



**WISCONSIN FIRE INSP. ASSOC.
OCTOBER 31, 2007
WCBC & THE IFC – HOW THEY
WORK TOGETHER**

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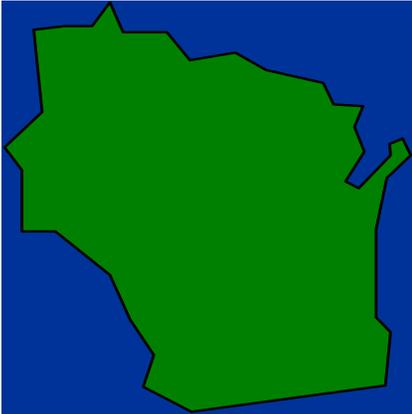
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- Provide specific info on those design and const'n provisions from the IFC that are ref'd from within the WCBC
- Explain the use and operational provisions of the IFC that are a contingency of the design and const'n provisions referenced from the WCBC



WISCONSIN UPDATE HISTORY

- **Importance of consistency in using IFC references from the WCBC has been recognized since the onset (1997) of research into the use of a model building code in Wisconsin.**
- **Decision to reference IFC retained when NFPA 1 chosen as the WI Fire Prevention Code.**

Where are the references?

IFC General

Comm 61.03 (13)

IFC Des. & Const.

Comm 61.03(13)(a)1.

**IFC Approval of
Doc's, Tests &
Oper'n.**

Comm 61.03(13)(a)4.

IFC Use & Oper'n.

Comm 61.03(13)(a)6.

Comm 14 to WCBC

Comm 14.003(2)(d)

Design & Construction

- **Comm 61.03(13)(a)1.**
- **IFC Provisions that are in bounds:**
- **Sect. 102.6; Ch's. 2 to 4; Sect's. 501 to 502 & 504 to 510; Sect's. 601 to 605 & 607 to 609; Ch's. 7 & 8; Sect's. 901.1 to 901.4.2, 901.4.4 to 909.18.9, & 909.20 to 913; Ch's. 10, 12 to 21, 23 to 29, 31 & 32; Sect. 3306; and Ch's. 36, 37, & 39 to 44.**

Use/Oper'n – linked to Const.

- **Comm 61.03(13)(a)6.**
- **IFC Provisions that are in bounds:**
- **Ch's. 2 to 4; Sect's. 501 to 502 & 504 to 510; Sect's. 601 to 605 & 607 to 609; Ch's. 7 & 8; Sect's. 901.1 to 901.4.2, 901.4.4 to 909.18.9, & 909.20 to 913; Ch's. 10, 12 to 21, 23 to 29, 31 & 32; Sect. 3306; and Ch's. 36, 37, & 39 to 44.**

WCBC to Comm 14

- How the WCBC & WI Fire Prevention code relate:
- Comm 14.003(2)(d) *Where differences occur between the reqmt's. of this chapter and chs. Comm 61 to 65, the reqmt's. of chs. Comm 61 to 65 shall govern.*

How often?

- **There are over 140 references to the International Fire Code from within the WCBC.**
- **140 X (#IFC details) = ??? WOW!**
- **See separate handout for the code section and language associated with each reference.**

Significance

- **Of those 140+ references, how to determine those of such significance they warrant mention in this session.**
- **Casual Reference or Specific reference?**
- **Only place to find information?**

Casual References

- The majority are General or casual references.
- Over 70 . . . in accordance with the IFC
- Over 25 . . . the applicable provisions of “this code” and the IFC

Detailed References

- The other extreme are the detailed/specific references.
- Only 3 refer to specific locations
 - . . . Requirements as set forth in Section xxxx.x.xx of the IFC
 - . . . in accord. with Chapters xx, xx, & xx of the IFC
 - . . . complying with Section xxxx.x.x.x of the IFC

Detailed Ref's. (cont.)

- **Fewer than 10 . . . as specified (or as prescribed) in the IFC**
- **Fewer than 40 . . . comply/complying with the IFC**

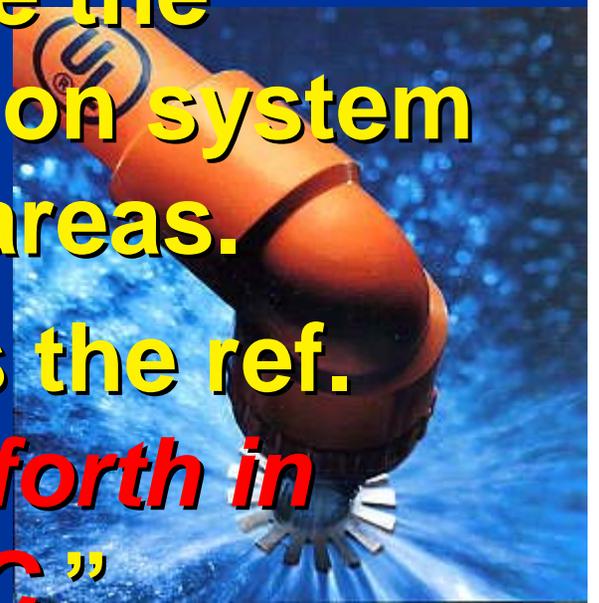
Specific References

Specific IFC References

- **IBC Table 903.2.15 – . . . reqmt's as set forth in Section xxxx.x.xx of the IFC**
- **IBC s. 907.2.5 - . . . in accord. with Chapters xx, xx, & xx of the IFC**
- **IMC s. 513.12.3 - . . . complying with Section xxxx.x.x.x of the IFC**

IBC Table 903.2.15

- Other required suppression systems
In add'n to the reqmt's of Section 903.2, the provisions indicated in Table 903.2.15 also require the installation of a suppression system for certain buildings and areas.
- One row in the table incl's the ref. *"Sprinkler reqmt's as set forth in Section 903.2.15 of the IFC."*



IFC Table 903.2.15

- IFC Section 903.2.15 in turn directs you to IFC Table 903.2.15
- Add'l Req'd. Fire-Exting'g. Sysys.

1208.2	Dry Cleaning Plants
1208.3	Dry Cleaning Machines
1504.1	Spay finish'g in A, E, I or R
1504.6	Spray Booths & Rooms
1505.1	Dip Tank Rooms
1505.6.1	Dip Tanks

IFC Table 903.2.15

1505.8.4	Hardening & Tempering Tanks
1803.10.1.1	HPM work station exhaust
1803.10.2	HPM gas cabinets
1803.10.3	HPM corridors
1803.10.4	HPM exhaust
1803.10.4.1	HPM noncombustible ducts
1803.10.4.2	HPM combustible ducts

IFC Table 903.2.15

1907.3	Lumber Prod'n. Conveyor Rms
1908.7	Recycling Facility Conveyor Rms
2106.1	Class A & B Industrial Ovens
2106.2	Class C & D Industrial Ovens
T. 2306.2	High-piled Comb. Stor. Triggers
2306.4	Solid Piled, Rack & Automated Storage
2703.8.3.1	Haz. Mat'l. Gas Rooms
2703.8.4.3	Haz. Mat'l. Exhausted Encl. to inc. MAQ

IFC Table 903.2.15

2704.5	Indoor Storage of Haz. Matl's.
2705.1.8	Indoor Dispensing of Haz. Matl's.
2804.4.1	Aerosol Warehouses
3306.5.2.1	Storage of Smokeless Propellants
3306.5.2.3	Storage of Small Arms Primers
3404.3.7.5.1	Flam. & Comb. Liquid Storage Rooms
3404.3.8.4	Flam. & Comb. Liquid Storage Whses
3405.3.7.3	Flam. & Comb. Liq. H-1 or H-2 Areas

IFC Table 903.2.15

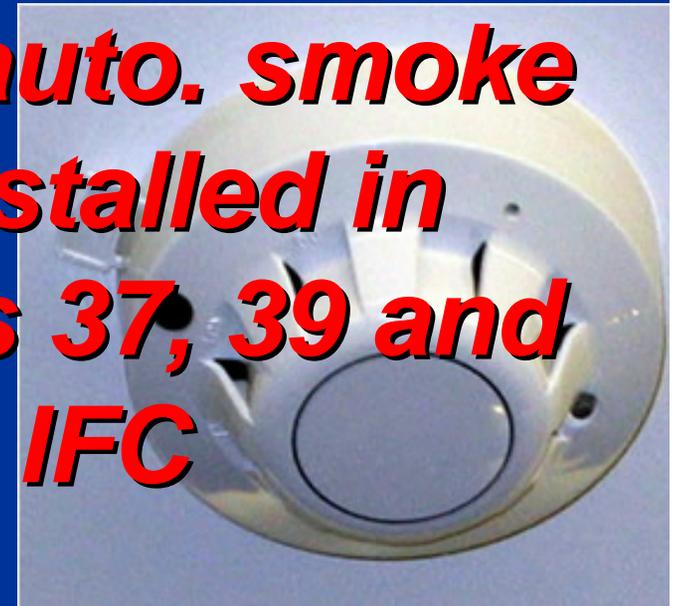
3704.1.2	Gas Cab's for Highly Tox. & Tox. Gas
3704.1.3	Exh'd Encl's for Highly Tox/Tox Gas
3704.2.7	Gas Rooms for Highly Tox/Tox Gas
3704.3.9	Outdoor stor. for Highly Tox/Tox Gas
4106.2.2	Exh'd Encl's or Gas Cabs for Silane Gas
4204.1.1	Pyroxylin Plastic Storage Cabinets
4204.1.3	Pyroxylin Plastic Storage Vaults
4204.2	Pyroxylin Plastic Storage & Manufactur'g.

Specific IFC References

- **IBC Table 903.2.15 – . . . reqmt's as set forth in Section xxxx.x.xx of the IFC**
- **IBC s. 907.2.5 - . . . in accord. with Chapters xx, xx, & xx of the IFC**
- **IMC s. 513.12.3 - . . . complying with Section xxxx.x.x.x of the IFC**

IBC s. 907.2.5 Group H

- A manual fire alarm system shall be inst. in all Group H-5 occy's & in occy's used for the manuf. of organic coatg's. *An auto. smoke det'n syst. shall be installed in accord. with Chapters 37, 39 and 40 respectively of the IFC*



IBC s. 907.2.5 Group H

IFC Chapters 37, 39 & 40

- Ch 37 Highly Toxic & Toxic Mat's.
[Auto Smoke Det. Syst.]
 - 3701 General, 3702 Definitions
 - 3703 Highly Tox. & Tox. Solids/Liq's
 - 3704 Highly Tox. & Tox. Comp. Gas
 - 3704.2.2.9 – in rooms/areas where compressed gas stored or used
 - 3705 Ozone Gas Generators

IBC s. 907.2.5 Group H

- **Ch 39 Organic Peroxides [Auto Det. Syst.]**
 - 3901 General, 3902 Definitions
 - 3903 General Requirements
 - **3904 Storage**
 - **3904.1.6 – Supv'd. system in rm's or areas where Class I, II, or III Org. Peroxides are stored.**
 - 3905 Use



IBC s. 907.2.5 Group H

- Ch 40 Oxidizers [Auto Smoke Det. Syst.]
 - 4001 General, 4002 Definitions
 - 4003 General Requirements
 - 4004 Storage
 - 4004.1.7 - Supv'd. system req'd inside indoor liq. & solid oxidizer storage areas.
 - 4005 Use



Specific IFC References

- IBC Table 903.2.15 – . . . reqmt's as set forth in Section xxxx.x.xx of the IFC
- IBC s. 907.2.5 - . . . in accord. with Chapters xx, xx, & xx of the IFC
- IMC s. 513.12.3 - . . . complying with Section xxxx.x.x.x of the IFC

IMC s. 513.12.3 Auto. Control (Smoke Control Syst.)

