HIGH-PILED STORAGE PLAN REVIEW

A Program of the National Fire Sprinkler Association

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PROGRAM DESCRIPTION

This course will provide attendees with the fundamental fire code requirements for authorities having jurisdiction for the application to facilities utilizing high-piled combustible storage. The course will primarily cover IFC Chapter 32 and outline what AHJs should consider when reviewing new construction drawings for these types of occupancies.

Additional criteria to be covered will include, how high-piled storage is defined and when IFC Chapter 32 applies, reviewing the different types of commodity classifications, the code official's role in determining the commodity classification, fire protection requirements based on the size of the high-piled storage area, along with sprinkler design criteria based on NFPA 13.

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PRESENTER BIO: JOHN SWANSON

- **Certified Fire Protection Specialist (NFPA)**
- **Codes & Standards Specialist-NFSA**
- **Former Deputy State Fire Marshal (MN)**
- **NFPA 72 Technical Committee**
- **Previous member – IBC Fire Safety Committee/IFC Interpretation Committee**
- **Instructor/SME for International Code Council and NFPA 72**
- **Appointed by MN Gov. Mark Dayton to MN Board of Architecture & Engineering (2013-2017)**

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MISCELLANEOUS INFORMATION

- Restrooms
- Breaks
- Roster
- Informal
- Participate
- Please ask questions

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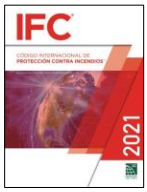
LEARNING OBJECTIVES

1. Understanding the criteria in the IFC specific to when Chapter 32 applies and how to define high-piled combustible storage.
2. Determining the commodity classification and the code official's role in determining the commodity classification.
3. Discuss the minimum requirements from NFPA 13 specific to high-piled storage sprinkler design.
4. Outline what AHJs should consider when reviewing new construction drawings for these types of occupancies



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ABOUT THE NFSA

NFSA Mission Statement

"To protect lives and property from fire
through the widespread acceptance of the fire sprinkler concept."

Our History

Established - November 22, 1905

Our Membership

We are the only all-inclusive association consisting of sprinkler contractors *(open shop and union shop),* suppliers and manufacturers, fire & building officials, and professional members.

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CODES & STANDARDS

The NFSA has:

- **180+** members and staff who participate on:
  - **60+** NFPA Technical Committees
  - **90+** NFPA Technical Committees seats
- **6+** staff on ICC code development, education, and ad-hoc committees

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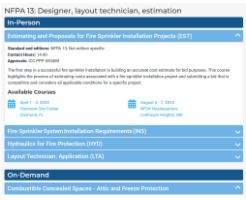
TRAINING & EDUCATION



Layout Technician Pathway

MasterClass

In-Person Seminars

On-demand Courses

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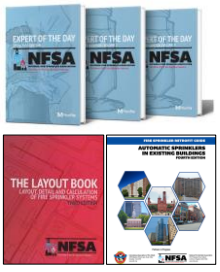
ENGINEERING



- Tech Tuesday – 3rd Tuesday at 12:30 pm (EST)
- Expert of the Day (EOD)
- NFSA Committees consists of the best technical minds in the industry:
  - Engineering and Standards (E&S) Committee
  - Inspection, Testing and Maintenance (ITM) Committee
  - Quality Assurance (QA) Committee
- NFSA staff alone commits over 3,500 hours annually in technical committee work.

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FIELD OPERATIONS

- Government Relations
- Legislation & Regulation
- State & Local Chapters

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PUBLIC FIRE PROTECTION

- Side-by-Side Burn Demonstrations
- Valve Trailer Training

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MODULE 1
CHALLENGES WITH HIGH-PILED STORAGE

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DISCUSSION SLIDE

- What has been some of the challenges you personally have experienced with high-piled storage occupancies?

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IFC DEFINITION: HIGH PILED STORAGE

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 greater than 12 feet (3658 mm) in height. Where required by the fire code official, high piled combustible storage also includes certain high hazard commodities, such as rubber tires, Group A plastics, flammable liquids, idle pallets and similar commodities, where the top of storage is greater than 6 feet in height."

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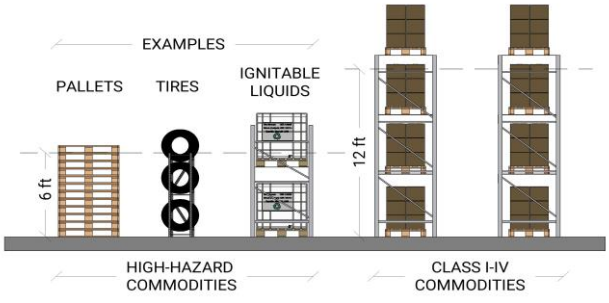
IFC CHAPTER 32



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NFPA 13 DEFINITION

"Solid-piled, palletized, rack storage, bin box, and shelf storage of Class I through Class IV commodities more than ft. in height and…Group A plastic commodities more than 5 ft. in height."

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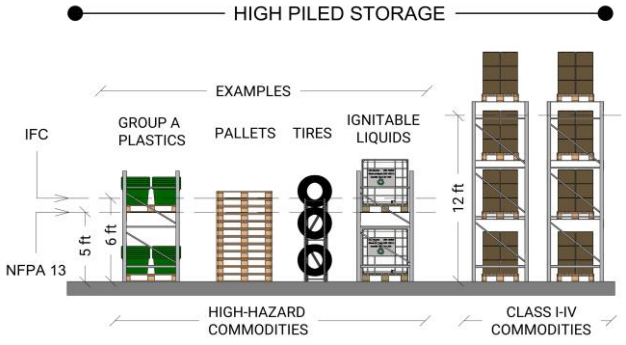

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BENEFITS OF HIGH PILED STORAGE

- **High-piled storage allows:**
  - The owner or tenant to maximize amount of goods stored in a smaller footprint,
    - Price of land allows less square footage for a building if materials can be stored vertically
  - Warehouses can be built quickly in areas of growing population and transportation hubs, creating greater efficiency, and,
  - With items available at the push of a button, companies want to ship and deliver materials in a timely manner.

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CHALLENGES

CHALLENGES FROM A FIRE SAFETY PERSPECTIVE:

- Increased fuel load

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CHALLENGES

CHALLENGES FROM A FIRE SAFETY PERSPECTIVE:

- Potential for significant company losses of goods and materials.

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CHALLENGES

CHALLENGES FROM A FIRE SAFETY PERSPECTIVE:

- Structural failure

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CHALLENGES

CHALLENGES FROM A FIRE SAFETY PERSPECTIVE:

- Materials constantly being moved/changed out

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CHALLENGES

CHALLENGES FROM A FIRE SAFETY PERSPECTIVE:

- New technologies and designs

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BE CAREFUL…

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BE CAREFUL…

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CHAPTER 32: HIGH PILED STORAGE

Other IFC chapters will apply:

- Chapter 3
  - General storage
  - Clearance to sprinklers,
  - Powered industrial trucks, etc.
- Chapter 9
- Chapter 10
- Chapter 50
  - Hazardous materials
- Chapter 51
  - Aerosols
- Chapter 57
  - Flammable/combustible liquids

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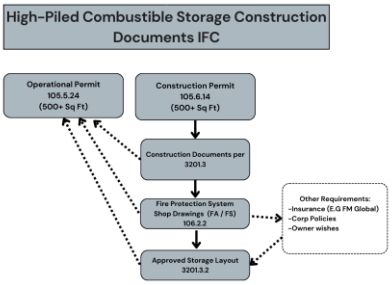
PERMITTING



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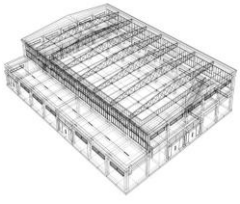
CONSTRUCTION PERMITS



- **Section 102.1 – Construction and design provisions**
  - Structures, facilities and conditions arising after the adoption of this code.
  - Existing structures…not legally in existence at time of adoption of this code.
  - Existing structures…where required by Chapter 11.
  - Existing structures…in the opinion of the fire code official, constitute a distinct hazard to life or property

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OPERATIONAL PERMITS

- **Section 102.2 – Administrative, operational, and maintenance features**
  1. Conditions and operations arising after the adoption of this code
  2. Existing conditions and operations
- Section 3201.3 Permits
  - Permits required as set forth in Sections 105.5 (Operational) and 105.6 (Construction)
- Section 105.6.22 Operational permit for buildings containing more than 500 ft² of high-piled storage.

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OPERATIONAL PERMITS

- **Section 102.2**
  - Administrative, operational, and maintenance features
    1. Conditions and operations arising after the adoption of this code
    2. Existing conditions and operations
- Section 105.6.22 Operational permit for buildings containing more than 500 ft² of high-piled storage.

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FM PROJECTS

- Some designers will utilize FM specifications as opposed to prescriptive (IFC/NFPA) code requirements.

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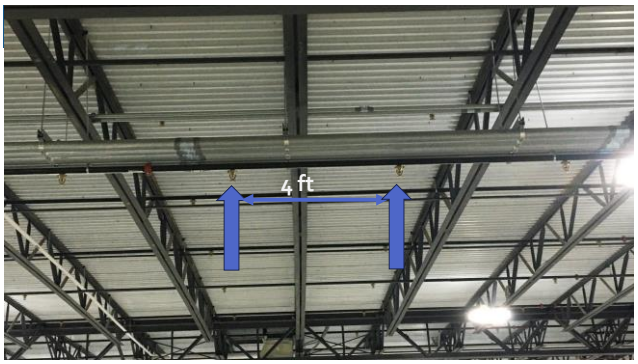

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MODULE 2
FIRE SAFETY REQUIREMENTS

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NFSA FIRE SAFETY AND EVACUATION PLAN

- HPS area exceeds 500,000 sq. ft.
- HPS exceeds 300,000 sq. ft. for high-hazard commodities
- HPS located in a Group H
- HPS located in a Group F or M with an occupant load >500 or > 100 above/below LED
- Where required by the fire code official

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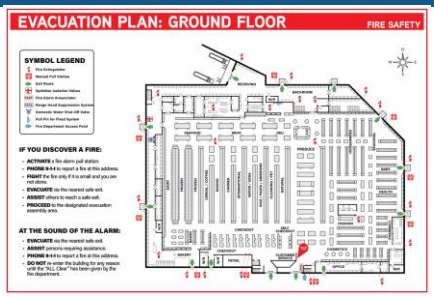
FIRE SAFETY AND EVACUATION PLAN



