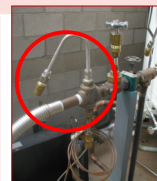
LP-Gas Dispensing



175

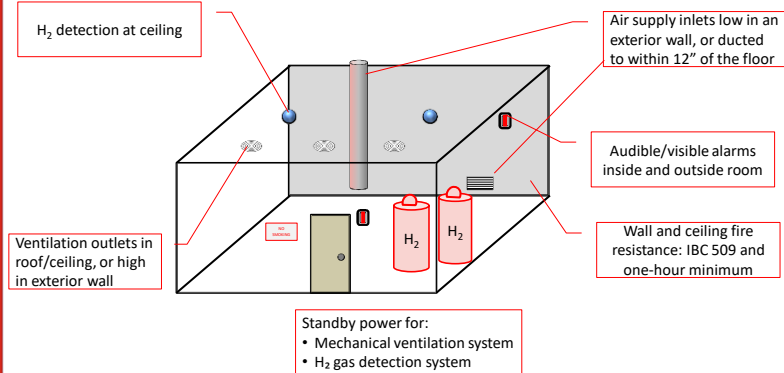
LP-Gas Dispensing (cont'd)

- Excess flow control valve at tank
- At dispenser, either
 - 2nd excess flow control valve, or
 - Differential backpressure valve
- Pressure relief valve
- Listed quick-action shutoff valve



176

5808.1 Hydrogen Fuel Gas Room



177

5707 On-Demand Mobile Fueling

- Vehicle must comply with NFPA 385 or carry ≤60 gallons
- Safety and emergency response plan
- Spill kit
- Operational permit required
- Approved location ≥25' from buildings, property lines, combustible storage, storm drains
- Equipment, hose, nozzles
- Operations while fueling
- New 5809 - Hydrogen fueling now allowed



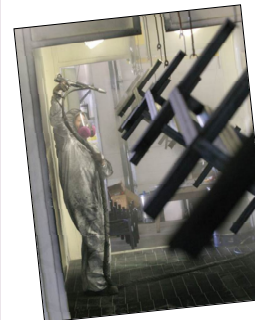
178

FLAMMABLE FINISHES



179

Chapter 24 Flammable Finishes



- Application of "**finishes** that are **flammable**"
 - Spray applied liquids
 - Dip tanks
 - Powder coating
 - Fiber glass
- Hazards
 - Atomized liquid particles
 - Combustible dusts
 - Vapor release in open top tanks

180

Spray Finishing Processes



- Pressurized flammable or combustible liquids through spray nozzle
- Powder coating
 - Plastic powders onto electrically energized metal
- Fiber-reinforced plastics
 - Common catalyst is methylethyl ketone peroxide (MEKP)

181

Spray Booth and Room Construction

- §2404.3.1 – Spray room
 - Permanent construction
 - Required in Group A, E, I and R occupancies
 - Minimum one-hour fire-resistance rated construction
- §2404.3.3 – Spray booth
 - Considered an “appliance”
 - Noncombustible construction



182

2404.6 Fire Protection

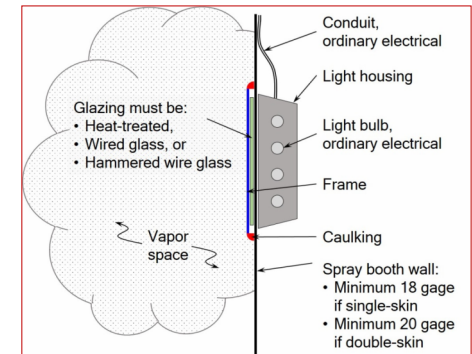


- Automatic fire extinguishing system in spray booths and rooms
 - Fire sprinkler system
 - Special hazard extinguishing system
- Plenums, ducts, both sides of dry filters
- Extra-hazard portables

183

2404.8.2 Illumination

- Fixed luminaires
 - External to spray area
 - Integral to spray area
- Portable electric lamps prohibited
 - Allowed for cleaning or repair operations
 - Only when approved for hazardous atmospheres



184

2404.9 Interlocks

- Interlock ventilation with spraying equipment
 - Air supply line solenoid connected to ventilation system motor
- Differential pressure switch
 - Measures pressure on each side of exhaust filters



..

185

2404.9.6 Mechanical Ventilation



- Removes flammable vapors or combustible dusts and exhausts them to safe location
- Designed to maintain the atmosphere
 - < 25% of the lower flammable limit for liquids
 - < 50% of the minimum explosive concentration for combustible dusts

Ventilation termination point:

- 30' from property lines
- 10' from building openings
- 6' above exterior walls and roofs
- 30' from combustible walls
- 10' above adjoining grade

..

