Public Input No. 234-NFPA 13-2022 [Global Input]

Remove "listed" when preceding devices in the standard and utilize "approved" prior to devices that are not required to be listed.

Statement of Problem and Substantiation for Public Input

System components essential to satisfactory operation are required to be listed, by specifying "listed" in front of some devices and not other causes confusion and is already addressed by Chapter 7. Where a component is not required to be listed the term "approved" should be inserted before the device.

Submitter Information Verification

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Submittal Date: Mon Apr 11 11:30:36 EDT 2022
Committee: AUT-SSD

Public Input No. 3-NFPA 13-2021 [Global Input]

[See attached NFPA TIA 13-22-4 Log No. 1600, Sections 21.1.1 and 23.1]

Additional Proposed Changes

File Name	Description	Approved
TIA_13_22_4.pdf	NFPA TIA 13-22-4 Log No. 1600	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 13-22-4 (Log 1600) issued by the Standards Council on August 26, 2021 and per the NFPA Regs., needs to be reconsidered by the Technical Committee for the next edition of the Document.

Substantiation: During the first draft of the A2021 revision cycle sections 21.1.1 and 23.1 were editorially revised to reference the specific chapter for the technology that the chapter is about. However, this section is not supposed to reference itself. It is supposed to reference Chapter 20 which sends the user back to the general requirements for storage applications. As currently written, there is nothing that tells the user that the general storage requirements also apply to each specific storage technology.

Emergency Nature: The standard contains an error or an omission that was overlooked during the regular revision process. It is important the user is directed back to the general storage chapter requirements to ensure that requirements are reviewed and applied during the system design process. If both the general storage requirement chapter and the technology specific chapter are not followed it could lead to inadequate system design and installations for the hazard it is intending to protect.

Submitter Information Verification

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City:
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Submittal Date: Tue Nov 02 11:28:02 EDT 2021
Committee: AUT-SSD

Tentative Interim Amendment

NFPA® 13

Standard for the Installation of Automatic Sprinkler Systems

2022 Edition

Reference: 21.1.1 and 23.1
TIA 22-4
(SC 21-8-21 / TIA Log #1600)

Note: Text of the TIA was issued and approved for incorporation into the document prior to printing.

1. Revise paragraph 21.1.1 to read as follows:

21.1.1 The criteria in Chapter ~~21~~20 shall apply to storage protected with CMDA sprinklers.

2. Revise paragraph 23.1 to read as follows:

23.1 General. The criteria in ~~this chapter~~ Chapter 20 shall apply to storage protected with ESFR sprinklers.

Issue Date: August 26, 2021

Effective Date: September 15, 2021

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/docinfo**)**

Public Input No. 451-NFPA 13-2022 [Global Input]

Move the contents of Section 20.19 into Chapter 25 as Section 25.3

Statement of Problem and Substantiation for Public Input

This section contains the guidelines specific to the installation of in-rack sprinklers in the presence of solid shelves. Since Chapter 25 is specific to the installation guidelines for in-rack sprinklers, this information should be maintained within Chapter 25.

Submitter Information Verification

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Submittal Date: Sun May 29 16:57:17 EDT 2022
Committee: AUT-SSD

Public Input No. 453-NFPA 13-2022 [Global Input]

Revise Figure 25.6.2.3.1(b) so that it matches the in-rack sprinkler arrangements shown in former Figures 25.8.2.4(d) and 25.8.2.4(f) from the 2019 Edition of NFPA 13.

Statement of Problem and Substantiation for Public Input

Figure 25.6.2.3.1(b) is the same drawing as Figure 25.6.2.3.1(c) and should have been a combination of Figures 25.8.2.4(d) and 25.8.2.4(f) from the 2019 Edition of NFPA 13.

Submitter Information Verification

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Submittal Date: Sun May 29 17:12:15 EDT 2022
Committee: AUT-SSD

Public Input No. 454-NFPA 13-2022 [Global Input]

Add the wording "and O" to Figure 25.6.2.3.1(e) since the figure incorporate both "X" and "O" as in-rack sprinklers.

Statement of Problem and Substantiation for Public Input

When this figure was created by staff for the 2019 Edition, it replaced some of the "X" in-rack sprinklers with "O" in-rack sprinklers. As a result, the additional proposed wording helps account for the presence of "O" in-rack sprinklers.

Submitter Information Verification

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Submittal Date: Sun May 29 17:16:26 EDT 2022
Committee: AUT-SSD

Public Input No. 455-NFPA 13-2022 [Global Input]

Add the wording "and O" to Figure 25.6.2.3.1(f) since the figure incorporate both "X" and "O" as in-rack sprinklers.

Statement of Problem and Substantiation for Public Input

When this figure was created by staff for the 2019 Edition, it replaced some of the "X" in-rack sprinklers with "O" in-rack sprinklers. As a result, the additional proposed wording helps account for the presence of "O" in-rack sprinklers.

Submitter Information Verification

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Submittal Date: Sun May 29 17:19:31 EDT 2022
Committee: AUT-SSD

Public Input No. 587-NFPA 13-2022 [Global Input]

Guidance on how to calculate sprinklers under obstructions when the sizing and pattern does not match the ceiling system or when different sprinklers are installed below obstruction then is at ceiling level is needed.

Statement of Problem and Substantiation for Public Input

NFPA 13 does not give guidance on how to calculate sprinklers under obstructions when the sizing and pattern does not match the ceiling system or when different sprinklers are installed below obstruction then is at ceiling level. For example:

Section 14.2.11.4 allows) QR sprinklers to be located below conveyors with ESFR sprinklers at ceiling. It is clear that the sprinkler under the obstruction does not need to be added to the ESFR calculation, however it is not clear if a separate calculation is needed and if so, how many sprinkler need to be included. Also in this case, the sprinklers under the conveyor should not need to meet the design criteria of the ceiling system which is at a higher elevation.

Another example is simply a line of sprinklers under an obstruction that does not follow the sizing and pattern of the ceiling system. Are calculations needed? and if so what would the design area be?

NFPA 13 has no guidance but probably should. There is no specific proposal included in this input.

Submitter Information Verification

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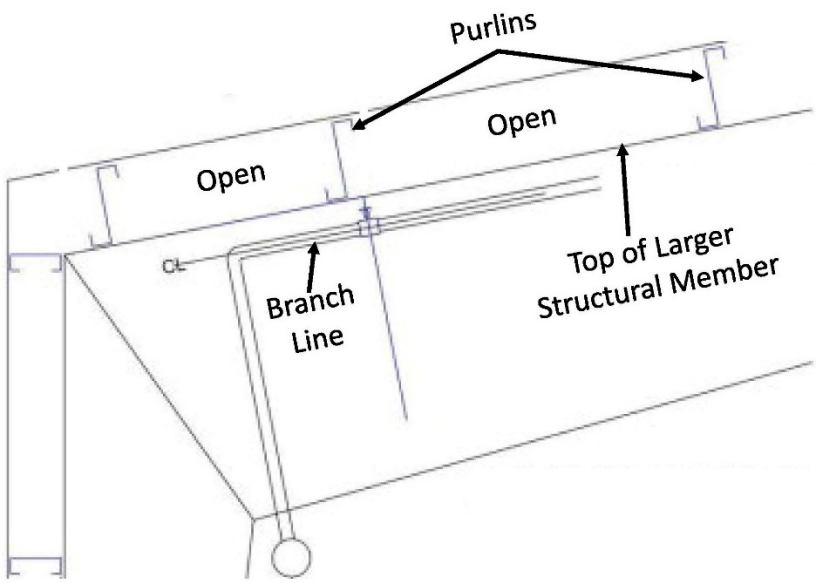
Committee: AUT-SSD

Public Input No. 468-NFPA 13-2022 [New Section after 3.3.80]

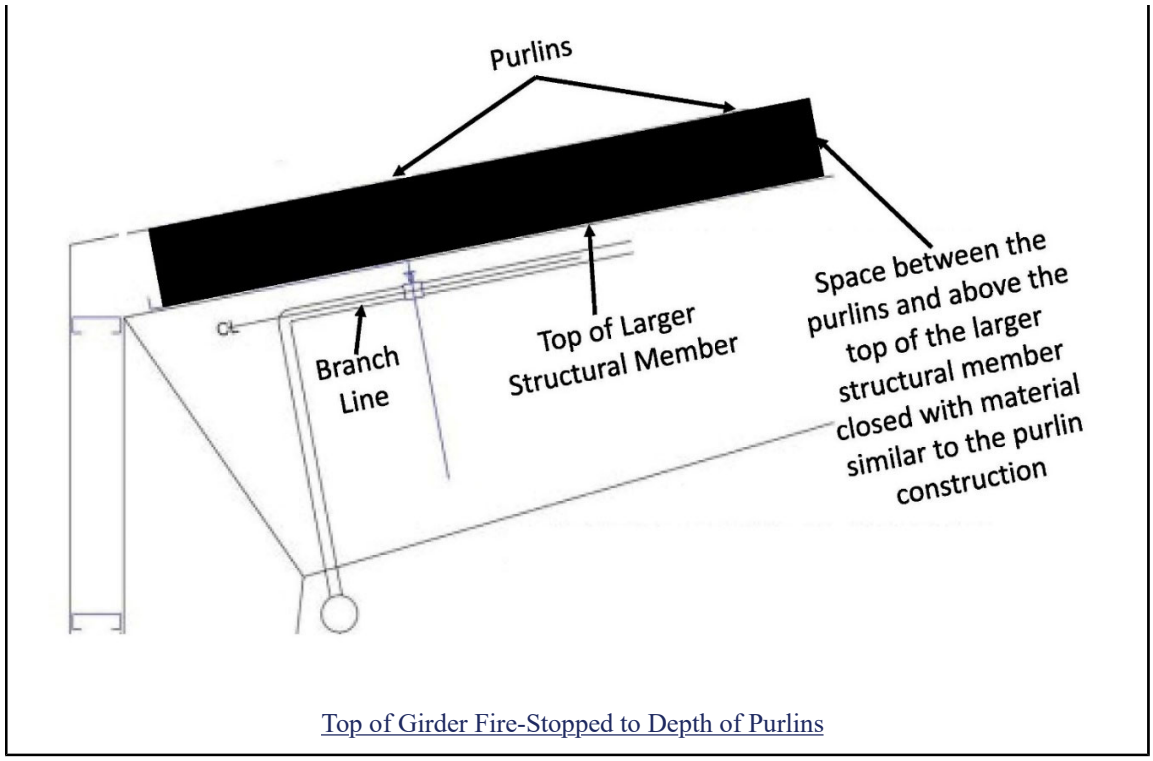
TITLE OF NEW CONTENT

3.3.81* Fire-Stopped . A means by which the horizontal spread of flame or heat during a fire event is stopped by the installation of materials equivalent to the combustibility of the structural member to limit the channeling of heat between structural members.

A.3.3.81. Fire-Stopped . Fire-stopping is required in several instances within this standard to restrict the horizontal flow of heat within channels created by obstructed construction, which is referred to as "channeling". The fire-stopping helps reduce the channeling effect created by obstructed construction so that the heat from a fire can fill a specified channel volume before eventually flowing horizontally under the structural members and activating ceiling sprinklers in a timely fashion. See Figure A.3.3.81 for an example of fire-stopping a purlin at the intersection of a girder. The material utilized for fire stopping does not have to have a fire resistive rating. This section only requires non-combustible fire stopping when the structural elements are noncombustible. The intent of this section is not to fill the small gaps created by a corrugated roof decking.



Opening Above Top of Girder



Top of Girder Fire-Stopped to Depth of Purlins

FIGURE A.3.3.81 Example of Fire-Stopping at Intersection of Purlins and Girders

Type your content here ...

Additional Proposed Changes

File Name	Description	Approved
Slope_Ceiling_1-Fire-Stopped.docx	full PI with graphic	

Statement of Problem and Substantiation for Public Input

The term fire-stopped is used in various parts of the standard but is not currently defined. As a result, a definition for this term has been proposed with accompanying Annex language and a figure to help demonstrate the intent of fire-stopping, especially as it will relate to requirements having to do with closing the openings caused when one structural member supports another in a sloped configuration.

This material was developed by the Sloped Ceiling Task Group, which was formed by the Technical Committee on Sprinkler Systems Discharge Criteria to incorporate the results of the FPRF Project on Sprinklers Under Sloped Ceilings into NFPA 13. The Task Group consisted of Ken Isman (Chair), Wes Baker, Chase Browning, Mike Joanis, Larry Frank, Joe Noble, and Abram Selim Fouad.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 476-NFPA 13-2022 [Section No. 10.2.6.1.2]	

Submitter Information Verification

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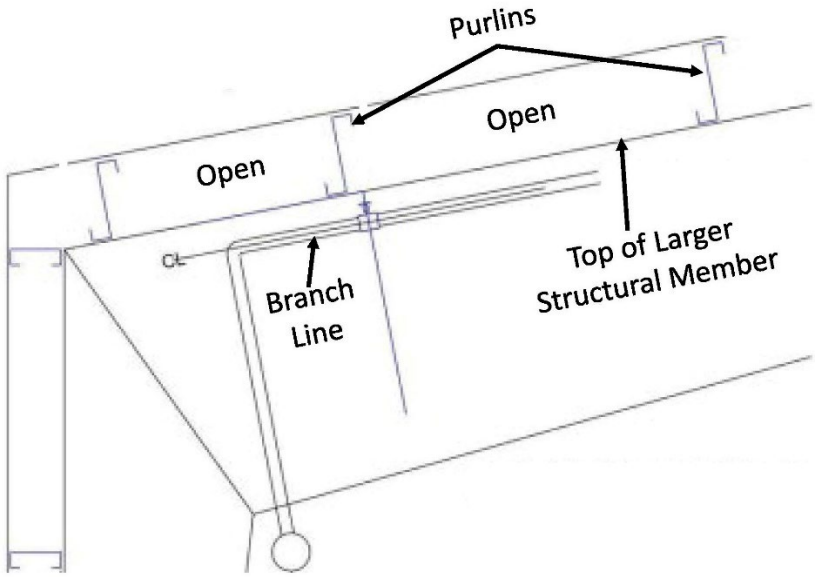
Submittal Date:	Tue May 31 09:27:38 EDT 2022
Committee:	AUT-SSD

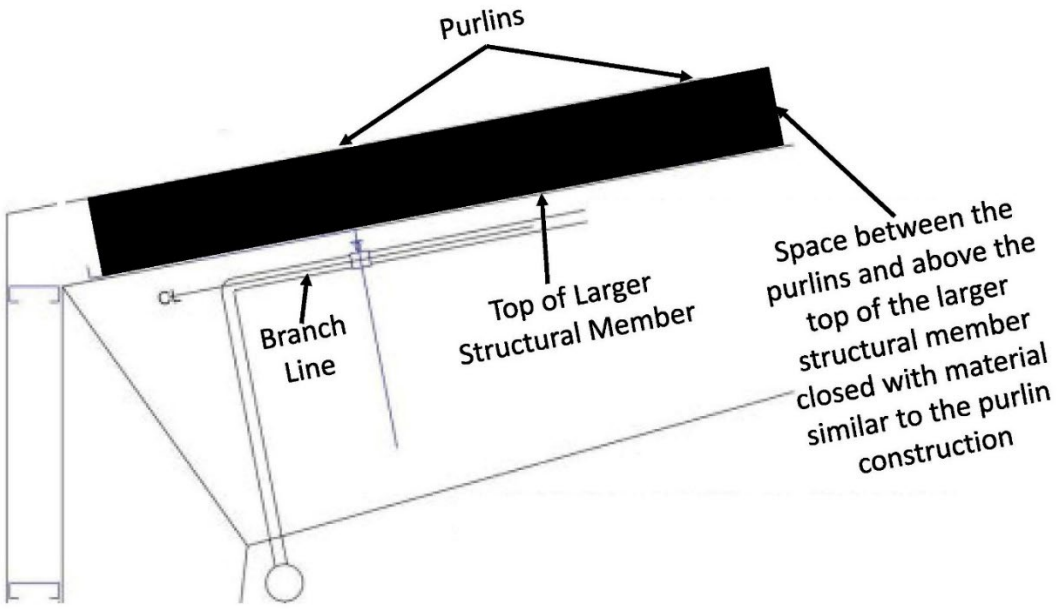
Proposal No. 1

3.3.81* Fire-Stopped. A means by which the horizontal spread of flame or heat during a fire event is stopped by the installation of materials equivalent to the combustibility of the structural member to limit the channeling of heat between structural members.

A.3.3.81. Fire-Stopped. Fire-stopping is required in several instances within this standard to restrict the horizontal flow of heat within channels created by obstructed construction, which is referred to as "channeling". The fire-stopping helps reduce the channeling effect created by obstructed construction so that the heat from a fire can fill a specified channel volume before eventually flowing horizontally under the structural members and activating ceiling sprinklers in a timely fashion. See Figure A.3.3.81 for an example of fire-stopping a purlin at the intersection of a girder. The material utilized for fire stopping does not have to have a fire resistive rating. This section only requires non-combustible fire stopping when the structural elements are noncombustible. The intent of this section is not to fill the small gaps created by a corrugated roof decking.



Opening Above Top of Girder



Top of Girder Fire-Stopped to Depth of Purlins

FIGURE A.3.3.81 Example of Fire-Stopping at Intersection of Purlins and Girders

Substantiation: The term fire-stopped is used in various parts of the standard but is not currently defined. As a result, a definition for this term has been proposed with accompanying Annex language to help demonstrate the intent of fire-stopping.

This material was developed by the Sloped Ceiling Task Group, which was formed by the Technical Committee on Sprinkler Systems Discharge Criteria to incorporate the results of the FPRF Project on Sprinklers Under Sloped Ceilings into NFPA 13. The Task Group consisted of Ken Isman (Chair), Wes Baker, Chase Browning, Mike Joanis, Larry Frank, Joe Noble, and Abram Selim Fouad.

Public Input No. 140-NFPA 13-2022 [Section No. 3.3.141]

~~**3.3.141** – Occupancies.~~

~~**3.3.141.1** – Extra Hazard (Group 1) (EH1).~~

~~Occupancies or portions of other occupancies where the quantity and combustibility of contents are very high or dust, lint, or other materials are present, introducing the probability of rapidly developing fires with high rates of heat release but with little or no combustible or flammable liquids. (AUT-SSD)~~

~~**3.3.141.2** – Extra Hazard (Group 2) (EH2).~~

~~Occupancies or portions of other occupancies with moderate to substantial amounts of flammable or combustible liquids or occupancies where shielding of combustibles is extensive. (AUT-SSD)~~

~~**3.3.141.3** – Light Hazard.~~

~~Occupancies or portions of other occupancies where the quantity and/or combustibility of contents is low and fires with relatively low rates of heat release are expected. (AUT-SSD)~~

~~**3.3.141.4** – Ordinary Hazard (Group 1) (OH1).~~

~~Occupancies or portions of other occupancies where combustibility is low, quantity of combustibles is moderate, stockpiles of contents do not exceed 8 ft (2.4 m), and fires with moderate rates of heat release are expected. (AUT-SSD)~~

~~**3.3.141.5** – Ordinary Hazard (Group 2) (OH2).~~

~~Occupancies or portions of other occupancies where the quantity and combustibility of contents are moderate to high, stockpiles of contents with moderate rates of heat release do not exceed 12 ft (3.7 m), and stockpiles of contents with high rates of heat release do not exceed 8 ft (2.4 m). (AUT-SSD)~~

Statement of Problem and Substantiation for Public Input

Occupancies are classified based on the requirements in Chapter 4 and these definitions are no longer applicable. Similarly, commodity classifications are not defined in Chapter 3 because they are classified through the requirements in Chapter 20.

Pointers to these definitions within Chapter 3 will also need to be deleted

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Submittal Date: Wed Feb 16 11:15:45 EST 2022
Committee: AUT-SSD

Public Input No. 18-NFPA 13-2021 [Section No. 4.1]

4.1 Level of Protection.

4.1.1– _ **Sprinklered Throughout**

4.1.1.1

A building, where protected by an automatic sprinkler system installation, shall be provided with sprinklers in all areas except where specific sections of this standard permit the omission of sprinklers.

4.1. 1. 2

Where sprinklers are provided in accordance with 4.1.1, the building shall be considered sprinklered throughout.

4.1.2 Limited Area Systems.

4.1.2.1

When partial sprinkler systems are installed, the requirements of this standard shall be used insofar as they are applicable.

4.1.2.2

The authority having jurisdiction shall be consulted in each case.

Statement of Problem and Substantiation for Public Input

We have received several questions from members on the application of "sprinklered throughout." Several reviewers misapplied the building code requiring sprinklers to be installed throughout and then installed in accordance with NFPA 13. There have been several instances where clear omissions in NFPA 13 were not allowed because the building code says "sprinklered throughout." The title was added to comply with the manual of style.

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Submittal Date: Tue Nov 02 23:32:52 EDT 2021
Committee: AUT-SSD

Public Input No. 151-NFPA 13-2022 [Section No. 4.1.2]

4.1.2 Limited Area Systems.

4.1.2.1

When partial sprinkler systems are installed, the requirements of this standard shall be used insofar as they are applicable.

4.1.2.2

The authority having jurisdiction shall be consulted in each case.

4.1.2.3*

Partial sprinkler systems shall be permitted to be installed in existing apartment buildings in accordance with 4.1.2.3 and NFPA 101.

4.1.2.3.1

Automatic sprinklers shall be installed in the corridor, along the corridor ceiling, utilizing the maximum spacing requirements of the standards referenced by Section 9.7. [**101** , 31.3.5.6.1]

4.1.2.3.2

An automatic sprinkler shall be installed within every dwelling unit that has a door opening to the corridor, with such sprinkler positioned over the center of the door, unless the door to the dwelling unit has not less than a 20-minute fire protection rating and is self-closing.
[**101** , 31.3.5.6.2]

A.4.1.2.3

NFPA 101 requires sprinklers to be installed throughout in all existing high-rise apartment buildings by 2033 with two exceptions, but currently permits partial sprinkler systems to be installed as an option.

