

The Dangerous Cs of Hazardous Materials Code Enforcement:

Combustible
Compressed
Corrosive
Cryogenic

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Presented by

- Michael Fitzgerald
 - Fire Marshal
 - Monroe Fire
 - mfitzgerald@monroefire.org
 - 360.805.0338

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What is a HazMat?

- “Those chemicals or substances which are *physical hazards* or *health hazards* as defined and classified in this chapter (50), whether the materials are in usable or waste condition.”
 - IFC 202

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Physical Hazard

- A chemical for which there is evidence that it is a *combustible liquid*, *cryogenic fluid*, *explosive*, flammable (solid, liquid or gas), organic peroxide (solid or liquid), oxidizer (solid or liquid), oxidizing gas, pyrophoric (solid, liquid or gas), unstable (reactive) material (solid, liquid or gas) or water-reactive material (solid or liquid).
 - IFC 202

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Health Hazard

- A classification of a chemical for which there is statistically significant evidence that acute or chronic health effects are capable of occurring in exposed persons. The term “health hazard” includes chemicals that are toxic, highly toxic and *corrosive*.
 - IFC 202

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Keys to Determining Type of Hazard

- MSDS
- Appendix F
- T5003.1.1(1) – T5003.1.1(4)

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Appendix F – Hazard Ranking

- Helps to classify the Health, Flammability, and Reactivity of the NFPA 704 placard



TABLE F 501.2
FIRE FIGHTER WARNING PLACARD DESIGNATIONS BASED ON HAZARD CLASSIFICATION CATEGORIES

HAZARD CATEGORY	DESIGNATION
Combustible liquid II	F2
Combustible liquid IIIA	F3
Combustible liquid IIIB	F4
Combustible dust	F5
Combustible fiber	F4, H3
Cryogenic flammable	OX, H3
Cryogenic oxidizing	R4
Explosive	F2
Flammable solid	F4
Flammable gas (gaseous)	F4
Flammable gas (liquid)	F4
Flammable liquid IA	F3
Flammable liquid IB	F3
Flammable liquid IC	R4
Oxygen peroxide, I, II	F4, H3
Oxygen peroxide I	F3, H3
Oxygen peroxide II	F2, H2
Oxygen peroxide IV	F1, H1
Oxygen peroxide V	None
Oxidizing gas (gaseous)	OX
Oxidizing gas (liquid)	OX
Oxidizer 1	OX4
Oxidizer 2	OX3
Oxidizer 3	OX2
Oxidizer 4	OX1
Oxidizer 5	OX2
Oxidizer 6	OX3
Pyrophoric gases	F4
Pyrophoric solids, liquids	F3
Unstable reactive 1	R4
Unstable reactive 2	R4
Unstable reactive 3	R2
Unstable reactive 4	R2
Water reactive 1	R2
Water reactive 2	None
Toxic	W3
Corrosive	W3
Flammable	H3
Highly toxic	H3, COR
	H4

E - Flammable (category)
F - Flammable (category)
H - Health category
W - Special hazard - water reactive
OX - Special hazard - oxidizing properties

COR - Corrosive
I, II - Ionized flammable material
H1 - Class 1 flammable material
H2 - Class 2 flammable material
H3 - Class 3 flammable material
H4 - Class 4 flammable material

Hazardous Materials in IFC

- Part V – Hazardous Materials
 - Chapters 50-79
 - Chapter 50 – HazMat General Provisions
 - Chapter 51 – Aerosols
 - Chapter 52 – Combustible Fibers
 - Chapter 53 – Compressed Gases
 - Chapter 54 – Corrosive Materials
 - Chapter 55 – Cryogenic Fluids
 - Etc.