186

2404.11 Limited Spray Spaces

- Designated spray area
 - Aggregate surface area sprayed $\leq 9 \text{ ft}^2$
 - Non-continuous operations
 - 6 air changes per hour
 - Class I, Division 2 wiring in vicinity
- 2404.5.4 Limited finishing workstation
Ventilated enclosure to capture effluent
 - NFPA 33, *Spray Application Using Flammable or Combustible Materials*



Limited finishing workstation

187

HIGH-PILED COMBUSTIBLE STORAGE



© International Code Council, Inc. (2024)

188

Chapter 32 High-piled Combustible Storage

Storage of combustible materials in closely packed piles or combustible materials on pallets, in racks or on shelves where the top of storage is > 12' in height

- May also include certain high-hazard commodities at > 6-foot height, like
 - Rubber tires
 - Group A plastics
 - Flammable liquids
 - Idle pallets and similar commodities

189

3203 Commodity Classification

- Based on product latent heat and heat release rate Includes products, packing materials and containers

CLASS	EXAMPLES	
I	Noncombustible products in cardboard boxes	Lowest fire hazard  Highest fire hazard
II	Noncombustible products in wood boxes or multi-thickness cardboard boxes	
III	Wood, paper, natural fiber cloth, Group C plastics	
IV	Class I, II or III products with Group A plastics, Group B plastics	
High hazard	Group A plastics, rubber tires, foam rubber & foam plastic mattresses	

190

Polymers/Plastics (Product or Package)

- Plastics are ranked into Groups A, B and C based on:
 - Heat of combustion
 - Potential heat released upon full combustion (Btu/lb.)
 - Heat Release Rate
- Group A plastics represent the most severe hazard while Group C represent the least severe
- Commodity classification affected by weight and volume
 - Especially Group A

191

Plastics (Selected Examples)

Group A

- ABS (Acrylonitrile-butadiene-styrene copolymer)
- Cellulose acetate butyrate
- Ethyl cellulose
- Polybutadiene
- Polyester elastomer

Group B

- Cellulose acetate
- FEP (fluorinated ethylene-propylene copolymer)
- ETF (ethylene-tetrafluoroethylene copolymer)
- Silicone rubber

Group C

- PTFE (polytetrafluoroethylene)
- Urea (urea formaldehyde)
- Melamine (melamine formaldehyde)
- PCTFE (polychlorotrifluoroethylene)

192

192

Storage Methods

- Solid-piled
- Palletized
- Racks or shelves



193

Table 3206 (Excerpt)

COMMODITY CLASS	SIZE OF HIGH-PILED STORAGE AREA ^a (SQUARE FEET)	ALL STORAGE AREAS ^b					SOLID-PILED STORAGE, SHELF STORAGE AND PALLETIZED STORAGE		
		Automatic Fire Extinguishing System	Automatic Fire Detection System	Building Access	Smoke and Heat Removal	Draft Curtains	Maximum Pile Dimension ^c	Maximum Permissible Storage Height ^d	Maximum Pile Volume
I-IV	2,501 – 12,000 Not open to public Option 1	Yes	NR	NR ^e	NR	NR	100	40	400,000
	2,501 – 12,000 Not open to public Option 2	NR ^a	Yes	Yes	Yes ^j	Yes ^j	100	30 ^f	200,000

194

OTHER SPECIAL USES AND PROCESSES



195

Chapter 22 – Dust Producing Operations

- Finely divided solid material ≤ 420 microns (0.0165") in diameter
 - Dispersed in air in proper proportions, can be ignited
 - Critical depth layer
 - Dust collection system equipment
 - Open flame/heat source separation
 - Housekeeping – dust accumulation
 - Emergency response plan
 - Dust Hazard Analysis – NFPA 652



DUST TYPE	CRITICAL DEPTH LAYER (INCHES)
Wood Flour	1/8
All Other Dusts	1/32

MATERIAL	SIZE (MICRON)
White granulated sugar	450–600
Sand	50 and greater
Talcum powder	10
Mold spores	10–30
Human hair	40–300
Wheat, corn, or soybean flour	1–100

196

Chapter 33 Fire Safety During Construction



- Assigned responsibilities
- Fire safety controls
- Open flames
- Hazardous materials storage and use
- Fire protection system maintenance

.....

197

Chapter 35 Welding and Hot Work

- Welding, cutting, torch-applied roofing
- Restricted areas
- Hot Work Program Permit
 - Inspect site prior to work start
 - Fire watch
 - Management of equipment
 - Document work
- Gas Welding/Cutting
 - Cylinder handling and use



.