Sample Fire Safety / Evacuation Plan

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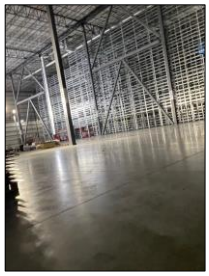
FIRE SERVICE FEATURES

- Fire department access roads (Section 503)
- Premise identification (Section 505)
- Key boxes (Section 507)
- Fire command center (Section 508)
  - 2021/2024 IFC will require S-1 > 500,000 sq. ft. to have a fire command center
- Emergency responder radio coverage (Section 510)



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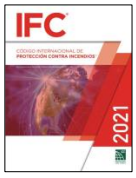
SPRINKLERS: GROUP S-1 – 903.2.9

- Fire area exceeds 12,000 sq. ft.
- Fire area located more than 3 stories above grade plane
- Combined fire area including mezzanines exceeds 24,000 sq. ft.
- Storage of commercial vehicles exceeds 5,000 sq. ft.
- Storage of upholstered furniture/mattresses exceeds 2,500 sq. ft.
- Bulk storage of tires when pile storage exceeds 20,000 cubic feet



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SPRINKLER MONITORING AND ALARMS – 903.4

- Valves and flow switches shall be electrically supervised.
- Exceptions (7 exceptions):
  - R-3 or <20 sprinklers,
  - NFPA 13R systems with combined sprinkler/domestic supply

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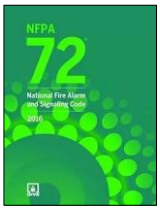
NFPA 72 & SPRINKLER MONITORING

- **Dedicated Function Fire Alarm System (2016)**
  - *"A protected premises fire alarm system installed specifically to perform fire safety function(s) where a building fire alarm system is not required"*
- Intended to address "systems" where notification appliances and/or detectors are not required by codes



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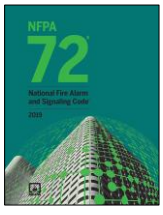
NFPA 72 & SPRINKLER MONITORING

- **Dedicated Function Fire Alarm Systems (2019)**
- Where codes, standards, or AHJs require monitoring of specific functions, but do not require a building fire alarm system, a dedicated function fire alarm system is appropriate.
  - Elevator recall
  - Sprinkler system
  - HVAC detectors
- Other functions of the fire alarm system are not required.



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FIRE EXTINGUISHERS – SECTION 906

- Required for Group S occupancies
- Selected, installed, and maintained in accordance with Section 906 and NFPA 10
- Spaced so travel distance doesn't exceed 75 ft.
- Conspicuous location
- See new exception in 2024 IFC for Group S

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FIRE ALARM SYSTEM

- Fire alarms only required for Group S occupancies used as public/self storage (added in the 2021 IFC).
- See Section 907.2.15
  - Section 907 requires a smoke detection system in HPS areas where required by Section 3206.5.
    - A fire alarm is not required when building/HPS area is protected with automatic sprinkler system (Table 3206.2)
    - Consider heat detection as an alternative.

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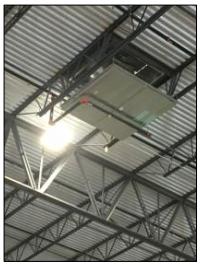
SMOKE AND HEAT REMOVAL

- Smoke and heat removal required by Table 3206.2 shall be provided in unsprinklered buildings.
- For sprinklered HPS, smoke and heat removal (when required by Table 3206.2) shall be installed in accordance with Section 910.3 and 910.4.
  - Note the Footnotes to Table 3206.2



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MEANS OF EGRESS

- Travel distance for Group S-1 limited to 200 ft. without sprinklers or 250 ft. with sprinklers.
- Travel distance can be increased to 400 ft. when:
  - Building is limited to one story
  - Height from floor to ceiling/roof is (minimum) 24 ft. high
  - Building is sprinklered.

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GENERAL REQUIREMENTS IFC SECTION 3201

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GENERAL REQUIREMENTS

- Permits
- Construction documents
- Approved storage layout
- Safety and evacuation plan when required by Section 403

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CONSTRUCTION DOCUMENTS – SECTION 3201.3

- Floor plan showing locations of HPS areas
- Useable storage height for each storage area
- Number of tiers within each rack, if applicable
- Clearance between top of storage and sprinkler deflector
- Aisle dimensions
- Maximum pile volume, if applicable
- Location and class of commodities
- Commodities that are banded/encapsulated
- Location of FD access doors
- Type of fire protection systems present
- Location of sprinkler control valves
- Type, location and specs of smoke removal and curtain boards, if applicable
- Location and dimension of transverse and longitudinal flue spaces
- Additional information specific to design features, commodities, or storage arrangement as required by the FCO

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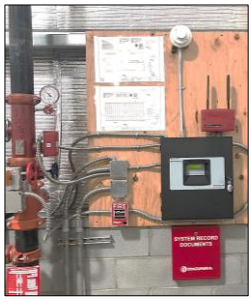
APPROVED STORAGE LAYOUT – SECTION 3201.3.2

- Storage layout plan :
  - Location, dimensions, rack layout
  - Design storage height
  - Type(s) and location(s) of commodities
  - Commodity clearance requirements
  - Aisle dimensions
  - Location of FD access doors
  - Location of sprinkler control valves



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MODULE 3
COMMODITY CLASSIFICATION: IFC SECTION 3203 AND NFPA 13

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COMMODITY CLASSIFICATION

- The commodity classification is the foundation for determining the fire protection requirements

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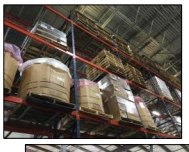
DETERMINING THE COMMODITY CLASSIFICATION

- Determining the commodity classification should be left to the design professional in responsible charge.
  - Not the building owner
  - Not the AHJ



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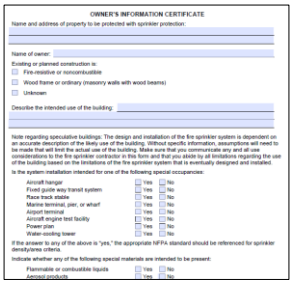
DETERMINING THE COMMODITY CLASSIFICATION

- The Owner's Certificate can be used as a guideline
  - NFPA 13 (2019) Section 4.2
- Changed to "Basis of Design for the Owner's Certificate" in 2025 edition

Key point:
Intended to be a 'front end' document. Secure this prior to starting the review!



OWNER'S INFORMATION CERTIFICATE

Name and address of property to be protected with sprinkler protection:

Name of owner:

Existing or planned construction is:

- Fire-resistive or noncombustible
- Wood frame or ordinary (masonry walls with wood beams)
- Unknown

Describe the intended use of the building:

Note regarding speculative buildings: The design and installation of the fire sprinkler system is dependent on an accurate description of the likely use of the building. Without specific information, assumptions will need to be made that will limit the actual use of the building. Make sure that you communicate any and all use considerations to the fire sprinkler contractor in this form and that you abide by all limitations regarding the use of the building based on the limitations of the fire sprinkler system that is eventually designed and installed.

Is the system installation intended for one of the following special occupancies:

Aircraft hangar	Yes	No
Fixed guide way transit system	Yes	No
Race track stable	Yes	No
Marine terminal, pier, or wharf	Yes	No
Airport terminal	Yes	No
Aircraft engine test facility	Yes	No
Power plan	Yes	No
Water-cooling tower	Yes	No

If the answer to any of the above is "yes," the appropriate NFPA standard should be referenced for sprinkler density/area criteria.

Indicate whether any of the following special materials are intended to be present:

Flammable or combustible liquids	Yes	No
Aerosol products	Yes	No

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PRODUCTS, PACKAGING AND PALLETS

To determine the commodity classification, the following MUST be known:

- **Product**
  - *What* is being stored?

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PRODUCTS, PACKAGING AND PALLETS

To determine the commodity classification, the following MUST be known:

- **Packaging**
  - *How* is the product stored?

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PRODUCTS, PACKAGING AND PALLETS

To determine the commodity classification, the following MUST be known:

- **Pallets**
  - What type of *pallets* are used (if applicable)?
  - See NFPA 13, Section 20.3.2 (2022)

Key point: Pallets are fuel!
Let's take a closer look...

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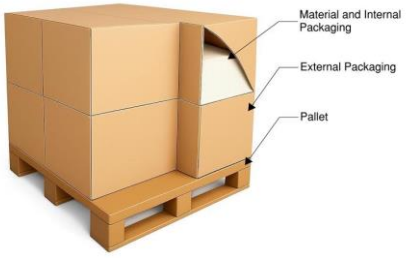
DETERMINING COMMODITY CLASSIFICATION

The commodity classification includes:



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THE EFFECT OF PLASTIC PALLETS

Commodity classification rules assume wooden or metal pallets

Plastic pallets are permitted

Unreinforced
- Classification shall be increased by one class
- Must have a permanent symbol marking them

Reinforced
- Classification shall be increased by two classes

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PALLETS

CMDA Sprinklers

Where solid-flat bottom, combustible pallets are used for rack storage of Class I-IV Commodities up to 25 feet in height:

- An increase of 20% density shall apply (unless in-rack sprinklers are provided)

These are also called 'Slave pallets' in NFPA 13

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COMMODITY CLASSIFICATION

- The commodity classification (both IFC and NFPA 13) is based on how quickly the product burns and the heat release rate (HRR).
- This is influenced by:
  - Material characteristics
  - Material quantity
  - Surface area/density
  - Ventilation

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RELATIVE FIRE HAZARD

Commodity Class	Fire Hazard Ranking
Special or High-Hazards: Tires, Rolled paper, Group A plastics, Flammable/Combustible liquids, Aerosols	Highest Fire Hazard
Class IV Commodity	
Class III Commodity	
Class II Commodity	
Class I Commodity	Lowest Fire Hazard

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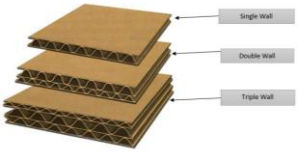
CLASS I COMMODITIES

A noncombustible product that meets one of the following criteria:

(1) Placed directly on wood pallets

(2) Placed in single-layer corrugated cartons, with or without single-thickness cardboard dividers, with or without pallets

(3) Shrink-wrapped or paper-wrapped as a unit load with or without pallets



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CLASS II COMMODITIES

A noncombustible product that is in slatted wooden crates, solid wood boxes, multiple-layered corrugated cartons, or equivalent combustible packaging material, with or without pallets.