- Wherever completely automatic control is req'd. or used, the auto. control sequences shall be initiated from an *appropriately zoned auto. sprink. syst. complying with Sect. 903.3.1.1 of the IFC* or from an appropriately zoned, total cov. Smoke det. Syst. complying with NFPA 72

IMC s. 513.12.3 Auto. Control of Smoke Cont. Syst.

- IFC Sect. **903.3.1.1**
- Just as in the IBC, the specific code section being referenced tells users that the type of sprinkler system being called for is one that is **designed & installed per NFPA 13.**

Focus on the Details

Details

As Spec'd/prescribed in the IFC

- **IBC Table 307.7(1) footnote e, Table 307.7(2) footnote f, Table 307.7(2) footnote h, 307.9, 414.3, 415.7.1.4**

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• **IMC 502.8.5.2**

“Spec’d in the IFC”

T.307.7.1 footnote e

- **Table 307.7(1) Control Area Quantities – Physical Hazards**
- **Footnote e. – Quantities shall be increased by 100 % *when stored in appr’d. cabinets, gas cabinets, exhausted enclosures or safety cans as specified in the IFC.***

T 307.7.1 footnote e

- **Cabinets, gas cabinets, exh'd. encl's or safety cans (cont.)**
- **Cabinet – 2703.8.6, 3705.3.1**
- **Gas Cab. – 1803.3.5, 1803.10.2, 1803.13.1.3, 2703.8.5, ~~3006.2.3~~, 3704.1.2, 4106.2.2 & 4106.4.1**
- **Exh'd. Encl. – 2702.1**
- **Safety Can – 2702.1**

T 307.7.1 footnote e

- **Cabinet** used to incr. Max. Allow. Quantities [2703.8.6]



- The entire interior to be treated coated or const. of mat'l's. that are nonreactive with the haz. mat'l. stored therein.
- Signage “HAZARDOUS-KEEP FIRE AWAY”

T 307.7.1 footnote e

- **Cabinet Const'n. [2703.8.6 - cont]**
 - **Listed per UL 1275 OR designed and constructed to meet all 3 of the following empirical criteria:**
 - 1.) **Constructed of steel with min. thickness of .0478 inch (No. 18 ga.)**

T 307.7.1 footnote e

- **Cabinet Const'n. - 3 empirical provisos [2703.8.6 - cont]**

2.) Cab. & doors of welded or riveted (if tight joints) double wall const. (1.5 inch air space between layers). Doors to be tight fitting & equipped with self-closing & self latching hardware.

T 307.7.1 footnote e

- **Cabinet Const'n.** - 3 empirical provisos [2703.8.6 - cont]

3.) Last but not least, if the cabinet is used for liquids, bottom to be liquid tight up to a height of 2 inches.

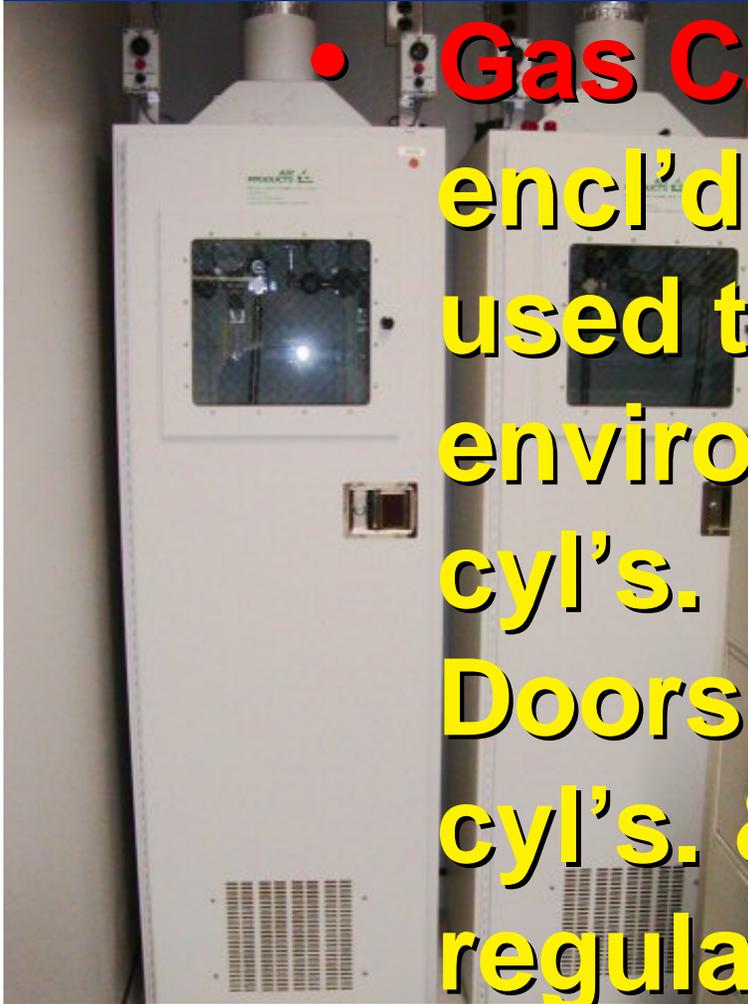


T 307.7.1 footnote e

- **Cabinet Ozone gas gen.[3705.3.1]**
 - Ozone gen. cab's. to be of materials compatible with ozone
 - Signage “OZONE GAS GENERATOR-HIGHLY TOXIC-OXIDIZER”
 - Vent'n. at 6AC with avg. velocity 200 ft./min at makeup air opening when cab. door(s) closed.



T 307.7.1 footnote e



- **Gas Cabinet [Def.]** A fully encl'd. noncomb. encl. used to provide an isolated environm't. for comp. gas cyl's. in storage or use. Doors & ports for chang'g cyl's. & access to regulators are permitted.

T 307.7.1 footnote e

- **Gas Cabinet (cont)**
- **1803.10.2 - Some that contain specific HPM compressed gases req. sprinkler prot.**
- **1803.13.1.3 – Continuous gas det. syst. for HPM gases**

T 307.7.1 footnote e

- **Gas Cab. (cont.)** – When used to incr. Max. Allow. Quant's. des. & const. to meet all 4 criteria
[2703.8.5]
 - 1.) Const. of min. 0.097 inch thick (No. 12 ga.) steel.
 - 2.) Prov. w/ self-clos'g. lim'd. access ports (or NC windows) for access to controls

T 307.7.1 footnote e

- **Gas Cab.** – MAQ increase 4 povisos [2703.8.5] (cont.)
 - 3.) Prov. w/ self-clos'g. doors
 - 4.) The entire interior is to be treated, coated or const. of matl's. that are nonreactive with the hazardous material stored therein.

T 307.7.1 footnote e

- **Gas Cab's for Highly Tox./Toxic comp. gases [3704.1.2] use Sect. 2703.8.5 plus 4 provisions:**
 - 1.) Avg. vel. of vent'n. at the face of access ports/windows to be at least 200 lin. fpm (150 lin. fpm min. at any point) & connected to exh. system



T 307.7.1 footnote e

- **Gas Cab's for Highly Tox./Toxic comp. gases [3704.1.2] 4 added provisos (cont):**
 - 2.) Not used as sole means of exh.
For rm./area.
 - 3.) Max. 3 cylinders in cabinet except when 1# cylinders, can be up to 100.
 - 4.) Some req. sprinkler prot. (ref. to **3704.2 & 3704.3**)

T 307.7.1 footnote e

- **Gas Cab. for Silane Gas & 2% mixt's. [4106.2.2] when stored inside bldg. use Sect. 2703.8.5 plus 4 provisions:**
 - 1.) Internally sprinkled
 - 2.) Velocity of ventilation across unwelded fittings/conn'ns on the piping syst. to be min. 200 lin. fpm.



T 307.7.1 footnote e

- **Gas Cab. for Silane Gas & 2% mixt's. [4106.2.2] when stored - 4 added provisos (cont.) :**
 - 3.) **Avg. velocity of vent'n. at the face of access ports/windows to be at least 200 lin. fpm (150 lin. fpm min. at any point)**
 - 4.) **Connect the Vent. Syst to emerg'y power**

T 307.7.1 footnote e

- **Gas Cab. for Silane Gas & 2% mixt's. [4106.4.1] when "used" or dispens'g inside follow 4106.2.2 (already uses 2703.8.5 & 4 provn's) plus 3 more:**
 - 1.) Provide remote manual shutdown of the operation

T 307.7.1 footnote e

- **Gas Cab. for Silane Gas & 2% mixt's. [4106.4.1] inside "use" or dispens'g - 3 add'l provisos (cont):**
 - 2.) Provide the ventilation syst. with auto. emergy. power source.
 - 3.) Provide purge panels [see 4106.4] using dedicated inert gas supply for purging operations.

T 307.7.1 footnote e

- **Exhausted Encl. (def)** - An appliance or piece of equip. consist'g. of a top, a back & 2 sides provid'g. a means of local exhaust for capturing gases, fumes, vapors & mists (Lab. Hoods, Exh. Fume Hoods, etc.). Exh'd. Rms are not a subst..



[2702.1]

Exhausted Enclosure

“full” enclosure not needed



Openings

T 307.7.1 footnote e

- **Exhausted Encl. General details**
- **1803.13.1.3** – When an enclosure is provided for HPM gases, a **Cont. Gas Det. Syst.** is req'd.
- When an exhausted encl. used to incr. Max. Allow. Quant's., the des. & const. to meet 3 criteria **[2703.8.4]**

T 307.7.1 footnote e

- **Exh. Encl.– 3 criteria to allow MAQ increase. [2703.8.4] (cont)**
 - 1.) Construct of NC material
 - 2.) Design the enclosures vent. syst. to operate at negative pressure
 - 3.) If used for flammable materials, provide an auto fire-extinguish'g system

T 307.7.1 footnote e

- **Exh'd. Encl. (cont.) for Silane Gas & 2% mixt [4106.2.2] stored inside meet Sect. 2703.8.4 plus:**
 1. **Must be internally sprinkled**
 2. **Details (i.e. Velocity & avg. vel.) of vent'n. system covered in the IMC**
 3. **Conn't. the Vent. Syst to emerg'y power**

T 307.7.1 footnote e

- Exhd. Encl. for **Silane Gas & 2% mixt's.** [4106.4.1] when **used** or dispens'g inside follow **4106.2.2** (already uses 2703.8.4) plus 3 provisions:
 - 1.) Provide remote manual shutdown of the gas process (outside of encl)

T 307.7.1 footnote e

- Exhd. Encl. for **Silane Gas & 2% mixt's.** [4106.4.1] "use" - 3 extra provisos (cont):
 - 2.) Provide the vent. syst. serving the hood with auto. emergy. power source.
 - 3.) Provide purge panels [see 4106.4] that use a dedicated inert gas supply for purging operations.

T 307.7.1 footnote e

- **Safety Can [2702.1] Definition**
- **An approved container of not more than 5 gallon capacity having a spring-closing lid and spout cover so designed that it will relieve internal pressure**
when subjected to fire exposure.