198

Chapter 38 Higher Education Laboratories

- College or university level
- Group B occupancy – sprinklered vs. unsprinklered
- Laboratory suites – different from control areas
- Allowable quantities – different from MAQ per control area

FLOOR LEVEL		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER LAB SUITE ^A	NUMBER OF LAB SUITES PER FLOOR	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS ^B
Above grade plane	21+	Not allowed	Not Permitted	Not Permitted
	16–20	25	1	2 ^C
	11–15	50	1	2 ^C
	7–10	50	2	2 ^C
	4–6	75	4	1
	3	100	4	1
Below grade plane	1–2	100	6	1
	1	75	4	1
	2	50	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

199

Chapter 39 Plant Processing and Extraction



- Prohibited in buildings with Group A, E, I or R occupancies
- Listed extraction equipment and technical report criteria
- Exit doors swing from extraction rooms
- Gas detection
 - Extraction room - CO₂ enriched atmosphere
 - Audible/visual alarm signals
 - Deactivation of heating systems
 - Mechanical ventilation – new code sections
 - De-energize electrical switches and outlets

200

Chapter 40 Distilled Spirits and Wines

- Beverages greater than 20 percent alcohol
 - Distilling process = Group F-1
 - Storage = Group S-1
 - Sprinklers in accordance with Chapter 9
- Ventilation – maintain rate <25% of LFL or specific CFM rate
- No smoking and limited use of open flame
- Palletized storage in wooden barrels – new
 - Max. 7 pallets high
 - Draft curtains
 - Fire sprinklers - based on ceiling and storage height



♦ ♦ ♦ ♦

201

Chapter 41 Temporary Heating and Cooking - New

- Consolidation of sections from other chapters in 2021 code
- Heating – electrical and fuel-fired
- Cooking
 - Operational permit required at construction sites, tents, and WUI areas
 - Portable fuel-fired and electrical appliances
- Mobile Food Preparation Vehicles



202

Hazardous Materials

PART VI



© International Code Council, Inc. (2023)

203

GENERAL REQUIREMENTS FOR HAZARDOUS MATERIALS



© International Code Council, Inc. (2024)

204

Table 5003.1.1(5) – Haz Mat Exemptions

- Consolidates scattered hazardous materials exceptions



205

205

Table 5003.1.1(5) Exemptions (Excerpt)

MATERIAL CLASSIFICATION	OCCUPANCY OR APPLICATION	EXEMPTION
Corrosives	Personal and household products	Corrosives in original packaging not limited
	Retail/wholesale sales	Medicines, foodstuffs, consumer products, < 50% alcohol in containers ≤ 1.3 gallons not limited
Explosives and fireworks	Groups M and R-3	Black powder, smokeless and small arms primers not limited
Any	Energy storage	Hazardous materials in: Stationary storage battery systems not limited
	Refrigeration systems	Refrigerants in refrigeration systems not limited

206

206

Hazardous Materials Regulatory Concepts

- Properly classify hazard(s)
 - Physical, health or both
 - All hazards addressed
 - Classes (1-4, I-IV)
 - State (solid, liquid, gas)
 - Environment (storage, open use, closed use)
 - Location (indoors or outdoors)

207

Why Does This Matter?

- Acrolein
 - Used in plastics manufacturing

CHARACTERISTIC	VALUE
Flash point	15 °F
Boiling point	127 °F
Absorption LD ₅₀	200 Mg/kg
Ingestion LD ₅₀	26 Mg/kg

- What is its classification?

Acrolein is a Class I-B flammable liquid and highly toxic liquid



208

Appendix E – Hazard Categories

Physical

- Combustible dusts and fibers
- Flammable and combustible
 - Liquids
 - Solids
 - Gases
 - Cryogenics
- Oxidizers
- Explosives and fireworks
- Organic peroxides
- Pyrophorics
- Unstable and water reactive

Health

- Corrosives
- Highly toxics
- Toxics



209

More Hazardous at Upper Rows

MATERIAL	CLASS
Unstable reactive	4
	3
	2
	1

MATERIAL	CLASS
Organic peroxide	UD (unstable detonable)
	I
	II
	III
	IV
	V

MATERIAL	CLASS
Flammable/Combustible Liquids	IA
	IB
	IC
	II
	IIIA
	IIIB

210

Appendix H – HMMP and HMIS

IFC 407 and 5001.5 Hazard Communication

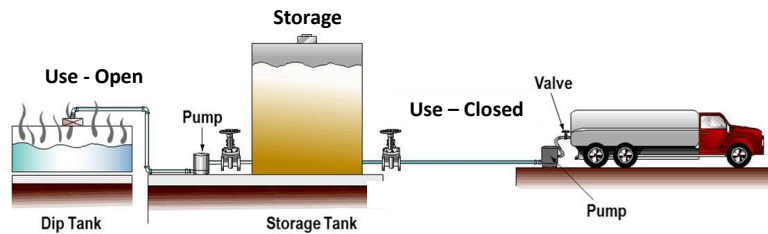
211

Hazardous Materials Control Concepts (cont'd)

- Keep quantities small to maintain control
- Keep products in original or closed containers where possible
- Isolate hazards from one another
- Provide security
- Mitigate unwanted releases and fires through engineering controls

212

Environments



213

Maximum Allowable Quantities (Excerpt)