A 12-year time frame has been developed to encourage building owners to plan for the design and installation of a fire sprinkler system. The time frame is not intended for building owners to wait 11 years and then try and get the work done in the last year. One method for getting a full sprinkler system installed over time is to get the water supply in place and put the sprinkler system in the common portions of the building first. Then, as building spaces are renovated and tenants turn over, the sprinkler system can be extended into those spaces.

In a building undergoing such sprinkler system installed over time, the sprinkler system will only cover portions of the building during the intervening years. While this is less than ideal, it is acceptable under NFPA 101 to have such a partial system as long as there is a plan to finish the full system design and installation within the time frame established under the adoption of NFPA 101. During the time that the building is partially sprinklered, the portions of the sprinkler system that are finished need to be inspected, tested, and maintained in operational condition.

One method that has been used to plan for the eventual installation of a full sprinkler system has been to install sprinklers in the corridors with one additional sprinkler into each opening off of the corridor in accordance with Option 3 of 31.3.5.6 in NFPA 101. If the system in the corridor is sized to accommodate the extension of the system eventually into all of the dwelling units and the penetration into the dwelling unit for the single sprinkler into the unit is sized properly to support the eventual extension of the system into the unit, then such a partial system can serve to meet NFPA 101 as long as there is an approved plan for finishing the full sprinkler system within the time frame established by the adoption of NFPA 101. It should be noted that during the time that the partial sprinkler system is in place, the building meets Option 3 of NFPA 101, which basically treats the building as “unsprinklered” in terms of the sprinkler trade-offs for provisions such as arrangements of egress and interior floor finish. Full credit for a sprinklered building can only be obtained when the sprinkler system is extended throughout the building in accordance with Option 4 of NFPA 101. [**101** , A.31.3.5.9.1]

Statement of Problem and Substantiation for Public Input

With the recent fatalities in unsprinklered apartment complexes, it is paramount that some level of protection is provided through a partial sprinkler system. This proposal is not a new requirement and is already permitted by NFPA 101; however, not all jurisdictions adopt NFPA 101 and this would permit

sprinklers to be installed in these occupancies where NFPA 13 is the referenced standard with the intent that they will eventually be upgraded to fully sprinklered buildings. This will also provide additional guidance to AHJs approving these limited systems.

Submitter Information Verification

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Submittal Date: Fri Feb 18 09:39:49 EST 2022
Committee: AUT-SSD

Public Input No. 276-NFPA 13-2022 [New Section after 4.2]

Installation and Repair

Installation and repairs shall be performed by qualified personnel or a qualified contractor.

Statement of Problem and Substantiation for Public Input

There is not a direct statement that installation and/or repair work must be performed by qualified personnel. This verbiage aligns with statements made in NFPA 25 and other standards.

Submitter Information Verification

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Affiliation: American Fire Sprinkler Association
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Submittal Date: Fri May 06 14:51:16 EDT 2022
Committee: AUT-SSD

Public Input No. 604-NFPA 13-2022 [New Section after 4.2]

4.3 Qualified Personnel

- 4.3.1 Qualified personnel shall meet at least one of the following qualifications:
  - (1) Meets the requirements and training for a given field acceptable to the AHJ.
  - (2) Is certified by a nationally recognized fire protection certification organizational acceptable to the AHJ.
  - (3) Is registered, licensed, or certified by a state or local authority to perform installation of sprinkler systems

Statement of Problem and Substantiation for Public Input

Provides qualification for installation of sprinkler systems

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 597-NFPA 13-2022 [Section No. 1.2.2]	Provides a list of qualifications options

Submitter Information Verification

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Submittal Date:	Wed Jun 01 16:01:24 EDT 2022
Committee:	AUT-SSD

Public Input No. 212-NFPA 13-2022 [Section No. 4.2]

4.2* Owner's Certificate.

The owner(s) of a building or structure where the fire sprinkler system is going to be installed or their authorized agent shall provide the sprinkler system installer with the following information prior to the layout and detailing of the fire sprinkler system *[see Figure A.28.1(b)]*:

(1) Intended use of the building, including the materials within the building and the maximum height of any storage

(2) A preliminary plan of the building or structure along with the design concepts necessary to perform the layout and detail for the fire sprinkler system

(3) Water supply information as identified in 5.2.2

(4) * Any special knowledge of the water supply, including known environmental conditions that might be responsible for corrosion, including microbiologically influenced corrosion (MIC)

(5) Whether seismic protection is required and the applicable short period response parameter

(6) Any special knowledge of the general environment in which the system will be installed that might be responsible for corrosion, including airborne chemicals that may contact system components or chemical solutions that may be applied to the sprinkler system components

Statement of Problem and Substantiation for Public Input

Information should be provided by owner such that due consideration can be given and decisions made about the proper type of piping, sprinkler finish, valve finish, etc. to protect the operating integrity of the system.

Submitter Information Verification

Submitter Full Name: Cary Webber
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Submittal Date: Fri Mar 18 16:03:24 EDT 2022
Committee: AUT-SSD

Public Input No. 252-NFPA 13-2022 [Section No. 4.2]

4.2* Owner's Certificate.

The owner(s) of a building or structure where the fire sprinkler system is going to be installed or their authorized agent shall provide the sprinkler system installer with the following information prior to the layout and detailing of the fire sprinkler system *[see Figure A.28.1(b)]*:

(1) Intended use of the building, including the materials within the building and the maximum height of any storage

(2) A preliminary plan of the building or structure along with the design concepts necessary to perform the layout and detail for the fire sprinkler system

(3) ~~Water supply information as~~ The required types of water supplies, as identified in 5.2~~.2~~ , necessary to satisify system demand, including all of the information required by 4.X and any adjustments, where required.

(4) * Any special knowledge of the water supply, including known environmental conditions that might be responsible for corrosion, including microbiologically influenced corrosion (MIC)

(5) Whether seismic protection is required and the applicable short period response parameter

Statement of Problem and Substantiation for Public Input

The previous requirement limited the water supply information to public/private water works systems. It should be known at the beginning of a project whether or not additional water supplies are necessary or utilized (i.e pump, tank, raw water, etc.). The water supply adjustment in accordance with 4.5 is intended to reference the work done by the Water Supply Task Group.

Submitter Information Verification

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Submittal Date: Tue Apr 26 16:35:02 EDT 2022
Committee: AUT-SSD

Public Input No. 356-NFPA 13-2022 [Section No. 4.2]

4.2* Owner's Certificate.

The owner(s) of a building or structure where the fire sprinkler system is going to be installed or their authorized agent shall provide the sprinkler system installer with the following information prior to the layout and detailing of the fire sprinkler system *[see Figure A.28.1(b)]*:

(1) Intended use of the building, including ~~the materials within the building and the maximum height of any storage~~ hazard classification of all protected areas as identified in 4.3 and any applicable storage protection criteria in 20.2 and 20.3

(2) A preliminary plan of the building or structure along with the design concepts necessary to perform the layout and detail for the fire sprinkler system

(3) Water supply information as identified in 5.2.2

(4) * Any special knowledge of the water supply, including known environmental conditions that might be responsible for corrosion, including microbiologically influenced corrosion (MIC)

(5) Whether seismic protection is required and the applicable short period response parameter

Statement of Problem and Substantiation for Public Input

This public input is intended to require additional information in the owner's certificate as it relates to identifying the hazard classification. While it is understood that the owner's certificate is intended to be a preliminary, front-end document, this is an effort to correlate with the required information on the working plans list, as well as the general information sign, which require information that must be known in order to complete a system design and layout.

Submitter Information Verification

Submitter Full Name: Michael Joanis
Organization: National Fire Sprinkler Association
Affiliation: NFSA Engineering and Standards Committee
Street Address:
City:
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Zip:
Submittal Date: Fri May 27 08:53:43 EDT 2022
Committee: AUT-SSD

Public Input No. 391-NFPA 13-2022 [Section No. 4.2]

4.2* Owner's Certificate.

The owner(s) of a building or structure where the fire sprinkler system is going to be installed or their authorized agent shall provide the sprinkler system installer with the following information prior to the layout and detailing of the fire sprinkler system *[see Figure A.28.1(b)]*:

(1) Intended use of the building, including the materials within the building and the maximum height of any storage

(2) A preliminary plan of the building or structure along with the design concepts necessary to perform the layout and detail for the fire sprinkler system

(3) ~~Water supply information as identified in~~ ~~5.2.2~~ * Determine and confirm the water supply including any necessary adjustments.

(4) * Any special knowledge of the water supply, including known environmental conditions that might be responsible for corrosion, including microbiologically influenced corrosion (MIC)

(5) Whether seismic protection is required and the applicable short period response parameter

Statement of Problem and Substantiation for Public Input

The topic of water supply adjustments has been discussed over past several cycles without achieving consensus throughout the entire NFPA 13 cycle. NITMAM were submitted during the 2019 and 2022 code cycles. This public input is being submitted by the Water Supply Task Group which was appointed by the SSD and SSI committees. This language reached consensus within the task group.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 392-NFPA 13-2022 [New Section after A.4.2]	
Public Input No. 393-NFPA 13-2022 [Section No. A.5.2.2]	
Public Input No. 394-NFPA 13-2022 [New Section after 5.2.2]	
Public Input No. 395-NFPA 13-2022 [New Section after A.5.2.2.2]	
Public Input No. 392-NFPA 13-2022 [New Section after A.4.2]	
Public Input No. 393-NFPA 13-2022 [Section No. A.5.2.2]	
Public Input No. 394-NFPA 13-2022 [New Section after 5.2.2]	
Public Input No. 395-NFPA 13-2022 [New Section after A.5.2.2.2]	

Submitter Information Verification

Submitter Full Name: Mark Hopkins
Organization: Terpconsulting
Affiliation: Water Supply Task Group
Street Address:
City:
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Zip:

Submittal Date: Fri May 27 14:41:14 EDT 2022
Committee: AUT-SSD

Public Input No. 598-NFPA 13-2022 [Section No. 4.2]

4.2* Owner's Certificate.

The owner(s) of a building or structure where the fire sprinkler system is going to be installed or their authorized agent shall provide the sprinkler system installer with the following information prior to the layout and detailing of the fire sprinkler system *[see Figure A.28.1(b)]*:

(1) Intended use of the building, including the materials within the building and the maximum height of any storage

(2) A preliminary plan of the building or structure along with the design concepts necessary to perform the layout and detail for the fire sprinkler system

(3) ~~Water supply information as identified in 5.2.2~~ * Determine and confirm the water supply including any necessary adjustments.

(4) * Any special knowledge of the water supply, including known environmental conditions that might be responsible for corrosion, including microbiologically influenced corrosion (MIC)

(5) Whether seismic protection is required and the applicable short period response parameter

Statement of Problem and Substantiation for Public Input

This language and associated public inputs on water supply evaluations mirror those submitted by the Water Supply Task Group

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 600-NFPA 13-2022 [New Section after A.4.2]	
Public Input No. 601-NFPA 13-2022 [Section No. A.5.2.2]	
Public Input No. 602-NFPA 13-2022 [New Section after 5.2.2.2]	
Public Input No. 603-NFPA 13-2022 [Section No. A.5.2.2.2]	
Public Input No. 605-NFPA 13-2022 [New Section after A.5.2.2.2]	

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Committee: AUT-SSD

Public Input No. 219-NFPA 13-2022 [Sections 4.3.1.4, 4.3.1.5, 4.3.1.6]

~~**Sections 4.3.1.4, 4.3.1.5, 4.3.1.6**~~

~~**4.3.1.4** * – Miscellaneous Storage.~~

~~**4.3.1.4.1** –~~

~~Miscellaneous storage shall not exceed 12 ft (3.7 m) in height.~~

~~**4.3.1.4.2** –~~

~~Miscellaneous storage shall not constitute more than 10 percent of the building area or 4000 ft^2 (370 m^2) of the sprinklered area, whichever is greater.~~

~~**4.3.1.4.3** –~~

~~Miscellaneous storage shall not exceed 1000 ft^2 (93 m^2) in one pile or area.~~

~~**4.3.1.4.4** –~~

~~Miscellaneous storage shall be separated from other storage piles or areas by at least 25 ft (7.6 m).~~

~~**4.3.1.4.5** –~~

~~Solid shelf racks in accordance with the requirements of Section 20.19 shall not apply to miscellaneous storage of Class I through Class IV commodities up to 12 ft (3.7 m) and Group A plastics up to 5 ft (1.5 m).~~

~~**4.3.1.5** – Low-Piled Storage.~~

~~**4.3.1.5.1** –~~

~~Low-piled storage of Class I through Class IV commodities shall not exceed 12 ft (3.7 m) in height.~~

~~**4.3.1.5.2** –~~

~~Low-piled storage of Group A plasticsshall not exceed 5 ft (1.5 m) in height.~~

~~**4.3.1.6** – Miscellaneous Tire Storage.~~

~~**4.3.1.6.1** –~~

~~Miscellaneous tire storage shall not exceed 2000 ft^2 (185 m^2).~~

~~**4.3.1.6.2** –~~

~~Miscellaneous tire storage piles on-tread, regardless of storage method, shall not exceed 25 ft (7.6 m) in the direction of the wheel holes.~~

Statement of Problem and Substantiation for Public Input

Sections 4.3.1.4, 4.3.1.5, and 4.3.1.6 are repeats of existing definitions in Chapter 3 that should be removed to avoid the possibility of future conflicts.

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Committee:	AUT-SSD

Public Input No. 363-NFPA 13-2022 [Section No. 4.3.1.4.5]

4.3.1.4.5

Solid shelf racks in accordance with the requirements of ~~Section~~ ~~20.19~~ ~~shall~~ Section 25.3 shall not apply to miscellaneous storage of Class I through Class IV commodities up to 12 ft (3.7 m) and Group A plastics up to 5 ft (1.5 m).

Statement of Problem and Substantiation for Public Input

Section 20.19 for the protection of racks with solid shelves only includes design options with in rack sprinklers and is proposed in PI 362 to be relocated to section 25.3.

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Public Input No. 220-NFPA 13-2022 [Section No. 4.3.1.7.1]

4.3.1.7.1 Protection Criteria for Miscellaneous and Low-Piled Storage.

4.3.1.7.1.1

The protection criteria for miscellaneous storage protected by ceiling sprinklers only shall be selected from Table 4.3.1.7.1.1~~ and 19 .2.3.1.1 in accordance with the density/area method of 19.2.3~~ .

Table 4.3.1.7.1.1 Discharge Criteria for Miscellaneous ~~Storage Up to 12 ft (3.7 m) in Height~~ and Low-Piled Storage

Commodity		Type of Storage	Storage Height ft	Storage Height m	Maximum Ceiling Height ft	Maximum Ceiling Height m	Design from 19.2.3.1.1	~~Note~~ In-Rack Sprinklers Required	Insi gpn
Class I to Class IV									
Class I		Solid-piled, palletized, bin box, shelf, single-, double-, or multiple-row rack, and back-to-back shelf storage	≤12	≤3.7	—	—	OH1—	No	0, 50,
Class II			≤10	≤3.0	—	—	OH1—	No	0, 50,
Class II			>10 to ≤12	>3.0 to ≤3.7	—	—	OH2—	No	0, 50,
Class III			≤12	≤3.7	—	—	OH2—	No	0, 50,
Class IV			≤10	≤3.0	—	—	OH2—	No	0, 50,
Class IV		Palletized, bin box, shelf, and solid-piled	>10 to ≤12	>3.0 to ≤3.7	32	9.8	OH2—	N/A	0, 50,
		-		Single-, double-, or multiple-row rack, and back-to-back shelf storage	>10 to ≤12	>3.0 to ≤3.7	32	9.8	EH1–
		-		Single-, double-, or multiple-row rack	>10 to ≤12	>3.0 to ≤3.7	32	9.8	See Chapter
Group A Plastic Storage									
Cartoned	Nonexpanded and expanded	Solid-piled, palletized, bin box, shelf, single-, double-, or multiple-	≤5	≤1.5	—	—	OH2—	No	0, 50,
		-		>5 to ≤10	>1.5 to ≤3.0	15	4.6	EH1—	No

Commodity		Type of Storage	Storage Height		Maximum Ceiling Height		Design from 19.2.3.1.1	Note In-Rack Sprinklers Required	Insi
			ft	m	ft	m			gpn
		row rack, and back-to-back shelf storage		>5 to ≤10	>1.5 to ≤3.0	20	6.1	EH2—	No
				>10 to ≤12	>3.0 to ≤3.7	17	5.2	EH2—	No
			Solid-piled, palletized, bin box, shelf, and back-to-back shelf storage	>10 to ≤12	>3.0 to ≤3.7	32	9.8	EH2—	N/A
			Single-, double-, or multiple-row rack	>10 to ≤12	>3.0 to ≤3.7	32	9.8	See Chapter 25.	+ 1 leve in-rac
Exposed	Nonexpanded and expanded	Solid-piled, palletized, bin box, shelf, single-, double-, or multiple-row rack, and back-to-back shelf storage	≤5	≤1.5	—	—	OH2—	No	0, 50,
		Solid-piled, palletized, bin box, shelf, and back-to-back shelf storage	>5 to ≤8	>1.5 to ≤2.4	28	8.5	EH2—	N/A	0, 50,
		Solid-piled, palletized, bin box, shelf, single-, double-, or multiple-row rack,	>5 to ≤10	>1.5 to ≤3.0	15	4.6	EH2—	No	0, 50,

Commodity	Type of Storage	Storage Height		Maximum Ceiling Height		Design from 19.2.3.1.1	Note In-Rack Sprinklers Required	Insi
		ft	m	ft	m			gpn
	and back-to-back shelf storage							
Nonexpanded	Solid-piled, palletized, bin box, shelf, single-, double-, or multiple-row rack, and back-to-back shelf storage	>5 to ≤10	>1.5 to ≤3.0	20	6.1	EH2—	No	0, 50, 1
Expanded	Single-, double-, or multiple-row rack	>5 to ≤10	>1.5 to ≤3.0	20	6.1	See Chapter 25.	+1 level of in-rack	0, 50, 1
Nonexpanded and expanded	Solid-piled, palletized, bin box, shelf, and back-to-back shelf storage	>10 to ≤12	>3.0 to ≤3.7	17	5.2	EH2—	N/A	0, 50, 1
	Single-, double-, or multiple-row rack	>10 to ≤12	>3.0 to ≤3.7	17	5.2	EH2—	No	0, 50, 1
		>10 to ≤12	>3.0 to ≤3.7	32	9.8	See Chapter 25.	+1 level of in-rack	0, 50, 1
Tire Storage								
Tires	On ~~floor or~~ floor or on side	>5 to ≤12	>1.5 to ≤3.7	32	9.8	EH1—	N/A	0, 50, 1
	On floor, on tread, or on side	≤5	≤1.5	—	—	OH2—	N/A	0, 50, 1
	Single-, double-, or multiple-row racks, on tread	≤5	≤1.5	—	—	OH2—	No	0, 50, 1

Commodity	Type of Storage	Storage Height ft	Storage Height m	Maximum Ceiling Height ft	Maximum Ceiling Height m	Design from 19.2.3.1.1	Note In-Rack Sprinklers Required	Insi gpn
	or on side							
	Single-row rack, portable, on tread or on side	>5 to ≤12	>1.5 to ≤3.7	32	9.8	EH1—	No	0, 50,
	Single-row rack, fixed, on tread or on side	>5 to ≤12	>1.5 to ≤3.7	32	9.8	EH1—	No	0, 50,
		>5 to ≤12	>1.5 to ≤3.7	32	9.8	See Chapter 25.	+1 level of in-rack	0, 50,
Rolled Paper Storage								
Heavyweight and mediumweight	On end	≤10	≤3.0	30	9.1	OH2—	N/A	0, 50,
Tissue and lightweight	On end	≤10	≤3.0	30	9.1	EH1—	N/A	0, 50,

4.3.1.7.1.2

~~The protection criteria for miscellaneous storage with racks protected by in-rack sprinklers~~ Ceiling sprinkler design shall be in accordance with ~~25~~ Section 19 .2. ~~1~~ 3 .

4.3.1.7.1.3

The maximum design area for miscellaneous storage shall not exceed 3000 ft^2 (280 m^2).

4.3.1.7.1.4

Where required by Table 4.3.1.7.1.1, in-rack sprinkler protection and ceiling sprinkler design shall be in accordance with Section 25.2.1.

4.3.1.7.1.5

The requirements of Section 20.19 for protection of racks with solid shelves shall not apply to solid shelf racks in miscellaneous storage.

Statement of Problem and Substantiation for Public Input

Current formatting reflects fracturing that occurred when low-piled storage was added to the standard. Proposal seeks to make requirements for miscellaneous and low-piled storage more consistent and concise.

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Submittal Date: Mon Mar 21 15:57:52 EDT 2022

Committee: AUT-SSD

Public Input No. 287-NFPA 13-2022 [Section No. 4.3.1.7.1.1]

4.3.1.7.1.1

The protection criteria for miscellaneous storage protected by ceiling sprinklers only shall be selected from Table 4.3.1.7.1.1 and 19.2.3.1.1in accordance with the density/area method of 19.2.3.