Chapter 50 – HazMat General Provisions

- Prevention, control and mitigation of dangers
 - Due to storage, dispensing, use and handling
 - IFC 5001.1
- When specific provisions are provided elsewhere, those specifics apply
 - IFC 5001.1



Chapter 50 – HazMat Exceptions

- Retail or wholesale occupancies:
 - Medicine, foods, consumer products, cosmetics packaged in \leq 1.3 gallon (5L) containers with \leq 50% water-miscible liquids with remainder non-flammable
 - Alcohol in containers \leq 1.3 gallons (5L)
 - Corrosives in personal and household products in Group M occupancies



Chapter 50 – HazMat Exceptions

- Application & release of pesticide and ag products for
 - Weed abatement, erosion control, soil amendment, similar applications



Chapter 50 – HazMat Exceptions

- Off-site transport of HazMat when in accordance with DOTn regulations.
- Building materials not otherwise regulated by IFC.
- Refrigeration systems (Ch. 6)
- Stationary storage battery systems (Ch. 6)
- Fireworks storage, sale, or use (Ch. 56)

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Chapter 50 – HazMat Exceptions

- Storage of distilled spirits and wines in wooden barrels and casks.
- Wall-mounted dispensers of alcohol-based hand rubs classified as Class I or II liquids per 5705.5.

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Chapter 50 Layout

- General – 5001
- Definitions – 5002 / 202
- General Requirements – 5003
- Storage – 5004
- Use, Dispensing, Handling - 5005

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3-way HazMat Protection

- Fire Prevention
- Passive Protection
- Active* Protection
- *My definition: motion or response

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HazMat Fire Prevention

- CRK (SARA Tier Two)
- Fire Inspection
- Permit Enforcement
- Pre-Incident Planning

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HazMat Fire Prevention: Inspection

- MSDS (5003.4)
- Hazard identification (5003.5)
- Signage (5003.6)
- Sources of ignition (5003.7)
- Personnel training (5003.9.1)
- Security (5003.9.2)
- Vehicle protection (5003.9.3)

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HazMat Fire Prevention: Inspection

- Proper storage
 - Static protection (5003.9.5)
 - Photosensitivity (5003.9.6)
 - Shock sensitivity (5003.9.7)
 - Incompatible materials (5003.9.8)
 - Shelf storage (5003.9.9)
 - Safety cans (5003.9.10)

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HazMat Fire Prevention: Inspection

- Handling & transportation (5003.10)
 - Protective caps in place
 - Carts and trucks with spill control
 - No incompatible materials
- Group M / S Storage (5003.11)
 - Allowances for exceeding MAQ
- Outdoor Control Areas (5003.12)

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HazMat Fire Prevention: Inspection

- Spill control (5004.2 / 5005.1.3)
- Clearance from Combustibles (5004.11 / 5005.3.8)
- Noncombustible floors (5004.12 / 5005.1.2)
- Adequate lighting (5005.1.7)
- Liquid transfer (5005.1.10)

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HazMat Fire Prevention: Permits

- Operational permits (105.6)
 - 105.6.20 – required to store, transport, dispense, use or handle HazMat in excess of amounts in T106.2.20
- Construction permits (105.7)
 - 105.7.3 – Compressed gases T105.6.8
 - 105.7.4 – Cryogenic fluids T105.6.10

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HazMat Fire Prevention: Pre-Incident Planning

- Presumes incident will occur
- Provides data to responders
- NFPA 1620: Standard for Pre-Incident Planning

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HazMat Passive Protection

- Isolation / Separation
- Containment

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HazMat Passive Protection

- Isolation / Separation
 - Construction per IBC (5003.8.1)
 - Detached buildings if required by T5003.8.2
 - Control Areas (5003.8.3 / 5003.12)
 - Gas rooms (5003.8.4)
 - Exhausted enclosures (5003.8.5)
 - Gas cabinets (5003.8.6)
 - HazMat storage cabinets (5003.8.7)
 - Incompatible materials (5004.4 / 5005.1.1)
 - Weather protection (5004.1.13 / 5005.3.9)



Control Areas

- Spaces where quantities of *hazardous materials* not exceeding the MAQ per control area are stored, dispensed, *used*, or handled. May be inside or outside a building (202).