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CLASS III COMMODITIES

A Combustible product (wood, paper, natural fibers, or Group C plastics)

- with or without cartons, boxes, or crates
- with or without pallets.
- Permitted to contain a limited amount of expanded or non-expanded plastics.
  - *See Figures 20.4.3.3 (a) & 20.4.3.3.(b)*

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CLASS IV COMMODITIES

Class IV commodities are:

- Constructed partially or totally of Group B plastics
- Free-flowing Group A plastics
- Cartoned or wooden container >5% up to 15%/25% nonexpanded/expanded Group A plastic
- See NFPA 13 20.4.4.

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GROUP A PLASTICS

Partial list includes:

- Acrylic
- PET (thermoplastic polyester)
- PE (polyethylene)
- PP (polypropylene)
- Natural Rubber

Fun fact:
IFC = Unexpanded
NFPA 13 = Nonexpanded
Intent is same

Group A plastics shall be further subdivided as either:

- **Expanded Plastic**
- **Nonexpanded Plastic**

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PLASTIC GEOMETRY

Plastics have three basic geometric forms:

- Expanded (foam coffee cups)
- Unexpanded (rigid, dense sheets or molds)
- Free-flowing (pellets or pill)

Expanded plastics greatest fire hazard

Free-flowing plastics least

Key Point: Geometry influences ease of ignition and heat release rate

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EXPANDED GROUP A PLASTIC

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UNEXPANDED GROUP A PLASTIC

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FREE-FLOWING GROUP A PLASTIC

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PLASTICS CLASSIFICATION: GENERAL

Relative Fire Severity
Group A *Expanded* Plastic
Group A *Unexpanded*
Group A *Free Flowing*
Group B
Group C

Higher heat of combustion/HRR

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GROUP A PLASTICS ON RACKS

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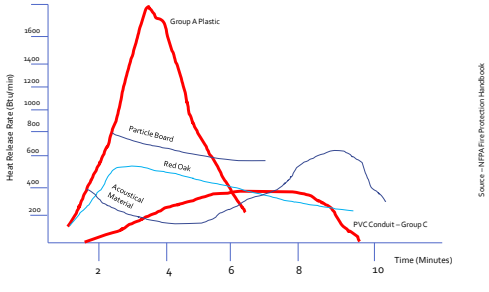
SAMPLE HEAT RELEASE RATES (HRR)



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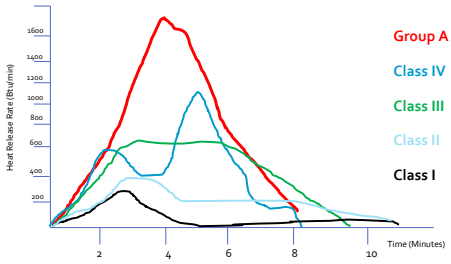
COMPARATIVE HEAT RELEASE RATES (HRR)



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DISCUSSION QUESTION

- As an AHJ or designer, how do you handle when there is disagreement on how to classify a commodity?

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MODULE 4
HIGH-PILED STORAGE CONFIGURATIONS

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SOLID PILE

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PALLETIZED

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OPEN BIN BOX STORAGE

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SHELF STORAGE

Shelf
< 30-in deep,



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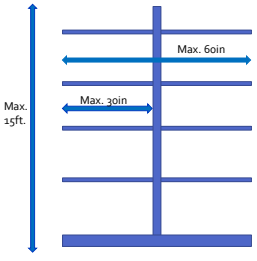
BACK-TO-BACK STORAGE

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RACK




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RACK SHELF AREA

- The area of the horizontal surface of a shelf in a rack defined by perimeter aisle(s) or nominal 6" (152 mm) flue spaces on all four sides, or by the placement of loads that block openings that would otherwise serve as the required flue spaces.

90

OPEN RACK DEFINITION

Racks without shelving or with shelving in racks that are:

- Fixed in place with shelves having a solid surface and,
- A shelf area equal to or less than 20 ft^2 or,
- With shelves having a wire mesh, slatted surface, or other material,
- With openings representing at least 50% of the shelf area including the horizontal area of rack members and,
- Where the flue spaces are maintained.

91

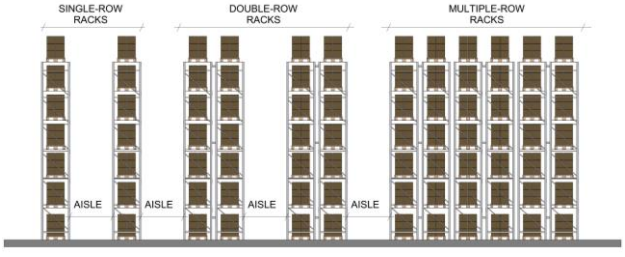
SINGLE- ROW RACK DOUBLE-ROW RACK

92

MULTI-ROW RACK AISLE WIDTH

93

RACK STORAGE ARRANGEMENTS



94

94

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The Voice of the Fire Sprinkler Industry

MODULE 5
DESIGNATION OF HIGH-PILED STORAGE AREAS IFC SECTION 3204

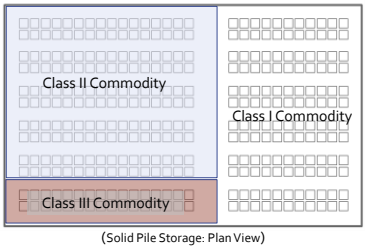
95

HIGH-PILED STORAGE AREAS

- Storage areas must be assigned a designation based on highest commodity class
  - Class I, II, III, IV or High-Hazard
- Exception for "engineered analysis option"
- Hazard class establishes fire protection requirements

96

WHAT CLASS IS THIS AREA?



(Solid Pile Storage: Plan View)

97

ENGINEERING ANALYSIS OPTION

- Design professional may classify a HPS storage area to lower commodity classification when:
  - Higher hazard commodity area is limited, and,
  - Automatic sprinkler protection design is adequate.

98

HOUSEKEEPING AND MAINTENANCE IFC SECTION 3205

99

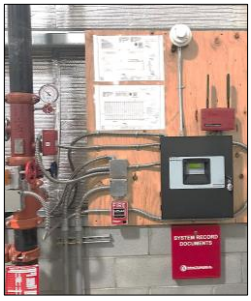
HOUSEKEEPING AND MAINTENANCE

Housekeeping and Maintenance

- Maintenance of storage layout plan
- Rack integrity
- Ignition sources
  - Smoking control
- Aisle maintenance
  - Unobstructed access doors
  - Manual stocking:
    - 24 in. in 48-in. aisle
    - 1/2 width > 48 in.
  - Mechanical
    - 44 inches
- Visual indicator of max height

100

HOUSEKEEPING AND MAINTENANCE



Maintenance of storage layout plan

Verified and evaluated annually

- Verification follows the conditions outlined in Section 3201.3.2.
- Modifications to the approved storage layout shall not be made without approval from the fire code official.

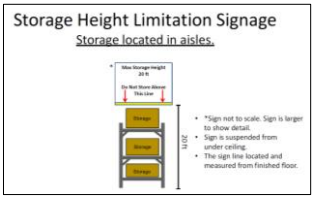
New to the 2021 IFC: Maintenance of storage plan

101

HOUSEKEEPING AND MAINTENANCE

Designation of Storage Heights

- Where required by the fire code official:
  - Provide visual method of indicating maximum allowable storage height



Here is an example of an illustration in one jurisdiction's permit packet

102

DISCUSSION QUESTIONS

- What are the primary housekeeping concerns fire code officials should be concerned about in HPS occupancies?

103

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MODULE 6
GENERAL FIRE PROTECTION & LIFE SAFETY
IFC SECTION 3206

104

Commodity Class	Size of High Piled Storage Area (square feet)	All Storage Areas				Solid-Piled Storage, Shelf Storage and Palletized Storage		
		Automatic Fire Sprinkler System	Automatic Fire Detection System	Fire Dept Access Doors	Smoke and Heat Removal	Maximum Pile Dimension	Maximum Permissible Storage Height	Maximum Pile Volume
I – IV	0-500	NR	NR	NR	NR	NR	NR	NR
	501 – 2,500	NR	Yes	NR	NR	120	40	100,000
	2501 – 12,000 Open to the Public	Yes	NR	NR	NR	120	40	400,000
	2501 – 12,000 Not Open to the Public (Option 1)	Yes	NR	NR	NR	120	40	400,000
	2501 – 12,000 Not Open to the Public (Option 2)	NR	Yes	Yes	Yes	120	30	200,000
	12,000 – 20,000	Yes	NR	Yes	Yes	120	40	400,000
	20,001 – 500,000	Yes	NR	Yes	Yes	120	40	400,000
	> 500,000	Yes	NR	Yes	Yes	120	40	400,000

105

Commodity Class	Size of High Piled Storage Area (square feet)	All Storage Areas				Solid-Piled Storage, Shelf Storage and Palletized Storage		
		Automatic Fire Extinguishing System	Automatic Fire Detection System	Fire Dept Access Doors	Smoke and Heat Removal	Maximum Pile Dimension	Maximum Permissible Storage Height	Maximum Pile Volume
High-Hazard	0-500	NR	NR	NR	NR	60	NR	NR
	501 – 2,500 Open to the Public	Yes	NR	NR	NR	60	30	400,000
	501 – 2,500 Not Open to the Public (Option 1)	Yes	NR	NR	NR	60	30	400,000
	501 – 2,500 Not Open to the Public (Option 2)	NR	Yes	Yes	Yes	60	20	200,000
	2,501 – 300,000	Yes	NR	Yes	Yes	60	30	400,000
	300,001 – 500,000	Yes	NR	Yes	Yes	60	30	400,000

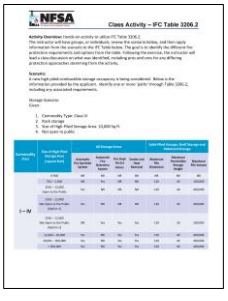
106

CLASS ACTIVITY

IFC Table 3206.2

- Review scenario
- Identify fire protection requirements
  - Are there different paths to compliance?
- Work in groups or individually

Look for 'Class Activity IFC Table 3206.2' Sheet near the end of your Participant Guide