Details

As Spec'd/prescribed in the IFC

- IBC Table 307.7(1) footnote e, **Table 307.7(2) footnote f**, Table 307.7(2) footnote h, 307.9, 414.3, 415.7.1.4

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• **IMC 502.8.5.2**

“Spec’d in the IFC”

T.307.7.2 footnote f

- **Table 307.7(2) Control Area Quantities – Health Hazards**
- **Footnote f. – Quantities shall be increased by 100 % *when stored in appr’d. cabinets, gas cabinets, or exhausted enclosures as specified in the IFC.***

T.307.7.2 footnote f

- Refer to the preceding series of slides regarding cabinets, gas cabinets and exh'd. enclosures. The specifications are the same whether dealing with a physical hazard or a health hazard.



Details

As Spec'd/prescribed in the IFC

- IBC Table 307.7(1) footnote e, Table 307.7(2) footnote f, **Table 307.7(2) footnote h**, 307.9, 414.3, 415.7.1.4

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• **IMC 502.8.5.2**

“Spec’d in the IFC” T.307.7.2 footnote h

- Table 307.7(2) Control Area Quantities – Health Hazards
- Footnote h. – The matl’s. noted **MUST** be *stored within app’d. exhausted gas cabinets, or exhausted enclosures as specified in the IFC.*

T.307.7.2 footnote h

- **Footnote h applies to the storage or “use-closed system” of gas that is class’d. Highly Toxic. To have the spec’d quantity, the gas cyl.(s) are to be located in an exh’d gas cab. or exh’d. encl.. There is no increase. See preceding slides for details of const. from IFC.**

Details

As Spec'd/prescribed in the IFC

- IBC Table 307.7(1) footnote e, Table 307.7(2) footnote f, Table 307.7(2) footnote h, **307.9**, 414.3, 415.7.1.4

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• **IMC 502.8.5.2**

“Spec’d in the IFC”- 307.9

- **Provides a list of exceptions for those uses that are not classified in Group “H”. Exc. 15 – Refers to the limited instances where black powder, smokeless propellant, small arms primers and special industrial expl. devices can be stored per the IFC.**

307.9 Exception 15

- **Exc. 15 – provided the *storage conforms to quant'y lim's. & reqmt's. prescribed in the IFC***
- **Black powder, smokeless propellant and small arms primers within groups M & R-3.**
- **Special industrial expl. devices within Groups B,F, M & S.**

307.9 Exception 15

- Quant'y limits and reqmt's. for M & R-3 [3306.1] black powder, smokeless propellant & small arms primers – not for spec. ind. explosive devices.
- IFC 3306.4 for R-3
- IFC 3306.5 for M

307.9 Exception 15

- **R-3 [3306.4] Stor. in residences**
- **Black Powder & Smokeless**
 - **20 lbs. if in original container(s)**
 - **Smokeless Powder can go up to 50 lbs. if kept in box/cabinet having walls of nominal 1” thick wood.**
- **Small Arms Primers – 10,000 primers max.**

307.9 Exception 15

- **Group M [3306.5] Display and Storage in retail stores**



- **3306.5.1 Display**

- **Smokeless up to 20 lbs. if in 1lb. (or smaller) containers**
- **Black Powder up to 1 lb.**
- **Primers up to 10,000 total**



307.9 Exception 15

- Group M [**3306.5.2**] storage of commercial stock **smokeless** [**3306.5.2.1**]
 - OK - Type 2 or 4 Magazine [see NFPA 495] , def. in IFC s. 3302 & prov's. of IFC s. 3304 - OR -
 - Up to 100 # in port. wood (min. 1" nom. thick) containers
 - Up to 800 # (400 # max. per cab.) in nonport. wood cabinets

307.9 Exception 15

- Group M [**3306.5.2.1**] smokeless storage (cont).
- Up to 5000 # in cab's prov. all the follow'g. 7 criteria satisfied:
 - (1) Not avail. to unauth. personnel.
 - (2) 1" wood cabinets with shelves at max. 3' spacing
 - (3) Max. 400 # per ea. cabinet

307.9 Exception 15

- **Group M [3306.5.2.1] smokeless stor. 5000 # - criteria (cont.):**
 - (4) Building is fully sprinkled per NFPA 13**
 - (5) Cabinets located against walls with at least 40' between cab's. if not barricaded**

307.9 Exception 15

- Group M [**3306.5.2.1**] **smokeless stor. 5000 # - criteria (cont.):**

(6) Cab. Spacing OK at 20' if barricades provided as follows

- 2 times cabinet height
- Located midway between cab's.
- Must extend at least 10' from wall
- 0.25" thick steel, 2" nom. thick wood, brick or CMU const.

307.9 Exception 15

- **Group M [3306.5.2.1] smokeless stor. 5000 # - criteria (cont.):**

(7) Separated from matl's. class'd. as Comb. Liq's., Flamm. Liq's, Flamm. Sol's, or Oxidizers by a 1-HR fire partition & the cab's. to be at least 25' from wall.

307.9 Exception 15

- Group M storage of commercial stock [3306.5.2.2] black powder
 - Allows less than 50# within a Type 2 or 4 Magazine [refer to NFPA 495] def. in IFC 3302 & prov's. of IFC s. 3304. If mag. stor. shared with smokeless, <50 # is total limit
 - When 50# or more, must be outdoor Magazines [Type 2 or 4]

307.9 Exception 15

- Group M storage of commercial stock small arms primers [3306.5.2.3]
 - OK in a Magazine per NFPA 495 & prov's. of IFC s. 3304 - OR -
 - Up to 750 K primers if in piles (max 100 K ea.) that are 15' apart
 - Over 750 K primers – several req's.

307.9 Exception 15

- Group M [**3306.5.2.3**] primer storage (cont).
- Over 750 K primers OK if all in cab's & all the follow'g. 7 criteria satisfied:
 - (1) Not avail. to unauth. personnel.
 - (2) Cab. shelves at max. 2' spc'g.
 - (3) Max. 200 K per ea. cabinet

307.9 Exception 15

- Group M [**3306.5.2.3**] primer storage >750K - criteria (cont.):
 - (4) Building is to fully sprinkled per NFPA 13
 - (5) Cabinets located against walls with at least 40' between cab's. if not barricaded

307.9 Exception 15

- Group M [**3306.5.2.3**] primer storage >750K - criteria (cont.):
(6) Cab. Spacing OK at 20' if barricades provided as follows
 - 2 times cabinet height
 - Located midway between cab's.
 - Must extend at least 10' from wall
 - 0.25" thick steel, 2" nom. thick wood, brick or CMU const.

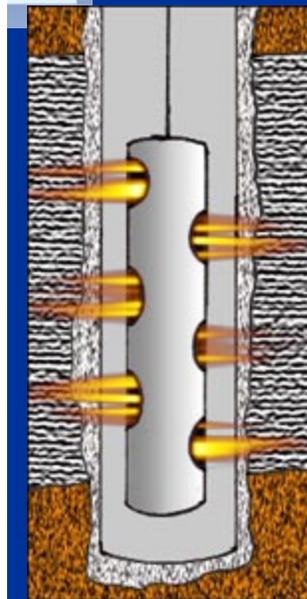
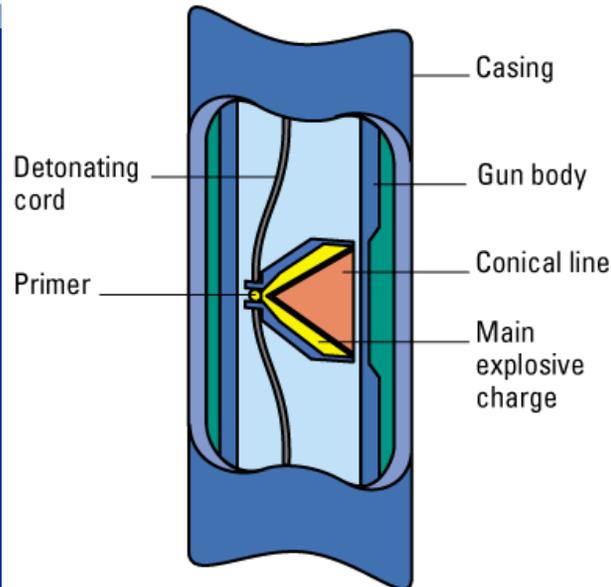
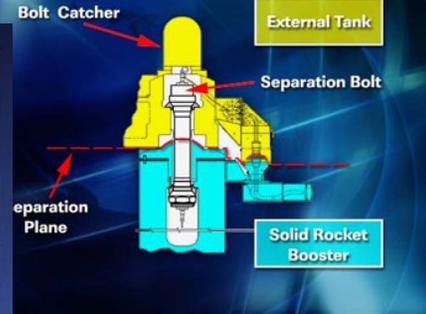
307.9 Exception 15

- Group M [**3306.5.2.3**] primer storage >750K - criteria (cont.):
(7) Separated from matl's. class'd. as Comb. Liq's., Flamm. Liq's, Flamm. Sol's, or Oxidizers by a 1-HR fire partition & the cab's. to be at least 25' from wall.

307.9 Exception 15

- Quant'y limits and reqmt's. for B, F, M & S [**special industrial explosive devices**] storage/use
- [**3302.1**] Definition – An explos. power pack contain'g. an expl. charge in the form of a cartridge or constn. Device (examples incl: expl. rivets, expl. bolts, cartrdges for expl. actuated power tools, etc.)

Special Industrial Explosive Devices



307.9 Exception 15

- Quant'y lim's/reqmt's. [Spec. Ind. Exp. Dev. stor./use] (cont)
- Scope [3301.1] of Expl. Chapt. incl's. 2 exc's.
- Any when agg. wght. < 50 #.
- No limit on blank ind. power load cartridges packaged per DOTn Reg's.

Details

As Spec'd/prescribed in the IFC

- IBC Table 307.7(1) footnote e, Table 307.7(2) footnote f, Table 307.7(2) footnote h, 307.9, **414.3**, **415.7.1.4**

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• **IMC 502.8.5.2**

“Spec’d in the IFC” - 414.3

- 414.3 – Ventilation. All spaces in H where the dust, mist, fumes or gases of haz. matl’s. reach danger levels are to be vent. per IMC & are to be *confined to the area in which generated as spec. in the IFC*. Dets within the IFC will differ for each specific mat’l.

Details

As Spec'd/prescribed in the IFC

- IBC Table 307.7(1) footnote e, Table 307.7(2) footnote f, Table 307.7(2) footnote h, 307.9, 414.3, **415.7.1.4**

International
Mechanical
Code

• **IMC 502.8.5.2**

“Spec’d in IFC”- 415.7.1.4

- **Comb. Dusts in H-2 – *Explos’n. control shall be prov. as spec’d. in the IFC*, or spaces shall be equipped with the equiv. mech. vent’n. per the IMC.**
- **Most choose to ventilate in a manner to keep atmosphere below explosive levels**

415.7.1.4 – Comb. Dusts

- **Comb. Dusts in H-2 – Explos'n. cont'l. in IFC based on specific materials & standards**
- **Refer to IFC Chapter 13 on Comb. Dust-Producing Opern's. and Table 1304.1 (Explosion Protection Standard)**

415.7.1.4 – Comb. Dusts

T-1304.1 Expl'n. Prot'n. Stds.