Table 4.3.1.7.1.1 Discharge Criteria for Miscellaneous and Low-Piled Storage Up to 12 ft (3.7 m) in Height

Commodity		Type of Storage	Storage Height ft	Storage Height m	Maximum Ceiling Height ft	Maximum Ceiling Height m	Design from 19.2.3.1.1	Note	Insi gpm
Class I to Class IV									
Class I		Solid-piled, palletized, bin box, shelf, single-, double-, or multiple-row rack, and back-to-back shelf storage	≤12	≤3.7	—	—	OH1	—	0, 50, 1
Class II			≤10	≤3.0	—	—	OH1	—	0, 50, 1
Class II			>10 to ≤12	>3.0 to ≤3.7	—	—	OH2	—	0, 50, 1
Class III			≤12	≤3.7	—	—	OH2	—	0, 50, 1
Class IV			≤10	≤3.0	—	—	OH2	—	0, 50, 1
Class IV		Palletized, bin box, shelf, and solid-piled	>10 to ≤12	>3.0 to ≤3.7	32	9.8	OH2	—	0, 50, 1
		-		Single-, double-, or multiple-row rack, and back-to-back shelf storage	>10 to ≤12	>3.0 to ≤3.7	32	9.8	EH1
		-		Single-, double-, or multiple-row rack	>10 to ≤12	>3.0 to ≤3.7	32	9.8	See Chapter
Group A Plastic Storage									
Cartoned	Nonexpanded and expanded	Solid-piled, palletized, bin box, shelf, single-, double-, or multiple-	≤5	≤1.5	—	—	OH2	—	0, 50, 1
		-		>5 to ≤10	>1.5 to ≤3.0	15	4.6	EH1	—

Commodity		Type of Storage	Storage Height		Maximum Ceiling Height		Design from 19.2.3.1.1	Note	Insi
			ft	m	ft	m			gpm
		row rack, and back-to-back shelf storage		>5 to ≤10	>1.5 to ≤3.0	20	6.1	EH2	—
				>10 to ≤12	>3.0 to ≤3.7	17	5.2	EH2	—
			Solid-piled, palletized, bin box, shelf, and back-to-back shelf storage	>10 to ≤12	>3.0 to ≤3.7	32	9.8	EH2	—
			Single-, double-, or multiple-row rack	>10 to ≤12	>3.0 to ≤3.7	32	9.8	See Chapter 25.	+ 1 leve in-rac
Exposed	Nonexpanded and expanded	Solid-piled, palletized, bin box, shelf, single-, double-, or multiple-row rack, and back-to-back shelf storage	≤5	≤1.5	—	—	OH2	—	0, 50, 1
		Solid-piled, palletized, bin box, shelf, and back-to-back shelf storage	>5 to ≤8	>1.5 to ≤2.4	28	8.5	EH2	—	0, 50, 1
		Solid-piled, palletized, bin box, shelf, single-, double-, or multiple-row rack,	>5 to ≤10	>1.5 to ≤3.0	15	4.6	EH2	—	0, 50, 1

Commodity	Type of Storage	Storage Height ft	Storage Height m	Maximum Ceiling Height ft	Maximum Ceiling Height m	Design from 19.2.3.1.1	Note	Insi gpm
	and back-to-back shelf storage							
Nonexpanded	Solid-piled, palletized, bin box, shelf, single-, double-, or multiple-row rack, and back-to-back shelf storage	>5 to ≤10	>1.5 to ≤3.0	20	6.1	EH2	—	0, 50, 1
Expanded	Single-, double-, or multiple-row rack	>5 to ≤10	>1.5 to ≤3.0	20	6.1	See Chapter 25.	+1 level of in-rack	0, 50, 1
Nonexpanded and expanded	Solid-piled, palletized, bin box, shelf, and back-to-back shelf storage	>10 to ≤12	>3.0 to ≤3.7	17	5.2	EH2	—	0, 50, 1
	Single-, double-, or multiple-row rack	>10 to ≤12	>3.0 to ≤3.7	17	5.2	EH2	—	0, 50, 1
		>10 to ≤12	>3.0 to ≤3.7	32	9.8	See Chapter 25.	+1 level of in-rack	0, 50, 1
Tire Storage								
Tires	On flooror on side	>5 to ≤12	>1.5 to ≤3.7	32	9.8	EH1	—	0, 50, 1
	On floor, on tread, or on side	≤5	≤1.5	—	—	OH2	—	0, 50, 1
	Single-, double-, or multiple-row racks, on tread or on side	≤5	≤1.5	—	—	OH2	—	0, 50, 1

Commodity	Type of Storage	Storage Height		Maximum Ceiling Height		Design from 19.2.3.1.1	Note	Insi
		ft	m	ft	m			gpm
	Single-row rack, portable, on tread or on side	>5 to ≤12	>1.5 to ≤3.7	32	9.8	EH1	—	0, 50, 1
	Single-row rack, fixed, on tread or on side	>5 to ≤12	>1.5 to ≤3.7	32	9.8	EH1	—	0, 50, 1
		>5 to ≤12	>1.5 to ≤3.7	32	9.8	See Chapter 25.	+1 level of in-rack	0, 50, 1
Rolled Paper Storage								
Heavyweight and mediumweight	On end	≤10	≤3.0	30	9.1	OH2	—	0, 50, 1
Tissue and lightweight	On end	≤10	≤3.0	30	9.1	EH1	—	0, 50, 1

Statement of Problem and Substantiation for Public Input

Table 4.3.1.7.1 applies to both miscellaneous and low-piled storage. Adding "low-piled" into the title of the table will benefit the user of the standard.

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Public Input No. 221-NFPA 13-2022 [Section No. 4.3.1.7.2]

4.3.1.7.2 Protection Criteria for Low-Piled Storage.

4.3.1.7.2.1

The protection criteria for low-piled storage ~~of Class I through Class IV commodities up to a maximum height of 12 ft (3.7 m) protected by ceiling sprinklers only~~ shall be selected from Table 4.3.1.7.1.1 ~~and 19 .2.3.1.1 in accordance with the density/area method of 19.2.3 .~~

4.3.1.7.2.2

~~The protection criteria for low-piled storage of Class I through Class IV commodities up to a maximum height of 12 ft (3.7 m) on open racks protected by in-rack sprinklers~~ Ceiling sprinkler design shall be in accordance with ~~25~~ Section 19 .2. ~~2~~ 3 .

4.3.1.7.2.3

~~Low~~ The maximum design area for low -piled storage ~~of Class I through Class IV commodities up to a maximum height of 12 ft (3.7 m) on solid shelf racks shall be protected with in-rack sprinklers in accordance with Section 20.19 and 25.2.2.2 , with corresponding ceiling sprinkler protection in accordance with 25.2.2.5.1 .~~ shall not exceed 3000 ft ^{2} (280 m ^{2}).

4.3.1.7.2.4

~~The protection criteria for low-piled storage of Group A plastic commodities up to a maximum height of 5 ft (1.5 m) protected by ceiling sprinklers only shall be selected from~~ Where required by Table 4.3.1.7.1.1 ~~and 19.2.3.1.1 in accordance with the density/area method of 19.2.3 .~~

~~**4.3.1.7.2.5** –~~

~~The protection criteria for low-piled storage of Group A plastic commodities up to a maximum height of 5 ft (1.5 m) on open racks protected by in-rack sprinklers shall~~ , in-rack sprinkler protection and ceiling sprinkler design shall be in accordance with Section 25.2.2 .

4.3.1.7.2.~~6~~ 5

~~Low-piled storage of Group A plastic commodities up to a maximum height of 5 ft (1.5 m) on solid shelf racks shall be protected with in-rack sprinklers in accordance with Section 20.19 and 25.2.2.2 , with corresponding ceiling sprinkler protection in accordance with 25.2.2.5.2 .~~

~~**4.3.1.7.2.7** –~~

~~The maximum design area for low-piled storage shall not exceed 3000 ft ^{2} (280 m ^{2})~~ The requirements of section 20.19 shall apply to racks with solid shelves in low-piled storage .

Statement of Problem and Substantiation for Public Input

It should not be necessary to repeat in the body all of the selections from the table. Proposal seeks to make the section more concise without changing technical content and also to make consistent with miscellaneous storage section.

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Committee:	AUT-SSD

Public Input No. 204-NFPA 13-2022 [Sections 4.3.4, 4.3.5]

Sections 4.3.4, 4.3.5

4.3.4* – **Extra Hazard Occupancies.**

4.3.4.1* Extra Hazard (Group 1) (EH1). - ~~The following shall be protected with EH1 occupancy criteria in this standard:~~

(1) Spaces with very high quantity and combustibility of contents

(2) Spaces where dust, lint, or other materials are present, introducing the probability of rapidly developing fires

4.3.5 4.2 * Extra Hazard (Group 2) (EH2). - ~~The following shall be protected with EH2 occupancy criteria in this standard:~~

(1) Spaces with very high quantity and combustibility of contents

(2) Spaces with substantial amounts of combustible or flammable liquids

(3) Spaces where shielding of combustibles is extensive

Statement of Problem and Substantiation for Public Input

Manual of style correction to mirror section 4.3.3 for Ordinary Hazard with two sub-groups. No technical changes.

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Committee: AUT-SSD

Public Input No. 202-NFPA 13-2022 [Section No. 4.4.1]

4.4.1

The maximum floor area on any one floor to be protected by sprinklers supplied by any one sprinkler system riser or combined system riser shall be as follows:

(1) Light hazard — 52,000 ft^2 (4830 m^2)

(2) Ordinary hazard — 52,000 ft^2 (4830 m^2)

(3) * Extra hazard — Hydraulically calculated — 40,000 ft^2 (3720 m^2)

(4) High-piled Storage — High-piled storage (as defined in 3.3.100) and storage covered by other NFPA standards — 40,000 ft^2 (3720 m^2)

(5) ~~In~~ Low ~~-~~ ~~rack Storage — 40,000 ft 2 (3720 m~~ piled Storage -- Low piled storage (as defined in 3.3.124) -- 40,000 ft^2 (3720 m^2)

Statement of Problem and Substantiation for Public Input

Current (5) references "In-rack Storage" which is one type of high-piled storage referenced in (4), and requirements for low-piled storage are not shown. By changing "In-rack Storage" to "Low-piled Storage," all configurations of storage are now addressed.

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Public Input No. 19-NFPA 13-2021 [New Section after 4.4.5]

4.4.6
The maximum floor area shall be permitted to exceed the requirements of 4.4.1 when approved by the AHJ.

Statement of Problem and Substantiation for Public Input

The removal/increase of the system area limitations was discussed at the last committee meeting. In the first draft, three public inputs (PI-132, PI-424, and PI-532) were submitted on this topic, and the committee did approve a first revision (FR-1176) allowing the maximum system area to be increased by 25% when electronically supervised control valve are provided; however, that change was reversed in the second draft. There were six public comments submitted (PI-113, PI-213, PI-262, PI-263, PI-3, PI-384). One was in opposition to FR-1176, one from the correlating committee requesting technical substantiation, and the remaining were correcting an editorial error with the section number. Ultimately, the technical committee reversed their decision with SR-1176 based on a lack of technical substantiation.

In a practical application, the size of the system does not affect system performance. It may make ITM activities more difficult in the future, but the level of fire protection is the same. While technical substantiation is needed to change an existing requirement. The issue is the technical basis for the original requirements is not that impressive. Based on old pipe schedule systems utilizing 400 sprinklers at 225 sq. ft, the maximum area of 52,000 sq. ft was determined for light and ordinary hazard systems and for extra hazard and storage the coverage of the sprinkler is reduced to 100 sq. ft for 400 sprinklers, or 40,000 sq. ft -- there was no high level scientific data going into the original requirement.

Allowing deviation from the maximum area based on AHJ approval would be a good compromise.

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Submittal Date: Tue Nov 02 23:39:16 EDT 2021
Committee: AUT-SSD

Public Input No. 341-NFPA 13-2022 [Section No. 5.1.4]

5.1.4* Water ~~Supply Treatment.~~ ~~**5.1.4.1**~~ ~~– Water~~ ~~Supplies and Environmental Conditions.~~

5.1.4.1.1 ~~–~~

Water supplies and environmental conditions shall be evaluated for the existence of microbes and conditions that contribute to microbiologically influenced corrosion (MIC).

5.1.4.1. ~~**.**~~ **2**

~~Where conditions that contribute to MIC are found, the owner(s) shall notify the sprinkler system installer and develop a plan to treat the system using one of the following methods:~~

(1) ~~Install system piping that will not be affected by the MIC microbes~~

(2) ~~Treat all water that enters the system using a listed bacterial inhibitor~~

(3) ~~Implement an approved plan for monitoring the interior conditions of the pipe at established time intervals and locations~~

(4) ~~Install a corrosion monitoring station and monitor at established intervals~~

~~**5.1.4.2**~~ ~~– Corrosion.~~

~~**5.1.4.2.1**~~ ~~–~~

Water supplies and environmental conditions shall be evaluated for conditions that contribute to unusual corrosive properties.

5.1.4.~~**2.2**~~ ~~–~~

~~Where conditions are found that contribute to unusual corrosive properties, the owner(s) shall notify the sprinkler system installer and a plan shall be developed to treat the system using at least one of the following methods:~~

(1) ~~Install system piping that is corrosion resistant~~

(2) ~~Treat water that enters the system using a listed corrosion inhibitor~~

(3) ~~Implement an approved plan for monitoring the interior conditions of the pipe at established intervals and locations~~

(4) ~~Install approved corrosion monitoring stations and monitor at established intervals~~

(5) ~~Fill dry-pipe or preaction systems with at least 98 percent pure nitrogen in lieu of air to mitigate against corrosion~~

(6) ~~Use a listed nitrogen generator that is sized and installed in accordance with the manufacturer's instructions~~

~~**5.1.4.**~~ **3** Inhibitors.

5.1.4.3.1

Where used, listed bacterial inhibitors and/or corrosion inhibitors shall be compatible with system components.

5.1.4.3.2

Where used together, listed bacterial inhibitors and corrosion inhibitors shall be compatible with each other.

Statement of Problem and Substantiation for Public Input

This PI deletes treatments from 5.1.4 but maintains the requirements for testing. The deleted text for treatment options is intended to be relocated to 16.4.2, Protection Against Corrosion. Additional PIs will further consolidate the language in 5.1.4. This chapter initially provided types of water supplies. The addition of corrosion protection requirements has continued to grow and distracts from the intent of the chapter. This should be limited to testing for MIC and unusual corrosive properties.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 340-NFPA 13-2022 [Section No. 5.1.4.2.2]	
Public Input No. 342-NFPA 13-2022 [Section No. 5.1.4.3]	
Public Input No. 343-NFPA 13-2022 [Section No. 5.1.4]	
Public Input No. 345-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 346-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 347-NFPA 13-2022 [New Section after 8.5]	
Public Input No. 342-NFPA 13-2022 [Section No. 5.1.4.3]	
Public Input No. 343-NFPA 13-2022 [Section No. 5.1.4]	
Public Input No. 345-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 346-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 347-NFPA 13-2022 [New Section after 8.5]	
Public Input No. 349-NFPA 13-2022 [Section No. 28.2.4.8.1]	
Public Input No. 350-NFPA 13-2022 [New Section after 8.2.6.9]	

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Committee: AUT-SSD

Public Input No. 343-NFPA 13-2022 [Section No. 5.1.4]

5.1.4* Water ~~Supply Treatment.~~ ~~**5.1.4.1**~~ ~~– Water Supplies and Environmental Conditions.~~

5.1.4.1.1

Water supplies and environmental conditions shall be evaluated for the existence of microbes and conditions that contribute to microbiologically influenced corrosion (MIC).

5.1.4.1. 2

~~Where conditions that contribute to MIC are found, the owner(s) shall notify the sprinkler system installer and develop a plan to treat the system using one of the following methods:~~

(1) ~~Install system piping that will not be affected by the MIC microbes~~

(2) ~~Treat all water that enters the system using a listed bacterial inhibitor~~

(3) ~~Implement an approved plan for monitoring the interior conditions of the pipe at established time intervals and locations~~

(4) ~~Install a corrosion monitoring station and monitor at established intervals~~

~~**5.1.4.2** – Corrosion.~~

~~**5.1.4.2.1** –~~

Water supplies and environmental conditions shall be evaluated for conditions that contribute to unusual corrosive properties.

~~**5.1.4.2.2** –~~

~~Where conditions are found that contribute to unusual corrosive properties, the owner(s) shall notify the sprinkler system installer and a plan shall be developed to treat the system using at least one of the following methods:~~

(1) ~~Install system piping that is corrosion resistant~~

(2) ~~Treat water that enters the system using a listed corrosion inhibitor~~

(3) ~~Implement an approved plan for monitoring the interior conditions of the pipe at established intervals and locations~~

(4) ~~Install approved corrosion monitoring stations and monitor at established intervals~~

(5) ~~Fill dry-pipe or preaction systems with at least 98 percent pure nitrogen in lieu of air to mitigate against corrosion~~

(6) ~~Use a listed nitrogen generator that is sized and installed in accordance with the manufacturer's instructions~~

~~**5.1.4.3** – Inhibitors.~~

~~**5.1.4.3.1** –~~

~~Where used, listed bacterial inhibitors and/or corrosion inhibitors shall be compatible with system components.~~

~~**5.1.4.3.2** –~~

~~Where used together, listed bacterial inhibitors and corrosion inhibitors shall be compatible with each other.~~

3 _

Liquid phase corrosion inhibitors shall be permitted to be used in accordance with 8.6.1.

Statement of Problem and Substantiation for Public Input

This PI consolidates the requirements in 5.1.4 and another PI relocates the requirements to 8.6.1.

This PI also deletes treatments from 5.1.4 but maintains the requirements for testing. The deleted text for treatment options is intended to be relocated to 16.4.2, Protection Against Corrosion. Additional PIs will further consolidate the language in 5.1.4. This chapter initially provided types of water supplies. The addition of corrosion protection requirements has continued to grow and distracts from the intent of the chapter. This should be limited to testing for MIC and unusual corrosive properties.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 340-NFPA 13-2022 [Section No. 5.1.4.2.2]	
Public Input No. 341-NFPA 13-2022 [Section No. 5.1.4]	
Public Input No. 342-NFPA 13-2022 [Section No. 5.1.4.3]	
Public Input No. 345-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 346-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 347-NFPA 13-2022 [New Section after 8.5]	
Public Input No. 341-NFPA 13-2022 [Section No. 5.1.4]	
Public Input No. 345-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 346-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 347-NFPA 13-2022 [New Section after 8.5]	
Public Input No. 349-NFPA 13-2022 [Section No. 28.2.4.8.1]	
Public Input No. 350-NFPA 13-2022 [New Section after 8.2.6.9]	

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Committee: AUT-SSD

Public Input No. 340-NFPA 13-2022 [Section No. 5.1.4.2.2]

5.1.4.2.2

Where conditions are found that contribute to unusual corrosive properties, the owner(s) shall notify the sprinkler system installer and a plan shall be developed to treat the system using at least one of the following methods:

(1) Install system piping that is corrosion resistant

(2) Treat water that enters the system using a listed corrosion inhibitor

(3) Implement an approved plan for monitoring the interior conditions of the pipe at established intervals and locations

(4) Install approved corrosion monitoring stations and monitor at established intervals

(5) Fill dry-pipe or preaction systems with at least 98 percent pure nitrogen in lieu of air to mitigate against corrosion

(6) Use a listed nitrogen generator that is sized and installed in accordance with the manufacturer's instructions

(7) **Use a VpCI delivery system sized and installed in accordance with the manufacturer's instructions**

Statement of Problem and Substantiation for Public Input

The technology has been available for many years and will soon be available as a listed product for use in dry pipe and preaction sprinkler systems. VpCIs have been used to protect metals from rust and corrosion in industrial and commercial applications for approximately 40 years. VpCIs were also used by the US to protect equipment during WWII. VPCI is effective at mitigating corrosion in dry pipe and preaction sprinkler systems.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 338-NFPA 13-2022 [New Section after 3.3.236]	
Public Input No. 339-NFPA 13-2022 [New Section after 3.3.120]	
Public Input No. 341-NFPA 13-2022 [Section No. 5.1.4]	
Public Input No. 342-NFPA 13-2022 [Section No. 5.1.4.3]	
Public Input No. 343-NFPA 13-2022 [Section No. 5.1.4]	
Public Input No. 345-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 346-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 349-NFPA 13-2022 [Section No. 28.2.4.8.1]	
Public Input No. 350-NFPA 13-2022 [New Section after 8.2.6.9]	

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Public Input No. 342-NFPA 13-2022 [Section No. 5.1.4.3]

5.1.4.3 ~~Inhibitors.~~

~~5.1.4.3.1~~ ~~–~~

~~Where used, listed bacterial inhibitors and/or~~

Liquid phase corrosion inhibitors shall be

~~compatible with system components.~~

~~5~~ permitted to be used in accordance with 8.6 .1. ~~4.3.2~~

~~Where used together, listed bacterial inhibitors and corrosion inhibitors shall be compatible with each other.~~

Statement of Problem and Substantiation for Public Input

This PI consolidates the requirements in 5.1.4 and another PI relocates the requirements to 8.6.1.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 341-NFPA 13-2022 [Section No. 5.1.4]	
Public Input No. 340-NFPA 13-2022 [Section No. 5.1.4.2.2]	
Public Input No. 341-NFPA 13-2022 [Section No. 5.1.4]	
Public Input No. 343-NFPA 13-2022 [Section No. 5.1.4]	
Public Input No. 345-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 346-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 347-NFPA 13-2022 [New Section after 8.5]	
Public Input No. 349-NFPA 13-2022 [Section No. 28.2.4.8.1]	
Public Input No. 350-NFPA 13-2022 [New Section after 8.2.6.9]	

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Public Input No. 394-NFPA 13-2022 [New Section after 5.2.2]

5.2.2.3*

Where a waterflow test was conducted to provide the water supply information, the date, day of the week, and time of day that the test was conducted shall be recorded with the data.

Statement of Problem and Substantiation for Public Input

The topic of water supply adjustments has been discussed over past several cycles without achieving consensus throughout the entire NFPA 13 cycle. NITMAM were submitted during the 2019 and 2022 code cycles. This public input is being submitted by the Water Supply Task Group which was appointed by the SSD and SSI committees. This language reached consensus within the task group.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 391-NFPA 13-2022 [Section No. 4.2]	
Public Input No. 392-NFPA 13-2022 [New Section after A.4.2]	
Public Input No. 393-NFPA 13-2022 [Section No. A.5.2.2]	
Public Input No. 395-NFPA 13-2022 [New Section after A.5.2.2.2]	
Public Input No. 391-NFPA 13-2022 [Section No. 4.2]	
Public Input No. 392-NFPA 13-2022 [New Section after A.4.2]	
Public Input No. 395-NFPA 13-2022 [New Section after A.5.2.2.2]	

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Public Input No. 602-NFPA 13-2022 [New Section after 5.2.2.2]

5.2.2.3*

Where a waterflow test was conducted to provide the water supply information, the date, day of the week, and time of day that the test was conducted shall be recorded with the data.