107

Commodity Class	Size of High Piled Storage Area (square feet)	All Storage Areas				Solid-Piled Storage, Shelf Storage and Palletized Storage		
		Automatic Fire Sprinkler System	Automatic Fire Detection System	Fire Dept Access Doors	Smoke and Heat Removal	Maximum Pile Dimension	Maximum Permissible Storage Height	Maximum Pile Volume
I – IV	0-500	NR	NR	NR	NR	NR	NR	NR
	501 – 2,500	NR	Yes	NR	NR	120	40	100,000
	2501 – 12,000 Open to the Public	Yes	NR	NR	NR	120	40	400,000
	2501 – 12,000 Not Open to the Public (Option 1)	Yes	NR	NR	NR	120	40	400,000
	2501 – 12,000 Not Open to the Public (Option 2)	NR	Yes	Yes	Yes	120	30	200,000
	12,000 – 20,000	Yes	NR	Yes	Yes	120	40	400,000
	20,001 – 500,000	Yes	NR	Yes	Yes	120	40	400,000
	> 500,000	Yes	NR	Yes	Yes	120	40	400,000

108

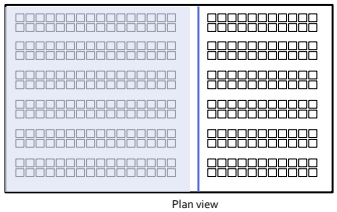
FIRE PROTECTION

- Fire protection requirements
  - Area
  - Commodity class
- Protection extent
  - Multiple areas

109

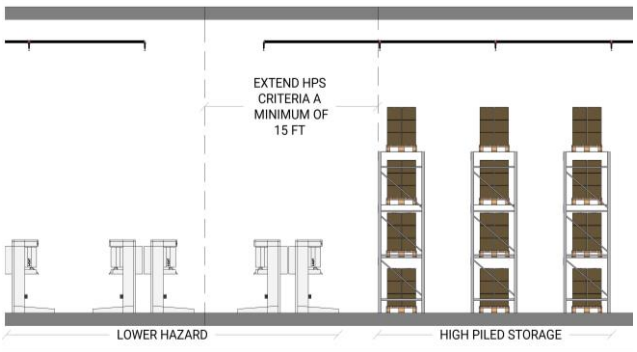
FIRE PROTECTION COVERAGE

- Protection extent for Table 3206.2
  - "Lesser of" 15 feet *or* full-height wall
  - NFPA 13 just requires a "barrier or partition" (draft curtain)



Plan view

110

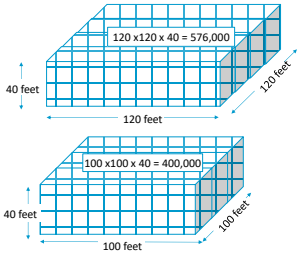


111

NFSA

Solid-Piled Storage, Shelf Storage and Palletized Storage

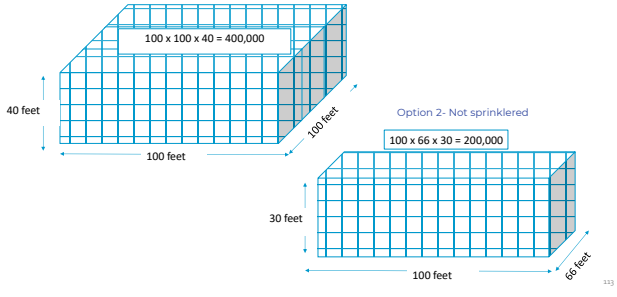
Maximum Pile Dimension	Maximum Permissible Storage Height	Maximum Pile Volume
120	40	400,000
120	40	400,000
120	30	200,000



112

112

NFSA

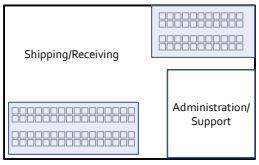


113

113

FIRE PROTECTION COVERAGE

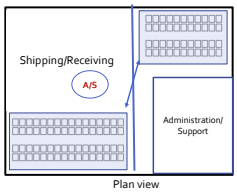
- High-piled storage area size, sum:
  - Footprint of storage, racks, shelves or piles
  - Interior aisles
  - Perimeter aisles
    - 44 or 96 in.



Plan view

FIRE PROTECTION COVERAGE

- Multiple high-piled areas
  - Consider the aggregate area, or,
    - One-hour fire barriers, *or,*
    - Separated by 100 feet if sprinklered

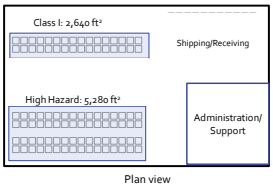


Plan view

FIRE PROTECTION COVERAGE

- Storage area size – Mixed commodity classes with High-hazard
  - Unless separated: All treated as high hazard
  - Aggregate area

Treat as 7,920 ft²
High Hazard



Plan view

FIRE DEPARTMENT ACCESS CONCERNS?

117

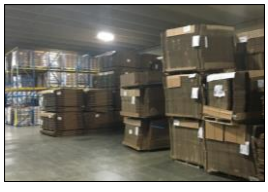
AUTOMATIC SPRINKLERS

- Section 3206.4
- Sprinkler system required in accordance with Sections 3207 (Solid Piled and Shelf Storage), 3208 (Rack Storage), and 3209 (Automated Storage)
- Owner or insurance provider may require greater (or additional) protection than what is specified in IFC, NFPA 13, etc.

118

SOLID PILED AND SHELF STORAGE (3207)

- Section 3207
- When required by Table 3206.2, automatic sprinklers required throughout the building or to a 1-hour fire barrier.
- Shelf storage
  - 12 ft. but less than 15 ft: Protect in accordance with NFPA 13
  - > 15 feet: Protected in an approved manner with special fire protection, such as in-racks



119

RACK STORAGE

- Section 3208
- When required by Table 3206.2, automatic sprinklers required throughout the building or to 1-hour fire barrier
- Plastic shelves: Designed by a specially engineers fire protection system
- Racks with solid shelving: Protect per NFPA 13
- Flue spaces: When protected with automatic sprinklers, flue spaces must be provided and maintained in accordance with Table 3208.3

120

AUTOMATED STORAGE

- Section 3209
- When required by Table 3206.2, automatic sprinklers required throughout
- Carousel storage > 500 sq. ft.:
  - Provided with one of the following:
    - An automatic smoke detection system per Section 907 with coverage extending 15 ft. beyond carousel storage areas that sounds a local alarm at a central location and stops carousel storage upon activation of a single detector.
    - An automatic smoke detection system per Section 907 and within enclosed carousel storage systems, that sounds a local alarm at a central location that stops carousel system.
    - A single dead-man type control switch that only allows operation of the carousel system when an operator is present.

121

FIRE DETECTION SYSTEMS

- Required for non-sprinklered storage areas

- Fire alarms are rarely required in sprinklered storage areas
  - But may still be provided/installed voluntarily.

Hazard Class	Area (ft^2)	Open to Public
Class I-IV	501-2,500	--
Class I-IV	2,501-12,000	No
High Hazard	501-2,500	No

122

FIRE DETECTION SYSTEMS

- Smoke detectors are preferred by IFC (907.2.15), but heat detection may be more appropriate.

- Heat detectors are limited to smooth, beam or sloped ceilings in a building ≤30' in height
  - NFPA 72 Table 17.6.3.5.1

- Ceilings >30' in height require a performance design for spot-type heat detectors, or,
- Linear cable or pneumatic rate-of-rise heat detection system may be an option.

123

FIRE DEPARTMENT HOSE CONNECTIONS

- When exit passageways are required by the IBC, a Class I standpipe shall be provided in accordance with Section 905 (3206.9).
- UFC required small hose stations (1 – ½ inch) for some HPS occupancies.
  - IFC no longer requires small hose stations
  - NFPA 13 still references small hose connections

124

FIRE DEPARTMENT ACCESS

- Fire Department Access:
  - Fire apparatus access roads
  - Fire department access doors
- Section 503 requires fire apparatus access roads to all buildings
- Table 3206.2 sets fire department access doors for manual suppression requirements
  - Exception for when access roads aren't possible or practical

125

FIRE DEPARTMENT ACCESS

- Doors must be accessible without a ladder.
- One access door every 125 lineal feet.
- Access doors at least 3’ wide by 6’ 8” high.
  - Roll-up doors not to be used unless approved.
- Only approved locking devices.
  - Key boxes may be required.

126

SMOKE/HEAT REMOVAL

- Provides aid in salvage and overhaul operations by providing post-extinguishment ventilation
- Changes made in 2015 IFC:
  - Draft curtains eliminated
  - Smoke and heat vents only in non-sprinklered storage areas
  - Smoke and heat vents *or* mechanical ventilation in sprinklered areas

127

SMOKE AND HEAT VENTS

- Vents must be listed and labeled to demonstrate compliance with:
  - UL 793, *Automatically Operated Roof Vents for Smoke and Heat,* or,
  - FM 4430, *Approval Standard for Heat and Smoke Vents.*

128

MECHANICAL SMOKE REMOVAL

- May be used as an alternate to smoke/heat vents
- Must meet the following criteria:
  - Sprinklered building
  - Design for two air changes per hour based on volume.
  - Maximum 30,000 CFM per exhaust fan
  - Automatic or manual make-up air
    - Openings within six feet of floor
    - Min. gross area 8 ft^2/1000 ft^3 of exhaust

129

AISLES

- Limit fire spread
  - Conduction
  - Convection
  - Radiation
- Provide egress routes
- Provide firefighter access

- Width is dependent on:
  - Sprinkler system design
  - Commodity classification
  - Storage method
  - Open to public

130

IS THIS OK?

131

AISLES

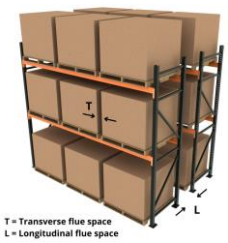
- Minimum width
  - Sprinklered
    - 44 inches when HPS is <2,500 sq. ft.
    - 96 inches when HPS exceeds 2,500 sq. ft.
    - 96 inches when open to the public when mechanical stocking is used
    - Two exceptions
  - Non-sprinklered:
    - 96 inches

132

FLUE SPACES

133

FLUE SPACES



T = Transverse flue space
L = Longitudinal flue space

134

FLUE SPACES

- Table 3208.3
- Flue spaces provided and maintained.
  - Table may conflict with NFPA 13
  - When a conflict occurs between the "code" and a referenced standard, which one prevails?