Standard	Subject
NFPA 61	Agricultural & Food Products
NFPA 69	Explosion Prevention
NFPA 120	Coal Preparation Plants
NFPA 480	Magnesium Solids & Powders
NFPA 481	Titanium
NFPA 482	Zirconium

415.7.1.4 – Comb. Dusts

T-1304.1 Expl'n. Stds. (cont'd)

Standard	Subject
NFPA 650	Conv'g. Comb. Particulate Solids
NFPA 651	Aluminum Powder
NFPA 654	Chem. Dye Pharm'ls. & Plastics
NFPA 655	Sulfer
NFPA 664	Prev. of Fire & Expl. - Woodwrkg.
NFPA 8503	Pulverized Fuel

Details

As Spec'd/prescribed in the IFC

- IBC Table 307.7(1) footnote e, Table 307.7(2) footnote f, Table 307.7(2) footnote h, 307.9, 414.3, 415.7.1.4

International
Mechanical
Code

• **IMC 502.8.5.2**

“Spec’d in the IFC”- IMC 502.8.5.2

- IMC 502.8.5.2 – Req. Exh Syst’s. Flamm & comb. Liq’s
- Liq. stor. rm’s & liq. stor. whses. with *quant’s of liq’s exc’g those specified in the IFC* shall be vent’d. in accord. with S. 502.7.1.
- Qt’y. Lim’s same as IBC (MAQ’s)

Flammable Finishes

IBC - 307.9

Flammable Finishes

- Provides a list of exceptions for those uses that are not classified in Group “H”. Exception 3 explains that flam. finishing operatn’s must still comply with s. 416 *and the IFC.*
- Flammable finishing – **IFC Ch 15**

Flammable Finish'g – Ch 15

- IFC Ch 15 incl's: Gen. Provn's, Def's, Prot. of Opern's, Spray Finish'g, Dipping Opern's, Electrostatic Apparatus, Powder Coating, Auto Undercoat'g, Organic Peroxide & Dual-Comp. Coatings and the Mfg. of Glass-Fiber-Reinf. Plastics

Flammable Finish'g – Ch 15

- Gen. Prov's [1501] – NFPA 33 for Spray'g & NFPA 34 for Dipp'g
- Protection of Operations [1503]
- Elect. wiring & equip. in spray spaces and vapor areas to be explosion-proof type. Areas are Class I, Div. 1 or Class II, Div 1



Flammable Finish'g – Ch 15

- Prot. of Openings [1503] (cont)
- Elect. wiring & equip. within 5' horiz. & 3' vert. of adjacent to openings of spray booths or rooms to be approved for use in Class I, Div. 2 or Class II, Div 2 haz. locations

Flammable Finish'g – Ch 15

- Prot. of Opern's [1503] (cont)
- Equipment or apparatus that may produce sparks or pieces of hot metal that might fall into the spray/vapor area must be fully enclosed.



Flammable Finish'g – Ch 15

- Prot. of Opern's [1503] (cont)
- Provide Warning Signs regarding Welding, Cutting and similar hot operations in the vicinity of the spray/vapor areas.



Warning Sign

NO WELDING
THE USE OF WELDING OR CUTTING
EQUIPMENT IN OR NEAR THIS AREA
IS DANGEROUS BECAUSE OF FIRE
AND EXPLOSION HAZARDS. WELDING
AND CUTTING SHALL BE DONE ONLY
UNDER THE SUPERVISION OF THE
PERSON IN CHARGE.

Flammable Finish'g – Ch 15

- **Spray Finishing [1504]**
- **Operations in Groups A, E, I or R must be loc'd. in a rm. sept'd from the remain'g. areas by 1-HR fire barriers and the room is to be protected by a sprinkler system.**
- **In others, OK to be in rooms, booths or spaces.**

Flammable Finish'g – Ch 15

- **Spraying [1504] (cont)**
- **Spray Rooms – Combustible floor const. must be covered by noncombustible non-sparking material. NC floor const. can be covered by thin strippable coating/covering to help facilitate cleaning.**

Flammable Finish'g – Ch 15

- **Spraying [1504] (cont)**
- **Spray Booths – Booths are to be constructed of NC materials other than aluminum. If of sheet metal – 18 gage for single-skin & 20 gage for double-skin. Seams can be caulked.**



Flammable Finish'g – Ch 15

- **Spraying [1504] - Booths (cont)**
- **Booth interior surfaces are to be smooth to facilitate cleaning**
- **Floors the same as spray rooms**
- **Booths to have at least 3' of clearance from combustible walls & clgs (or roof assy's)**

Flammable Finish'g – Ch 15

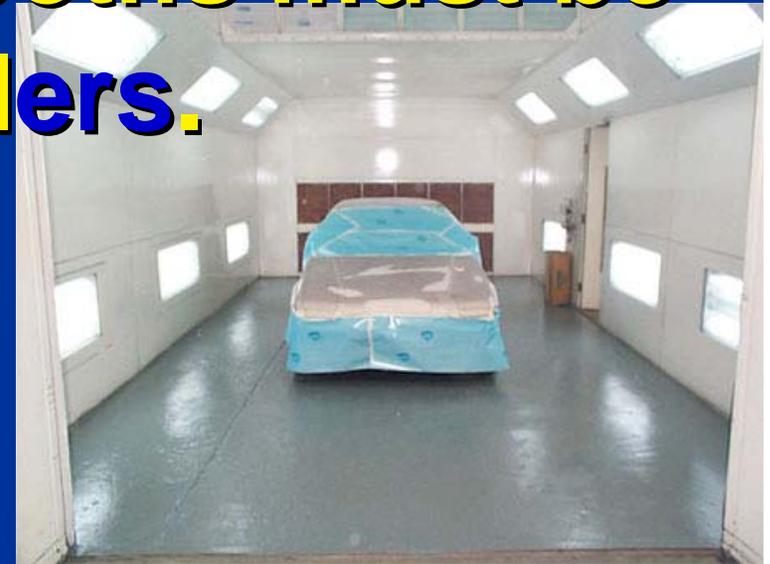
- **Spraying [1504] - Booths (cont)**
- **Aggregate area of booths is limited to the lesser of 10% of floor area or the base area (i.e. without increases) of an H-2**
- **Single booth to be lesser of 1500 SF or aggr. area limit (single booth up to 500 SF OK)**

Flammable Finish'g – Ch 15

- **Spraying [1504] (cont)**
- **Spray Spaces – Floors same as rooms and booths**
- **Limited Spraying Spaces – only used for infreq. spray'g of small (max. 9 SF surface area) pieces. Space req's vent'n. Elect. must be des'd. for Class 1, Div 2**

Flammable Finish'g – Ch 15

- Spraying [1504] (cont)
- Of the 4 types (rooms, booths, areas and limited spaces), spray rooms and spray booths must be protected by sprinklers.



Flammable Finish'g – Ch 15

- **Spraying [1504] (cont)**
- **Rooms & booths cannot be used for drying unless only low-vol. spraying & safety interlocks that:**
 - **Prevent both spray'g & dry'g**
 - **Purge space (3 min's) before dry'g**
 - **Dryer shutoff if vent syst fails**
 - **Dryer shutoff if air temp >200° F**

Flammable Finish'g – Ch 15

- Spraying [1504] (cont)
- Portable infrared dryers or their related wiring not to be left within the rooms or booths when spraying.
- Don't allow install'n of dryers that use open flame or may produce sparks in the area.



Flammable Finish'g – Ch 15

- **Dipping Operations [1505] - This is one of the areas where the safe “use” provisos dominate**
- **Construction – Dip-tank opern's to be in a separated room/area when in Groups A, I or R.**
 - **Most related equip. (i.e conveyors, tank covers etc.) to be auto-off or fail safe (cov's close) in event of fire.**

Dip Tank Const [1505]

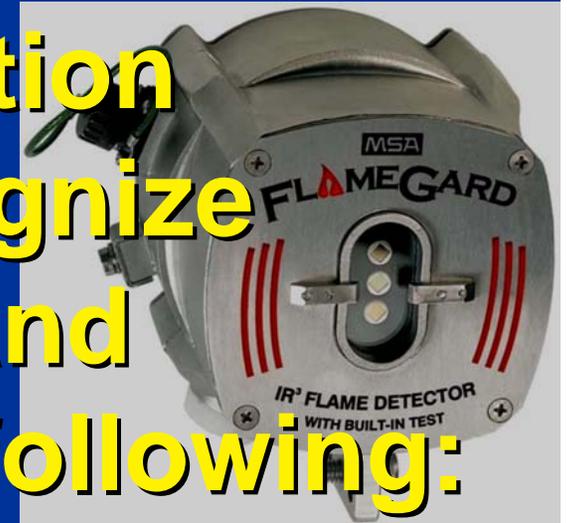


Flammable Finish'g – Ch 15

- **Electrostatic Apparatus [1506]**
- **Special Safety primarily assoc'd with the high voltage equip.**
- **Emergency shutdown by any of:**
 - **Stoppage of the ventilation system**
 - **Stoppage of the conveyor**
 - **Threat of imminent ground/ground**
 - **Reduct'n in clearances (spark dist.)**

Flammable Finish'g – Ch 15

- **Electrostatic App. [1506] (cont)**
- **Supervised flame detection apparatus that will recognize flame within 0.5 sec's. and accomplish all 5 of the following:**
 - 1) **Sound local alarm and fire alarm syst. if provided**
 - 2) **Shut down delivery or the coating material.**



Flammable Finish'g – Ch 15

- **Electrostatic [1506] - supervised flame detection provisos (cont)**
 - 3) **Terminate spray appl. opern's**
 - 4) **Shut down delivery of the coating material**
 - 5) **Disconnect power to both the sys. & the high-volt. elements in the spraying area.**

Flammable Finish'g – Ch 15

- **Electrostatic App. [1506] (cont)**
- **Provide barriers that will keep personnel and stored matl's at least 5' away from the operat'n**
- **Barriers to be of conductive mat'l that is properly grounded**
- **Signs – Very dangerous area due to electrostatic nature (only qual. personnel, grounding, etc.)**

Flammable Finish'g – Ch 15

- Powder Coating [1507]
- Coating operations to be in enclosed rooms of NC const., encl'd. powder coating facilities, or spray booths as per s. 1504 [refer to earlier slides]
- Listed booths of other materials are OK

Flammable Finish'g – Ch 15

- Powder Coat'g [1507] (cont)
- Superv'd flame detect'n appar. that will recognize flame within 0.5 sec's. and accomplish all 3 of the following:
 - 1) Sound local alarm audible throughout the room

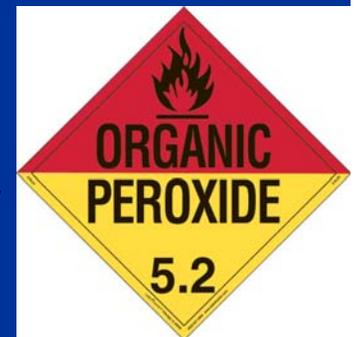


Flammable Finish'g – Ch 15

- **Powder Coat'g [1507] - supervised flame detection provisos (cont)**
 - 2) **Shut down energy (elect. & comp. air) to conveyor, vent., applic'n., transfer & powder coll'n equip.**
 - 3) **Close the segregation dampers in assoc. ductwork**

Flammable Finish'g – Ch 15

- **Auto Undercoat'g [1508]**
 - Can be exempt from spraying provisos of s. 1504 when using Class IIIA or IIIB comb. liq's..
- **Organic Peroxide & Dual-Component Coatings [1509]**
 - Spray only in sprinkled spray booths [1504 – earlier slides]



Misc. Det's – Flam. Finish (cont)

- the Mfg. of Glass-Fiber-Reinf. Plastics (GFRP's) [1511]
- Cover processes involving spray or hand application
- Resin application areas must be protected by a sprinkler system with a design based on a min. 3000 SF area & Ordinary Haz. Group 2.