MATERIAL	CLASS	GROUP WHEN THE MAQ IS EXCEEDED	STORAGE ^b			USE-CLOSED SYSTEM ^b			USE-OPEN SYSTEMS ^b	
			SOLID LBS. (cu.ft.)	LIQUID GALLONS (lbs.)	GAS (ft ³ at NTP)	SOLID LBS. (cu.ft.)	LIQUID GALLONS (lbs.)	GAS (ft ³ at NTP)	SOLID LBS. (cu.ft.)	LIQUID GALLONS (lbs.)
Combustible fibers ^a	Loose	H-3	(100)			(100)			(20)	
	Baled		(1,000)			(1,000)			(200)	
Combustible liquid ^{c,i}	II	H-2 or H-3	N/A	120 ^{d,e}	NA	NA	120 ^d	NA	NA	30 ^d
Flammable liquid ^a	IA	H2 or H-3	NA	30 ^{d,e}	NA	NA	30 ^d	NA	NA	10 ^d
	IB and IC			120 ^{d,e}			120 ^d			30 ^d
Oxidizer	2	H-3	250 ^{d,e}	(250) ^{d,e}	NA	250 ^d	(250) ^d	NA	50 ^d	(50) ^d

214

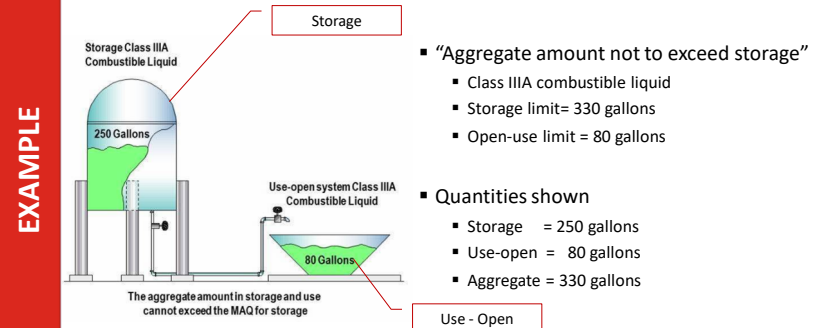
Table 5003.1.1(1) Notes (Excerpt)

NOTE	CONTENT
b	Aggregate may not exceed "storage" amount
d	Increase amount 100% for sprinklers*
e	Increase amount 100% for cabinets, day boxes, exhausted enclosures, listed safety cans*
l	For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2.
m	See 5003.11 for Group M or S storage and display
n	CORRECTION: See 5704.3.4 for flammable and combustible liquids in Group M
q	"High BV" and "Low BV" Category 1B flammable descriptions

*Where notes "d" and "e" apply, values are accumulative.

215

Table 5003.3.1.1(1) Note "b"



216

Class IB Flammable Liquid										
MATERIAL	CLASS	GROUP WHEN THE MAQ IS EXCEEDED	STORAGE ^b			USE-CLOSED SYSTEM ^b			USE-OPEN SYSTEMS ^b	
			SOLID LBS. (cu.ft.)	LIQUID GALLONS (lbs.)	GAS (ft ³ at NTP)	SOLID LBS. (cu.ft.)	LIQUID GALLONS (lbs.)	GAS (ft ³ at NTP)	SOLID LBS. (cu.ft.)	LIQUID GALLONS (lbs.)
Flammable liquid ⁿ	IA	H-2 or H-3	NA	30 ^{d,e}	NA	NA	30 ^d	NA	NA	10 ^d
	IB and IC			120 ^{d,e}			120 ^d			30 ^d

■ Notes "d", "e" and "n" apply

217

Class IB Flammable Liquid (cont'd)

- Table 5003.3.1.1(1) value = 120 gallons in storage
- Notes "d", "e"

■ Note "d" Sprinklers

+ 100%
 = 240 gals

■ Note "e" Cabinets

+ 100%
 = 240 gals

■ Notes "d", "e" Sprinklers and Cabinets

+ 100% for sprinklers
 = 240 gals for sprinklers
PLUS

 + 100% for cabinets
 = 240 gals for cabinets
= 480 gals total

...

218

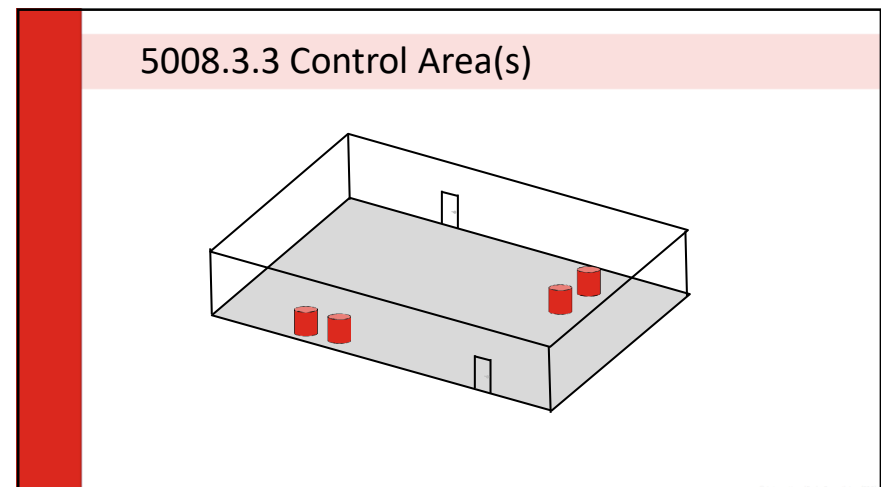
Maximum Allowable Quantities/Control Area			
LIQUID TYPE	MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA (gallons)		
	Sprinklered ^b with noted densities and arrangements	Sprinklered per Tables 5704.3.6.3(4) through 5704.3.6.3(8) and 5704.3.7.5.1	Nonsprinklered
Class IA	60	60	30
Class IB, IC, II and IIIA	7,500 ^c	15,000 ^c	1,600
Class IIIB	Unlimited	Unlimited	13,200