Statement of Problem and Substantiation for Public Input

This language on water supply evaluations mirror those submitted by the Water Supply Task Group.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 598-NFPA 13-2022 [Section No. 4.2]	
Public Input No. 600-NFPA 13-2022 [New Section after A.4.2]	
Public Input No. 601-NFPA 13-2022 [Section No. A.5.2.2]	
Public Input No. 603-NFPA 13-2022 [Section No. A.5.2.2.2]	
Public Input No. 605-NFPA 13-2022 [New Section after A.5.2.2.2]	

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Committee: AUT-SSD

Public Input No. 49-NFPA 13-2021 [Section No. 19.1.6.3]

19.1.6.3

Where inside hose ~~connections~~ stations are planned or are required, the following shall apply:

(1) A total water allowance of 50 gpm (190 L/min) for a single hose ~~connection~~ station installation shall be added to the sprinkler requirements.

(2) A total water allowance of 100 gpm (380 L/min) for a multiple hose ~~connection installation~~ station installation shall be added to the sprinkler requirements.

(3) The water allowance shall be added in 50 gpm (190 L/min) increments beginning at the most remote hose ~~connection~~ station , with each increment added at the pressure required by the sprinkler system design at that point.

19.1.6.3.1

Where the system is a combined sprinkler/standpipe system (Class I or Class III) and the building is fully sprinklered in accordance with NFPA 13, no inside hose demand shall be required at any of the standpipe outlets.

Statement of Problem and Substantiation for Public Input

Inside hose should only be accounted for when a hose line is attached to the hose valve for ready operation by a building fire brigade. Hose connections that are solely for fire department use should not be included in inside hose allowances.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 10-NFPA 13-2021 [New Section after 3.3]	Defines Hose Station

Submitter Information Verification

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Committee: AUT-SSD

Public Input No. 555-NFPA 13-2022 [Section No. 19.2.2.3]

19.2.2.3

The pipe schedule method shall be permitted as follows:

(1) ~~Additions or modifications to existing pipe schedule systems sized according to the pipe schedules of Section 28.5~~

(2) ~~Additions or modifications to existing extra hazard pipe schedule systems~~

(3) New systems of 5000 ft^2 (465 m^2) or less

(4) New systems exceeding 5000 ft^2 (465 m^2) where the flows required in Table 19.2.2.1 are available at a minimum residual pressure of 50 psi (3.4 bar) at the highest elevation of sprinkler

Statement of Problem and Substantiation for Public Input

Section 19.2.2.3(1) and Section 19.2.2.3(2) are both currently addressed in Section 30.4.1.

Submitter Information Verification

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Submittal Date:	Tue May 31 20:21:52 EDT 2022
Committee:	AUT-SSD

Public Input No. 228-NFPA 13-2022 [Section No. 19.2.3.1.1]

19.2.3.1.1

The water demand for sprinklers shall be determined only from one of the following, at the discretion of the designer:

(1) For new systems, the density/area selected from Table 19.2.3.1.1 in accordance with the density/area method of 19.2.3.2

(2) For the evaluation or modification of existing systems, the density/area curves of Figure 19.2.3.1.1 in accordance with the density/area method of 19.2.3.2

(3) The room that creates the greatest demand in accordance with the room design method of 19.2.3.3

(4) Special design areas in accordance with 19.2.3.4

~~Table 19~~ Insert new Table 19 .2.3.1.~~1 Density/Area~~

~~Hazard Density/Area [gpm/ft 2 /ft 2 (mm/min/m 2)] Light 0.1/1500 or 0.07/3000* (4.1/140 or 2.9/280) Ordinary~~

1 as shown below (I will also include the Table in a Word Document):

Table 19.2.3.1.1

Hazard Classification	Density/Area Criteria for Situations Where the Design Area is Not Required to be 3,000 ft 2 (280 m 2) per Section 19.2.3.1.5	Density/Area Criteria for Si Where the Design Area is R to be 3,000 ft 2 (280 m 2 Section 19.2.3.1.5
Light Hazard	0.1 gpm per ft 2 over 1500 ft 2 (4.1 mm/min over 140 m 2)	0.07 gpm per ft 2 over 300 (2.9 mm/min over 280 m 2)
Ordinary Hazard Group 1	0.15	

~~/1500 or 0.12/3000*~~

gpm per ft 2 over 1500 ft 2 (6.1 mm /	

~~140 or~~

min over 140 m 2)	0.12 gpm per ft 2 over 3000 ft 2 (4.9 mm / min over 280 m 2)
Ordinary Hazard Group 2	0.2

~~/1500 or 0.17/3000*~~

gpm per ft 2 over 1500 ft 2 (8.1 mm /	

~~140 or~~

min over 140 m 2)	0.17 gpm per ft 2 over 3000 ft 2 (6.9 mm / min over 280 m 2)
Extra Hazard Group 1	0.3

~~/2500 or 0.28/3000*~~

gpm per ft 2 over 2500 ft 2 (12.2 mm /	

~~230 or~~

min over 230 m 2)	0.28 gpm per ft 2 over 3000 ft 2 (11.4 mm / min over 280 m 2)
Extra Hazard Group 2	0.4

~~/2500 or 0.38/3000*~~

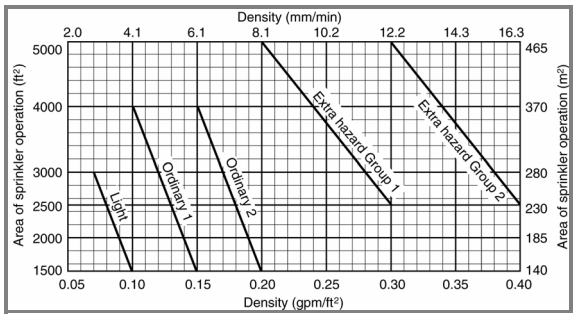
gpm per ft 2 over 2500 ft 2 (16.3 mm /

~~230 or~~

min over 230 m 2)	0.38 gpm per ft 2 over 3000 ft 2 (15.5 mm / min over 280 m 2)

~~*When required by 19.2.3.1.5.~~

Figure 19.2.3.1.1 Density/Area Curves for the Evaluation or Modification of Existing Systems.



Additional Proposed Changes

File Name	Description	Approved
Table_19-2-3-1-1.docx	Proposed Table 19.2.3.1.1 in Word format	

Statement of Problem and Substantiation for Public Input

There are a number of reasons that this table needs to be modified:
1) The units are difficult for someone to figure out that does not use the standard often. There is only one "/" in the column headings, but there are two "/" marks in the table, so is the density supposed to be 0.1 gpm for light hazard with a design area of 1500 ft2/ft2? The answer is no, but that is what the table looks like it is saying.
2) The metric units are hard to match up with their ft-lb unit counterparts.
3) The note about the second criteria only applying for unsprinklered combustible concealed spaces only applies to ft-lb units in the 2022 edition. There is no "*" in the metric units.
4) The explanation as to when to use the second set of criteria amounts to a requirement, which is in a note. That is not allowed (or at least very heavily frowned upon) under the Style Manual.

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Committee:	AUT-SSD

Table 19.2.3.1.1

Hazard Classification	Density/Area Criteria for Situations Where the Design Area is Not Required to be 3,000 ft^2 (280 m^2) per Section 19.2.3.1.5	Density/Area Criteria for Situations Where the Design Area is Required to be 3,000 ft^2 (280 m^2) per Section 19.2.3.1.5
Light Hazard	0.1 gpm per ft^2 over 1500 ft^2 (4.1 mm/min over 140 m^2)	0.07 gpm per ft^2 over 3000 ft^2 (2.9 mm/min over 280 m^2)
Ordinary Hazard Group 1	0.15 gpm per ft^2 over 1500 ft^2 (6.1 mm/min over 140 m^2)	0.12 gpm per ft^2 over 3000 ft^2 (4.9 mm/min over 280 m^2)
Ordinary Hazard Group 2	0.2 gpm per ft^2 over 1500 ft^2 (8.1 mm/min over 140 m^2)	0.17 gpm per ft^2 over 3000 ft^2 (6.9 mm/min over 280 m^2)
Extra Hazard Group 1	0.3 gpm per ft^2 over 2500 ft^2 (12.2 mm/min over 230 m^2)	0.28 gpm per ft^2 over 3000 ft^2 (11.4 mm/min over 280 m^2)
Extra Hazard Group 2	0.4 gpm per ft^2 over 2500 ft^2 (16.3 mm/min over 230 m^2)	0.38 gpm per ft^2 over 3000 ft^2 (15.5 mm/min over 280 m^2)

Public Input No. 358-NFPA 13-2022 [Section No. 19.2.3.1.1]

19.2.3.1.1

The water demand for sprinklers shall be determined only from one of the following, at the discretion of the designer:

(1) For new systems, the density/area selected from Table 19.2.3.1.1 in accordance with the density/area method of 19.2.3.2

(2) For the evaluation or modification of existing systems, ~~the density/area curves of Figure 19.2.3.1.1 in accordance with the density/area method of 19.2.3.2~~ refer to Chapter 30.

(3) The room that creates the greatest demand in accordance with the room design method of 19.2.3.3

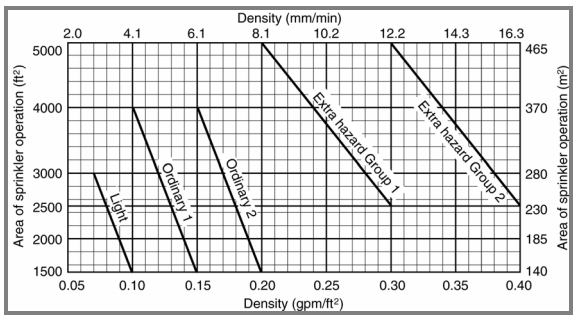
(4) Special design areas in accordance with 19.2.3.4

Table 19.2.3.1.1 Density/Area

Hazard	Density/Area [gpm/ft^2/ft^2 (mm/min/m^2)]
Light	0.1/1500 or 0.07/3000* (4.1/140 or 2.9/280)
Ordinary Group 1	0.15/1500 or 0.12/3000* (6.1/140 or 4.9/280)
Ordinary Group 2	0.2/1500 or 0.17/3000* (8.1/140 or 6.9/280)
Extra Group 1	0.3/2500 or 0.28/3000* (12.2/230 or 11.4/280)
Extra Group 2	0.4/2500 or 0.38/3000* (16.3/230 or 15.5/280)

*When required by 19.2.3.1.5.

Figure 19.2.3.1.1 Density/Area Curves for the Evaluation or Modification of Existing Systems.



Statement of Problem and Substantiation for Public Input

The area density curves are applicable to evaluating existing systems only and should be located in Chapter 30.

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Committee:	AUT-SSD

Public Input No. 503-NFPA 13-2022 [Section No. 19.2.3.1.1]

19.2.3.1.1

The water demand for sprinklers shall be determined only from one of the following, at the discretion of the designer:

(1) ~~For new systems, the~~ The density/area selected from Table 19.2.3.1.1 in accordance with the density/area method of 19.2.3.2

(2) ~~For the evaluation or modification of existing systems, the density/area curves of Figure 19.2.3.1.1 in accordance with the density/area method of 19.2.3.2~~

(3) The room that creates the greatest demand in accordance with the room design method of 19.2.3.3

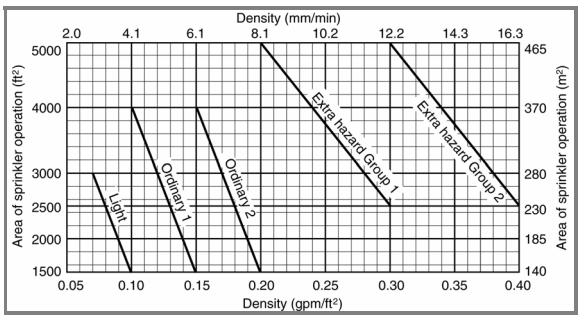
(4) Special design areas in accordance with 19.2.3.4

Table 19.2.3.1.1 Density/Area

Hazard	Density/Area [gpm/ft^2/ft^2 (mm/min/m^2)]
Light	0.1/1500 or 0.07/3000* (4.1/140 or 2.9/280)
Ordinary Group 1	0.15/1500 or 0.12/3000* (6.1/140 or 4.9/280)
Ordinary Group 2	0.2/1500 or 0.17/3000* (8.1/140 or 6.9/280)
Extra Group 1	0.3/2500 or 0.28/3000* (12.2/230 or 11.4/280)
Extra Group 2	0.4/2500 or 0.38/3000* (16.3/230 or 15.5/280)

*When required by 19.2.3.1.5.

~~**Figure 19.2.3.1.1 Density/Area Curves for the Evaluation or Modification of Existing Systems.**~~



Statement of Problem and Substantiation for Public Input

The requirements in Section 19.2.3.1.1(2) are specific to existing systems and are being deleted due to a proposal to relocate these requirements into Chapter 30. See the proposal for relocating this language along with Figure 19.2.3.1.1 to Section 30.4.3.2. With the removal of references to existing systems in this section, the term “new” relative to systems can be removed from 19.2.3.1.1(1).

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Public Input No. 139-NFPA 13-2022 [Section No. 19.2.3.1.5.1 [Excluding any Sub-Sections]]

When using the density/area or room design method, unless the requirements of 19.2.3.1.5.2 are met for buildings having unsprinklered combustible concealed spaces, as described in 9.2.1 ~~and~~ .3 through 9.2.2, the minimum area of sprinkler operation for that portion of the building shall be 3000 ft^2 (280 m^2).

Statement of Problem and Substantiation for Public Input

Sections 9.2.1.1, 9.2.1.1.1, 9.2.1.1.2, 9.2.1.2, 9.2.1.2.1, and 9.2.1.2.2 are not combustible concealed spaces and should not be considered by this requirement. They are noncombustible concealed spaces and do not require an increase in design area.

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Public Input No. 138-NFPA 13-2022 [Section No. 19.2.3.1.5.2]

19.2.3.1.5.2

The following ~~unsprinklered~~ unsprinklered combustible concealed spaces shall not require a minimum area of sprinkler operation of 3000 ft^2 (280 m^2):

(1) ~~Noncombustible and limited-combustible concealed spaces with minimal combustible loading having no access, including those with small openings such as those used as return air for a plenum~~

(2) ~~Noncombustible and limited-combustible concealed spaces with limited access and not permitting occupancy or storage of combustibles, including those with small openings such as those used as return air for a plenum~~

(3) Combustible concealed spaces filled entirely with noncombustible insulation

(4)* Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are directly attached to the bottom of solid wood joists or solid limited-combustible construction or noncombustible construction to create enclosed joist spaces 160 ft^3 (4.5 m^3) or less in volume, including space below insulation that is laid directly on top or within the ceiling joists in an otherwise sprinklered concealed space

(5) Concealed spaces where rigid materials are used and the exposed surfaces comply with one of the following in the form in which they are installed in the space:

(a) The surface materials have a flame spread index of 25 or less and the materials have been demonstrated to not propagate fire more than 10.5 ft (3.2 m) when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials,* or UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, extended for an additional 20 minutes in the form in which they are installed in the space

(b) The surface materials comply with the requirements of ASTM E2768, *Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30 min Tunnel Test)*

(6) Concealed spaces in which the exposed materials are constructed entirely of fire-retardant-treated wood as defined by NFPA 703

(7) Concealed spaces over isolated small rooms not exceeding 55 ft^2 (5.1 m^2) in area

(8) Vertical pipe chases under 10 ft^2 (0.9 m^2), provided that in multifloor buildings the chases are firestopped at each floor using materials equivalent to the floor construction and pipe penetrations at each floor are properly sealed, and where such pipe chases contain no sources of ignition, and piping is noncombustible

(9) Exterior columns under 10 ft^2 (0.9 m^2) in area formed by studs or wood joists, supporting exterior canopies that are fully protected with a sprinkler system

(10)* Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are attached to the bottom of composite wood joists either directly or on to metal channels not exceeding 1 in. (25 mm) in depth, provided the adjacent joist channels are firestopped into volumes not exceeding 160 ft^3 (4.5 m^3) using materials equivalent to ½ in. (13 mm) gypsum board, and at least 3½ in. (90 mm) of batt insulation is installed at the bottom of the joist channels when the ceiling is attached utilizing metal channels

(11) Cavities within unsprinklered wall spaces

(12) Exterior soffits, eaves, overhangs, and decorative frame elements complying with 9.2.1.20.

Statement of Problem and Substantiation for Public Input

Paren 1 and 2 are not examples of combustible concealed spaces and would not require an increase in design area regardless of the requirements of this section.

Submitter Information Verification

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Committee: AUT-SSD

Public Input No. 407-NFPA 13-2022 [Section No. 19.2.3.1.5.2]

19.2.3.1.5.2

The following unsprinklered concealed spaces shall not require a minimum area of sprinkler operation of 3000 ft^2 (280 m^2):

(1) Noncombustible and limited-combustible concealed spaces with minimal combustible loading having no access, including those with small openings such as those used as return air for a plenum

(2) Noncombustible and limited-combustible concealed spaces with limited access and not permitting occupancy or storage of combustibles, including those with small openings such as those used as return air for a plenum

(3) Combustible concealed spaces filled entirely with noncombustible insulation

(4)* Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are directly attached to the bottom of solid wood joists or solid limited-combustible construction or noncombustible construction to create enclosed joist spaces 160 ft^3 (4.5 m^3) or less in volume, including space below insulation that is laid directly on top or within the ceiling joists in an otherwise sprinklered concealed space

(5) Concealed spaces where rigid materials are used and the exposed surfaces comply with one of the following in the form in which they are installed in the space:

(a) The surface materials have ~~a flame~~ a flame spread index of 25 or less , and the materials have ~~been demonstrated to not propagate fire~~ demonstrated that the flame front does not progress more than 10. ~~5 ft~~ 5 ft (3. ~~2 m) when~~ 2 m) beyond the centerline of the burners at any time during the test period, when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials* , or UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials* , extended for an additional 20 minutes ~~in~~ , in the form in which they are installed in the space

(b) The surface materials comply with the requirements of ASTM E2768, *Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30 min Tunnel Test)*

(6) Concealed spaces in which the exposed materials are constructed entirely of fire-retardant-treated wood as defined by NFPA 703

(7) Concealed spaces over isolated small rooms not exceeding 55 ft^2 (5.1 m^2) in area

(8) Vertical pipe chases under 10 ft^2 (0.9 m^2), provided that in multifloor buildings the chases are firestopped at each floor using materials equivalent to the floor construction and pipe penetrations at each floor are properly sealed, and where such pipe chases contain no sources of ignition, and piping is noncombustible

(9) Exterior columns under 10 ft^2 (0.9 m^2) in area formed by studs or wood joists, supporting exterior canopies that are fully protected with a sprinkler system

(10)* Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are attached to the bottom of composite wood joists either directly or on to metal channels not exceeding 1 in. (25 mm) in depth, provided the adjacent joist channels are firestopped into volumes not exceeding 160 ft^3 (4.5 m^3) using materials equivalent to ½ in. (13 mm) gypsum board, and at least 3½ in. (90 mm) of batt insulation is installed at the bottom of the joist channels when the ceiling is attached utilizing metal channels

(11) Cavities within unsprinklered wall spaces

(12) Exterior soffits, eaves, overhangs, and decorative frame elements complying with 9.2.1.20.

Statement of Problem and Substantiation for Public Input

The proposed change makes the language consistent with code language and with language in ASTM

E2768. No technical change is being made but the standard describes "flame front progress" and not "fire propagation".

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 406-NFPA 13-2022 [Section No. 9.2.1.12]	
Public Input No. 408-NFPA 13-2022 [Section No. 20.10.2]	
Public Input No. 606-NFPA 13-2022 [Section No. 20.10.2]	

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Committee: AUT-SSD

Public Input No. 504-NFPA 13-2022 [Section No. 19.2.3.2.1]

19.2.3.2.1 Water Supply.

19.2.3.2.1.1

The water supply requirement for sprinklers only shall be calculated from Table 19.2.3.1.1 ~~for new systems and from the density/area curves of Figure 19.2.3.1.1 for the evaluation~~ or ~~modification of existing systems, or~~ from Chapter 27 where density/area criteria are specified for special occupancy hazards.

~~**19.2.3.2.1.2** –~~

~~When using Figure 19.2.3.1.1 , the calculations shall satisfy any single point on the appropriate density/area curve.~~

~~**19.2.3.2.1.3** –~~

~~When using Figure 19.2.3.1.1 , it shall not be necessary to meet all points on the selected curves.~~

Statement of Problem and Substantiation for Public Input

The requirements in Sections 19.2.3.2.1.2 and 19.2.3.2.1.3, as well as the requirements from Section 19.2.3.2.1.1 specific to existing systems, are being deleted due to a proposal to relocate these requirements into Chapter 30. See the proposal specific to Section 30.4.3.4 and Section 30.4.3.5. With the removal of references to existing systems within this section, the term “new” relative to systems can be removed from 19.2.3.2.1.

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Public Input No. 317-NFPA 13-2022 [New Section after 19.2.3.2.4]

19.2.3.2.5* Ceiling Heights Over 30 ft (9.1 m).

Where sprinklers are installed in areas with ceiling heights that are greater than 30 ft (9.1 m) but do not exceed 60 ft (18.3 m) above the finished floor, the requirements from 19.2.3.2 shall apply except as modified in 19.2.3.2.5 and summarized in Table 19.2.3.2.5.