Flammable Finish'g – Ch 15

- **Manuf. Of GFRP's [1511] (cont)**
- **Mitigate potential ignition by use of proper elect. wiring & equip. [inst. as req'd for haz. (class'd) locn's], grounding of metallic components [ductwork, piping, equip, etc] & locate hot surfaces to reduce surface build-up**

Treating Exhaust Air

IBC 414.3

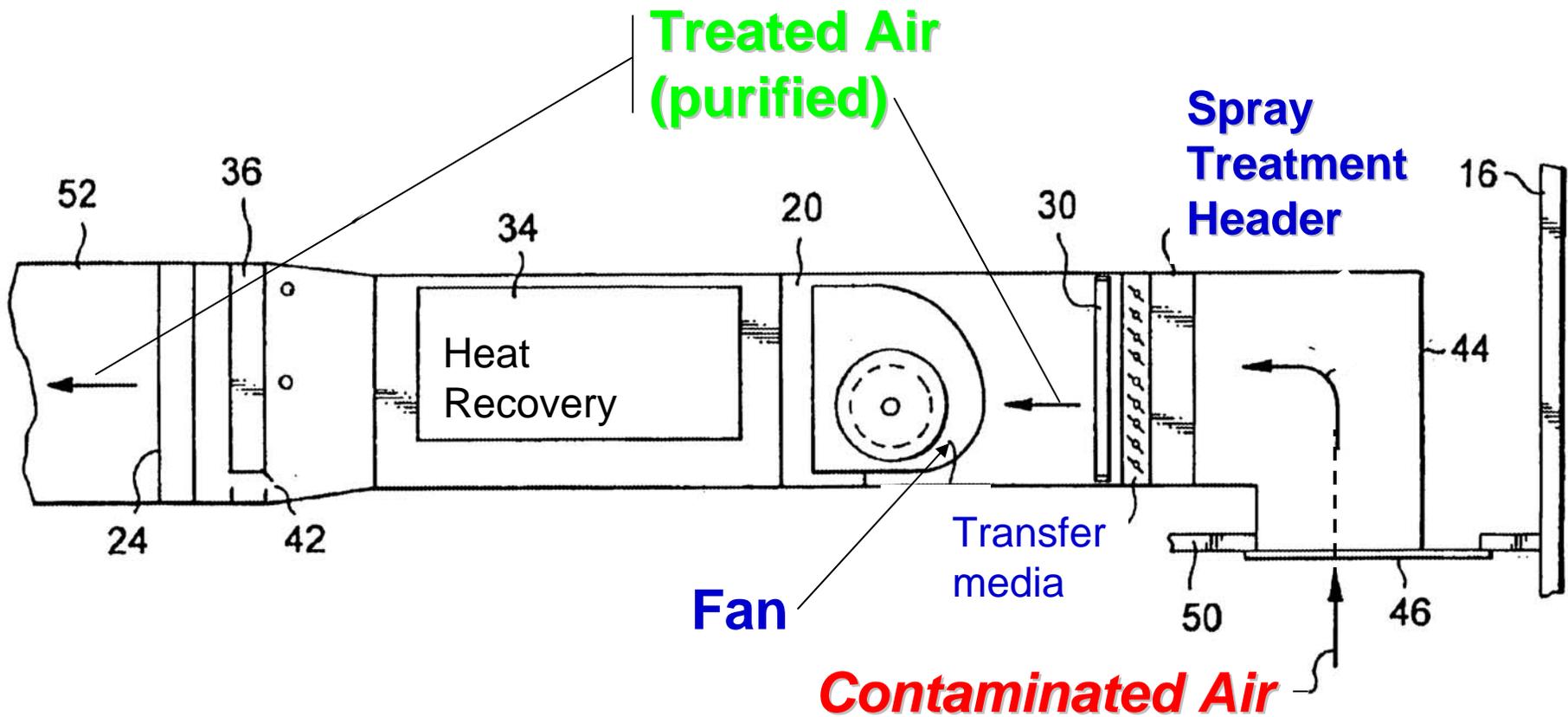
Treated in Accord. with the IFC

- 414.3 – Ventilation. Exhaust air contam'd. by highly toxic mat'l. is to be *treated in accord. with the IFC.*
- [3703.1] liquids . . . only where a spill is likely to release Highly Toxic vapors at normal temp's & pressure.

Exhaust Air Treatment

- **[3704] Toxic & Highly Toxic Compr. Gas**
- **[3704.2.2.7] For the accidental release of gas**
- **Generally, treatment involves processing the toxics so as to red. the max. concentrn's to $\frac{1}{2}$ the IDLH (Immedi'y Dangerous to Life & Health) at the pt. of discharge**

Exhaust Air Treatment



Ventilation

IMC 502.7

Vaults encl'g. Class I Liq's. & the add'l vent. reqmt's above those in IMC 502.7.1.1. [~~3404.2.8~~]

- Refer to Comm 10 & NFPA 30 to see if they have add'l ventilation similar to that in the IFC [i.e. Min. 150 cfm exh. rate + Duct (Supp. & Exh.) to extend to w/in 3", but not more than 12", of the floor]**

**Spill Control
Drainage
Containment**

IBC 414.5 – Spill Control, Drainage & Containment

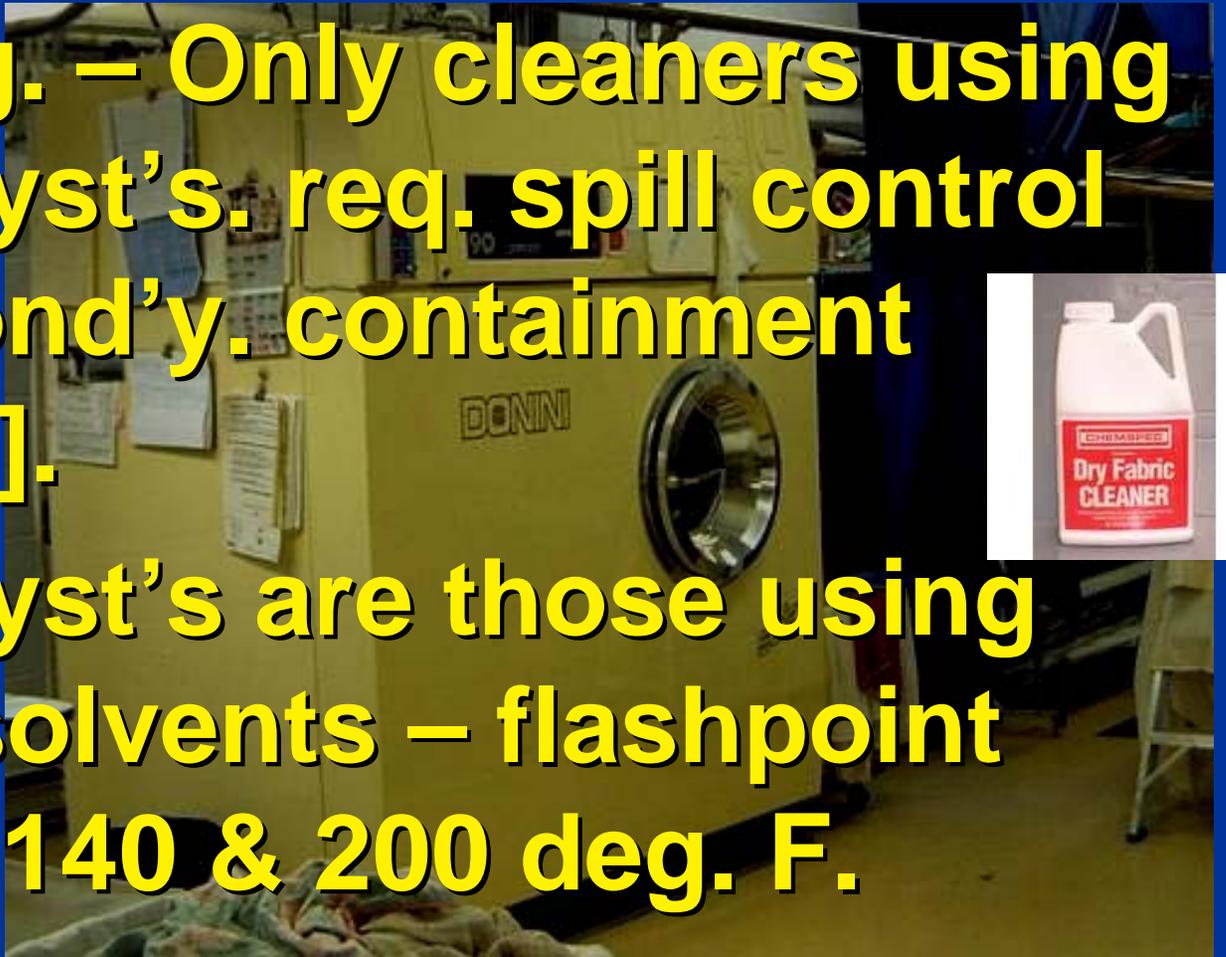
- 414.5.5 – Rm's., bldg's. or areas used for the stor. of solid and liq. haz. matl's.
 - A means to control spillage & contain or drain off spillage and fire prot. water disch'd in the storage area *where req'd in the IFC.*
 - Methods of spill control are to be *in accord. with the IFC.*

IBC 414.5 – Spill Control, Drainage & Containment

- Where Required
- Some Dry Cln'g. [1207], Flamm. & Comb. Liq's. [3403 NOT USED – See Comm 10], Lead Acid Battery Syst's. [608], Service Stn's. & Rep. Garages [2205], and Haz. Matl's. [2704 & 2705].

IBC 414.5 – Spill Control, Drainage & Containment

- Dry Cln'g. – Only cleaners using Type II Syst's. req. spill control and second'y. containment [1207.2.3].
- Type II Syst's are those using Class II solvents – flashpoint between 140 & 200 deg. F.