Maximum Allowable Quantity (MAQ)

- The highest amount of HazMat allowed for storage or use within a control area (202)



Control Area Construction

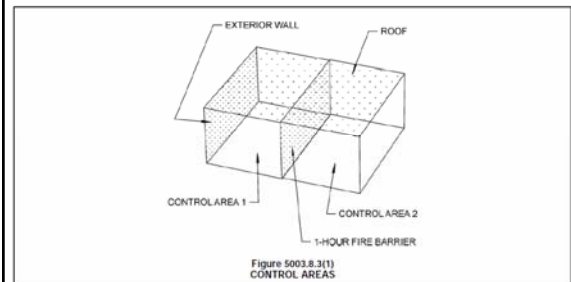
- Separated from other control areas by *fire barriers* (5003.8.3.1 / IBC 414.2.1), rated according to T414.2.2
- Ventilated



**TABLE 5003.8.3.2
DESIGN AND NUMBER OF CONTROL AREAS**

FLOOR LEVEL	PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA ^a	NUMBER OF CONTROL AREAS PER FLOOR	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS ^b
Above grade plane	Higher than 9	5	1
	7-9	5	2
	6	12.5	2
	5	12.5	2
	4	12.5	2
	3	30	2
Below grade plane	2	75	3
	1	100	4
	Lower than 2	Not Allowed	Not Allowed
	Not Allowed	Not Allowed	Not Allowed

a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 5003.1.1(1) and 5003.1.1(2), with all increases allowed to the footnotes to those tables.
 b. Separation shall include fire barriers and horizontal assemblies as necessary to provide separation from other portions of the building.



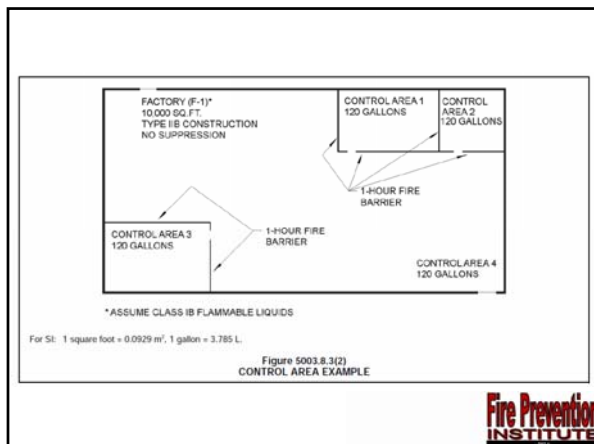


TABLE 5003.8.2 DETACHED BUILDING REQUIRED
A DETACHED BUILDING IS REQUIRED WHEN THE QUANTITY OF MATERIAL EXCEEDS THAT LISTED HEREIN

Material	Class	Solids and liquids (tons) ^{a,b}		Gases (cubic feet) ^a
		Maximum Allowable Quantity	Maximum Allowable Quantity	
Explosives	Division 1.1	Maximum Allowable Quantity		Not Applicable
	Division 1.2	Maximum Allowable Quantity		
	Division 1.3	Maximum Allowable Quantity		
	Division 1.4	Maximum Allowable Quantity		
	Division 1.4 ^c	1		
	Division 1.5	Maximum Allowable Quantity		
Oxidizers	Class 4	Maximum Allowable Quantity	Maximum Allowable Quantity	
	Class 3	2,000		
Unstable (reactive) detonable	Class 3 or 4	Maximum Allowable Quantity	Maximum Allowable Quantity	
	Class 2	2,000		Not Applicable
Organic peroxides	Class I	Maximum Allowable Quantity		Not Applicable
	Class II	25		
	Class III	50		
	Class 3	1		
Unstable (reactive) nondetonable	Class 3	1	2,000	
	Class 2	25	10,000	
Water reactives	Class 1	1		Not Applicable
	Class 2	25		
Pyrophoric gases	Not Applicable	Not Applicable		2,000

For SI: 1 pound = 0.454 kg, 1 cubic foot = 0.02832 m³, 1 ton = 2,000 lbs. = 907.2 kg.
 a. For materials which are detonable, the distance to other buildings or lot lines shall be as specified in the *International Building Code*. For materials classified as explosives, the required separation distances shall be as specified in Chapter 56.
 b. "Maximum Allowable Quantity" means the maximum allowable quantity per control area set forth in Table 5003.1.1(1).
 c. Limited to Division 1.4 materials and articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco, Firearms and Explosives regulations, or un packaged articles used in process operations that do not propagate a detonation or deflagration between articles, providing the net explosive weight of individual articles does not exceed 1 pound.