■ Note "n" Group M wholesale and retail sales uses

- Based on full-scale fire tests

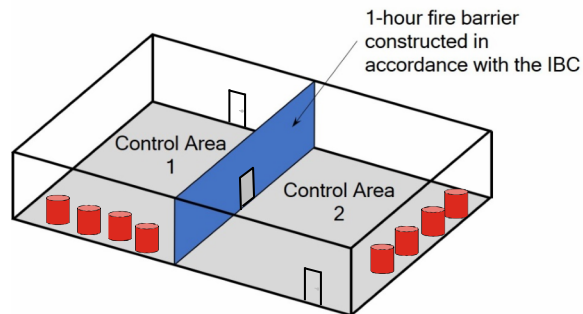
■ **CORRECTED** -- Table 5704.3.4.1

219



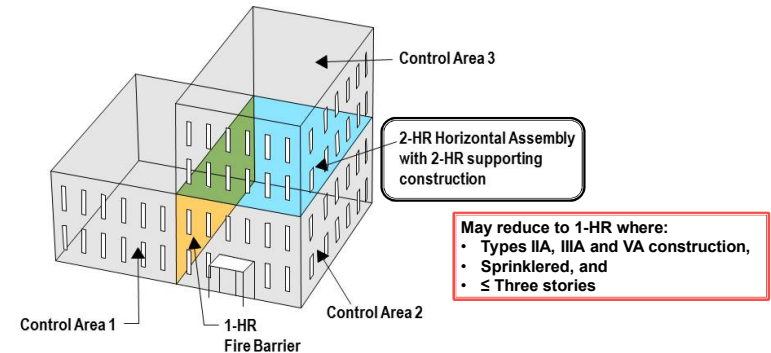
220

5008.3.3 Control Area(s)



221

5008.3.3 Control Area Separation



222

Table 5003.8.2 Control Areas

FLOOR LEVEL	PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA	NUMBER OF CONTROL AREAS PER FLOOR	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS
Higher than 9	5	1	2
7-9	5	2	2
6	12.5	2	2
5	12.5	2	2
4	12.5	2	2
3	50	2	1
2	75	3	1
1	100	4	1
Above grade plane			
1	75	3	1
2	50	2	1
Below grade plane			
Lower than 2	Not Allowed	Not Allowed	Not Allowed

...

223

APPLICATION

- 1) Specialized optics manufacture
- 2) Two-story Group F-1, Type IIA, sprinklered, one-hour control area fire barriers
- 3) Class II liquid organic peroxide storage and use (MAQ = 20 lbs)
- 4) Company asks:

a) What is the maximum number control areas?

b) What is the quantity in each control area without cabinets?

c) What is the total volume of organic peroxide in the building?

Table 5003.8.3.2

1st floor = 4

2nd floor = 3

Total = 7

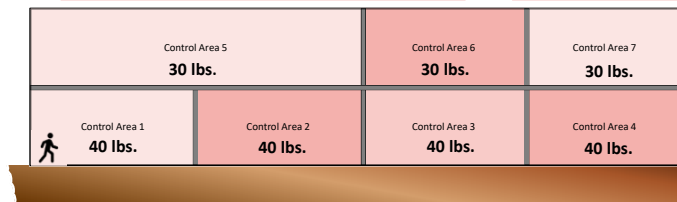
1st floor = 20 lbs X 2 = 40 lbs per control area

2nd floor = (20 lbs X 2) X 75% = 30 lbs per control area

1st floor = 160 lbs

2nd floor = 90 lbs

Building total = 250 lbs



224

224

Hazard Identification Signs

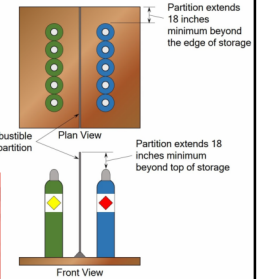
- NFPA 704, *Identification of the Hazards of Materials for Emergency Response*
- Health, fire, reactivity, special information
- Appendix F – Hazard Rankings



225

5003.9.8 Incompatible Material Separation

- Determine incompatibility
 - SDS
 - HMEX®
- Separation required when:
 - >5 lbs.
 - >½ gallon
 - Any amount compressed gases
- Separation
 - 20'
 - Haz mat storage cabinets
 - Gas storage cabinets
 - Physical barrier