IBC 414.5 – Spill Control, Drainage & Containment

- **Lead Acid Batt'y Syst's. [s. 608]**
- **608.4 – Control/neutralization must be designed for a spill of electrolyte from the largest lead-acid battery. The pH must be reduced (neutrlz'd) to a range between 7.0 & 9.0.**



IBC 414.5 – Spill Control, Drainage & Containment

- **Serv. Stn's. & Rep. Gar's [2205]**
- **Provisions to prevent liquids spilled during dispensing operations from flowing into bldgs. Methods may incl. slop'g drives away from bldg. or using raised door sills.**

IBC 414.5 – Spill Control, Drainage & Containment

- **Hazardous matl's. [2704 = Stor. & 2705 = Use]**
- **2704.2.1 [Storage] – When Individual Vessel >55 Gals. or Agg. Cap. >1,000 Gals., spill control is needed.**

IBC 414.5 – Spill Control, Drainage & Containment

- Haz. Mat'l Stor. [2704.2.2] (cont)
- 2704.2.2 – Secondary Contnm't req'd where the haz. mat'l. liq's. & solids of T-2704.2.2. exceed:
 - Liq's. – Ind. Vess. >55 Gals or agg. >1,000 Gals
 - Solid - Ind. Vess. >550 lbs or agg. >10,000 lbs

IBC 414.5 – Spill Control, Drainage & Containment

- **Sec. Cont. – from T-2704.2.2**

Organic Peroxides – All but Class V	Unstable (Reactive) Mat'ls. – All but Class I
Oxidizers – All but Class I	Water Reactives – All but Class I
Pyrophorics – Not Req'd for Solids	Corrosives - Not Req'd for Solids
All Highly Toxics	All Toxics

Spill Control Secondary Containment



IBC 414.5 – Spill Control, Drainage & Containment

- **Haz. Mat'l Use 2705**
- **2705.1.10 – Where there is the gravity transfer of liq's having a haz. ranking of 3 or 4 (ref. to NFPA 704), cont'l. & secondary containm't req'd.. Gravity dispensing of Highly-Toxic liq's. prohibited**

IBC 414.5 – Spill Control, Drainage & Containment

- Haz. Mat'l Use (cont) Open Systems [2705.2.1]
- **2705.2.1.3** – Spill control req'd where haz. mat'l. liq's. are disp'd. into vessels >1.3 Gals or used in open syst's. >5.3 Gals.

IBC 414.5 – Spill Control, Drainage & Containment

- Haz. Mat'l Open Use [2705](cont)
- 2705.2.1.4 – Second'y. containm't req'd where those haz. mat'l. liq's. listed in T-2705.2.1.4 are disp'd. into or used in indiv. Vessel/syst. >1.3 Gals or multi Vsls./systs. Aggregt'g >5.3 Gals.

IBC 414.5 – Spill Control, Drainage & Containment

- **Sec. Cont. – from T-2705.2.1.4**

Organic Peroxides – All Liq's but Class V	Unstable (Reactive) Mat'ls. – All Liq's but Class I
All Liq. Oxidizers	Water Reactives – All Liq's but Class I
All Liq. Pyrophorics	All Liq. Corrosives
All Highly Toxics	All Liq. Toxics

IBC 414.5 – Spill Control, Drainage & Containment

- Haz. Mat'l Use (cont) Closed Systems [2705.2.2]
- 2705.2.2.4 – Spill control req'd where haz. mat'l. liq's. are used in individual vessels >55 Gals

IBC 414.5 – Spill Control, Drainage & Containment

- Haz. Mat'l Use (cont) Closed Systems [2705.2.2]
- **2705.2.2.5** – Secondary Cont. req'd for HM's in **T-2705.2.1.4**
 - Individ. Vessel or System >55 gals.
 - Mult-vessel or Syst. >1,000 gals.

Spill Control Methodology - How To

- **Methods of spill control and secondary containment [2704.2] are ref'd from within all the aforementioned triggers for Dry Cln'g., Flamm. & Comb. Liq's., Lead Acid Battery Syst's., Service Stn's./Rep. Garages, and Hazardous matl's..**

Spill Control

How To [2704.2]

- **2704.2.1 Control – Keep spill of larges't vess. to area by 1 meth:**
 1. Liq.-tight sloped/recessed flr.
 2. Liq.-tight flr's. & curbs/dykes
 3. Sumps & Collection syst's.
 4. Other Eng'd. Syst's.

**NOTE: Other than surface, all to be
NC**

Spill Control

How To [2704.2]

- **2704.2.2 Secondary Containment**
 - Same methods as Spill Control plus drainage syst allowed:
- Designed for spill of largs't vess.
PLUS the design flow vol. of fire prot. water calc'd to discharge from the fire syst. for 20 min's.

Combustible Storage

IBC s. 413

Combustible Storage

- This sect'n is only 2 para's long
- 413.1 – Outlines the basic requirement and scope.
- **High-piled stock or rack storage in any occupancy group *shall comply with the IFC. All the detail is in IFC Ch 23.***

High-Piled Stock or Rack Storage of Combustibles

- High-piled Combustible Storage [Chapter 23] includes;
- General Provisions [2306]
- Solid-Piled & Shelf Stor. [2307]
- Rack Storage [2308]
- Automated Storage [2309]
- Specialty Storage [2310]

High-Piled Storage

Chapter 23



- **First things first**
- **Is it governed? – definition**
- **High-piled Comb. Stor. – Stor. of comb. matls in closely packed piles, on pallets, in racks or on shelves where the top is greater than 12' high. Code Off. can chose 6' ht. for items like tires**

High-Piled Storage

Chapter 23

- **First things (cont)**
- **Classify the Commodities & the Plastics being Stored**
- **Class I, II, III, IV or High-Hazard Commodities**
- **Class A, B, or C Plastics**

Commodity Classification

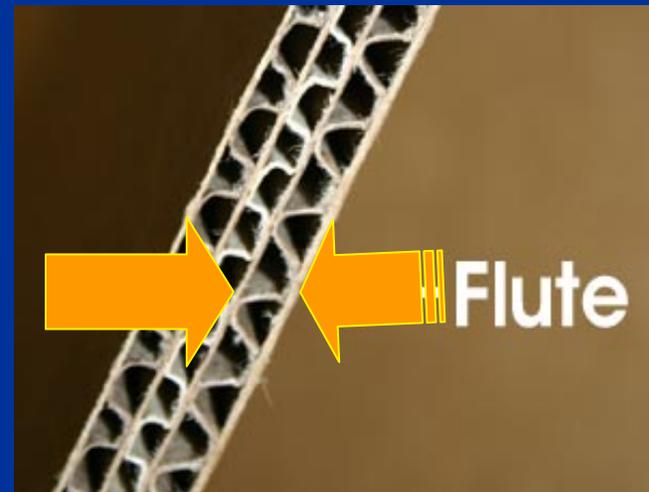
- **Class I – essentially NC prod's on solid deck wood pallets, in ordinary corrug'd cartons or paper wrap**

- **Drywall, Frozen Food, 6 pks beer in cans, food in cans.**



Commodity Classification

- **Class II – Essentially same as Class I except on slatted crates, in solid wood boxes, or in multi-thickness paper/corrugated containers.**



Commodity Classification

- Class III – Wood, paper, natural fiber cloth, or Grp. C plastics (comparable combustibility)
- Aerosols (Lvl. 1), Lumber, Oil base paint in met. cans, bagged feed, bottled/packageq liq. (up to 160 proof).



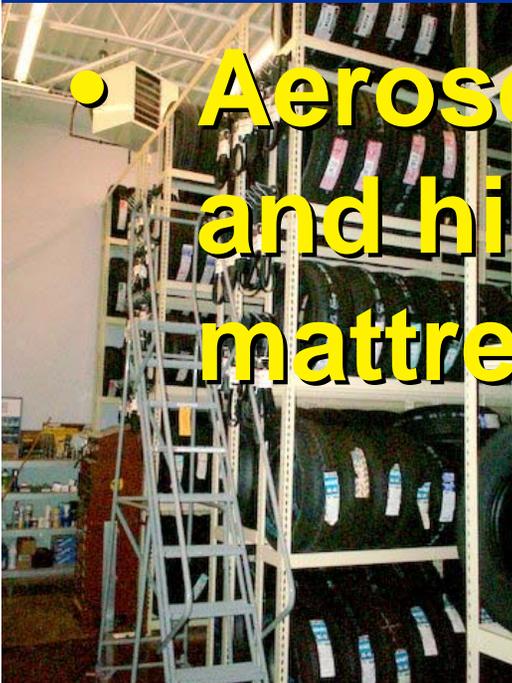
Commodity Classification

- **Class IV – Group A plastics in cartons, Grp I, II, or III in Grp A plast. packaging (comp. comb.)**
- **Aerosols (Lvl. 2), Shingles, Foam-back rugs, vinyl flooring, comb. metal products.**



Commodity Classification

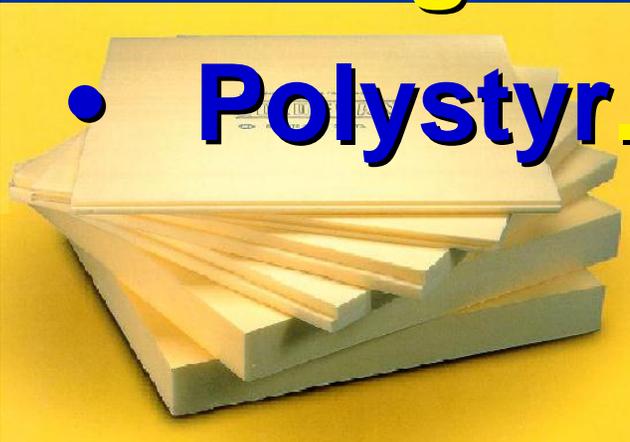
- High-Hazard – Prod's presenting special fire hazards beyond those of I, II, III, & IV.
- Aerosols (Lvl. 3), liq. (160 proof and higher), Rubber tires, foam mattresses, oil in plastic cont's.



Commodity Classification

- **Group A Plast. – Plast. Matl's hav'g a heat of comb. rate & a burn'g rate much higher than that of ord. comb's. Burn'g rate is higher than B Plastics.**

- **Polystyr., EPDM, Polyurethane**



Commodity Classification

- **Group B Plast. – Plast. Matl's hav'g a heat of comb. rate & a burn'g rate much higher than that of ord. comb's., but not as high as A Plastics.**

- **Silicone Rubber, FEP, Nylon 6, ETFE, Chloroprene Rubber**



Commodity Classification

- **Group C Plast. – Plast. Matl's hav'g a heat of comb. rate & a burn'g rate similar to that of ord. combustibles**
- **Phenol, Urea, PVF, PCTFE, PTFE, Melamine**



High-Piled Storage

Chapter 23

- **Next Step – Des. & designate the areas for the “worst case” commodity class within the area**
- **Design’t’n to a lower haz. class can be via engnr’g analysis to show the limited qty. of other matls. will not overpower the sprinklers**

High-Piled Storage

Chapter 23 General Provisions

- **General [2306]** – applies to all
- **Table 2306.2** – Reqmt's & limits for Commodities I through IV or High Hazard (Size or Areas)
- **Sprinks, det'n, access, smoke-heat vents, curtain boards**
- **Ht. Limits (Sol. pile, shelf, pallet)**