135

IFC TABLE 3208.3

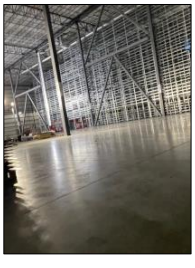
Rack Configuration	Flue Design		Sprinklers at the Ceiling With or Without Minimum In-Rack Sprinklers		In-Rack Sprinklers at Every Tier
			≤ 25 feet	> 25 feet	Any Height
Double-row Rack (Option 1)	Transverse Flue space	Size	6 inches	3 inches	Not Required
		Vertically aligned	Not Required	Yes	Not Applicable
	Longitudinal Flue space		Not Required	6 inches	Not Required
Double-row Rack (Option 2)	Transverse Flue space	Size	3 inches	6 inches	Not Required
		Vertically aligned	Not Required	Yes	Not Applicable
	Longitudinal Flue space		6 inches	Not Required	Not Required

136

EXTRA-HIGH-RACK STORAGE

- Buildings with extra-high-rack combustible storage to be protected with a *specially engineered* automatic sprinkler system.

Commodity Class	Height (feet)
I, II, III, IV	> 40
High-hazard	> 30



137

EXTRA-HIGH-RACK STORAGE

- Buildings with extra-high-rack combustible storage to be protected with a *specially engineered* automatic sprinkler system.

- Youtube Video

Construction of the tallest cold-storage warehouse in Europe

138

AUTOMATED STORAGE

139

CLASS ACTIVITY

Construction Documents – IFC Section 3201.3

- Look for items on plan
- What is missing?
- What is needing clarification?

- Work in groups or individually

Look for 'HPS Example Plan' near the end of your Participant Guide

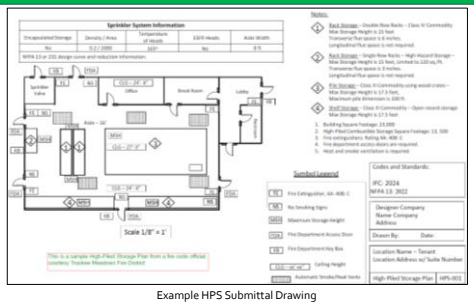
140

NFSA CONSTRUCTION DOCUMENTS – SECTION 3201.3

- Floor plan showing locations of HPS areas
- Useable storage height for each storage area
- Number of tiers within each rack, if applicable
- Clearance between top of storage and sprinkler deflector
- Aisle dimensions
- Maximum pile volume, if applicable
- Location and class of commodities
- Commodities that are banded/encapsulated
- Location of FD access doors
- Type of fire protection systems present
- Location of sprinkler control valves
- Type, location and specs of smoke removal and curtain boards, if applicable
- Location and dimension of transverse and longitudinal flue spaces
- Additional information specific to design features, commodities, or storage arrangement as required by the FCO

141

Check The Plans!

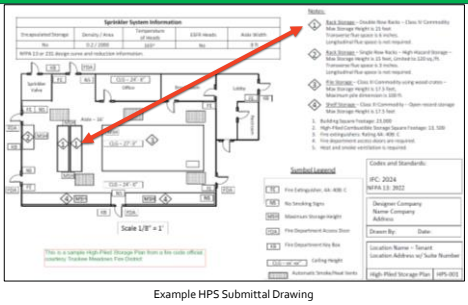


Example HPS Submittal Drawing

142

142

Check The Plans!

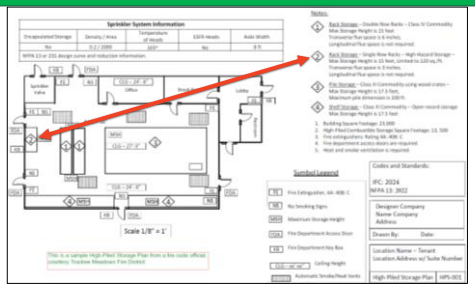


Example HPS Submittal Drawing

143

143

Check The Plans!

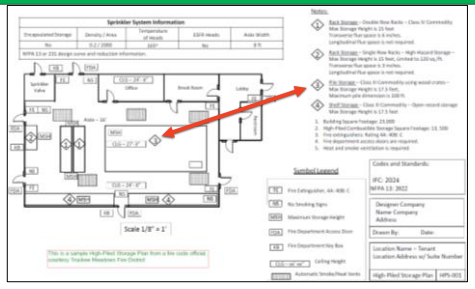


Example HPS Submittal Drawing

144

144

Check The Plans!

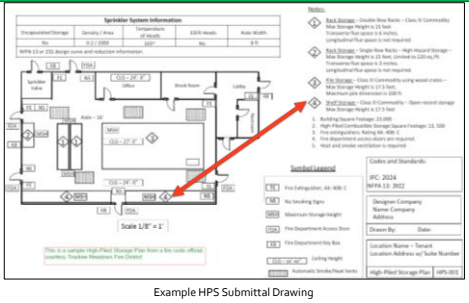


Example HPS Submittal Drawing

145

145

Check The Plans!



Example HPS Submittal Drawing

146

146

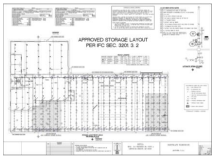
CLASS ACTIVITY

Approved Storage Layout– IFC Section 3201.3.2

- Look for items on plan
- What is missing?
- What is needing clarification?

- Work in groups or individually

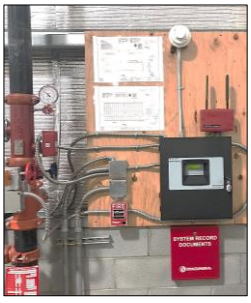
Look for 'Northgate Warehouse Approved Storage Layout' at the end of your Participant Guide



147

APPROVED STORAGE LAYOUT – SECTION 3201.3.2

- Storage layout plan :
  - Location, dimensions, rack layout
  - Design storage height
  - Type(s) and location(s) of commodities
  - Commodity clearance requirements
  - Aisle dimensions
  - Location of FD access doors
  - Location of sprinkler control valves

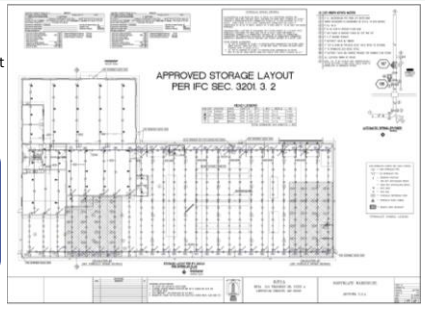


148

Check The Plans!

Example Approved Storage Layout

Can the sprinkler drawing be used? Yes, if it has the correct info

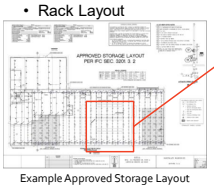


149

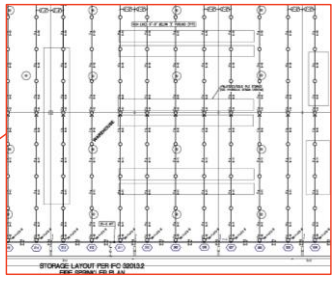
Check The Plans!

Approved Storage Layout

- **Location of High-Piled Storage Areas**
  - Dimensions
  - Rack Layout



Example Approved Storage Layout

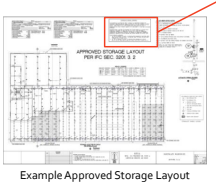


150

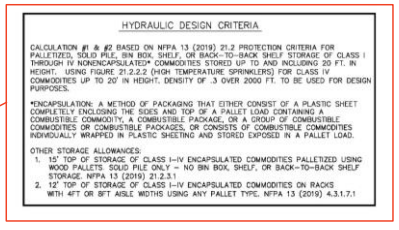
Check The Plans!

Approved Storage Layout

- **Design Storage height**
- **Types of Commodities**



Example Approved Storage Layout



HYDRAULIC DESIGN CRITERIA

CALCULATION #1 & #2 BASED ON NFPA 13 (2019) 21.2 PROTECTION CRITERIA FOR PALLETIZED, SOLID PILE, BIN BOX, SHELF, OR BACK-TO-BACK SHELF STORAGE OF CLASS I THROUGH IV NONENCAPSULATED* COMMODITIES STORED UP TO AND INCLUDING 20 FT. IN HEIGHT. USING FIGURE 21.2.2.2 (HIGH TEMPERATURE SPRINKLERS) FOR CLASS IV COMMODITIES UP TO 20' IN HEIGHT. DENSITY OF .3 OVER 2000 FT. TO BE USED FOR DESIGN PURPOSES.

*ENCAPSULATION: A METHOD OF PACKAGING THAT EITHER CONSIST OF A PLASTIC SHEET COMPLETELY ENCLOSING THE SIDES AND TOP OF A PALLET LOAD CONTAINING A COMBUSTIBLE COMMODITY, A COMBUSTIBLE PACKAGE, OR A GROUP OF COMBUSTIBLE COMMODITIES OR COMBUSTIBLE PACKAGES, OR CONSISTS OF COMBUSTIBLE COMMODITIES INDIVIDUALLY WRAPPED IN PLASTIC SHEETING AND STORED EXPOSED IN A PALLET LOAD.

OTHER STORAGE ALLOWANCES:
1. 15' TOP OF STORAGE OF CLASS I–IV ENCAPSULATED COMMODITIES PALLETIZED USING WOOD PALLETS. SOLID PILE ONLY – NO BIN BOX, SHELF, OR BACK-TO-BACK SHELF STORAGE. NFPA 13 (2019) 21.2.3.1
2. 12' TOP OF STORAGE OF CLASS I–IV ENCAPSULATED COMMODITIES ON RACKS WITH 4FT OR 8FT AISLE WIDTHS USING ANY PALLET TYPE. NFPA 13 (2019) 4.3.1.7.1

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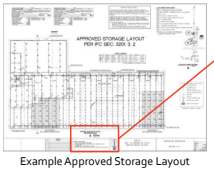
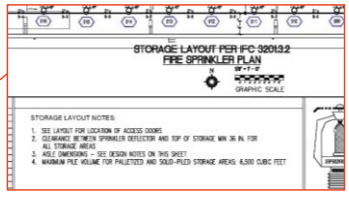
Check The Plans!

Approved Storage Layout

- **Commodity Clearance**
  - Sprinkler deflector to top of storage
- **Maximum Pile Volume**
  - For palletized and solid-piled



Example Approved Storage Layout

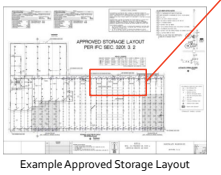


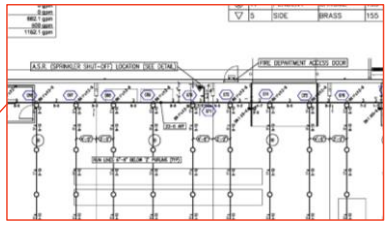
152

Check The Plans!