226

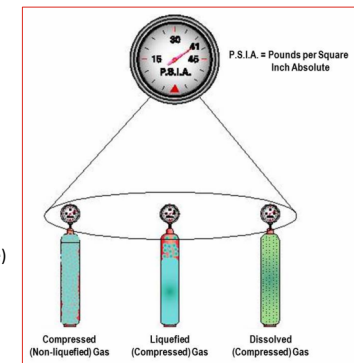
COMPRESSED GASES



227

Compressed Gases

- Gas categories
 - Compressed
 - Liquefied
 - Dissolved
- Chapter 50 Hazardous Materials
 - Inert
 - Corrosive
 - Flammable
 - Low burning velocity
 - Oxidizing
 - Pyrophoric
 - Unstable (reactive)
 - Toxic
 - Highly Toxic
 - Radioactive



228

Compressed Gases (cont'd)



- Chapter 53 Compressed Gases
 - Use and handling
 - Control product or energy release
- Chapter-specific requirements
 - 58 – Flammable gases and cryogenic fluids
 - 60 – Highly toxic and toxic
 - 61 – Liquefied petroleum gases
 - 63 – Oxidizers
 - 64 – Pyrophorics
 - 66 – Unstable reactives

229

Appendix E – Category 1A Flammable Gases

Extremely flammable gas at 68° F and a standard pressure of 14.7 psia:

1. Are ignitable when in a mixture of 13% or less by volume in air, or
2. Have a flammable range in air of at least 12 percentage points regardless of lower flammability limit unless data show they meet the criteria for Category 1B.

- Includes pyrophoric or chemically unstable gases (e.g., diborane, dichloroborane, phosphine, silane)

230

Appendix E – Category 1B Flammable Gases

Extremely flammable gas at 68°F and 14.7 psia standard pressure, and has at least either:

1. A lower flammability limit of more than 6% by volume in air; or
2. A fundamental burning velocity of less than 3.9 ft/s

- Does **not** include pyrophoric or chemically unstable gases

231

Table 5003.11.2 Note “d”– Category 1B in Group M and S

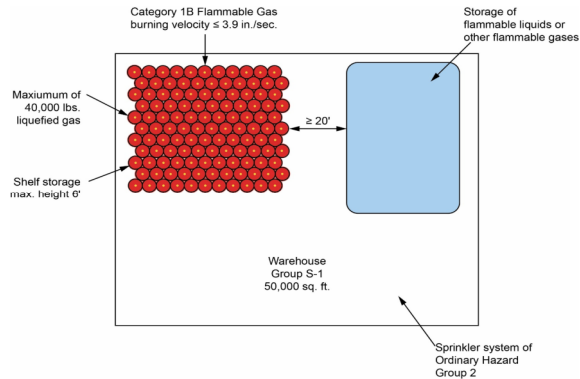
Maximum Allowable Quantity per Control Area^a

Category 1B (Low BV)	Sprinklered – OH Group 2	Non-sprinklered
Gaseous	390,000 ft ³	195,000 ft ³
Liquefied	40,000 lb ^c	20,000 lb

232

232

5003.11.2 Category 1B Gas: Group M and S



233

233

Table 5003.11.2 – Note “c” Increases

- Category 1B
- Maximum allowable quantity in Group M or S control areas may be increased, where
 - Storage area > 50,000 sq. ft.
 - 2% per 1000 sq. ft.
 - Not to exceed 100% or 80,000 lbs

234

234

Table 5003.11.2 – Note “c” Increases

Given:

- 68,000 sq. ft. sprinklered storage area
- Ordinary Hazard Group 2 sprinkler design

How much Category 1B liquefied gas may be stored in this area?

54,000 lbs

235

235

5303 Storage Vessels

- Compressed gas container standards
 - US Department of Transportation
 - ASME Boiler and Pressure Vessel Code
- Compatible with gas stored
- Proper container use
 - Vertical or horizontal
- Valves and fittings
 - Gas-specific
- Markings
 - Construction standards
 - Gas contents/characteristics



236

5303.3 Pressure Relief Devices

- Prevent catastrophic vessel failure
 - Internal
 - External
 - Burst disc
 - Fusible plugs
- Some exceptions based on specific gases



237

Pressure Relief Valves (cont'd)

EXAMPLE



Burst disks



Fusible plugs

238

5303.5 Security



Cylinder rack



Nesting

- Containers must have:
 - Security when outdoors
 - Falling or vehicle impact protection

239

Exhausted Enclosures and Gas Cabinets

- Appliances designed to capture and exhaust a leak from gas container or piping system
 - Gas cabinet
 - Exhausted enclosure
- Both:
 - allow a 100% increase of most gases
 - provide a means of separating incompatibles



240

6109.15 LP-gas Cylinder Exchange



- Goal is to remove unsafe LP-gas cylinders from use
 - Lockable, ventilated cabinet
 - Entry door sign
 - Emergency contact information
- Automated LP-gas cylinder exchange station