Table 19.2.3.2.5 Summary of Requirements for Ceiling Heights Over 30 ft (9.1 m)

Ceiling height ft (m)	Occupancy hazard	Sprinkler coverage	Nominal Sprinkler K-factor US (metric)	Sprinkler response	Sprinkler orientation	Minimum sprinkler density gpm/ft 2 (mm/min)	In d f 1
Over 30 and up to 40 (Over 9.1 and up to 12.2)	OH1	Standard or extended	Minimum 5.6 (80)	SR or QR	Upright or pendent	Per Table 19.2.3.1.1	
	OH2	Standard	Minimum 11.2 (160)	SR or QR	Upright or pendent	0.37 (15.1)	
		Extended	11.2 (160) or 14.0 (200)	SR or QR	Upright	0.37 (15.1)	
			Minimum 25.2 (360)	SR or QR	Upright or Pendent	0.37 (15.1)	
	EH1 & EH2	Standard	Minimum 16.8 (240)	SR	Upright or pendent	0.45 (18.3)	
		Extended	Minimum 25.2 (360)	SR	Upright or pendent	0.45 (18.3)	
Over 40 and up to 60 (Over 12.2 and up to 18.3)	OH1	Standard or extended	Minimum 5.6 (80)	SR or QR	Upright or pendent	Per Table 19.2.3.1.1	
	OH2	Standard	Minimum11.2 (160)	QR	Upright or Pendent	0.45 (18.3)	
		Extended	11.2 (160) or 14.0 (200)	SR or QR	Upright	0.45 (18.3)	
			Minimum 25.2 (360)	SR or QR	Upright or Pendent	0.45 (18.3)	
	EH1 & EH2	Standard	Minimum 16.8 (240)	SR	Upright or Pendent	0.45 (18.3)	
		Extended	Minimum 25.2 (360)	SR	Upright or Pendent	0.45 (18.3)	

19.2.3.2.5.1 Sprinklers for Ceiling Heights Over 30 ft (9.1 m)

19.2.3.2.5.1.1 Sidewall sprinklers shall not be permitted for use in Ordinary Hazard Group 1 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

19.2.3.2.5.1.2 Sprinklers having a nominal K-factor less than K-11.2 (K-160) shall not be permitted for use in Ordinary Hazard Group 2 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

19.2.3.2.5.1.3 Extended-coverage pendent sprinklers having a nominal K-factor of K-22.4 (K-320) or less shall not be permitted for use in Ordinary Hazard Group 2 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

19.2.3.2.5.1.4 Standard-response standard-coverage sprinklers shall not be permitted for use in Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft (12.2 m).

19.2.3.2.5.2 Sprinkler Designs for Ceiling Heights Over 30 ft (9.1 m)

19.2.3.2.5.2.1* For Ordinary Hazard Group 1 occupancies where the ceiling height is greater than 30 ft (9.1 m) but does not exceed 60 ft (18.3 m), the design areas obtained from Table 19.2.3.1.1 shall be increased by 30 percent.

19.2.3.2.5.2.2* For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 30 ft. (9.1 m) but does not exceed 40 ft. (12.2 m), the ceiling sprinkler system shall use a minimum density of 0.37 gpm/ft² (15.1 mm/min) in combination with the design area obtained from Table 19.2.3.1.1.

19.2.3.2.5.2.3* For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft. (12.2 m) but does not exceed 60 ft. (18.3 m), the ceiling sprinkler system shall:

(1) Use a minimum density of 0.45 gpm/ft² (18.3 mm/min), and

(2) Increase the design areas obtained from Table 19.2.3.1.1 by 30 percent

(3) The design areas from Table 19.2.3.1.1 shall be permitted, without a 30 percent increase, where an extended-coverage sprinkler having a minimum nominal K-factor of K-25.2 (K-360) is used

19.2.3.2.5.2.4* For Extra Hazard Groups 1 and 2 occupancies where the ceiling height is greater than 30 ft (9.1 m) but does not exceed 60 ft. (18.3 m), the ceiling sprinkler system shall use a minimum density of 0.45 gpm/ft² (18.3 mm/min) in combination with the design areas obtained from Table 19.2.3.1.1.

Additional Proposed Changes

File Name	Description	Approved
Clean_Copy_of_High_Ceiling_Clearance_Draft_Proposed_Language_WCB_13-May-2022_Rev_B.docx	Word file containing the work of the High Clearance Task Group that developed a new section 19.2.3.2.5 along with related annex paragraphs; and revised paragraphs 10.3.2(3), 19.2.3.2.6, and 19.2.3.2.7.	

Statement of Problem and Substantiation for Public Input

Historically the ceiling sprinkler system designs indicated in Table 19.2.3.1.1 have applied to buildings of any ceiling height. Full-scale fire tests involving storage occupancies have demonstrated that ceiling heights can impact not only the ceiling sprinkler system designs, but also the allowable ceiling sprinklers to be used. When ceiling heights and clearances between the top of storage and the ceiling

increase, so does the fire hazard, thus resulting in the need for increased flow and pressure from the ceiling sprinklers. The increase in fire hazard can also render some types of sprinklers ineffective due to either their limited droplet sizes or their ability to respond to a fire in a timely manner.

Test data obtained from three separate public sources has suggested that this same affect can impact the sprinkler protection used for occupancies that are not considered storage. Test data that was publicly available simulated occupancy hazards applicable to both Ordinary Hazard Group 1 as well as Occupancy Hazard Group 2 with ceiling heights over 30 ft (9.1 m) and up to a maximum ceiling height of 60 ft (18.3 m). The results of these tests suggest that the design densities and design areas indicated in Table 19.2.3.1.1 for Ordinary and Extra Hazard occupancies may not be effective and should be increased for ceiling heights over 30 ft (9.1 m).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 318-NFPA 13-2022 [Section No. 19.2.3.2.6]	A proposed revision to 19.2.3.2.6 to avoid an operating area reduction for high-temperature sprinklers when ceilings are over 30 ft. and to align with a proposed new section 19.2.3.2.5.
Public Input No. 319-NFPA 13-2022 [Section No. 19.2.3.2.7]	A proposed revision to 19.2.3.2.7 to avoid an operating area reduction for K11.2 (160) or larger sprinklers in EH1 or EH2 occupancies where ceilings are over 30 ft. and to align with a proposed new section 19.2.3.2.5.
Public Input No. 320-NFPA 13-2022 [Section No. 10.3.2 [Excluding any Sub-Sections]]	A proposed revision to 10.3.2(3) to avoid sidewall sprinklers in ordinary hazard areas where ceilings are over 30 ft. and to align with a proposed new section 19.2.3.2.5.
Public Input No. 321-NFPA 13-2022 [New Section after A.19.2.3.1.5.2(10)]	Proposed new annex sections related to the proposed new 19.2.3.2.5.
Public Input No. 322-NFPA 13-2022 [New Section after C.26]	A proposed new section C.27 to capture fire test data related to the high ceiling guidance proposed in the new 19.2.3.2.5.
Public Input No. 318-NFPA 13-2022 [Section No. 19.2.3.2.6]	
Public Input No. 319-NFPA 13-2022 [Section No. 19.2.3.2.7]	
Public Input No. 320-NFPA 13-2022 [Section No. 10.3.2 [Excluding any Sub-Sections]]	
Public Input No. 321-NFPA 13-2022 [New Section after A.19.2.3.1.5.2(10)]	
Public Input No. 322-NFPA 13-2022 [New Section after C.26]	

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Committee: AUT-SSD

19.2.3.2.5* Ceiling Heights Over 30 ft (9.1 m). Where sprinklers are installed in areas with ceiling heights that are greater than 30 ft (9.1 m) but do not exceed 60 ft (18.3 m) above the finished floor, the requirements from 19.2 shall apply except as modified in 19.2.3.2.5 and summarized in Table 19.2.3.2.5.

Table 19.2.3.2.5 Summary of Requirements for Ceiling Heights Over 30 ft (9.1 m)

Ceiling height ft (m)	Occupancy hazard	Sprinkler coverage	Nominal Sprinkler K-factor US (metric)	Sprinkler response	Sprinkler orientation	Minimum sprinkler density gpm/ft^2 (mm/min)	Increase to design area obtained from Table 19.2.3.1.1
Over 30 and up to 40 (Over 9.1 and up to 12.2)	OH1	Standard or extended	Minimum 5.6 (80)	SR or QR	Upright or pendent	Per Table 19.2.3.1.1	30% increase
	OH2	Standard	Minimum 11.2 (160)	SR or QR	Upright or pendent	0.37 (15.1)	None
		Extended	11.2 (160) or 14.0 (200)	SR or QR	Upright	0.37 (15.1)	None
			Minimum 25.2 (360)	SR or QR	Upright or Pendent	0.37 (15.1)	None
	EH1 & EH2	Standard	Minimum 16.8 (240)	SR	Upright or pendent	0.45 (18.3)	None
		Extended	Minimum 25.2 (360)	SR	Upright or pendent	0.45 (18.3)	None
Over 40 and up to 60 (Over 12.2 and up to 18.3)	OH1	Standard or extended	Minimum 5.6 (80)	SR or QR	Upright or pendent	Per Table 19.2.3.1.1	30% increase
	OH2	Standard	Minimum11.2 (160)	QR	Upright or Pendent	0.45 (18.3)	30% increase
		Extended	11.2 (160) or 14.0 (200)	SR or QR	Upright	0.45 (18.3)	30% increase
			Minimum 25.2 (360)	SR or QR	Upright or Pendent	0.45 (18.3)	None
	EH1 & EH2	Standard	Minimum 16.8 (240)	SR	Upright or Pendent	0.45 (18.3)	None
		Extended	Minimum 25.2 (360)	SR	Upright or Pendent	0.45 (18.3)	None

A.19.2.3.2.5 Full-scale fire testing has demonstrated that the protection needed for Ordinary Hazard Group 1 and Group 2 occupancies is greater than the protection indicated in Table 19.2.3.1.1. See Table C.27 for fire test data specific to Ordinary Hazard Group 1 and Group 2 type occupancies where the ceiling heights exceed 30 ft (9.1 m).

C.27 [19.2.3.2.5] Publicly available full-scale fire testing for simulated Ordinary Hazard Group 1 and Group 2 type occupancies were used to establish the requirements of Section 19.2.3.2.5 and are available in the following three separate documents:

(1) Nam, Soonil; Antonio Braga; Hsiang-Cheng Kung; and Joan M. A. Troup. "Fire Protection for Non-Storage Occupancies with High Ceiling Clearances". Fire Safety Science – Proceedings of the 7th International Symposium, International Association for Fire Safety Science, 2002, pp. 493-504. Web. Web accessed 20220425. www.iafss.org/publications/fss/7/493/view/fss_7-493.pdf
(2) Nam, S. "Fire Protection at High Ceiling Clearance Facilities". International Association for Fire Safety Science. 2007. Web. Web accessed 20220425. www.iafss.org/publications/aofst/7/84/view/aofst_7-84.pdf
(3) Thomas, Peter. "Sprinkler Protection of Non-storage Occupancies with High Ceiling Clearance". Suppression-Detection Conference, NFPA Fire Protection Research Foundation, 2014. Web. Web accessed 20220425. https://www.nfpa.org/-/media/Files/News-and-Research/Resources/Research-Foundation/Symposia/2014-supdet/2014-papers/SUPDET2014Thomas.ashx?la=en

Table C.27 summarizes selected data from these reports.

Table C.27 Full-Scale Test Data for High Ceilings over Non-Storage Occupancies

Test No.	Test Sponsored By	Research Report Date and Test Number	Test Commodity	Storage Height ft (m)	Aisle Width Between Main and Target Arrays ft (m)	Occupancy Hazard Classification	Ceiling Height ft (m)	Sprinkler K-Factor	Sprinkler Temperature Rating °F (°C)	Sprinkler RTI Rating	Sprinkler Orientation	Sprinkler Spacing ft (m)	Sprinkler Density gpm/ft² (mm/min)	Ignition Location	No. of Operating Sprinklers	Test Results
1	FM Global	2002 Test 2 and 2007 Test 1	Class II	~ 8 (2.3)	DNA	OH 1	58 (17.7)	K5.6 (K80)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.15 (6)	Under 1 Sprinkler	17	P
2	FM Global	2002 Test 1 and 2007 Test 2	Class II	~ 8 (2.3)	DNA	OH 1	58 (17.7)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	15	P
3	FM Global	2007 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	OH 2	60 (18.3)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	20	F
4	FM Global	2007 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	OH 2	60 (18.3)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Under 1 Sprinkler	19	F
5	FM Global	2002 Test 3 and 2007 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	58 (17.7)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	26	F
6	FM Global	2002 Test 4 and 2007 Test 6	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K11.2 (K160)	155 (68)	Quick-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Under 1 Sprinkler	16	P
7	FM Global	2007 Test 7	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K11.2 (K160)	155 (68)	Quick-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Among 4 Sprinklers	13	P
8	FM Global	2002 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K25.2EC (K360EC)	165 (74)	Quick-Response	Upright	20 x 20 (6.1 x 6.1)	0.45 (18)	Under 1 Sprinkler	1	P
9	Victaulic Sprinkler	2014 Test 1	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	40 (12)	K8.0 (K115)	155 (68)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	0.37 (15)	Under 1 Sprinkler	12	F
10	Victaulic Sprinkler	2014 Test 2	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	52 (16)	K8.0 (K115)	155 (68)	Quick-Response	Pendent	10 x 10 (3.0 x 3.0)	0.50 (20)	Under 1 Sprinkler	3	F
11	Victaulic Sprinkler	2014 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	52 (16)	K11.2 (K160)	165 (74)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	0.58 (23)	Under 1 Sprinkler	1	F
12	Victaulic Sprinkler	2014 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18)	K25.2 (K360)	160 (71)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	1.00 (40)	Under 1 Sprinkler	1	F
13	Victaulic Sprinkler	2014 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18)	K25.2 (K360)	160 (71)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	1.00 (40)	Among 4 Sprinklers	3	P

19.2.3.2.5.1 Sprinklers for Ceiling Heights Over 30 ft (9.1 m)

19.2.3.2.5.1.1 Sidewall sprinklers shall not be permitted for use in Ordinary Hazard Group 1 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.1 The full-scale fire testing applicable to the requirements of this section did not include the use of sidewall sprinklers. As a result, sidewall sprinklers are not currently allowed for the protection of Ordinary Hazard Group 1 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.2 Sprinklers having a nominal K-factor less than K-11.2 (K-160) shall not be permitted for use in Ordinary Hazard Group 2 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.2 The full-scale fire testing applicable to the requirements of this section demonstrated that sprinklers with a K-factor of K-8.0 (K-115) were not effective in providing fire control for a simulated Ordinary Hazard Group 2 occupancy with the ceiling height greater than 30 ft (9.1 m), whereas sprinklers with a minimum K-factor of K-11.2 (K-160) were effective at providing fire control. As a result, sprinklers with a K-factor less than K-11.2 (K-160) are not currently allowed for the protection of Ordinary Hazard Group 2 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.3 Extended-coverage pendent sprinklers having a nominal K-factor of K-22.4 (K-320) or less shall not be permitted for use in Ordinary Hazard Group 2 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.3 The full-scale fire testing applicable to the requirements of this section did not include the use of extended-coverage sprinklers with a K-factor of less than K-25.2 (K-360). Testing at FM Global, however has demonstrated that upright extended-coverage sprinklers with a K-factor of K-11.2 (K-160) and K-14.0 (K-200) can be effective for Ordinary Hazard Group 1 and 2 occupancies where the ceiling height is greater than 30 ft (9.1 m), whereas the testing at FM Global did not demonstrate this for the pendent version of these extended-coverage sprinklers. As a result, pendent extended-coverage sprinklers with K-factors of K-22.4 or less are not currently allowed for the protection of Ordinary Hazard Group 2 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.4 Standard-response standard-coverage sprinklers shall not be permitted for use in Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft (12.2 m).

A.19.2.3.2.5.1.4 The full-scale fire testing applicable to the requirements of this section demonstrated that for standard-coverage sprinklers, the use of quick-response sprinklers provided an acceptable level of fire control for simulated Ordinary Hazard Group 2 occupancy hazards. As a result, quick-response standard-coverage sprinklers with K-factors of K-11.2 (K-160) or greater are required for the protection of Ordinary Hazard Group 2 occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.2 Sprinkler Designs for Ceiling Heights Over 30 ft (9.1 m)

19.2.3.2.5.2.1* For Ordinary Hazard Group 1 occupancies where the ceiling height is greater than 30 ft (9.1 m) but does not exceed 60 ft (18.3 m), the design areas obtained from Table 19.2.3.1.1 shall be increased by 30 percent.

A.19.2.3.2.5.2.1 The results of Test Nos. 1 and 2 listed in Table C.27 demonstrate that standard-response K-5.6 (K-80) and K-8.0 (K-115) sprinklers can provide fire control for a simulated Ordinary Hazard Group 1 storage array under a 58 ft. (17.7 m) high ceiling using a 0.15 gpm/ft² (6.1 mm/min) density. However, the number of sprinklers that operated resulted in a design area larger than that specified in Table 19.2.3.1.1 coupled with significant sprinkler skipping for both tests. As a result, the design areas in Table 19.2.3.1.1 are being increased, while maintaining the same design density, to account for the test results.

19.2.3.2.5.2.2* For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 30 ft. (9.1 m) but does not exceed 40 ft. (12.2 m), the ceiling sprinkler system shall use a minimum density of 0.37 gpm/ft² (15.1 mm/min) in combination with the design area obtained from Table 19.2.3.1.1.

A.19.2.3.2.5.2.2 The results of Test No. 9 listed in Table C.27 demonstrated that standard-response K-8.0 (K-115) sprinklers can provide fire control for a simulated Ordinary Hazard Group 2 storage array under a 40 ft (12.2 m) high ceiling using a 0.37 gpm/ft² (15.1 mm/min) density. However, with 12 sprinklers operating during this test, it demonstrated that a density of 0.37 gpm/ft² (15.1 mm/min) is more applicable than the density of 0.20 gpm/ft² (8.1 mm/min) that is provided in Table 19.2.3.1.1 and therefore has been given as the design density for this ceiling height. In addition, the results from Test Nos. 6, 7, and 11 listed in Table C.27 suggest that the use of a K-11.2 (K-160) sprinkler will provide better fire control, as suggested by the requirements given in 21.1.4, even though this is not a storage occupancy.

19.2.3.2.5.2.3* For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft. (12.2 m) but does not exceed 60 ft. (18.3 m), the ceiling sprinkler system shall:

(1) Use a minimum density of 0.45 gpm/ft² (18.3 mm/min), and

(2) Increase the design areas obtained from Table 19.2.3.1.1 by 30 percent

(3) The design areas from Table 19.2.3.1.1 shall be permitted, without a 30 percent increase, where an extended-coverage sprinkler having a minimum nominal K-factor of K-25.2 (K-360) is used

A.19.2.3.2.5.2.3 The results of Test Nos. 6 and 7 listed in Table C.27 demonstrated that quick-response K-11.2 (K-160) sprinklers can provide fire control for a simulated Ordinary Hazard Group 2 storage array under a 60 ft (18.3 m) high ceiling using a 0.45 gpm/ft² (18.3 mm/min) density. However, with 13 and 16 sprinklers operating during these two tests, it demonstrated that a density of 0.45 gpm/ft² (18.3 mm/min) is more applicable than the density of 0.20 gpm/ft² (8.1 mm/min) that is provided in Table 19.2.3.1.1 coupled with a design area greater than the 1,500 ft² (140 m²) given in Table 19.2.3.1.1. As a result, the original design density of 0.20 gpm/ft² (8.1 mm/min) has been increased to 0.45 gpm/ft² (18.3 mm/min) and the design area of 1,500 ft² (140 m²) has been increased by 30 percent. The 30 percent increase to the design area, however, was not applied to the K-25.2 (K-360) extended-coverage sprinkler due to the very positive results (only 1 sprinkler operated) obtained with it during Test 8 listed in Table C.27.

19.2.3.2.5.2.4* For Extra Hazard Groups 1 and 2 occupancies where the ceiling height is greater than 30 ft (9.1 m) but does not exceed 60 ft. (18.3 m), the ceiling sprinkler system shall use a minimum density of 0.45 gpm/ft² (18.3 mm/min) in combination with the design areas obtained from Table 19.2.3.1.1.

A.19.2.3.2.5.2.4 The test data listed in Table C.27 does not include any tests representing simulated occupancy hazards for either Extra Hazard Group 1 or Extra Hazard Group 2. However, based on the results from the test data listed in Table C.27, the minimum design density requirements of 0.30 gpm/ft² (12.2 mm/min) for Extra Hazard Group 1, and 0.40 gpm/ft² (16.3 mm/min) for Extra Hazard Group 2 are both now less than the 0.45 gpm/ft² (18.3 mm/min) design density required for Ordinary Hazard Group 2. Therefore, the minimum design density for both Extra Hazard Group 1 and Extra Hazard Group 2 has been increased to 0.45 gpm/ft² (18.3 mm/min), while maintaining the same required design area.

Revise the following existing paragraphs

10.3.2(3) In ordinary hazard occupancies with smooth, flat ceilings <u>not exceeding 30 ft (9.1 m) in height</u>, where specifically listed for such use.

19.2.3.2.6 High-Temperature Sprinklers. <u>For ceilings not exceeding 30 ft. (9.1 m) in height</u> where high-temperature sprinklers are used for extra hazard occupancies, the area of sprinkler operation shall be permitted to be reduced by 25 percent without revising the density, but not to less than 2000 ft² (185 m²).

19.2.3.2.7 <u>For ceilings not exceeding 30 ft. (9.1 m) in height</u> where K-11.2 (160) or larger sprinklers are used with Extra Hazard Group 1 or Extra Hazard Group 2 design curves and 19.2.3.1.1, the design area shall be permitted to be reduced by 25 percent but not below 2000 ft² (185 m²), regardless of temperature rating.

Substantiation:

Historically the ceiling sprinkler system designs indicated in Table 19.2.3.1.1 have applied to buildings of any ceiling height. Full-scale fire tests involving storage occupancies have demonstrated that ceiling heights can impact not only the ceiling sprinkler system designs, but also the allowable ceiling sprinklers to be used. When ceiling heights and clearances between the top of storage and the ceiling increase, so does the fire hazard, thus resulting in the need for increased flow and pressure from the ceiling sprinklers. The increase in fire hazard can also render some types of sprinklers ineffective due to either their limited droplet sizes or their ability to respond to a fire in a timely manner.