**TABLE 2306.2
GENERAL FIRE PROTECTION AND LIFE SAFETY REQUIREMENTS**

COMMODITY CLASS	SIZE OF HIGH-PILED STORAGE AREA ^a (square feet) (see Sections 2306.2 and 2306.4)	ALL STORAGE AREAS (See Sections 2306, 2307 and 2308) ^b					SOLID-PILED STORAGE, SHELF STORAGE AND PALLETIZED STORAGE (see Section 2307.3)		
		Automatic fire-extinguishing system (see Section 2306.4)	Fire detection system (see Section 2306.5)	Building access (see Section 2306.6)	Smoke and heat removal (see Section 2306.7)	Draft curtains (see Section 2306.7)	Maximum pile dimension ^c (feet)	Maximum permissible storage height ^d (feet)	Maximum pile volume (cubic feet)
I-IV	0-500	Not Required ^a	Not Required	Not Required ^a	Not Required	Not Required	Not Required	Not Required	Not Required
	501-2,500	Not Required ^a	Yes ⁱ	Not Required ^a	Not Required	Not Required	100	40	100,000
	2,501-12,000 Public accessible	Yes	Not Required	Not Required ^a	Not Required	Not Required	100	40	400,000
	2,501-12,000 Nonpublic accessible (Option 1)	Yes	Not Required	Not Required ^a	Not Required	Not Required	100	40	400,000
	2,501-12,000 Nonpublic accessible (Option 2)	Not Required ^a	Yes	Yes	Yes ^j	Yes ^j	100	30 ^f	200,000
	12,001-20,000	Yes	Not Required	Yes	Yes ^j	Not Required	100	40	400,000
	20,001-500,000	Yes	Not Required	Yes	Yes ^j	Not Required	100	40	400,000
	Greater than 500,000 ^a	Yes	Not Required	Yes	Yes ^j	Not Required	100	40	400,000
High hazard	0-500	Not Required ^a	Not Required	Not Required ^a	Not Required	Not Required	50	Not Required	Not Required
	501-2,500 Public accessible	Yes	Not Required	Not Required ^a	Not Required	Not Required	50	30	75,000
	501-2,500 Nonpublic accessible (Option 1)	Yes	Not Required	Not Required ^a	Not Required	Not Required	50	30	75,000
	501-2,500 Nonpublic accessible (Option 2)	Not Required ^a	Yes	Yes	Yes ^j	Yes ^j	50	20	50,000
	2,501-300,000	Yes	Not Required	Yes	Yes ^j	Not Required	50	30	75,000
	300,001-500,000 ^{a, h}	Yes	Not Required	Yes	Yes ^j	Not Required	50	30	75,000

High-Piled Storage

Chapter 23 General Provisions

- **Extent & Type of Protection from Table 2306.2**
- **The mandated protection must extend at least 15' beyond the High-Piles area (or wall if closer)**
- **Syst's Des – most rest. commod**

High-Piled Storage

Chapter 23 General Provisions

- **Areas aggregated unless sept'd by 1-HR fire barriers**
- **Where High-Haz commod's exist, the more restrictive area limits of same apply to all commod's unless separated by 1-HR F.B's.**

High-Piled Storage

Chapter 23 General Provisions

- Where Building Access is req'd by **T-2306.2**:
- Apparatus Rd's within 150'
- One access door in ea 100 LF of wall facing the apparatus rds..

High-Piled Storage

Chapter 23 General Provisions

- Aisle req'd to access exits and the bld'g access when >500SF
- Min. 44" wide in sprkld bldg., 96" if >2,500 SF or if not sprkld.
- Follow NFPA 231 or 231C for pile spacing aisles.

Solid-Piled or Shelf

High-Piled Chapter 23

Solid Piled or Shelf Storage

- **Solid-Piled & Shelf Stor. [2307]**
- **Used For solid piles, solid piles on pallets, bin boxes smaller than 5' in any dim., & shelf storage (shelves <30" deep and spaced not over 3' vertically). Go to Rack Storage for larger bin boxes & shelving**

High-Piled Shelf Storage [2307]



High-Piled Chapter 23

Solid Piled or Shelf Storage

- Where sprklr's req'd by **T-2306.2**, prot. entire bldg. or to 1HR FB's (fire-barriers).
- Shelf hgts 12'-15' use NFPA 231. Over 15' use in-rack prot.



Rack Storage

High-Piled Chapter 23

Rack Storage

- Rack Storage [2308]
- Incl's bin boxes >5' in any dim.
- Where sprklr's req'd by T-2306.2, prot entire bldg., or to 1HR FB's
- When plastic pallet or shelves, eng'rd. sprkl'r syst to take into account same.



High-Piled Chapter 23 Rack Storage

- Racks with solid shelves >32 SF between flues must use NFPA 231C for fire-prot. syst..
 - Racks w/ 50% open shelves (mesh, grate, etc.) where opg's at 6" min. spc'g & are not consid. "solid"

High-Piled Chapter 23 Rack Storage

- All rack storage must have flues as req'd by T-2308.3

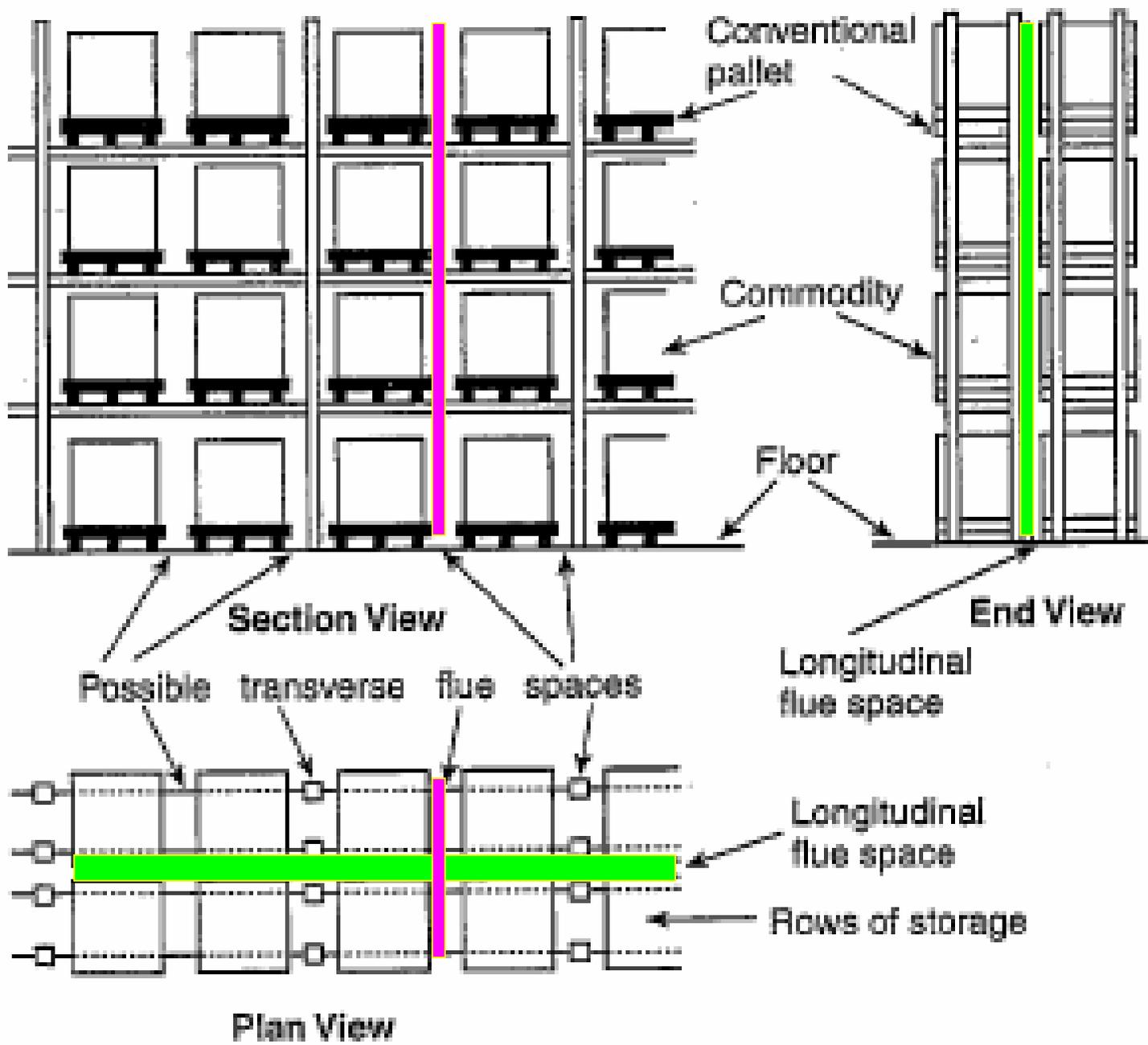


**TABLE 2308.3
REQUIRED FLUE SPACES FOR RACK STORAGE**

RACK CONFIGURATION	AUTOMATIC SPRINKLER PROTECTION		SPRINKLER AT THE CEILING WITH OR WITHOUT MINIMUM IN-RACK SPRINKLERS			IN-RACK SPRINKLERS AT EVERY TIER	NONSPRINKLERED
			≤ 25 feet		≥ 25 feet		
	Storage height		Option 1	Option 2			Any height
Single-row rack	Transverse flue space	Size ^b	3 inches	Not Applicable	3 inches	Not Required	Not Required
		Vertically aligned	Not Required	Not Applicable	Yes	Not Applicable	Not Required
	Longitudinal flue space		Not Required	Not Applicable	Not Required	Not Required	Not Required
Double-row rack	Transverse flue space	Size ^b	6 inches ^a	3 inches	3 inches	Not Required	Not Required
		Vertically aligned	Not Required	Not Required	Yes	Not Applicable	Not Required
	Longitudinal flue space		Not Required	6 inches	6 inches	Not Required	Not Required
Multi-row rack	Transverse flue space	Size ^b	6 inches	Not Applicable	6 inches	Not Required	Not Required
		Vertically aligned	Not Required	Not Applicable	Yes	Not Applicable	Not Required
	Longitudinal flue space		Not Required	Not Applicable	Not Required	Not Required	Not Required

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Three-inch transverse flue spaces shall be provided at least every 10 feet where ESFR sprinkler protection is provided.
- b. Random variations are allowed, provided that the configuration does not obstruct water penetration.



High-Piled Chapter 23 Rack Storage

- **All rack storage must have steel columns protected as per NFPA 231C**
 - **Some may req. 1-HR fireprf'g or sidewall sprink(s) directed to one side of the column**

High-Piled Chapter 23 Rack Storage

- **Extra High (>40' hgt for CL I, II, III or IV commod's. & >30' hgt for high-haz. commod's.)**
- **Rack storage & building to be protected by spec. engineered sprinkler system.**

Automated Storage

High-Piled Chapter 23 Automated Storage

- Automated Storage [2309]
- Automated type - carousel storage.
- Where sprklr's req'd by T-2306.2, prot. entire bldg. or to 1HR FB's
- When > 500 SF, must have auto shutdown.