- ### HazMat Passive Protection
- Containment
 - Spill control (5004.2.1 / 5005.1.3 / 5005.2.1.3 / 5005.3.4 / 5005.3.6 / 5005.2.2.3)
 - Secondary containment (5004.2.2 / 5005.2.2.4 / 5005.2.1.4 / 5005.3.5 / 5005.3.7)

TABLE 5004.2 REGISTERED SECONDARY CONTAINMENT—HAZARDOUS MATERIAL SOLIDS AND LIQUIDS STORAGE

MATERIAL	INDOOR STORAGE		OUTDOOR STORAGE	
	Solids	Liquids	Solids	Liquids
Combustible liquids	Class II	See Chapter 57	See Chapter 57	See Chapter 57
	Class IIA	See Chapter 57	See Chapter 57	See Chapter 57
	Class IIB	See Chapter 57	See Chapter 57	See Chapter 57
Corrosive fluids	Class I	See Chapter 55	See Chapter 55	See Chapter 55
	Class II	See Chapter 55	See Chapter 55	See Chapter 55
Explosives	Class IA	See Chapter 56	See Chapter 56	See Chapter 56
	Class IB	See Chapter 56	See Chapter 56	See Chapter 56
	Class IC	See Chapter 56	See Chapter 56	See Chapter 56
Flammable liquids	Class I	Not Applicable	Not Applicable	Not Applicable
	Class II	Not Applicable	Not Applicable	Not Applicable
	Class III	Not Applicable	Not Applicable	Not Applicable
Flammable solids	Class I	Not Required	Not Required	Not Required
	Class II	Not Required	Not Required	Not Required
	Class III	Not Required	Not Required	Not Required
Organic peroxides	Class I	Required	Required	Not Required
	Class II	Required	Required	Not Required
	Class III	Required	Required	Not Required
	Class IV	Required	Required	Not Required
Oxidizers	Class 1	Not Required	Not Required	Not Required
	Class 2	Required	Required	Not Required
	Class 3	Required	Required	Not Required
	Class 4	Not Required	Not Required	Not Required
Pyrophorics	Class 1	Not Required	Required	Not Required
	Class 2	Not Required	Required	Not Required
	Class 3	Not Required	Required	Not Required
Unstable (reactive)	Class 1	Not Required	Not Required	Not Required
	Class 2	Required	Required	Required
	Class 3	Not Required	Not Required	Not Required
	Class 4	Not Required	Not Required	Not Required
Water reactives	Class 1	Not Required	Not Required	Not Required
	Class 2	Not Required	Not Required	Not Required
	Class 3	Not Required	Not Required	Not Required
Corrosives	Class 1	Not Required	Not Required	Not Required
	Class 2	Not Required	Not Required	Not Required
Highly toxic	Not Required	Required	Not Required	Required
Toxics	Not Required	Required	Required	Required

- ### HazMat Active Protection
- Ventilation (5004.3 / 5003.8.4.2 / 5003.8.5.2 / 5005.1.9 / 5005.2.1.1. / 5005.2.2.1)
 - Fire Sprinklers (5004.5 / 5005.1.8)
 - Explosion Control (5004.6 / 5005.2.1.2 / 5005.2.2.2)
 - Standby Power (5004.7 / 5005.1.5)
 - Limit Controls (5004.8 / 5005.1.4)
 - Emergency Alarm (5004.9)
 - Supervision / Monitoring (5004.10)