Test data obtained from three separate public sources has suggested that this same affect can impact the sprinkler protection used for occupancies that are not considered storage. Test data that was publicly available simulated occupancy hazards applicable to both Ordinary Hazard Group 1 as well as Occupancy Hazard Group 2 with ceiling heights over 30 ft (9.1 m) and up to a maximum ceiling height of 60 ft (18.3 m). The results of these tests suggest that the design densities and design areas indicated in Table 19.2.3.1.1 for Ordinary and Extra Hazard occupancies may not be effective and should be increased for ceiling heights over 30 ft (9.1 m).

Public Input No. 189-NFPA 13-2022 [Section No. 19.2.3.2.4]

19.2.3.2.4 Sloped Ceilings.

The system area of operation shall be increased by 30 percent without revising the density when the following types of sprinklers are used on sloped ceilings ~~with a pitch exceeding 1~~ in ~~6 (a rise of 2 units in a run of 12 units, a roof slope of 16.7 percent) in~~ nonstorage applications:

(1) Spray sprinklers, including extended coverage sprinklers listed in accordance with 11.2.1(4), and quick-response sprinklers

(2) CMSA sprinklers

Statement of Problem and Substantiation for Public Input

All sloped ceilings exceed 1 in 6 (2 in 12) by definition. The deleted language was redundant.

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Public Input No. 491-NFPA 13-2022 [Section No. 19.2.3.2.4]

19.2.3.2.4 Sloped Ceilings.

~~The system area of operation shall be increased by 30 percent without revising the density when the following types of sprinklers are used on sloped ceilings with a pitch exceeding 1 in 6 (a rise of 2 units in a run of 12 units, a roof slope of 16.7 percent) in nonstorage applications:~~

(1) ~~Spray sprinklers, including extended coverage sprinklers listed in accordance with 11.2.1(4) , and quick-response sprinklers~~

(2) ~~CMSA sprinklers~~

Where spray sprinklers, including extended-coverage and quick-response sprinklers, are installed under a ceiling/roof deck with a slope that exceeds 2 in 12, one of the following requirements shall be implemented:

(1) A horizontal false ceiling capable of withstanding an uplift force of 3 lb./ft² (14.6 kg/m²) is installed below the sloped ceiling and supplemented with ceiling sprinklers.

(2) The design area for the ceiling sprinkler system is increased by 30 percent for unobstructed construction.

(3) The design area for the ceiling sprinkler system is increased by 30% for obstructed construction where the slope exceeds 4 in 12.

Statement of Problem and Substantiation for Public Input

This section has been revised to

1) Account for the potential installation of a false ceiling to address the presence of excessive ceiling slope.

2) Remove the reference to CMSA sprinklers as there is no current path for CMSA sprinklers to be installed over an occupancy that is based on the Density/Area Method, which is the header for this section.

3) Only require the 30% increase for situations where the FPRF project showed that an increase in the ceiling sprinkler design area is appropriate.

This material was developed by the Sloped Ceiling Task Group, which was formed by the Technical Committee on Sprinkler Systems Discharge Criteria to incorporate the results of the FPRF Project on Sprinklers Under Sloped Ceilings into NFPA 13. The Task Group consisted of Ken Isman (Chair), Wes Baker, Chase Browning, Mike Joanis, Larry Frank, Joe Noble, and Abram Selim Fouad. Unfortunately, while the concept was agreed to by most of the task group members, the exact language was selected by the chair in order to meet the NFPA deadline for the submission of Public Inputs and was not reviewed by the entire task group.

This material was developed by the Sloped Ceiling Task Group, which was formed by the Technical Committee on Sprinkler Systems Discharge Criteria to incorporate the results of the FPRF Project on Sprinklers Under Sloped Ceilings into NFPA 13. The Task Group consisted of Ken Isman (Chair), Wes Baker, Chase Browning, Mike Joanis, Larry Frank, Joe Noble, and Abram Selim Fouad.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 476-NFPA 13-2022 [Section No. 10.2.6.1.2]	Location of the SSP-SSU sprinklers to make this discharge criteria work.
Public Input No. 482-NFPA 13-2022 [Section No. 11.2.4.1.2]	Location of the EC sprinklers to make this discharge criteria work
Public Input No. 494-NFPA 13-2022 [Section No. 28.2.4.2]	

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Public Input No. 318-NFPA 13-2022 [Section No. 19.2.3.2.6]

19.2.3.2.6 High-Temperature Sprinklers.

~~Where high~~ For ceilings not exceeding 30 ft. (9.1 m) in height where high -temperature sprinklers are used for extra hazard occupancies, the area of sprinkler operation shall be permitted to be reduced by 25 percent without revising the density, but not to less than 2000 ft^2 (185 m^2).

Additional Proposed Changes

File Name	Description	Approved
Clean_Copy_of_High_Ceiling_Clearance_Draft_Proposed_Language_WCB_13-May-2022_Rev_B.docx	Word file containing the work of the High Clearance Task Group that developed a new section 19.2.3.2.5 along with related annex paragraphs; and revised paragraphs 10.3.2(3), 19.2.3.2.6, and 19.2.3.2.7.	

Statement of Problem and Substantiation for Public Input

This relates to a new section 19.2.3.2.5.

Historically the ceiling sprinkler system designs indicated in Table 19.2.3.1.1 have applied to buildings of any ceiling height. Full-scale fire tests involving storage occupancies have demonstrated that ceiling heights can impact not only the ceiling sprinkler system designs, but also the allowable ceiling sprinklers to be used. When ceiling heights and clearances between the top of storage and the ceiling increase, so does the fire hazard, thus resulting in the need for increased flow and pressure from the ceiling sprinklers. The increase in fire hazard can also render some types of sprinklers ineffective due to either their limited droplet sizes or their ability to respond to a fire in a timely manner.

Test data obtained from three separate public sources has suggested that this same affect can impact the sprinkler protection used for occupancies that are not considered storage. Test data that was publicly available simulated occupancy hazards applicable to both Ordinary Hazard Group 1 as well as Occupancy Hazard Group 2 with ceiling heights over 30 ft (9.1 m) and up to a maximum ceiling height of 60 ft (18.3 m). The results of these tests suggest that the design densities and design areas indicated in Table 19.2.3.1.1 for Ordinary and Extra Hazard occupancies may not be effective and should be increased for ceiling heights over 30 ft (9.1 m).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 317-NFPA 13-2022 [New Section after 19.2.3.2.4]	A proposed new section 19.2.3.2.5 with guidance for ceilings over 30 ft.
Public Input No. 319-NFPA 13-2022 [Section No. 19.2.3.2.7]	A proposed revision to 19.2.3.2.7 to avoid an operating area reduction for K11.2 (160) or larger sprinklers in EH1 or EH2 occupancies where ceilings are over 30 ft. and to align with a proposed new section 19.2.3.2.5.
Public Input No. 320-NFPA 13-2022 [Section No. 10.3.2 [Excluding any Sub-Sections]]	A proposed revision to 10.3.2(3) to avoid sidewall sprinklers in ordinary hazard areas where ceilings are over 30 ft. and to align with a proposed new section 19.2.3.2.5.
Public Input No. 321-NFPA 13-2022 [New Section after A.19.2.3.1.5.2(10)]	Proposed new annex sections related to the proposed new 19.2.3.2.5.
Public Input No. 322-NFPA 13-2022 [New Section after C.26]	A proposed new section C.27 to capture fire test data related to the high ceiling guidance proposed in the new 19.2.3.2.5.
Public Input No. 317-NFPA 13-2022 [New Section after 19.2.3.2.4]	
Public Input No. 319-NFPA 13-2022 [Section No. 19.2.3.2.7]	
Public Input No. 320-NFPA 13-2022 [Section No. 10.3.2 [Excluding any Sub-Sections]]	
Public Input No. 321-NFPA 13-2022 [New Section after A.19.2.3.1.5.2(10)]	
Public Input No. 322-NFPA 13-2022 [New Section after C.26]	

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19.2.3.2.5* Ceiling Heights Over 30 ft (9.1 m). Where sprinklers are installed in areas with ceiling heights that are greater than 30 ft (9.1 m) but do not exceed 60 ft (18.3 m) above the finished floor, the requirements from 19.2 shall apply except as modified in 19.2.3.2.5 and summarized in Table 19.2.3.2.5.

Table 19.2.3.2.5 Summary of Requirements for Ceiling Heights Over 30 ft (9.1 m)

Ceiling height ft (m)	Occupancy hazard	Sprinkler coverage	Nominal Sprinkler K-factor US (metric)	Sprinkler response	Sprinkler orientation	Minimum sprinkler density gpm/ft^2 (mm/min)	Increase to design area obtained from Table 19.2.3.1.1
Over 30 and up to 40 (Over 9.1 and up to 12.2)	OH1	Standard or extended	Minimum 5.6 (80)	SR or QR	Upright or pendent	Per Table 19.2.3.1.1	30% increase
	OH2	Standard	Minimum 11.2 (160)	SR or QR	Upright or pendent	0.37 (15.1)	None
		Extended	11.2 (160) or 14.0 (200)	SR or QR	Upright	0.37 (15.1)	None
			Minimum 25.2 (360)	SR or QR	Upright or Pendent	0.37 (15.1)	None
	EH1 & EH2	Standard	Minimum 16.8 (240)	SR	Upright or pendent	0.45 (18.3)	None
		Extended	Minimum 25.2 (360)	SR	Upright or pendent	0.45 (18.3)	None
Over 40 and up to 60 (Over 12.2 and up to 18.3)	OH1	Standard or extended	Minimum 5.6 (80)	SR or QR	Upright or pendent	Per Table 19.2.3.1.1	30% increase
	OH2	Standard	Minimum11.2 (160)	QR	Upright or Pendent	0.45 (18.3)	30% increase
		Extended	11.2 (160) or 14.0 (200)	SR or QR	Upright	0.45 (18.3)	30% increase
			Minimum 25.2 (360)	SR or QR	Upright or Pendent	0.45 (18.3)	None
	EH1 & EH2	Standard	Minimum 16.8 (240)	SR	Upright or Pendent	0.45 (18.3)	None
		Extended	Minimum 25.2 (360)	SR	Upright or Pendent	0.45 (18.3)	None

A.19.2.3.2.5 Full-scale fire testing has demonstrated that the protection needed for Ordinary Hazard Group 1 and Group 2 occupancies is greater than the protection indicated in Table 19.2.3.1.1. See Table C.27 for fire test data specific to Ordinary Hazard Group 1 and Group 2 type occupancies where the ceiling heights exceed 30 ft (9.1 m).

C.27 [19.2.3.2.5] Publicly available full-scale fire testing for simulated Ordinary Hazard Group 1 and Group 2 type occupancies were used to establish the requirements of Section 19.2.3.2.5 and are available in the following three separate documents:

(1) Nam, Soonil; Antonio Braga; Hsiang-Cheng Kung; and Joan M. A. Troup. "Fire Protection for Non-Storage Occupancies with High Ceiling Clearances". Fire Safety Science – Proceedings of the 7th International Symposium, International Association for Fire Safety Science, 2002, pp. 493-504. Web. Web accessed 20220425. www.iafss.org/publications/fss/7/493/view/fss_7-493.pdf
(2) Nam, S. "Fire Protection at High Ceiling Clearance Facilities". International Association for Fire Safety Science. 2007. Web. Web accessed 20220425. www.iafss.org/publications/aofst/7/84/view/aofst_7-84.pdf
(3) Thomas, Peter. "Sprinkler Protection of Non-storage Occupancies with High Ceiling Clearance". Suppression-Detection Conference, NFPA Fire Protection Research Foundation, 2014. Web. Web accessed 20220425. https://www.nfpa.org/-/media/Files/News-and-Research/Resources/Research-Foundation/Symposia/2014-supdet/2014-papers/SUPDET2014Thomas.ashx?la=en

Table C.27 summarizes selected data from these reports.

Table C.27 Full-Scale Test Data for High Ceilings over Non-Storage Occupancies

Test No.	Test Sponsored By	Research Report Date and Test Number	Test Commodity	Storage Height ft (m)	Aisle Width Between Main and Target Arrays ft (m)	Occupancy Hazard Classification	Ceiling Height ft (m)	Sprinkler K-Factor	Sprinkler Temperature Rating °F (°C)	Sprinkler RTI Rating	Sprinkler Orientation	Sprinkler Spacing ft (m)	Sprinkler Density gpm/ft² (mm/min)	Ignition Location	No. of Operating Sprinklers	Test Results
1	FM Global	2002 Test 2 and 2007 Test 1	Class II	~ 8 (2.3)	DNA	OH 1	58 (17.7)	K5.6 (K80)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.15 (6)	Under 1 Sprinkler	17	P
2	FM Global	2002 Test 1 and 2007 Test 2	Class II	~ 8 (2.3)	DNA	OH 1	58 (17.7)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	15	P
3	FM Global	2007 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	OH 2	60 (18.3)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	20	F
4	FM Global	2007 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	OH 2	60 (18.3)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Under 1 Sprinkler	19	F
5	FM Global	2002 Test 3 and 2007 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	58 (17.7)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	26	F
6	FM Global	2002 Test 4 and 2007 Test 6	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K11.2 (K160)	155 (68)	Quick-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Under 1 Sprinkler	16	P
7	FM Global	2007 Test 7	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K11.2 (K160)	155 (68)	Quick-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Among 4 Sprinklers	13	P
8	FM Global	2002 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K25.2EC (K360EC)	165 (74)	Quick-Response	Upright	20 x 20 (6.1 x 6.1)	0.45 (18)	Under 1 Sprinkler	1	P
9	Victaulic Sprinkler	2014 Test 1	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	40 (12)	K8.0 (K115)	155 (68)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	0.37 (15)	Under 1 Sprinkler	12	F
10	Victaulic Sprinkler	2014 Test 2	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	52 (16)	K8.0 (K115)	155 (68)	Quick-Response	Pendent	10 x 10 (3.0 x 3.0)	0.50 (20)	Under 1 Sprinkler	3	F
11	Victaulic Sprinkler	2014 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	52 (16)	K11.2 (K160)	165 (74)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	0.58 (23)	Under 1 Sprinkler	1	F
12	Victaulic Sprinkler	2014 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18)	K25.2 (K360)	160 (71)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	1.00 (40)	Under 1 Sprinkler	1	F
13	Victaulic Sprinkler	2014 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18)	K25.2 (K360)	160 (71)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	1.00 (40)	Among 4 Sprinklers	3	P

19.2.3.2.5.1 Sprinklers for Ceiling Heights Over 30 ft (9.1 m)

19.2.3.2.5.1.1 Sidewall sprinklers shall not be permitted for use in Ordinary Hazard Group 1 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.1 The full-scale fire testing applicable to the requirements of this section did not include the use of sidewall sprinklers. As a result, sidewall sprinklers are not currently allowed for the protection of Ordinary Hazard Group 1 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.2 Sprinklers having a nominal K-factor less than K-11.2 (K-160) shall not be permitted for use in Ordinary Hazard Group 2 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.2 The full-scale fire testing applicable to the requirements of this section demonstrated that sprinklers with a K-factor of K-8.0 (K-115) were not effective in providing fire control for a simulated Ordinary Hazard Group 2 occupancy with the ceiling height greater than 30 ft (9.1 m), whereas sprinklers with a minimum K-factor of K-11.2 (K-160) were effective at providing fire control. As a result, sprinklers with a K-factor less than K-11.2 (K-160) are not currently allowed for the protection of Ordinary Hazard Group 2 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.3 Extended-coverage pendent sprinklers having a nominal K-factor of K-22.4 (K-320) or less shall not be permitted for use in Ordinary Hazard Group 2 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.3 The full-scale fire testing applicable to the requirements of this section did not include the use of extended-coverage sprinklers with a K-factor of less than K-25.2 (K-360). Testing at FM Global, however has demonstrated that upright extended-coverage sprinklers with a K-factor of K-11.2 (K-160) and K-14.0 (K-200) can be effective for Ordinary Hazard Group 1 and 2 occupancies where the ceiling height is greater than 30 ft (9.1 m), whereas the testing at FM Global did not demonstrate this for the pendent version of these extended-coverage sprinklers. As a result, pendent extended-coverage sprinklers with K-factors of K-22.4 or less are not currently allowed for the protection of Ordinary Hazard Group 2 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.4 Standard-response standard-coverage sprinklers shall not be permitted for use in Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft (12.2 m).

A.19.2.3.2.5.1.4 The full-scale fire testing applicable to the requirements of this section demonstrated that for standard-coverage sprinklers, the use of quick-response sprinklers provided an acceptable level of fire control for simulated Ordinary Hazard Group 2 occupancy hazards. As a result, quick-response standard-coverage sprinklers with K-factors of K-11.2 (K-160) or greater are required for the protection of Ordinary Hazard Group 2 occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.2 Sprinkler Designs for Ceiling Heights Over 30 ft (9.1 m)

19.2.3.2.5.2.1* For Ordinary Hazard Group 1 occupancies where the ceiling height is greater than 30 ft (9.1 m) but does not exceed 60 ft (18.3 m), the design areas obtained from Table 19.2.3.1.1 shall be increased by 30 percent.

A.19.2.3.2.5.2.1 The results of Test Nos. 1 and 2 listed in Table C.27 demonstrate that standard-response K-5.6 (K-80) and K-8.0 (K-115) sprinklers can provide fire control for a simulated Ordinary Hazard Group 1 storage array under a 58 ft. (17.7 m) high ceiling using a 0.15 gpm/ft² (6.1 mm/min) density. However, the number of sprinklers that operated resulted in a design area larger than that specified in Table 19.2.3.1.1 coupled with significant sprinkler skipping for both tests. As a result, the design areas in Table 19.2.3.1.1 are being increased, while maintaining the same design density, to account for the test results.

19.2.3.2.5.2.2* For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 30 ft. (9.1 m) but does not exceed 40 ft. (12.2 m), the ceiling sprinkler system shall use a minimum density of 0.37 gpm/ft² (15.1 mm/min) in combination with the design area obtained from Table 19.2.3.1.1.

A.19.2.3.2.5.2.2 The results of Test No. 9 listed in Table C.27 demonstrated that standard-response K-8.0 (K-115) sprinklers can provide fire control for a simulated Ordinary Hazard Group 2 storage array under a 40 ft (12.2 m) high ceiling using a 0.37 gpm/ft² (15.1 mm/min) density. However, with 12 sprinklers operating during this test, it demonstrated that a density of 0.37 gpm/ft² (15.1 mm/min) is more applicable than the density of 0.20 gpm/ft² (8.1 mm/min) that is provided in Table 19.2.3.1.1 and therefore has been given as the design density for this ceiling height. In addition, the results from Test Nos. 6, 7, and 11 listed in Table C.27 suggest that the use of a K-11.2 (K-160) sprinkler will provide better fire control, as suggested by the requirements given in 21.1.4, even though this is not a storage occupancy.

19.2.3.2.5.2.3* For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft. (12.2 m) but does not exceed 60 ft. (18.3 m), the ceiling sprinkler system shall:

(1) Use a minimum density of 0.45 gpm/ft² (18.3 mm/min), and

(2) Increase the design areas obtained from Table 19.2.3.1.1 by 30 percent

(3) The design areas from Table 19.2.3.1.1 shall be permitted, without a 30 percent increase, where an extended-coverage sprinkler having a minimum nominal K-factor of K-25.2 (K-360) is used

A.19.2.3.2.5.2.3 The results of Test Nos. 6 and 7 listed in Table C.27 demonstrated that quick-response K-11.2 (K-160) sprinklers can provide fire control for a simulated Ordinary Hazard Group 2 storage array under a 60 ft (18.3 m) high ceiling using a 0.45 gpm/ft² (18.3 mm/min) density. However, with 13 and 16 sprinklers operating during these two tests, it demonstrated that a density of 0.45 gpm/ft² (18.3 mm/min) is more applicable than the density of 0.20 gpm/ft² (8.1 mm/min) that is provided in Table 19.2.3.1.1 coupled with a design area greater than the 1,500 ft² (140 m²) given in Table 19.2.3.1.1. As a result, the original design density of 0.20 gpm/ft² (8.1 mm/min) has been increased to 0.45 gpm/ft² (18.3 mm/min) and the design area of 1,500 ft² (140 m²) has been increased by 30 percent. The 30 percent increase to the design area, however, was not applied to the K-25.2 (K-360) extended-coverage sprinkler due to the very positive results (only 1 sprinkler operated) obtained with it during Test 8 listed in Table C.27.

19.2.3.2.5.2.4* For Extra Hazard Groups 1 and 2 occupancies where the ceiling height is greater than 30 ft (9.1 m) but does not exceed 60 ft. (18.3 m), the ceiling sprinkler system shall use a minimum density of 0.45 gpm/ft² (18.3 mm/min) in combination with the design areas obtained from Table 19.2.3.1.1.

A.19.2.3.2.5.2.4 The test data listed in Table C.27 does not include any tests representing simulated occupancy hazards for either Extra Hazard Group 1 or Extra Hazard Group 2. However, based on the results from the test data listed in Table C.27, the minimum design density requirements of 0.30 gpm/ft² (12.2 mm/min) for Extra Hazard Group 1, and 0.40 gpm/ft² (16.3 mm/min) for Extra Hazard Group 2 are both now less than the 0.45 gpm/ft² (18.3 mm/min) design density required for Ordinary Hazard Group 2. Therefore, the minimum design density for both Extra Hazard Group 1 and Extra Hazard Group 2 has been increased to 0.45 gpm/ft² (18.3 mm/min), while maintaining the same required design area.

Revise the following existing paragraphs

10.3.2(3) In ordinary hazard occupancies with smooth, flat ceilings <u>not exceeding 30 ft (9.1 m) in height</u>, where specifically listed for such use.

19.2.3.2.6 High-Temperature Sprinklers. <u>For ceilings not exceeding 30 ft. (9.1 m) in height</u> where high-temperature sprinklers are used for extra hazard occupancies, the area of sprinkler operation shall be permitted to be reduced by 25 percent without revising the density, but not to less than 2000 ft² (185 m²).