Specialty Storage

High-Piled Chapter 23 Specialty Storage

- Specialty Storage [2310]
- Covers Record Storage Facility's using shelf or racks to store paper records (remember 12' trigger). Use Section 2306, 2308 and NFPA 231C.
- Palletized record storage use 2307

IBC s. 907.2.16

Detection

- IBC s. 907.2.16 - An auto fire detection syst. is to be installed throughout *where required by the IFC*
- Req'd per **T 2306.2** & included in 2 of the 3 auto shutdown options for automated storage (carousels) [**2309.3**]

Explosion Control

Explosion Control

- **Explosion control shall be provided *in accordance with the IFC* when required by T-414.5.1**
- **Req'd when MAQ's exceeded for the materials listed in T-414.5.1**



**TABLE 414.5.1
EXPLOSION CONTROL REQUIREMENTS^a**

MATERIAL	CLASS	EXPLOSION CONTROL METHODS	
		Barricade construction	Explosion (deflagration) venting or explosion (deflagration) prevention systems ^b
HAZARD CATEGORY			
Combustible dusts ^c	—	Not Required	Required
Cryogenic flammables	—	Not Required	Required
Explosives	Division 1.1	Required	Not Required
	Division 1.2	Required	Not Required
	Division 1.3	Not Required	Required
	Division 1.4	Not Required	Required
	Division 1.5	Required	Not Required
	Division 1.6	Required	Not Required
Flammable gas	Gaseous	Not Required	Required
	Liquefied	Not Required	Required
Flammable liquid	IA ^d	Not Required	Required
	IB ^e	Not Required	Required
Organic peroxides	U	Required	Not Permitted
	I	Required	Not Permitted
Oxidizer liquids and solids	4	Required	Not Permitted
Pyrophoric gas	—	Not Required	Required
Unstable (reactive)	4	Required	Not Permitted
	3 Detonable	Required	Not Permitted
	3 Nondetonable	Not Required	Required
Water-reactive liquids and solids	3	Not Required	Required
	2 ^g	Not Required	Required
SPECIAL USES			
Acetylene generator rooms	—	Not Required	Required
Grain processing	—	Not Required	Required
Liquefied petroleum gas-distribution facilities	—	Not Required	Required
Where explosion hazards exist ^f	Detonation Deflagration	Required Not Required	Not Permitted Required

Explosion Control

- Expls'n contr'l methods spelled out in **Chapter 9** and specifically **Section 911 of the IFC.**
 - Potentially 3 methods
 - Venting*
 - Prevention Systems
 - Barricades
- * Not allowed for Detonation hazards

Explosion venting

Explosion Venting

Expl'n. Venting (Not Detonat'n)

1. Walls & Clg's/Roofs des. To resist greater of internal pressure of 100PSF or 5 times the maximum internal relief pressure (see point 5).
2. Only at ext. wall/roof unless prov. with spec. des. Shafts

Explosion Venting

3. Prevent unacceptable structural damage or venting in a way the vent closures would become life threatening to persons on property or public way

Explosion Venting

4. Aggregate clear area of vents or vent'g devices based on the pressure from point # 1 & the max. internal pressure allowed by point # 5



Explosion Venting

5. Any one or combo of the following based on 20 PSF release (outward)

•Exterior Walls

•Hatch Covers

•Swing Doors

•Roofs

•Listed Venting Devices

Explosion Venting

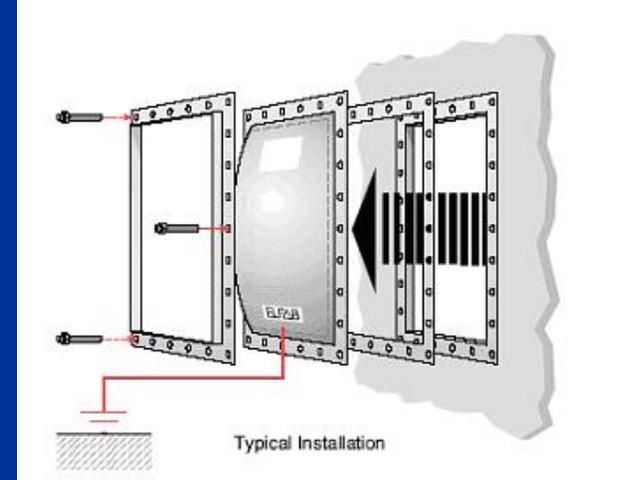
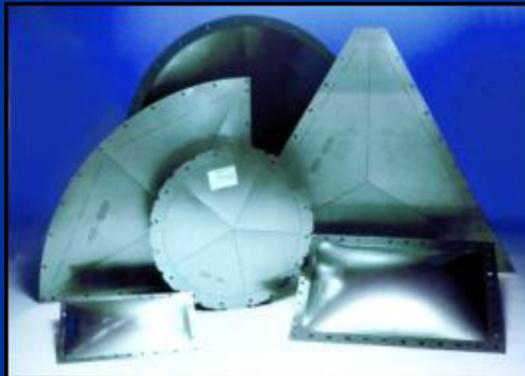
6. Vents that release require 50 ft. of unoccupied space (including setback to P.L.) adjacent to the vents

Explosion Venting

- 7. Where the vent component stays attached to the bld'g, the opening min. setback is reduced**
- **10' Vert. - windows & exit doors.**
 - **20' Horiz. - exit doors of the bldg, P.L's, & wdw's./doors of adj. bldgs on prop.**

Explosion Venting

8. Last but not least . . . never, ever vent (i.e. discharge) into the interior of a building.



Explosion Barricades

Explosion Barricades

- **Use NFPA 495 for des./install**
- **“Barricaded” means the effective screening of a bldg contain’g explosives from another bldg/mag, a railway, or a highway by a natural or artificial barrier.**

Explosion Barricades

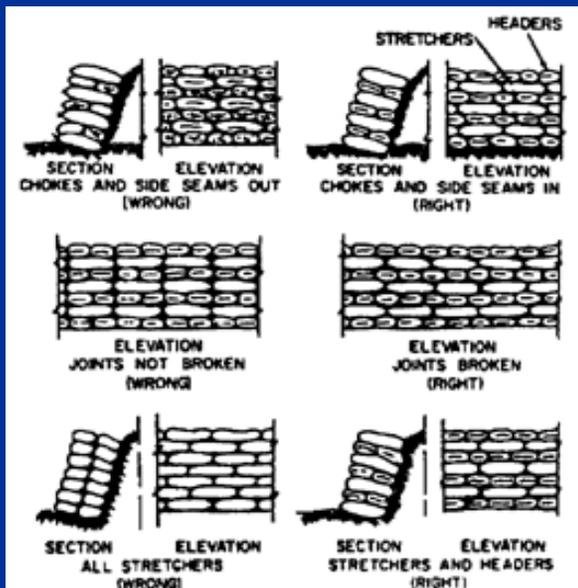
Barricades & NFPA 495

Natural – features of the ground, such as hills, or timber of suff. density the surrounding expos's need'g protection can't be seen from the magazine when the trees are bare of leaves

Explosion Barricades

Barricades & NFPA 495

- **Artificial** – a man-made mound or revetted wall of earth of that is at least 3 ft thick



Explosion Barricades

Barricades & NFPA 495

- **Effective Screening - A straight line from the top of any sidewall of the bldg containing expl. matl's to the eave line of any mag. or other bldg or to a point 12 ft above the center of a railway or highway must pass through the barricade.**

Explosion Prevention

Explosion Prevention

Explosion Prevention Systems

- Follow NFPA 69 for the design and installation
- Methodology - 2 groups
 1. Prevent Combustion
 2. Limit or prevent damage



Explosion Prevention

Prev. Syst's - NFPA 69

Preventing combustion:

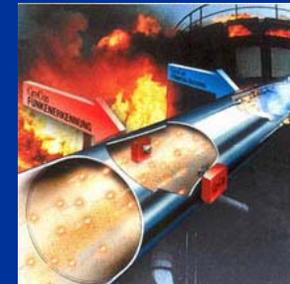
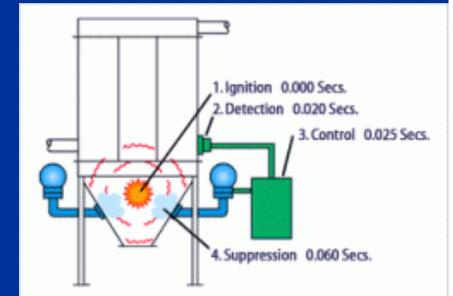
- (a) Oxidant concentration reduction
- (b) Combustible concentration reduction

Explosion Prevention

Prev. Syst's - NFPA 69



- Limiting or preventing damage:
 - (a) Deflagration suppression
 - (b) Deflagration pressure containment
 - (c) Spark extinguishing systems
 - (d) Isolation methods



Explosion Monitoring

Monitor Control Equipment

- IBC s. 414.5.2 Req's *monitor control equipment where required by the IFC.*
- Essentially limit controls incl'g. Temp. Level Contl's., Liq. Level Contl's for Atmosph'c Tanks, etc.
- Where? [**2704.8 & 2705.1.4**]

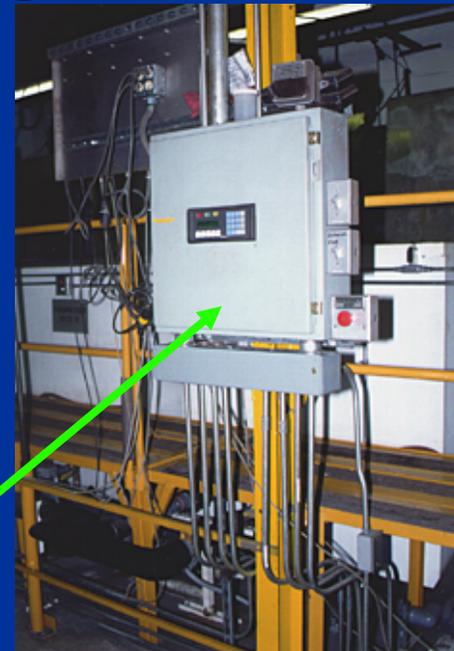
Monitor Control Equipment

- Requirements of the various “level” controls differ based on whether the Haz. Mat’l in question is in storage [2704.8] or in use [2705.1.4]



*Temp./lev.
Control
Relays*

Temp. Level Cont.



Monitor Control Equipment

- **Storage [2704.8] Limit Controls**
- **Temperature - Matl's that must be kept at other than the normal ambient temp. to prevent a haz. reaction need a primary and second'y means to maintain the temp. w/in a safe range. Alt. means to prevent a reaction can be OK'd.**

Monitor Control Equipment

- **Storage [2704.8] Controls (cont)**
- **Pressure – Tanks/Equip hold'g matl's that generate excessive internal pressures due to internal reaction or ext. fire, req's const. or controls to relieve the excessive int. pressures. (vent to approved loc., to exh. scrubber or to a trtmn't. system)**

Monitor Control Equipment

- Storage [2704.8] Controls (cont)
- 2704.7 - Remember that where the temperature limit controls or the pressure limit controls involve electrical systems, those systems must be connected to an emergency elect syst. or a standby power syst.. [s. 604]

Monitor Control Equipment

- Use [2705.1.4] Limit Controls
- High-Liquid-Level Control - Open tanks containing liquid Haz. Matl's. req. a liquid-level limit control or other means to prevent overfilling the tank

Monitor Control Equipment

- Use [2705.1.4] Controls (cont)
- Low-Liquid-Level Control – Provide safeguards to prevent a low-liquid level in a tank from creating a hazardous condition (haz. conditions incl. overheating tank or contents)

Monitor Control Equipment

- Use [2705.1.4] Controls (cont)
- Temperature Control – Same as for storage [see prec. slides and 2704.8.1]
- Pressure Control – Same as for storage [see prec. slides and 2704.8.2]

Monitor Control Equipment

- Use [2705.1.4] Controls (cont)
- 2705.1.5 - Remember that where the temperature limit controls or the pressure limit controls involve electrical systems, those systems must be connected to an emergency elect syst. or a standby power syst.. [s. 604]

Aerosol Storage

Aerosol Storage

- IBC s. 907.2.16 – Provide a manual fire alarm system *where required by the IFC*
- The IFC does not directly require the alarm. The alarm is called for within NFPA 30B



Aerosol Storage

- **NFPA 30B & Alarm**

*Segregated Aerosol
Storage Area*



Aerosol Storage

- **Man. alarm & NFPA 30B (cont.)**
- **Throughout bldg's used for the warehousing of segregated Level 2 or Level 3 aerosols.**
- **Activation to automatically close all fire doors or gates protecting openings in the encl. surrounding the segregated storage area.**

Questions ???