- ### Alternative to Requirements of Chapters 51-79
- Performance-based design (IFC 5001.3)
 - Minimize risk of releases, fires, explosions
 - Minimize consequences of HazMat incident
 - Subject to approval of fire code official
 - 5001.3.3.1 – 5001.3.3.18

Combustible Fibers

- Chapter 52
 - Storage of *combustible fibers* in any quantity

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Combustible Fibers – Fire Prevention

- Noncombustible waste receptacles; removed daily (5203.1)
- Grass or weeds shall not accumulate (5203.2)
- Three foot clearance from sprinklers and piles (5203.3)
- HMMP (5001.5.1)
- Operational permit for > 100 ft³ (105.6.7)
 - Not required for agricultural storage

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Combustible Fibers: Passive Protection

- Separation
 - Agricultural products (5203.4)
 - 100 ton stack
 - Minimum 20' separation
 - Loose fibers (5204)
 - $\leq 100\text{ ft}^3$: stored in self-closing metal bin
 - >100 ft³ to 500 ft³: 1-hour fire barrier with protected openings (3/4 hour)
 - > 500 ft³ to 1,000 ft³: 2-hour fire barrier with protected openings (1 ½ hour)
 - >1,000 ft³: 2-hour fire barrier with protection openings and fire sprinklers
 - Maximum of 2,500 ft³ in a detached building

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Combustible Fibers: Passive Protection

- Separation
 - Baled storage (5205.1)
 - Single blocks or piles $\leq 25,000\text{ ft}^3$ not including aisles
 - Aisles 5' or greater; or
 - Flash-fire barrier from floor to 1' above pile & 1' or more beyond sides.
 - Bales bound with fibers that swell when wet:
 - Store to allow for expansion without affecting structure
 - » Minimum 3' between walls and piles (5205.2)

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Combustible Fibers: Active Protection

- Fire sprinklers required in storage rooms > 1,000 ft³

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Compressed Gases

- Chapter 53: Storage, use, handling of
 - Containers, cylinders, tanks, systems
 - Exceptions:
 - refrigerants (606)
 - CNG as vehicle fuel (Chapter 23 / NFPA 52 / IFGC)
 - LNG as vehicle fuel (NFPA 52 / NFPA 59A)

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Washington State Amendment

- WAC 51-54A-5306 – Medical Gas Systems
 - 5306.1 Exception Added
 - **Exception:** All distribution piping, supply manifolds, connections, regulators, valves, alarms, sensors and associated equipment shall be in accordance with the Plumbing Code.

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Washington State Amendment

- WAC 51-54A-5306 – Medical Gas Systems
 - **5306.4 Medical gas systems.** The maintenance and testing of medical gas systems including, but not limited to, distribution piping, supply manifolds, connections, pressure regulators and relief devices and valves, shall comply with the maintenance and testing requirements of NFPA 99 and the general provisions of this chapter.

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Compressed Gases Layout

- General (5301)
- Definitions (5302 / 202)
- General requirements (5303)
- Storage (5304)
- Use & handling (5305)
- Medical gas systems (5306)
- Compressed gases not otherwise regulated (5307)

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Compressed Gases: Fire Prevention

- Operational permit threshold per 105.6.8

Type of Gas	Amount (ft ³) at NTP
Corrosive	200
Flammable (except cryogenic & LPG)	200
Highly toxic	Any
Inert & simple asphyxiant	6,000
Oxidizing	504
Pyrophoric	Any
Toxic	Any

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Compressed Gases: Fire Prevention

- Construction permit to install, repair, abandon, remove, place out of service, close, or substantially modify a *compressed gas* system: same threshold as operational permit (105.7.3)
 - Exceptions:
 - Routine maintenance
 - Emergency repair: permit application may be delayed 2 days

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Compressed Gases: Fire Prevention

- Marking of containers / cylinders (5303.4)
- Security (5303.5 / 5303.10)
- Wiring (5303.8)
- Repair (5303.9 / 5303.12)
- Environmental corrosion (5303.13 / 5303.14)
- Lighting (5303.15)
- Storage / use methods (5304.1 / 5305.6)
- Personnel (5305.7)
- Inflation: inert only (5305.8)