19.2.3.2.7 <u>For ceilings not exceeding 30 ft. (9.1 m) in height</u> where K-11.2 (160) or larger sprinklers are used with Extra Hazard Group 1 or Extra Hazard Group 2 design curves and 19.2.3.1.1, the design area shall be permitted to be reduced by 25 percent but not below 2000 ft² (185 m²), regardless of temperature rating.

Substantiation:

Historically the ceiling sprinkler system designs indicated in Table 19.2.3.1.1 have applied to buildings of any ceiling height. Full-scale fire tests involving storage occupancies have demonstrated that ceiling heights can impact not only the ceiling sprinkler system designs, but also the allowable ceiling sprinklers to be used. When ceiling heights and clearances between the top of storage and the ceiling increase, so does the fire hazard, thus resulting in the need for increased flow and pressure from the ceiling sprinklers. The increase in fire hazard can also render some types of sprinklers ineffective due to either their limited droplet sizes or their ability to respond to a fire in a timely manner.

Test data obtained from three separate public sources has suggested that this same affect can impact the sprinkler protection used for occupancies that are not considered storage. Test data that was publicly available simulated occupancy hazards applicable to both Ordinary Hazard Group 1 as well as Occupancy Hazard Group 2 with ceiling heights over 30 ft (9.1 m) and up to a maximum ceiling height of 60 ft (18.3 m). The results of these tests suggest that the design densities and design areas indicated in Table 19.2.3.1.1 for Ordinary and Extra Hazard occupancies may not be effective and should be increased for ceiling heights over 30 ft (9.1 m).

Public Input No. 319-NFPA 13-2022 [Section No. 19.2.3.2.7]

19.2.3.2.7

~~Where~~ For ceilings not exceeding 30 ft. (9.1 m) in height where K-11.2 (160) or larger sprinklers are used with Extra Hazard Group 1 or Extra Hazard Group 2 design curves and 19.2.3.1.1, the design area shall be permitted to be reduced by 25 percent but not below 2000 ft^2 (185 m^2), regardless of temperature rating.

Additional Proposed Changes

File Name	Description	Approved
Clean_Copy_of_High_Ceiling_Clearance_Draft_Proposed_Language_WCB_13-May-2022_Rev_B.docx	Word file containing the work of the High Clearance Task Group that developed a new section 19.2.3.2.5 along with related annex paragraphs; and revised paragraphs 10.3.2(3), 19.2.3.2.6, and 19.2.3.2.7.	

Statement of Problem and Substantiation for Public Input

This relates to a new section 19.2.3.2.5.

Historically the ceiling sprinkler system designs indicated in Table 19.2.3.1.1 have applied to buildings of any ceiling height. Full-scale fire tests involving storage occupancies have demonstrated that ceiling heights can impact not only the ceiling sprinkler system designs, but also the allowable ceiling sprinklers to be used. When ceiling heights and clearances between the top of storage and the ceiling increase, so does the fire hazard, thus resulting in the need for increased flow and pressure from the ceiling sprinklers. The increase in fire hazard can also render some types of sprinklers ineffective due to either their limited droplet sizes or their ability to respond to a fire in a timely manner.

Test data obtained from three separate public sources has suggested that this same affect can impact the sprinkler protection used for occupancies that are not considered storage. Test data that was publicly available simulated occupancy hazards applicable to both Ordinary Hazard Group 1 as well as Occupancy Hazard Group 2 with ceiling heights over 30 ft (9.1 m) and up to a maximum ceiling height of 60 ft (18.3 m). The results of these tests suggest that the design densities and design areas indicated in Table 19.2.3.1.1 for Ordinary and Extra Hazard occupancies may not be effective and should be increased for ceiling heights over 30 ft (9.1 m).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 317-NFPA 13-2022 [New Section after 19.2.3.2.4]	A proposed new section 19.2.3.2.5 with guidance for ceilings over 30 ft.
Public Input No. 318-NFPA 13-2022 [Section No. 19.2.3.2.6]	A proposed revision to 19.2.3.2.6 to avoid an operating area reduction for high-temperature sprinklers when ceilings are over 30 ft. and to align with a proposed new section 19.2.3.2.5.
Public Input No. 320-NFPA 13-2022 [Section No. 10.3.2 [Excluding any Sub-Sections]]	A proposed revision to 10.3.2(3) to avoid sidewall sprinklers in ordinary hazard areas where ceilings are over 30 ft. and to align with a proposed new section 19.2.3.2.5.
Public Input No. 321-NFPA 13-2022 [New Section after A.19.2.3.1.5.2(10)]	Proposed new annex sections related to the proposed new 19.2.3.2.5.
Public Input No. 322-NFPA 13-2022 [New Section after C.26]	A proposed new section C.27 to capture fire test data related to the high ceiling guidance proposed in the new 19.2.3.2.5.
Public Input No. 317-NFPA 13-2022 [New Section after 19.2.3.2.4]	
Public Input No. 318-NFPA 13-2022 [Section No. 19.2.3.2.6]	
Public Input No. 320-NFPA 13-2022 [Section No. 10.3.2 [Excluding any Sub-Sections]]	
Public Input No. 321-NFPA 13-2022 [New Section after A.19.2.3.1.5.2(10)]	
Public Input No. 322-NFPA 13-2022 [New Section after C.26]	

Submitter Information Verification

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Committee: AUT-SSD

19.2.3.2.5* Ceiling Heights Over 30 ft (9.1 m). Where sprinklers are installed in areas with ceiling heights that are greater than 30 ft (9.1 m) but do not exceed 60 ft (18.3 m) above the finished floor, the requirements from 19.2 shall apply except as modified in 19.2.3.2.5 and summarized in Table 19.2.3.2.5.

Table 19.2.3.2.5 Summary of Requirements for Ceiling Heights Over 30 ft (9.1 m)

Ceiling height ft (m)	Occupancy hazard	Sprinkler coverage	Nominal Sprinkler K-factor US (metric)	Sprinkler response	Sprinkler orientation	Minimum sprinkler density gpm/ft^2 (mm/min)	Increase to design area obtained from Table 19.2.3.1.1
Over 30 and up to 40 (Over 9.1 and up to 12.2)	OH1	Standard or extended	Minimum 5.6 (80)	SR or QR	Upright or pendent	Per Table 19.2.3.1.1	30% increase
	OH2	Standard	Minimum 11.2 (160)	SR or QR	Upright or pendent	0.37 (15.1)	None
		Extended	11.2 (160) or 14.0 (200)	SR or QR	Upright	0.37 (15.1)	None
			Minimum 25.2 (360)	SR or QR	Upright or Pendent	0.37 (15.1)	None
	EH1 & EH2	Standard	Minimum 16.8 (240)	SR	Upright or pendent	0.45 (18.3)	None
		Extended	Minimum 25.2 (360)	SR	Upright or pendent	0.45 (18.3)	None
Over 40 and up to 60 (Over 12.2 and up to 18.3)	OH1	Standard or extended	Minimum 5.6 (80)	SR or QR	Upright or pendent	Per Table 19.2.3.1.1	30% increase
	OH2	Standard	Minimum11.2 (160)	QR	Upright or Pendent	0.45 (18.3)	30% increase
		Extended	11.2 (160) or 14.0 (200)	SR or QR	Upright	0.45 (18.3)	30% increase
			Minimum 25.2 (360)	SR or QR	Upright or Pendent	0.45 (18.3)	None
	EH1 & EH2	Standard	Minimum 16.8 (240)	SR	Upright or Pendent	0.45 (18.3)	None
		Extended	Minimum 25.2 (360)	SR	Upright or Pendent	0.45 (18.3)	None

A.19.2.3.2.5 Full-scale fire testing has demonstrated that the protection needed for Ordinary Hazard Group 1 and Group 2 occupancies is greater than the protection indicated in Table 19.2.3.1.1. See Table C.27 for fire test data specific to Ordinary Hazard Group 1 and Group 2 type occupancies where the ceiling heights exceed 30 ft (9.1 m).

C.27 [19.2.3.2.5] Publicly available full-scale fire testing for simulated Ordinary Hazard Group 1 and Group 2 type occupancies were used to establish the requirements of Section 19.2.3.2.5 and are available in the following three separate documents:

(1) Nam, Soonil; Antonio Braga; Hsiang-Cheng Kung; and Joan M. A. Troup. "Fire Protection for Non-Storage Occupancies with High Ceiling Clearances". Fire Safety Science – Proceedings of the 7th International Symposium, International Association for Fire Safety Science, 2002, pp. 493-504. Web. Web accessed 20220425. www.iafss.org/publications/fss/7/493/view/fss_7-493.pdf
(2) Nam, S. "Fire Protection at High Ceiling Clearance Facilities". International Association for Fire Safety Science. 2007. Web. Web accessed 20220425. www.iafss.org/publications/aofst/7/84/view/aofst_7-84.pdf
(3) Thomas, Peter. "Sprinkler Protection of Non-storage Occupancies with High Ceiling Clearance". Suppression-Detection Conference, NFPA Fire Protection Research Foundation, 2014. Web. Web accessed 20220425. https://www.nfpa.org/-/media/Files/News-and-Research/Resources/Research-Foundation/Symposia/2014-supdet/2014-papers/SUPDET2014Thomas.ashx?la=en

Table C.27 summarizes selected data from these reports.

Table C.27 Full-Scale Test Data for High Ceilings over Non-Storage Occupancies

Test No.	Test Sponsored By	Research Report Date and Test Number	Test Commodity	Storage Height ft (m)	Aisle Width Between Main and Target Arrays ft (m)	Occupancy Hazard Classification	Ceiling Height ft (m)	Sprinkler K-Factor	Sprinkler Temperature Rating °F (°C)	Sprinkler RTI Rating	Sprinkler Orientation	Sprinkler Spacing ft (m)	Sprinkler Density gpm/ft² (mm/min)	Ignition Location	No. of Operating Sprinklers	Test Results
1	FM Global	2002 Test 2 and 2007 Test 1	Class II	~ 8 (2.3)	DNA	OH 1	58 (17.7)	K5.6 (K80)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.15 (6)	Under 1 Sprinkler	17	P
2	FM Global	2002 Test 1 and 2007 Test 2	Class II	~ 8 (2.3)	DNA	OH 1	58 (17.7)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	15	P
3	FM Global	2007 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	OH 2	60 (18.3)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	20	F
4	FM Global	2007 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	OH 2	60 (18.3)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Under 1 Sprinkler	19	F
5	FM Global	2002 Test 3 and 2007 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	58 (17.7)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	26	F
6	FM Global	2002 Test 4 and 2007 Test 6	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K11.2 (K160)	155 (68)	Quick-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Under 1 Sprinkler	16	P
7	FM Global	2007 Test 7	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K11.2 (K160)	155 (68)	Quick-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Among 4 Sprinklers	13	P
8	FM Global	2002 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K25.2EC (K360EC)	165 (74)	Quick-Response	Upright	20 x 20 (6.1 x 6.1)	0.45 (18)	Under 1 Sprinkler	1	P
9	Victaulic Sprinkler	2014 Test 1	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	40 (12)	K8.0 (K115)	155 (68)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	0.37 (15)	Under 1 Sprinkler	12	F
10	Victaulic Sprinkler	2014 Test 2	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	52 (16)	K8.0 (K115)	155 (68)	Quick-Response	Pendent	10 x 10 (3.0 x 3.0)	0.50 (20)	Under 1 Sprinkler	3	F
11	Victaulic Sprinkler	2014 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	52 (16)	K11.2 (K160)	165 (74)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	0.58 (23)	Under 1 Sprinkler	1	F
12	Victaulic Sprinkler	2014 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18)	K25.2 (K360)	160 (71)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	1.00 (40)	Under 1 Sprinkler	1	F
13	Victaulic Sprinkler	2014 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18)	K25.2 (K360)	160 (71)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	1.00 (40)	Among 4 Sprinklers	3	P

19.2.3.2.5.1 Sprinklers for Ceiling Heights Over 30 ft (9.1 m)

19.2.3.2.5.1.1 Sidewall sprinklers shall not be permitted for use in Ordinary Hazard Group 1 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.1 The full-scale fire testing applicable to the requirements of this section did not include the use of sidewall sprinklers. As a result, sidewall sprinklers are not currently allowed for the protection of Ordinary Hazard Group 1 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.2 Sprinklers having a nominal K-factor less than K-11.2 (K-160) shall not be permitted for use in Ordinary Hazard Group 2 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.2 The full-scale fire testing applicable to the requirements of this section demonstrated that sprinklers with a K-factor of K-8.0 (K-115) were not effective in providing fire control for a simulated Ordinary Hazard Group 2 occupancy with the ceiling height greater than 30 ft (9.1 m), whereas sprinklers with a minimum K-factor of K-11.2 (K-160) were effective at providing fire control. As a result, sprinklers with a K-factor less than K-11.2 (K-160) are not currently allowed for the protection of Ordinary Hazard Group 2 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.3 Extended-coverage pendent sprinklers having a nominal K-factor of K-22.4 (K-320) or less shall not be permitted for use in Ordinary Hazard Group 2 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.3 The full-scale fire testing applicable to the requirements of this section did not include the use of extended-coverage sprinklers with a K-factor of less than K-25.2 (K-360). Testing at FM Global, however has demonstrated that upright extended-coverage sprinklers with a K-factor of K-11.2 (K-160) and K-14.0 (K-200) can be effective for Ordinary Hazard Group 1 and 2 occupancies where the ceiling height is greater than 30 ft (9.1 m), whereas the testing at FM Global did not demonstrate this for the pendent version of these extended-coverage sprinklers. As a result, pendent extended-coverage sprinklers with K-factors of K-22.4 or less are not currently allowed for the protection of Ordinary Hazard Group 2 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.4 Standard-response standard-coverage sprinklers shall not be permitted for use in Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft (12.2 m).

A.19.2.3.2.5.1.4 The full-scale fire testing applicable to the requirements of this section demonstrated that for standard-coverage sprinklers, the use of quick-response sprinklers provided an acceptable level of fire control for simulated Ordinary Hazard Group 2 occupancy hazards. As a result, quick-response standard-coverage sprinklers with K-factors of K-11.2 (K-160) or greater are required for the protection of Ordinary Hazard Group 2 occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.2 Sprinkler Designs for Ceiling Heights Over 30 ft (9.1 m)

19.2.3.2.5.2.1* For Ordinary Hazard Group 1 occupancies where the ceiling height is greater than 30 ft (9.1 m) but does not exceed 60 ft (18.3 m), the design areas obtained from Table 19.2.3.1.1 shall be increased by 30 percent.

A.19.2.3.2.5.2.1 The results of Test Nos. 1 and 2 listed in Table C.27 demonstrate that standard-response K-5.6 (K-80) and K-8.0 (K-115) sprinklers can provide fire control for a simulated Ordinary Hazard Group 1 storage array under a 58 ft. (17.7 m) high ceiling using a 0.15 gpm/ft² (6.1 mm/min) density. However, the number of sprinklers that operated resulted in a design area larger than that specified in Table 19.2.3.1.1 coupled with significant sprinkler skipping for both tests. As a result, the design areas in Table 19.2.3.1.1 are being increased, while maintaining the same design density, to account for the test results.

19.2.3.2.5.2.2* For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 30 ft. (9.1 m) but does not exceed 40 ft. (12.2 m), the ceiling sprinkler system shall use a minimum density of 0.37 gpm/ft² (15.1 mm/min) in combination with the design area obtained from Table 19.2.3.1.1.

A.19.2.3.2.5.2.2 The results of Test No. 9 listed in Table C.27 demonstrated that standard-response K-8.0 (K-115) sprinklers can provide fire control for a simulated Ordinary Hazard Group 2 storage array under a 40 ft (12.2 m) high ceiling using a 0.37 gpm/ft² (15.1 mm/min) density. However, with 12 sprinklers operating during this test, it demonstrated that a density of 0.37 gpm/ft² (15.1 mm/min) is more applicable than the density of 0.20 gpm/ft² (8.1 mm/min) that is provided in Table 19.2.3.1.1 and therefore has been given as the design density for this ceiling height. In addition, the results from Test Nos. 6, 7, and 11 listed in Table C.27 suggest that the use of a K-11.2 (K-160) sprinkler will provide better fire control, as suggested by the requirements given in 21.1.4, even though this is not a storage occupancy.

19.2.3.2.5.2.3* For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft. (12.2 m) but does not exceed 60 ft. (18.3 m), the ceiling sprinkler system shall:

(1) Use a minimum density of 0.45 gpm/ft² (18.3 mm/min), and

(2) Increase the design areas obtained from Table 19.2.3.1.1 by 30 percent

(3) The design areas from Table 19.2.3.1.1 shall be permitted, without a 30 percent increase, where an extended-coverage sprinkler having a minimum nominal K-factor of K-25.2 (K-360) is used

A.19.2.3.2.5.2.3 The results of Test Nos. 6 and 7 listed in Table C.27 demonstrated that quick-response K-11.2 (K-160) sprinklers can provide fire control for a simulated Ordinary Hazard Group 2 storage array under a 60 ft (18.3 m) high ceiling using a 0.45 gpm/ft² (18.3 mm/min) density. However, with 13 and 16 sprinklers operating during these two tests, it demonstrated that a density of 0.45 gpm/ft² (18.3 mm/min) is more applicable than the density of 0.20 gpm/ft² (8.1 mm/min) that is provided in Table 19.2.3.1.1 coupled with a design area greater than the 1,500 ft² (140 m²) given in Table 19.2.3.1.1. As a result, the original design density of 0.20 gpm/ft² (8.1 mm/min) has been increased to 0.45 gpm/ft² (18.3 mm/min) and the design area of 1,500 ft² (140 m²) has been increased by 30 percent. The 30 percent increase to the design area, however, was not applied to the K-25.2 (K-360) extended-coverage sprinkler due to the very positive results (only 1 sprinkler operated) obtained with it during Test 8 listed in Table C.27.

19.2.3.2.5.2.4* For Extra Hazard Groups 1 and 2 occupancies where the ceiling height is greater than 30 ft (9.1 m) but does not exceed 60 ft. (18.3 m), the ceiling sprinkler system shall use a minimum density of 0.45 gpm/ft² (18.3 mm/min) in combination with the design areas obtained from Table 19.2.3.1.1.

A.19.2.3.2.5.2.4 The test data listed in Table C.27 does not include any tests representing simulated occupancy hazards for either Extra Hazard Group 1 or Extra Hazard Group 2. However, based on the results from the test data listed in Table C.27, the minimum design density requirements of 0.30 gpm/ft² (12.2 mm/min) for Extra Hazard Group 1, and 0.40 gpm/ft² (16.3 mm/min) for Extra Hazard Group 2 are both now less than the 0.45 gpm/ft² (18.3 mm/min) design density required for Ordinary Hazard Group 2. Therefore, the minimum design density for both Extra Hazard Group 1 and Extra Hazard Group 2 has been increased to 0.45 gpm/ft² (18.3 mm/min), while maintaining the same required design area.

Revise the following existing paragraphs

10.3.2(3) In ordinary hazard occupancies with smooth, flat ceilings <u>not exceeding 30 ft (9.1 m) in height</u>, where specifically listed for such use.

19.2.3.2.6 High-Temperature Sprinklers. <u>For ceilings not exceeding 30 ft. (9.1 m) in height</u> where high-temperature sprinklers are used for extra hazard occupancies, the area of sprinkler operation shall be permitted to be reduced by 25 percent without revising the density, but not to less than 2000 ft² (185 m²).

19.2.3.2.7 <u>For ceilings not exceeding 30 ft. (9.1 m) in height</u> where K-11.2 (160) or larger sprinklers are used with Extra Hazard Group 1 or Extra Hazard Group 2 design curves and 19.2.3.1.1, the design area shall be permitted to be reduced by 25 percent but not below 2000 ft² (185 m²), regardless of temperature rating.

Substantiation:

Historically the ceiling sprinkler system designs indicated in Table 19.2.3.1.1 have applied to buildings of any ceiling height. Full-scale fire tests involving storage occupancies have demonstrated that ceiling heights can impact not only the ceiling sprinkler system designs, but also the allowable ceiling sprinklers to be used. When ceiling heights and clearances between the top of storage and the ceiling increase, so does the fire hazard, thus resulting in the need for increased flow and pressure from the ceiling sprinklers. The increase in fire hazard can also render some types of sprinklers ineffective due to either their limited droplet sizes or their ability to respond to a fire in a timely manner.

Test data obtained from three separate public sources has suggested that this same affect can impact the sprinkler protection used for occupancies that are not considered storage. Test data that was publicly available simulated occupancy hazards applicable to both Ordinary Hazard Group 1 as well as Occupancy Hazard Group 2 with ceiling heights over 30 ft (9.1 m) and up to a maximum ceiling height of 60 ft (18.3 m). The results of these tests suggest that the design densities and design areas indicated in Table 19.2.3.1.1 for Ordinary and Extra Hazard occupancies may not be effective and should be increased for ceiling heights over 30 ft (9.1 m).

Public Input No. 115-NFPA 13-2022 [Section No. 19.3.1.3]

19.3.1.3

Unless the requirements of 19.3.1.4 are met, the minimum required discharge from each design area sprinkler shall be ~~the greater~~ one of the following:

(1) In accordance with minimum flow rates indicated in the sprinkler listings

(2) In rooms or compartments greater than 800 ft^2 (74 m^2), calculated based on delivering a minimum of 0.1 gpm/ft^2 (4.1 mm/min) over the design area in accordance with the provisions of 9.5.2.1

(3) In rooms or compartments 800 ft^2 (74 m^2) or less calculated based on delivering a minimum of 0.1 gpm/ft^2 (4.1 mm/min) over the room or the compartment using the area of the room divided by the number of sprinklers in the room

Statement of Problem and Substantiation for Public Input

When following this requirement the minimum manufacturer's listing discharges well over the .1 gpm/ft^2, which makes it no longer beneficial. By allowing "one of the following", the layout technician or designer can decide which is the most hydraulically beneficial and still meets the intent of the residential design.