Approved Storage Layout

- **Location of Sprinkler Valves**
- **Fire department Access Doors**





Example Approved Storage Layout

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MODULE 7
APPLICATION OF IFC HAZARDOUS MATERIALS REQUIREMENTS

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CHAPTER 50 – HAZARDOUS MATERIALS

- The following slides will include a basic review for the hazardous materials requirements in the MSFC/IFC.
- 5001 – General
  - Scope
  - Classifying materials
  - Physical hazards
  - Health hazards
  - Performance requirements
  - Permits (when applicable)
  - Facility closure requirements

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MODULE 8
NFPA 13 HIGH-PILED STORAGE PROTECTION CRITERIA

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NFPA 13 STORAGE CRITERIA

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NFPA 13 - CHAPTERS 20-26

Discharge Rules for Storage and Special Occupancies

20. General Req's for Storage
21. Protection of High Piled Storage Using CMDA Sprinklers
22. CMSA Requirements for Storage Applications
23. ESFR Requirements for Storage Applications
24. Alternative System Designs for Chapters 20-25
25. Protection of Rack Storage Using In-Rack Sprinklers
26. Special Designs of Storage Protection
27. Special Occupancy Requirements

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REQUIRED DOCUMENTATION PRIOR TO REVIEW

Project Plans

- Architectural:
  - height, area, use, riser room, concealed spaces
- Mechanical:
  - plenum spaces
- Electrical:
  - electrical room equipment
- Plumbing:
  - backflow
- Site:
  - underground, FDC location, landscaping, geography

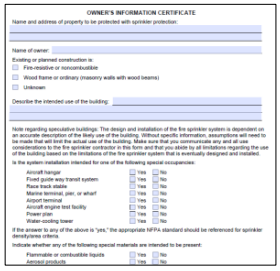
175

REQUIRED DOCUMENTATION PRIOR TO REVIEW

Owner's Information Certificate

- Signed copy is required
  - NFPA 13 (2019) Section 4.2
- Changed to "Basis of Design for the Owner's Certificate" in 2025 edition

Key point:
Intended to be a 'front end' document. Secure this prior to starting the review!



OWNER'S INFORMATION CERTIFICATE

Name and address of property to be protected with sprinkler protection:

Name of owner:

Existing or planned construction is:

- Fire-resistive or noncombustible
- Wood frame or ordinary (masonry walls with wood beams)
- Unknown

Describe the intended use of the building:

Note regarding speculative buildings: The design and installation of the fire sprinkler system is dependent on an accurate description of the likely use of the building. Without specific information, assumptions will need to be made that will limit the actual use of the building. Make sure that you communicate any and all use considerations to the fire sprinkler contractor in this form and that you abide by all limitations regarding the use of the building based on the limitations of the fire sprinkler system that is eventually designed and installed.

Is the system installation intended for one of the following special occupancies:

Aircraft hangar	☐ Yes	☐ No
Fixed guide way transit system	☐ Yes	☐ No
Race track stable	☐ Yes	☐ No
Marine terminal, pier, or wharf	☐ Yes	☐ No
Airport terminal	☐ Yes	☐ No
Aircraft engine test facility	☐ Yes	☐ No
Power plan	☐ Yes	☐ No
Water-cooling tower	☐ Yes	☐ No

If the answer to any of the above is "yes," the appropriate NFPA standard should be referenced for sprinkler density/area criteria.

Indicate whether any of the following special materials are intended to be present:

Flammable or combustible liquids	☐ Yes	☐ No
Aerosol products	☐ Yes	☐ No

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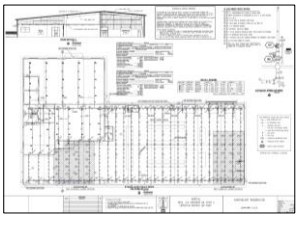
REQUIRED DOCUMENTATION PRIOR TO REVIEW

Shop Drawings



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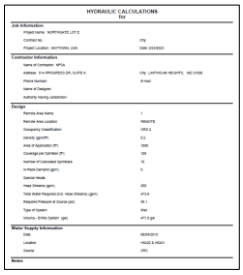
REQUIRED DOCUMENTATION PRIOR TO REVIEW

Hydraulic Calculations

- Hydraulically calculated systems will consist of several pages.
- Each design area will be a separate calculation.
- Checklist has all of the necessary sheets for review.
- Review of these are later, remember, this is just submittal review.


HYDRAULIC CALCULATIONS

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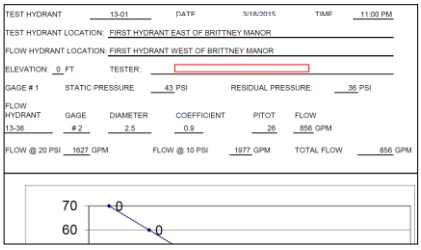
REQUIRED DOCUMENTATION PRIOR TO REVIEW

Water Supply Info / Report


TEST HYDRANT 13-01 DATE 3/18/2015 TIME 11:00 PM

TEST HYDRANT LOCATION: FIRST HYDRANT EAST OF BRITTNEY MANOR

FLOW HYDRANT LOCATION: FIRST HYDRANT WEST OF BRITTNEY MANOR

ELEVATION: 0 FT TESTER:

GAGE # 1 STATIC PRESSURE 43 PSI RESIDUAL PRESSURE: 36 PSI

FLOW HYDRANT	GAGE	DIAMETER	COEFFICIENT	PITOT	FLOW
13-36	# 2	2.5	0.9	26	856 GPM

FLOW @ 20 PSI 1627 GPM FLOW @ 10 PSI 1977 GPM TOTAL FLOW 856 GPM

70
60

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REQUIRED DOCUMENTATION PRIOR TO REVIEW

Cut Sheets

- Typically, anything water flows through:
  - Sprinklers
  - Pipe
  - Valves

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REQUIRED DOCUMENTATION PRIOR TO REVIEW

System Area Limits

- Light and Ordinary hazard = 52,000 sq.ft.
- Extra hazard = 40,000 sq.ft.
- High pile storage = 40,000 sq.ft.

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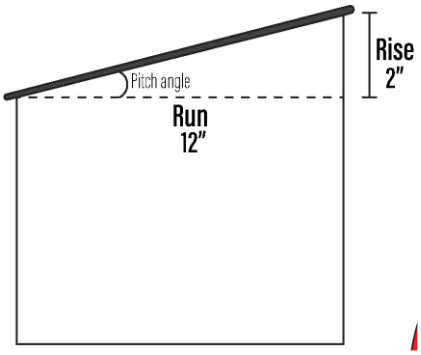

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STORAGE ALLOWED W/SLOPED CEILINGS:

For the first time Sloped Ceilings may be allowed for Storage

2025 Edition of NFPA 13

Ceiling Slope greater then 2 in 12 in storage:

Slope Ceiling:
Slope exceeding 2 in 12

· **Protection Options (6):**

1) In-rack sprinklers (no storage above in-racks)
2) Install false ceiling that can withstand 3 lb/sq ft uplift force
3) Install per Chapter 20 through 26 (which permits ceiling in excess of 2 in 12)
4) CMDA (up to 4 in 12)– Sprinklers in every Channel
5) Unobstructed (up to 4 in 12)– Increase design area by 50%
6) Obstructed (up to 4 in 12) :
   - Purlins run across roof slope
   - Purlins do not exceed 18 in deep and 5 ft O.C.
   - Purlins supported by girders 40 ft O.C or less
   - Purlin channels are provided with blocking above each girder

The term "firestopped" was changed to "blocking"

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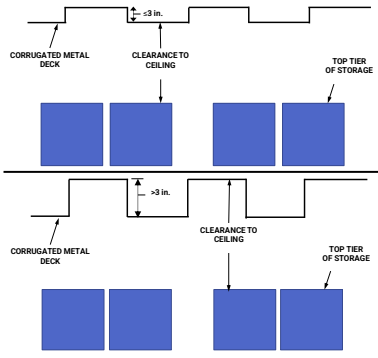

CORRUGATED DECK 3 INCHES OR LESS IN DEPTH

CORRUGATED DECK GREATER THAN 3 INCHES IN DEPTH

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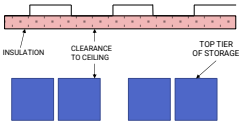
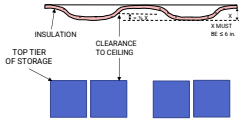
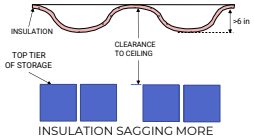


INSULATION TIGHT TO CEILING



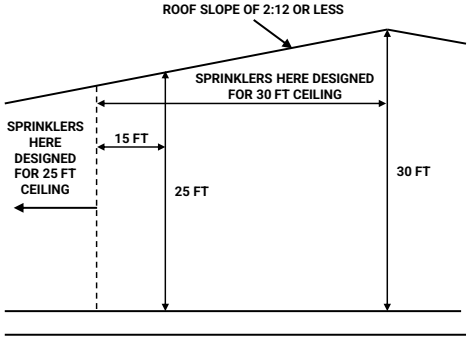
INSULATION SAGGING 6 INCHES



INSULATION SAGGING MORE THAN 6 INCHES

185

185



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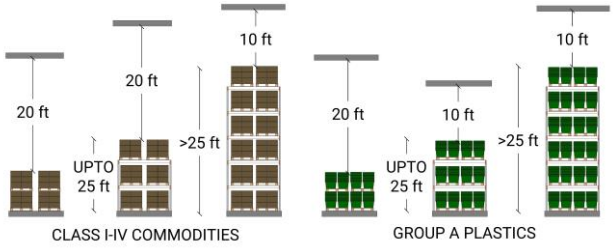

CRITERIA Commodity	Class I – IV	Group A Plastic
Palletized, solid-piled, bin box, shelf, or back-to-back shelf storage	20 ft	20 ft
Rack storage up to 25 ft	20 ft	10 ft
Rack Storage >25ft	10 ft	10 ft

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CRITERIA WHEN MAXIMUM CEILING CLEARANCE IS EXCEEDED FOR CLASS I-IV COMMODITIES

Storage Configuration	Where the clearance to the ceiling exceeds	Protection is based upon the storage height that would result in a clearance to the ceiling of…	In-Rack Sprinklers
Palletized, solid-piled, bin box, shelf, or back-to-back shelf storage	20 ft	20 ft	N/A
Rack storage up to and including 25 ft in height	20 ft	20 ft	Permitted as alternative to presumed clearance of 20 ft
Rack Storage over 25 ft in height	10 ft	10 ft	Permitted as alternative to presumed clearance of 10 ft