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Compressed Gases: Passive Protection

- Valve protection (5303.6)
- Isolation / separation
 - Incompatible materials (5303.7.1)
 - Combustible waste (5303.7.2)
 - Hazard separation (5303.7.3 – 5303.7.11 / 5303.11)
 - Vault design (5303.16)
 - Medical gas isolation (5306)
 - Medical gas passive venting (5306.2.1)

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Compressed Gases: Active Protection

- Pressure relief devices (5303.3)
- Automatic controls (5305.2)
- Valves (5305.4)
- Venting (5305.5)
- Medical gas room sprinkler (5306.2.1)
- Medical gas interior room ventilation (5306.2.2)
- NOR gas ventilation (5307.2)

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Corrosive Materials

- Chapter 54
 - Storage and use of *corrosive* materials
 - Exceptions:
 - Display and storage in Group M
 - Storage in Group S
 - Stationary storage battery systems (608)
 - Not R-717 ammonia refrigerant (606)

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Corrosives Layout

- General (5401)
- Definition (5402 / 202)
- General Requirements (5403)
- Storage (5404)
- Use (5405)

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Corrosives: Fire Prevention

- Permit thresholds per 105.6.20
 - Gases 200 ft³
 - Liquids 55 gallons
 - Solids 1000 pounds
- Storage distance to exposures (5404.2.2)
- Liquid transfer – per 5005.1.10 (5405.1.1)

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Corrosives: Passive Protection

- Isolation / Separation
 - < MAQ: per Chapter 50
 - > MAQ: per Chapters 50 & 54
 - Liquid-tight floor construction (5404.1.1)
- Containment
 - Secondary containment (5404.2.1)

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Corrosives: Active Protection

- Mechanical ventilation required when dispensed or used (5405.1.2)

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Cryogenics

- Chapter 55
 - Storage, use, handling of *cryogenic fluids*
 - Exceptions:
 - Refrigerants (606)
 - LNG (NFPA 59A)

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Cryogenics Layout

- General (5501)
- Definitions (5502 / 202)
- General Requirements (5503)
- Storage (5504)
- Use & Handling (5505)

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Cryogenics: Fire Prevention

- Operational permit conditions per 105.6.10

Type	Inside	Outside
Flammable	>1 gal.	60 gal.
Inert	60 gal.	500 gal.
Oxidizing	10 gal.	50 gal.
Physical / health hazard	Any amt.	Any amt.
	not indicated above	

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Cryogenics: Fire Prevention

- Required submittal data (5503.1.1.1)
- Containers / supports (5503.1.2/5503.1.3)
- Marking of cryogenics (5503.4)
- Security (5503.5 / 5503.8 / 5503.9)
- Wiring (5503.6)
- Repair (5503.7)
- Lighting (5503.10)
- Vehicle unloading (5505.4.2)

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Cryogenics: Passive Protection

- Isolation / Separation
 - Separation requirements (5504.3.1 / 5505.3.1)
 - Material-specific piping installation (5505.1.2)
 - Physical protection (5505.1.2.4)

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**TABLE 5504.3.1.1
SEPARATION OF STATIONARY CONTAINERS FROM EXPOSURE
HAZARDS**

EXPOSURE	MINIMUM DISTANCE (feet)
Buildings, regardless of construction type	1
Wall openings	1
Air intakes	10
Lot lines	5
Places of public assembly	50
Nonambulatory patient areas	50
Combustible materials such as paper, leaves, weeds, dry grass or debris	15
Other hazardous materials	In accordance with Chapter 50

For SI: 1 foot = 304.8 mm.

Cryogenics: Active Protection

- Pressure relief (5503.2 / 5503.3)
- Ventilation per IMC (5504.2.1.3 / 5504.2.2.3 / 5505.4.1)
- Shutoff valves (5505.1.2.3 / 5505.3.2)
- Limit controls (5505.4.3)

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