241

5307.3 CO₂ Beverage Dispensing



- Liquid CO₂ for beverage dispensing
 - >100 lbs requires permit
 - Continuous mechanical ventilation required, or
 - Gas detection system
 - Supervisory alarm at 5,000 ppm (PEL)
 - Emergency alarm at 30,000 ppm (TLV-STEL)

Example: 370-lb vessel

242

FLAMMABLE AND COMBUSTIBLE LIQUIDS


© International Code Council, Inc. (2043)

243

Liquid Classification

- Closed-cup flash point testing provides a repeatable result

CLASSIFICATION	FLASH POINT TEMPERATURE	BOILING POINT TEMPERATURE	EXAMPLE LIQUIDS BY CLASS
FLAMMABLE LIQUIDS			
Class IA	<73 °F	<100 °F	N-Pentane; Ethyl Ether
Class IB	<73 °F	≥100 °F	Gasoline; Isopropyl Alcohol
Class IC	≥73 and <100 °F	Not Applicable	Methyl Ethyl Ketone
COMBUSTIBLE LIQUIDS			
Class II	≥100 °F and <140 °F	Not Applicable	No. 2 Diesel fuel; Kerosene
Class IIIA	≥140 °F and <200 °F	Not Applicable	Turpentine; No. 3 Fuel Oil
Class IIIB	≥200 °F	Not Applicable	Motor Oil; Cooking Oil; No.6 (bunker) Fuel Oil

244

Maximum Allowable Quantities/Control Area

- Table 5704.3.4.1
- Wholesale and retail sales occupancies
 - Based on full-scale fire tests

LIQUID TYPE	MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA (gallons)		
	Sprinklered ^b with noted densities and arrangements	Sprinklered per Tables 5704.3.6.3(4) through 5704.3.6.3(8) and 5704.3.7.5.1	Nonsprinklered
Class IA	60	60	30
Class IB, IC, II and IIIA	7,500 ^c	15,000 ^c	1,600
Class IIIB	Unlimited	Unlimited	13,200

245

202 Containers and Tanks

VESSEL	CAPACITY (gals.)	SPECIAL CONDITIONS
Container	≤ 60	Metal, plastic, fiberboard or any combination of approved materials
Portable tank	> 60	Designed for transportation
Tank	> 60	Stationary location
Intermediate bulk container	≤ 793	Designed for transportation, metal, plastic, composites



246

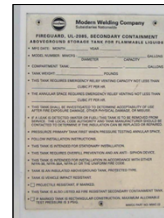
5704.2 Stationary Tanks



- Stationary tanks are designed for permanent installation
- Stationary tanks can be installed:
 - Above ground
 - Below ground
 - Inside buildings
 - In vaults
- Tanks can be field-erected or fabricated in a shop

247

5704.2.7 Design and Construction



- Must meet NFPA 30, *Flammable and Combustible Liquids Code*
- Material must be chemically compatible with liquid
 - Must have a normal and emergency vents
- Construction nameplate
 - Design standard
 - Manufacture date
 - Volume and tank weight
 - Emergency venting rates

248

Table 2306.2.3 Aboveground Tanks for Dispensing

CLASS OF LIQUID AND TANK TYPE	INDIVIDUAL TANK CAPACITY (GALLONS)	MINIMUM DISTANCE FROM NEAREST IMPORTANT BUILDING ON SAME PROPERTY (FEET)	MINIMUM DISTANCE FROM NEAREST FUEL DISPENSER (FEET)	MINIMUM DISTANCE FROM LOT LINE THAT IS OR CAN BE BUILT UPON, INCLUDING THE OPPOSITE SIDE OF A PUBLIC WAY (FEET)	MINIMUM DISTANCE FROM NEAREST SIDE OF ANY PUBLIC WAY (FEET)	MINIMUM DISTANCE BETWEEN TANKS (FEET)
Protected above-ground tanks	≤6,000	5	25 ^{a,c}	15	5	3
	>6,000	15	25 ^{a,c}	25	15	3
Tanks in vaults	0 – 20,000	0 ^b	0	0 ^b	0	Separate compartment required for each tank
Other tanks	All	50	50	100	50	3

...

249

UL 2085, *Protected Aboveground Tanks*

- Installation meets Chapters 23 and 57

- Tank size

- Location

- Exposures

- Overfill prevention

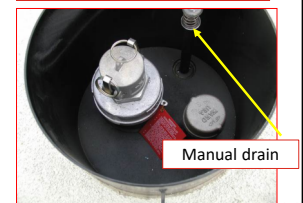
- Slows filling at 90% capacity

- Stops filling at 95% capacity

- Spill collection

- Five-gallon maximum

- Drain to tank



250

5704.2.7.3 Storage Tank Openings



Class I liquids require pressure-vacuum vent cap

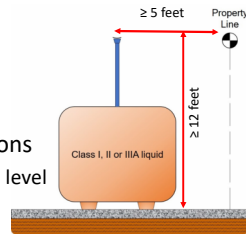
- Normal vent

- ≥ 12 feet above ground

- ≥ 5 feet from property line

- Liquid fill and withdrawal connections

- Valve on all connections below liquid level



251

Emergency Vent

- Required on all aboveground tanks

- Pressure relief from exposure fire

- Sized on tank capacity

- Wetted area

- Mushroom, long-bolt, flip-up, rupture disk

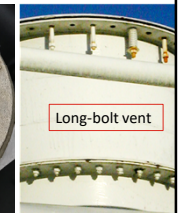
Mushroom vent

Design characteristics:

- Opens at 0.5 psig (8 oz/in²) internal pressure
- Full open pressure = 2.5 psig
- Flow rate w/Screen = 114,800 SCFH
- Flow rate w/o screen = 118-750 SCFH



Post-installation screens – check vent rates



Long-bolt vent

252

Referenced Standards

PART VII



253

Referenced Standards

- Alphabetical by organization
 - Alpha-numeric by standard identification
 - Edition reference
- Lists applicable IFC section(s)

CGA Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151
ANSI/CGA G-13—(2015): Storage and Handling of Silane and Silane Mixtures
 6404.1, 6404.2, 6405.3
ANSI/CGA P-18—(2018): Standard for Bulk Inert Gas Systems
 5501.1
C-7—(2020): Guide to Classification and Labeling of Compressed Gases
 5303.4.2, 5503.4.2
P-1—(2015): Standard for Safe Handling of Compressed Gases in Containers
 5305.7
S-1.1—(2019): Pressure Relief Device Standards—Part 1—Cylinders for Compressed Gases
 5303.3.2, 5503.2

254

Appendices

PART VIII



255

Appendices – partial list

- A –Board of Appeals and administrative procedures
- G – Cryogenic fluid weight and volume equivalents
- I – Non-compliant fire protection system remediation
- J – Building information sign
- K –Construction for existing ambulatory care facilities
- L – Firefight air replenishment systems
- M – High-rise retroactive sprinkler requirements
- N - Indoor trade shows and exhibitions

256

Appendix O – Valet Trash and Recycling

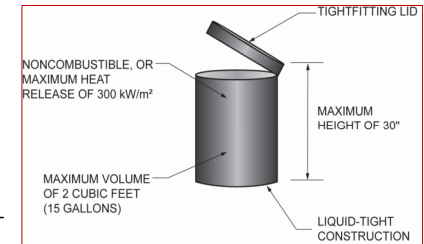


- IFC 304.1.1 requires fire code official approval, or
- Appendix O adoption for Group R-2 occupancies

257

Appendix O – Valet Trash and Recycling

- Containers
 - Liquid-tight
 - Fully closing lid
 - Max 2.0 cubic feet; 30" high
 - One per unit at a time (trash or recycling)
 - Noncombustible or ASTM E1354 - 17 at 50 kw/m²



258

258

Appendix O – Valet Trash and Recycling (cont'd)

- Cannot obstruct egress width
 - Prohibited from stairways
- Time limit
 - Full: 6 hours within any 24 hours
 - Empty: 12 hours within any 24 hours
 - Collection rules and penalties
 - Possible suspension



259

259

GOAL & OBJECTIVES

1. Recall the 2024 IFC scope and purpose
2. Provide examples of common fire hazards and describe how the 2024 IFC addresses correction, mitigation or elimination



260

GOAL & OBJECTIVES

4. Summarize how 2024 IFC addresses life safety and fire protection in building design and construction
5. Discuss how the 2024 IFC applies to building and facility maintenance for fire and life safety
6. Generalize how the 2024 IFC addresses hazardous materials



261

COPYRIGHT © 2024 by INTERNATIONAL CODE COUNCIL, INC.

This presentation is copyrighted work owned by the International Code Council, Inc. ("ICC"). Without advanced written permission from the ICC, no part of this presentation may be reproduced, distributed, or transmitted in any form or by any means, including, without limitation, electronic, optical or mechanical means.

For information on use rights, permissions, or licensing, please contact ICC Training at 4051 Flossmoor Road, Country Club Hills, IL 60478 or via email: Learn@ICCSAFE.org.

Images from private sources, Shutterstock, and Getty Images used under license or permission.

262

IACET Accreditation



- The International Code Council® is accredited as an Authorized Provider by the International Association for Continuing Education and Training (IACET).
 - ICC® is authorized to offer IACET continuing education units (CEUs) for its programs that qualify under the ANSI/IACET Standard.
- You will obtain full CEUs for this course if you actively participate in the training activities and stay for the entire session. Evidence of this will be the sign out sheet.

263

AIA Accreditation



- The International Code Council® is a Registered Provider with The American Institute of Architects Continuing Education Systems (CES).
- Credit earned on completion of this program will be reported to CES Records for AIA members. Certificates of Completion for non-AIA members are available on request.
- This program is registered with the AIA/CES for continuing professional education. It does **not** include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.
- Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

264



265



266



267