CRITERIA WHEN MAXIMUM CEILING CLEARANCE IS EXCEEDED FOR GROUP A PLASTICS AND TIRES

Storage Configuration	Where the clearance to the ceiling exceeds	Protection is based upon the storage height that would result in a clearance to the ceiling of…	In-Rack Sprinklers
General Storage	20 ft	20 ft	N/A
Rack storage up to and including 25 ft in height	20 ft	20 ft	Permitted as alternative to presumed clearance of 10 ft
Rack Storage over 25 ft in height	10 ft	10 ft	Required

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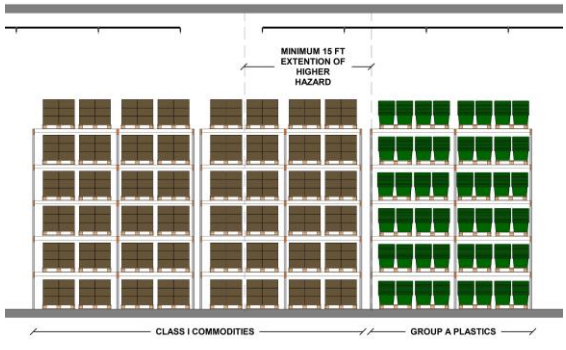

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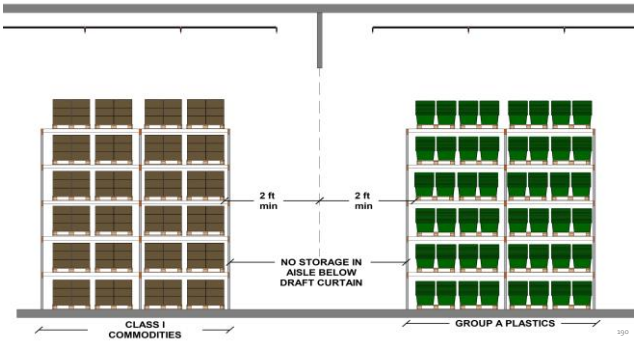
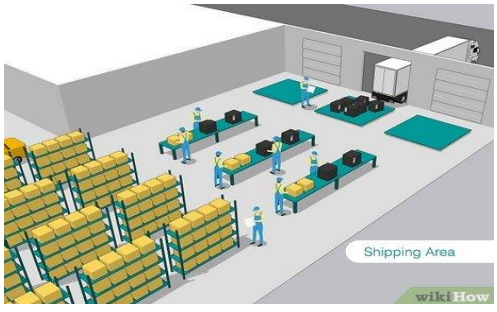


190

HIGH-PILED STORAGE PROTECTION AREA

Photo courtesy of: https://www.wikihow.com/Set-Up-a-Shipping-and-Receiving-Area



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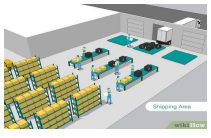
HIGH-PILED STORAGE PROTECTION AREA

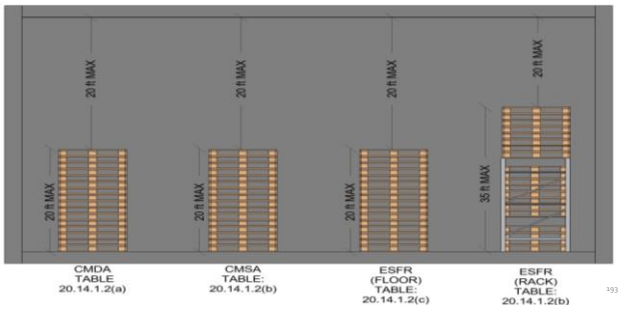
Adjacent hazards and protection criteria

- NFPA 13: Protection must extend to a draft curtain or barrier, a minimum of 24" from the adjacent hazard on both sides
- IFC Section 3206.2.1:
  - Fire safety features required…shall extend to the lesser of 15 ft. beyond the HPS area OR to a full height wall.



192

IDLE PALLETS



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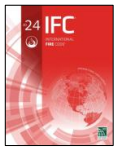
SMOKE AND HEAT VENTS

- Fire Code (2027)
- Automatic AND manual release
- Automatic means of release:
  - Fusible link – 360F
  - Fixed temp heat detector 360F



- NFPA 13 (2025)
  - Not required in sprinklered areas
  - If provided, higher temp than sprinklers

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HVLS FANS

- NFPA 13 (2022)
  - Fan shuts down upon waterflow
  - Sprinklers spaced around fan

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SPRINKLER TYPES IN STORAGE

CMDA

CMSA

ESFR

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REVIEW NFPA 13 CHAPTER 21
CMDA SPRINKLERS

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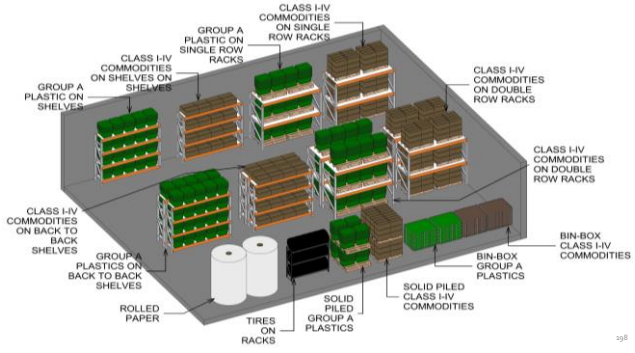

198

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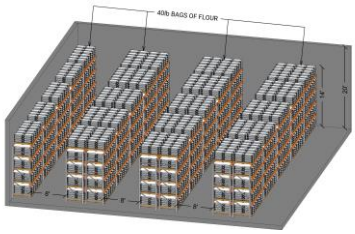
CMDA EXAMPLE

E
X
A
M
P
L
E



199

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ANSWER:

- Table 21.4.1.2
- Figure 21.4.1.2(b)
- Curves A or B
- If Curve A is chosen, why is the density lower when high temperature sprinklers are used?
- .325 gpm/sq ft over 2000 sq ft
- Minimum 11.2K factor
- Total Flow: 650 gpm (.325 gpm/sq. ft. x 2000 sq. ft. = 650)

200

200

REVIEW NFPA 13 CHAPTER 22

CMSA SPRINKLERS

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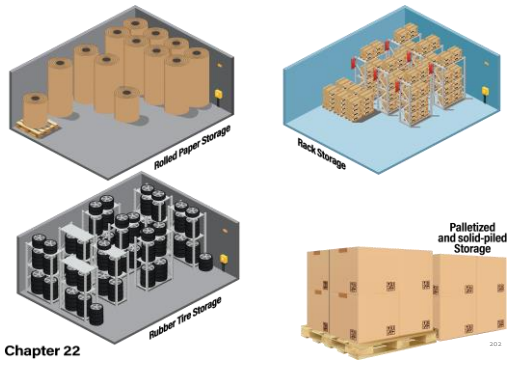
201



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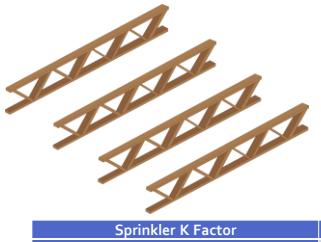
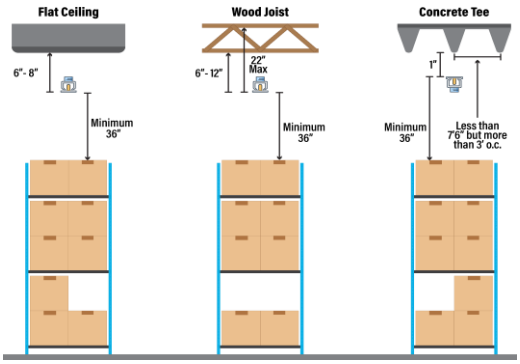
Construction Type	Protection Area	Maximum Spacing
Noncombustible	130 sqft	12 ft
Combustible Unobstructed	130 sqft	12 ft
Combustible Obstructed	100 sqft	10 ft
Rack Storage: All Construction Unobstructed and Noncombustible Obstructed	100 sqft	12 ft

203



Sprinkler K Factor	Minimum Operating Pressure
K = 11.2	50
K = 16.8	22
K = 19.6 or larger	Refer to Table 22.4
K= 11.2 or 16.8 *	Refer to Table 22.4

204



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NFSA

What is the primary different between an ESFR sprinkler And CMDA/CMSA Sprinkler?

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NFSA

REVIEW NFPA 13 CHAPTER 23

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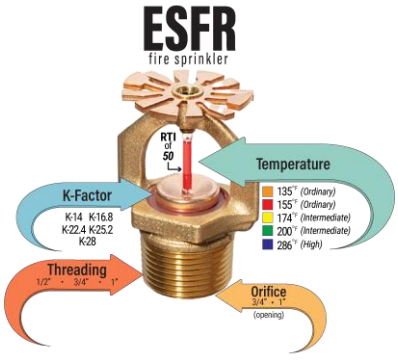
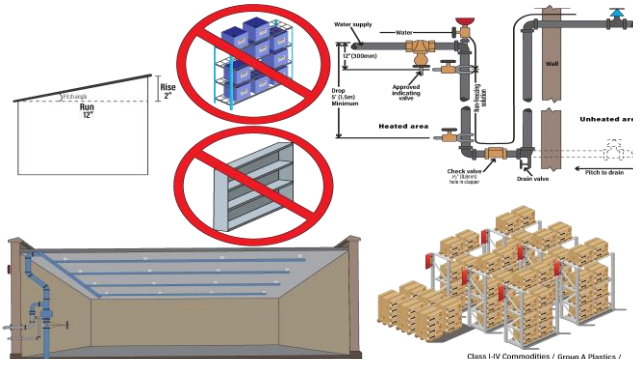
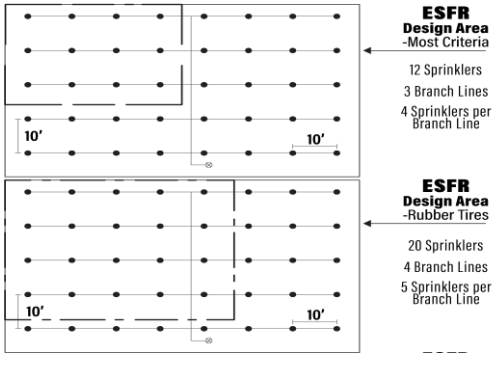

ESFR
fire sprinkler
RTI
Of
50
Temperature
135° (Ordinary)
155° (Ordinary)
174° (Intermediate)
200° (Intermediate)
286° (High)
K-Factor
K-14 K-16.8
K-22.4 K-25.2
K-28
Threading
1/2" - 3/4" - 1"
Orifice
3/4" - 1"
(opening)

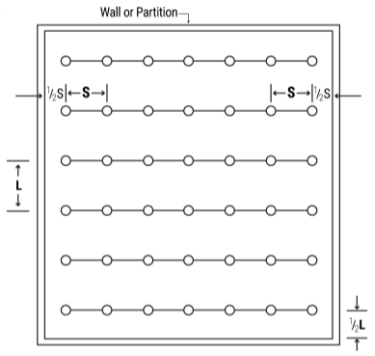
208


Rise
2"
Run
12"
Water supply
Water
Wall
Heated area
Unheated ar
Pitch to drain
Check valve
Drain valve
Class I-IV Commodities / Group A Plastics /

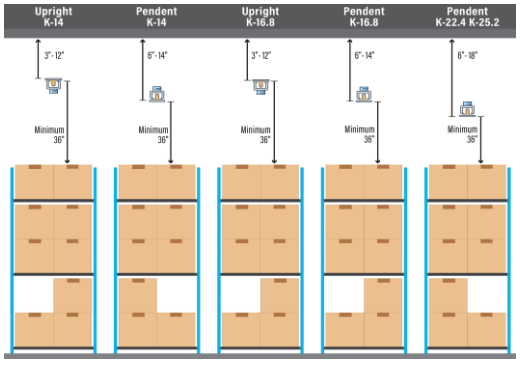
209


ESFR
Design Area
-Most Criteria
12 Sprinklers
3 Branch Lines
4 Sprinklers per
Branch Line
10'
10'
ESFR
Design Area
-Rubber Tires
20 Sprinklers
4 Branch Lines
5 Sprinklers per
Branch Line
10'
10'

210



211



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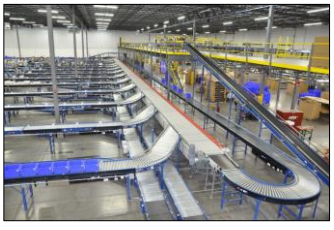
NFSA ESFR AND CONVEYERS

New criteria for ESFR sprinklers
Protection under conveyers
Section 14.2.11.4

New in the 2022 Edition



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ESFR AND CONVEYERS

Sprinklers shall be arranged to comply with one of the following:

1. QR sprinklers are permitted under conveyers without HPS underneath

214

ESFR AND CONVEYERS

Sprinklers shall be arranged to comply with one of the following:

2. Ceiling level sprinklers shall be installed below conveyers with HPS underneath

215

ESFR AND CONVEYERS

Sprinklers shall be arranged to comply with one of the following:

3. Sprinklers NOT required below belt (or similar) type conveyers when 70% open

216

ESFR AND CONVEYERS

Sprinklers shall be arranged to comply with one of the following:

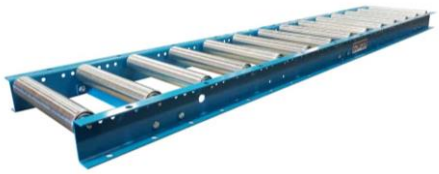
4. Sprinklers not required below belt type conveyers up to 4 ft. wide where the area below the conveyer has no HPS

217

ESFR AND CONVEYERS

Sprinklers shall be arranged to comply with one of the following:

5. Sprinklers not required below roller conveyers where the horizontal opening between rollers is ≥ to the



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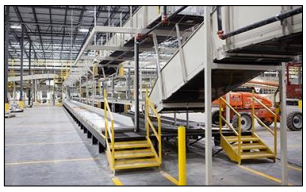
ESFR AND CONVEYERS

Sprinklers shall be arranged to comply with one of the following:

6. Sprinklers not required below roller conveyers where the area below has no HPS.



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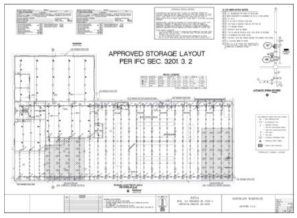
KEY FEATURES ON THE SPRINKLER DRAWING

Key Features for Review

- Storage Information
- Design Area
- Spacing of Sprinklers
- Hydraulic path
- Use NFPA 13 Working Plans List!

Let's take a closer look...



See NFSA's one, and two-day Sprinkler Plan Review Classes!

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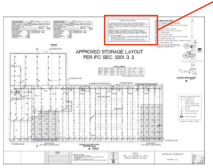
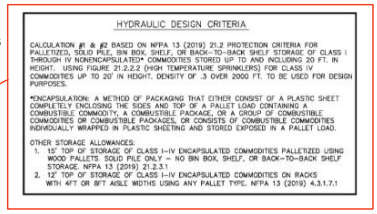
Check The Plans!

Storage Information

- **What are we protecting?**
  - Products, Packaging, Pallets
  - Array / height / clearance
  - Aisles



Northgate Warehouse


HYDRAULIC DESIGN CRITERIA

CALCULATION #1 & #2 BASED ON NFPA 13 (2019) 21.2 PROTECTION CRITERIA FOR PALLETIZED, SOLID PILE, BIN BOX, SHELF, OR BACK-TO-BACK SHELF STORAGE OF CLASS I THROUGH IV NONENCAPSULATED* COMMODITIES STORED UP TO AND INCLUDING 20 FT. IN HEIGHT. USING FIGURE 21.2.2.2 (HIGH TEMPERATURE SPRINKLERS) FOR CLASS IV COMMODITIES UP TO 20' IN HEIGHT. DENSITY OF .3 OVER 2000 FT. TO BE USED FOR DESIGN PURPOSES.

*ENCAPSULATION: A METHOD OF PACKAGING THAT EITHER CONSIST OF A PLASTIC SHEET COMPLETELY ENCLOSING THE SIDES AND TOP OF A PALLET LOAD CONTAINING A COMBUSTIBLE COMMODITY, A COMBUSTIBLE PACKAGE, OR A GROUP OF COMBUSTIBLE COMMODITIES OR COMBUSTIBLE PACKAGES, OR CONSISTS OF COMBUSTIBLE COMMODITIES INDIVIDUALLY WRAPPED IN PLASTIC SHEETING AND STORED EXPOSED IN A PALLET LOAD.

OTHER STORAGE ALLOWANCES:
1. 15' TOP OF STORAGE OF CLASS I–IV ENCAPSULATED COMMODITIES PALLETIZED USING WOOD PALLETS. SOLID PILE ONLY – NO BIN BOX, SHELF, OR BACK-TO-BACK SHELF STORAGE. NFPA 13 (2019) 21.2.3.1
2. 12' TOP OF STORAGE OF CLASS I–IV ENCAPSULATED COMMODITIES ON RACKS WITH 4FT OR 8FT AISLE WIDTHS USING ANY PALLET TYPE. NFPA 13 (2019) 4.3.1.7.1

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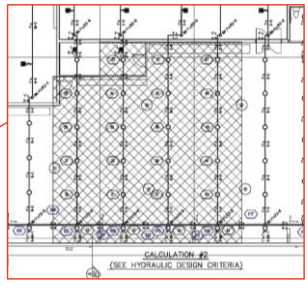
Check The Plans!

Design Area

- **How many sprinklers do we expect to open? Based on:**
  - Properly identified commodity
  - Array / arrangement

Northgate Warehouse



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Check The Plans!

Sprinkler Spacing

- **Each sprinkler has a job to do!**
  - Distance between sprinklers (S)
  - Distance between branch lines (L)
  - Area per sprinkler (As) is As = SxL

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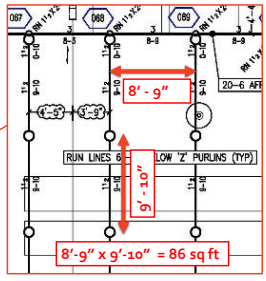

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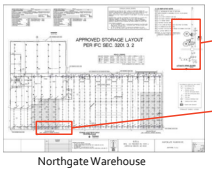
Check The Plans!

Hydraulic Path

- **'Proves' adequacy of water supply**
  - System demand cannot exceed
  - Consists of flowing nodes, and
  - Other hydraulic characteristics



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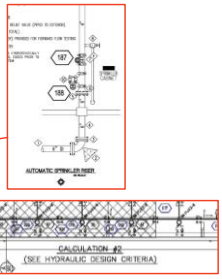

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NFSA KEY FEATURES ON THE SPRINKLER DRAWING

NFPA Working Plans Checklist

- Sec 28.1.3
- Over 24 key focus areas
- 2022 edition addresses storage info
- Includes all of the items required to be shown

See NFSA's one, and two-day Sprinkler Plan Review Classes!

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SUMMARY

- Apply the IFC fire protection requirements based on **what** is being stored and **how** it is being stored.
  - If this information is not provided by the design professional, ask for it
- Understand the impact commodity classification has on the fire protection requirements
  - If not known, don't guess (or estimate)
- Understand the type of sprinklers chosen by the designer and its protection criteria, limitations, etc.

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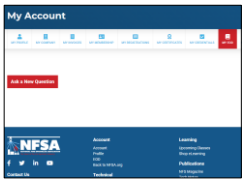
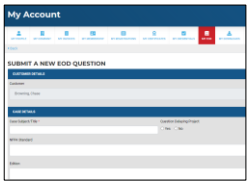
HOW TO DO AN EOD



1. Login at nfsa.org and go to 'My EOD'

2. Enter information

3. Get your answer soon!



nfsa.org/expert-of-the-day

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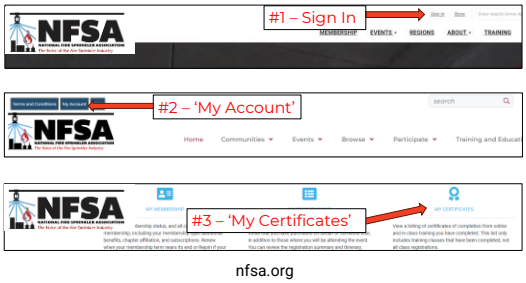
HOW TO FIND YOUR CERTIFICATE



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CONTACT INFORMATION

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Swanson@nfsa.org
443-863-4406

QUESTIONS?

For questions that arise from this course, please contact:

training@nfsa.org