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Committee: AUT-SSD

Public Input No. 505-NFPA 13-2022 [Section No. 19.3.1.4]

~~**19.3.1.4** –~~

~~For modifications or additions to existing systems equipped with residential sprinklers, the listed discharge criteria less than 0.1 gpm/ft^2 (4.1 mm/min) shall be permitted to be used.~~

~~**19.3.1.4.1** –~~

~~Where replacing residential sprinklers manufactured prior to 2003 that are no longer available from the manufacturer and that are installed using a design density less than 0.05 gpm/ft^2 (2.0 mm/min), a residential sprinkler with an equivalent K-factor (± 5 percent) shall be permitted to be used provided the currently listed coverage area for the replacement sprinkler is not exceeded.~~

Statement of Problem and Substantiation for Public Input

The requirements in Sections 19.3.1.4 and 19.3.1.4.1 are being deleted due to a proposal to relocate these requirements into Chapter 30. See the proposal specific to Section 30.3.6.

Submitter Information Verification

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Committee:	AUT-SSD

Public Input No. 310-NFPA 13-2022 [New Section after 19.4]

19.5 Car Stackers and Car Lift Systems

19.5.1 For buildings having car stackers and car lift systems with 2 cars stacked vertically, water demand requirements shall be in accordance with section 19.2.3 for Extra Hazard Group 2.

19.5.2 Where sidewall or in-rack sprinklers are installed in buildings having car stackers and car lift systems with 2 cars stacked vertically and the sprinklers are placed under each level of cars, water demand requirements shall be in accordance with section 19.2.3 for Ordinary Hazard Group 2.

19.5.3 Where sidewall or in-rack sprinklers are installed in buildings having car stackers and car lift systems with more than 2 cars stacked vertically and the sprinklers are placed under each level of cars, water demand requirements shall be in accordance with Chapter 25 and shall be protected as an exposed, unexpanded Group A plastic.

Statement of Problem and Substantiation for Public Input

This change adds additional clarity on how to address car stackers and adds additional clarity on automatic retrieval systems used in parking garages.

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Public Input No. 430-NFPA 13-2022 [New Section after 19.4]

19.5 Hydraulic Design of Supplemental Sprinklers. Where sprinklers are required below obstructions in accordance with Chapters 9 through 14, they shall be hydraulically designed in accordance with 19.5.

19.5.1 Supplemental Sprinklers Not Requiring Hydraulic Balancing with the Ceiling Sprinkler System

19.5.1.1 Where supplemental sprinklers are fed on a wet sprinkler system by pipe equal to or greater in size than the size of the branch lines feeding the ceiling sprinklers, the supplemental sprinklers shall not require to be hydraulically designed nor hydraulically balanced with the ceiling sprinkler system when any of the requirements of 19.5.1.2 through 19.5.1.8 are met.

19.5.1.2 Where the supplemental sprinklers have the same characteristics as the ceiling sprinklers.

19.5.1.3 Where the supplemental sprinklers have the same characteristics as the ceiling sprinklers but are quick-response instead of standard-response.

19.5.1.4 Where the supplemental sprinklers have the same characteristics as the ceiling sprinklers but have a lower nominal temperature rating than the ceiling sprinklers.

19.5.1.5 Where the supplemental sprinklers have the same characteristics as the ceiling sprinklers but are standard-coverage instead of extended-coverage.

19.5.1.6 Where the supplemental sprinklers have the same characteristics as the ceiling sprinklers but have a K-factor greater than the K-factor of the ceiling sprinklers.

19.5.1.7 Where the supplemental sprinklers have the same characteristics as the ceiling sprinklers but are pendent instead of upright.

19.5.1.8 Where the supplemental sprinklers have the same characteristics as the ceiling sprinklers but are pendent or upright instead of sidewall.

19.5.2 Supplemental Sprinklers Requiring Hydraulic Balancing with the Ceiling Sprinkler System.

19.5.2.1 Where the requirements of 19.5.1 are not met, the supplemental sprinklers shall be hydraulically designed in accordance with 19.5.2.2.

19.5.2.2 Hydraulic Design for Supplemental Sprinklers.

19.5.2.2.1 The hydraulic design for supplemental sprinklers installed below obstructions shall be determined as follows:

(1) Use the underside of the obstruction as a virtual ceiling for determining the protection requirements of the supplemental sprinkler being installed.

(2) Where spray sprinklers will be used as supplemental sprinklers, the number of sprinklers in the design area shall be based on 28.2.4.2.

(3) Where CMSA sprinklers will be used as supplemental sprinklers, the number of sprinklers in the design area shall be based on 28.2.4.3.

(4) Where ESFR sprinklers will be used as supplemental sprinklers, the number of sprinklers in the design area shall be based on 28.2.4.4.

19.5.2.2.2 Where the supplemental sprinklers are installed on a wet system, the flow and pressure

required for the supplemental sprinklers shall not be required to be hydraulically balanced with the overhead ceiling sprinkler system.

19.5.2.2.3 Where the supplemental sprinklers are installed on a dry system, the flow and pressure required for the supplemental sprinklers shall be hydraulically balanced with the overhead ceiling sprinkler system at their point of connection.

Statement of Problem and Substantiation for Public Input

This is a proposed new section that will instruct the user how to hydraulic design the supplemental sprinklers when they are required. If offers an option where the sprinklers do not have to be accounted for in the hydraulic design of the ceiling sprinkler system, in the same manner that is currently indicated. This new section also offers a way to install supplemental sprinklers where the same sprinkler at ceiling level does not need to be used as a supplemental sprinkler nor does the same sprinkler branch line pipe used for the ceiling have to be used to feed the supplemental sprinklers.

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Committee: AUT-SSD

Public Input No. 85-NFPA 13-2021 [New Section after 19.4]

19.4.1 All open sprinklers or nozzles on a deluge system shall be included in the hydraulic design area.

Statement of Problem and Substantiation for Public Input

While this is common sense, nowhere in NFPA 13 does it specify the hydraulic design area criteria for a deluge system. This would provide the missing criteria.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 86-NFPA 13-2021 [Section No. 19.4]	

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Committee: AUT-SSD

Public Input No. 86-NFPA 13-2021 [Section No. 19.4]

19.4 Deluge Systems.

Open sprinkler and deluge systems shall be hydraulically calculated ~~according~~ in accordance with 19.4.1. or to applicable standards.

Statement of Problem and Substantiation for Public Input

Editorial change for the inclusion of section 19.4.1.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 85-NFPA 13-2021 [New Section after 19.4]	

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Public Input No. 373-NFPA 13-2022 [Section No. 20.3.3]

20.3.3 Open-Top Container.

A container of any shape that is entirely or partially open on the top and arranged to allow for the collection of discharging sprinkler water cascading through the storage array shall be ~~considered outside the criteria of rack storage protection outlined in Chapters~~ 21 ~~through~~ protected with in rack sprinklers at every level in accordance with Chapter 25. *(See Section C.12.)*

Statement of Problem and Substantiation for Public Input

NFPA 13 does not currently address protection of open top containers. These are common in fulfillment centers and pick facilities. NFSA intends to test open top containers with in rack sprinkler protection at every level and provide data to the committee for review.

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Committee: AUT-SSD

Public Input No. 132-NFPA 13-2022 [Sections 20.4.8.1, 20.4.8.2]

Sections 20.4.8.1, 20.4.8.2

20.4.8.1

Unless the requirements of 20.4.3 are met, Group B plastics ~~and~~ or free-flowing Group A plastics shall be protected the same as Class IV commodities.

20.4.8.2

Group C plastics shall be protected the same as Class III commodities.

Statement of Problem and Substantiation for Public Input

The current section does not account for mixed commodities and an over classification of unit loads that only contain a percentage of Group B plastics.

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Submittal Date: Tue Feb 15 16:13:12 EST 2022
Committee: AUT-SSD

Public Input No. 133-NFPA 13-2022 [Section No. 20.4.11.1]

20.4.~~11.1~~ 12 Baled Cotton.

Baled cotton shall be protected in accordance with Section 26.5. *(See Table A.3.3.14.)*

Statement of Problem and Substantiation for Public Input

This should not be a subsection of Display of Group A plastics and should be its own section. Renumber the remaining sections in 20.4

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Committee: AUT-SSD

Public Input No. 272-NFPA 13-2022 [Section No. 20.5]

20.5– Equivalent Storage Arrangement.

20.5.1 Movable Racks.

Rack storage in movable racks shall be protected in the same manner as multiple-row racks.

20.5.2 Portable Racks.

Except where otherwise allowed in this standard, portable rack storage shall be protected in the same manner as multiple-row racks.

20.5.3* Rack Storage.

20.5.3.1 Shelving.

20.5.3.1.1

Shelving material that is less than 50 percent open, or placement of loads that block openings that would otherwise serve as the required flue spaces, greater than 20 ft^2 (1.9 m^2) in area shall be treated as solid shelf racks.

20.5.3.1.2 Double-Row Racks.

20.5.3.1.2.1

Unless the requirements of 20.5.3.1.2.2 are met, double-row racks without solid shelves shall be considered racks with solid shelves where longitudinal flue spaces are not provided.

20.5.3.1.2.2

Double-row racks without solid shelves and a longitudinal flue space shall be considered open racks where the storage height does not exceed 25 ft (7.6 m) and transverse flue spaces are provided at maximum 5 ft (1.5 m) intervals.

20.5.3.1.3 Multiple-Row Racks.

Unless the requirements of 20.5.3.1.3.1 or 20.5.3.1.3.2 are met, multiple-row racks without solid shelves shall be considered racks with solid shelves.

20.5.3.1.3.1

Multiple-row racks without solid shelves shall be considered open racks where both transverse and longitudinal flue spaces are provided at maximum 5 ft (1.5 m) intervals.

20.5.3.1.3.2

Multiple-row racks without solid shelves shall be considered open racks where transverse flue spaces are provided at maximum 5 ft (1.5 m) intervals and the rack depth does not exceed 20 ft (6.1 m) between aisles that are a minimum width of 3.5 ft (1.1 m).

20.5.3.2* Slatted Shelves.

Slatted rack shelves shall be considered equivalent to solid rack shelves where the shelving is not considered open rack shelving or where the requirements of 26.4.1.2 or 26.4.1.3 are not met. *(See Section C.20.)*

20. 5.3.3 6 Aisle and Flue Space Requirements for Storage

20.6.1 Aisles.

20 20 . 5 6 . 3 1 . 3. 1 –

Aisles required by Chapters 21 through 25 shall not be obstructed unless Chapters 21 through 25 include specific guidance allowing obstructions over the aisle.

20.5 6 .3.4 2 Flues.

20.5 6 .3 2 .4. 1 Longitudinal Flue Space.

20. 5 6 . 3 2 . 4. 1.1 – _

For Class I through Class IV and Group A plastic commodities in double-row open racks, a longitudinal flue space shall not be required for storage up to and including 25 ft (7.6 m). *(See Section C.13.)*

20.5 6 .3 2 .4. 1.2

For Class I through IV and Group A plastic nominal 6 in. (150 mm) longitudinal flue spaces shall be provided in double-row racks for storage over 25 ft (7.6 m).

20.5 6 .3 2 .4. 2 Transverse Flue Space.

20. 5 6 . 3 2 . 4. 2.1 – _

Nominal 6 in. (150 mm) transverse flue spaces between loads and at rack uprights shall be maintained in single-row, double-row, and multiple-row racks.

20.5 6 .3.4. 2.2 3

Random variations in the width of flue spaces or in their vertical alignment shall be permitted. *(See Section C.26.)*

~~**20.5.4** – Plastic Motor Vehicle Components.~~

~~Group A plastic automotive components and associated packaging material consisting of exposed, expanded Group A plastic dunnage, instrument panels, and plastic bumper fascia shall be permitted to be protected in accordance with Section 26.2 .~~

Statement of Problem and Substantiation for Public Input

This PI is submitted on behalf of the SSI Task Group #3, Clean Up

This PI has two parts requesting revisions to Section 20.5.

The first part is to just revise the title of Section 20.5 to match the contents of the first part of the section, which deals with storage protection equivalencies (ie. Movable racks and Portable racks are protected the same as Multiple-row racks, etc.).
The second proposal is to move the second part of Section 20.5 to a separate new Section 20.6, since that part deals with a separate subject.

The second part of Section 20.5 deals discusses Aisles and Flue Spaces. Since the first and second parts deal with two different subjects, the provisions should be located in different sections. Therefore, so it is proposed to renumber the second part as Section 20.6

The existing 20.5.4 is proposed for deletion, because the text is redundant to the existing Section 20.7.

The following provisions must then be renumbered accordingly.

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Submittal Date: Mon May 02 20:25:35 EDT 2022
Committee: AUT-SSD

Public Input No. 362-NFPA 13-2022 [Section No. 20.5]

~~20~~ 25 .~~5~~ 3 Storage Arrangement.

~~20~~ 25 .~~5~~ 3 .1 Movable Racks.

Rack storage in movable racks shall be protected in the same manner as multiple-row racks.

~~20~~ 25 .~~5~~ 3 .2 Portable Racks.

Except where otherwise allowed in this standard, portable rack storage shall be protected in the same manner as multiple-row racks.

~~20~~ 25 .~~5~~ 3 .3* Rack Storage.

~~20~~ 25 .~~5~~ 3 .3.1 Shelving.

~~20~~ 25 .~~5~~ 3 .3.1.1

Shelving material that is less than 50 percent open, or placement of loads that block openings that would otherwise serve as the required flue spaces, greater than 20 ft^2 (1.9 m^2) in area shall be treated as solid shelf racks.

~~20~~ 25 .~~5~~ 3 .3.1.2 Double-Row Racks.

~~20~~ 25 .~~5~~ 3 .3.1.2.1

Unless the requirements of 20.5.3.1.2.2 are met, double-row racks without solid shelves shall be considered racks with solid shelves where longitudinal flue spaces are not provided.

~~20~~ 25 .~~5~~ 3 .3.1.2.2

Double-row racks without solid shelves and a longitudinal flue space shall be considered open racks where the storage height does not exceed 25 ft (7.6 m) and transverse flue spaces are provided at maximum 5 ft (1.5 m) intervals.

~~20~~ 25 .~~5~~ 3 .3.1.3 Multiple-Row Racks.

Unless the requirements of 20.5.3.1.3.1 or 20.5.3.1.3.2 are met, multiple-row racks without solid shelves shall be considered racks with solid shelves.

~~20~~ 25 .~~5~~ 3 .3.1.3.1

Multiple-row racks without solid shelves shall be considered open racks where both transverse and longitudinal flue spaces are provided at maximum 5 ft (1.5 m) intervals.

~~20~~ 25 .~~5~~ 3 .3.1.3.2

Multiple-row racks without solid shelves shall be considered open racks where transverse flue spaces are provided at maximum 5 ft (1.5 m) intervals and the rack depth does not exceed 20 ft (6.1 m) between aisles that are a minimum width of 3.5 ft (1.1 m).

~~20~~ 25 .~~5~~ 3 .3.2* Slatted Shelves.

Slatted rack shelves shall be considered equivalent to solid rack shelves where the shelving is not considered open rack shelving or where the requirements of 26.4.1.2 or 26.4.1.3 are not met. *(See Section C.20.)*

~~20~~ 25 .~~5~~ 3 .3.3 Aisles.

~~20~~ 25 .~~5~~ 3 .3.3.1

Aisles required by Chapters 21 through 25 shall not be obstructed unless Chapters 21 through 25 include specific guidance allowing obstructions over the aisle.

~~20~~ 25 .~~5~~ 3 .3.4 Flues.

~~20~~ 25 .~~5~~ 3 .3.4.1 Longitudinal Flue Space.

~~20~~ 25 .~~5~~ 3 .3.4.1.1

For Class I through Class IV and Group A plastic commodities in double-row open racks, a longitudinal flue space shall not be required for storage up to and including 25 ft (7.6 m). *(See Section C.13.)*

~~20~~ 25 .~~5~~ 3 .3.4.1.2

For Class I through IV and Group A plastic nominal 6 in. (150 mm) longitudinal flue spaces shall be provided in double-row racks for storage over 25 ft (7.6 m).

~~20~~ 25 .~~5~~ 3 .3.4.2 Transverse Flue Space.

~~20~~ 25 .~~5~~ 3 .3.4.2.1

Nominal 6 in. (150 mm) transverse flue spaces between loads and at rack uprights shall be maintained in single-row, double-row, and multiple-row racks.

~~20~~ 25 .~~5~~ 3 .3.4.2.2

Random variations in the width of flue spaces or in their vertical alignment shall be permitted. *(See Section C.26.)*

~~20~~ 25 .~~5~~ 3 .4 Plastic Motor Vehicle Components.

Group A plastic automotive components and associated packaging material consisting of exposed, expanded Group A plastic dunnage, instrument panels, and plastic bumper fascia shall be permitted to be protected in accordance with Section 26.2.

Statement of Problem and Substantiation for Public Input

Section 20.19 for the protection of racks with solid shelves only includes design options with in rack sprinklers and is more appropriately located in section (25.3).

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Committee: AUT-SSD

Public Input No. 324-NFPA 13-2022 [New Section after 20.5.3.1.3.2]

TITLE OF NEW CONTENT

20.5.3.1.3.3 Multiple-row racks without solid shelves shall be considered open racks when transverse flue spaces are provided on maximum ft (1.5 m) intervals, and the rack depth does not exceed 20 ft (6.1 m) as defined by a minimum aisle of not less than 3 ft 6 in (1.1 m) at the front of the rack and a vertical barrier at the back of the rack. The vertical barrier shall consist of either minimum 3/8 in (10 mm) plywood or particleboard, 22-gauge (0.78 mm) sheet metal, or equivalent, and span the entire length of the multiple-row rack as well as start a maximum of 4 in. (100 mm) above the floor and extend to the maximum height of storage.

Statement of Problem and Substantiation for Public Input

This is identical language that was proposed for a TIA request for the 2022 edition. Many of the no votes centered on the lack of testing for solid barriers as a design option. The intent is to provide an alternative option to the 3.5 foot wide aisle by allowing the installation of a vertical barrier to prevent horizontal flame spread from the multiple row rack to an adjacent one. Depending on the type of racking installed, there will be a time when a building owner can maximize their storage footprint by placing two maximum 20 foot deep multiple-row racks with adequate transverse flue spaces, back to back with a space separation of less than 3.5 feet. By allowing the installation of a vertical barrier to be an acceptable alternative to a minimum 3.5 foot aisle, building owners will have the option to increase their storage footprint without having to install in-rack sprinklers at every tier level.

The use of a vertical barrier has been recognized in the standard for various storage arrangements and based on the testing on those configurations should be acceptable for this. Specifically a vertical barrier is required by Section 23.4.7 which provides protection for expanded exposed Group A plastic. The barrier served to stop the fire and limit damage to one bay. Vertical barriers are also required by 26.7.4 and 26.7.5 in compact storage to limit fire spread through the storage. Solid barriers are also required in back to back shelf storage (Section 3.3.13). If the barrier has been shown to work for these configurations, it can be extrapolated to work in the back to back arrangement.

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Public Input No. 374-NFPA 13-2022 [New Section after 20.5.3.3.1]

20.5.3.3.2

20.5.3.3.2 When aisles are obstructed, in rack sprinkler protection shall be provided at every level in accordance with Chapter 25.

Statement of Problem and Substantiation for Public Input

NFPA 13 does not currently address protection of racks with obstructed aisles. These are common in fulfillment centers and pick facilities with mezzanine walk ways. NFSA intends to test obstructed aisles with in rack sprinkler protection at every level and provide data to the committee for review.

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Committee: AUT-SSD

Public Input No. 449-NFPA 13-2022 [New Section after 20.5.3.4.1]

20.5.3.4.1.3

For Class I through Class IV and Group A plastic commodities in multiple-row open racks, longitudinal flue spaces shall not be required when:

(1) Minimum nominal 6 in. (150 mm) wide transverse flue spaces are provided on maximum 5 ft (1.5 m) intervals

(2) The rack depth does not exceed 20 ft (6.1 m)

(3) The minimum aisle width is 3-1/2 ft (1.1 m)

Statement of Problem and Substantiation for Public Input

This is to help provide guidance on longitudinal flue spaces for multiple-row racks based on the guidance added to the 2019 Edition of the standard.

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Committee: AUT-SSD

Public Input No. 448-NFPA 13-2022 [Section No. 20.5.3.4.1]

20.5.3.4.1 Longitudinal Flue Space.

20.5.3.4.1.1

For Class I through Class IV and Group A plastic commodities in double-row open racks, a longitudinal flue space shall not be required for storage up to and including 25 ft (7.6 m). *(See Section C.13.)*

20.5.3.4.1.2

For Class I through IV and Group A plastic commodities in double-row open racks, a nominal 6 in. (150 mm) longitudinal flue ~~spaces shall~~ space shall be provided ~~in double-row racks~~ for storage over 25 ft (7.6 m).

Statement of Problem and Substantiation for Public Input

Editorial in nature to better match the previous section.

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Public Input No. 135-NFPA 13-2022 [Section No. 20.5.4]

~~**20.5.4** – Plastic Motor Vehicle Components.~~

~~Group A plastic automotive components and associated packaging material consisting of exposed, expanded Group A plastic dunnage, instrument panels, and plastic bumper fascia shall be permitted to be protected in accordance with Section 26.2 .~~

Statement of Problem and Substantiation for Public Input

This is a duplicate requirement to the existing section 20.7 and is also not located in the appropriate section. This section should be under commodity classes. See PI-134.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 134-NFPA 13-2022 [Section No. 20.7]	Duplicate requirement

Submitter Information Verification

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Public Input No. 210-NFPA 13-2022 [Section No. 20.5.4]

~~**20.5.4** – Plastic Motor Vehicle Components.~~

~~Group A plastic automotive components and associated packaging material consisting of exposed, expanded Group A plastic dunnage, instrument panels, and plastic bumper fascia shall be permitted to be protected in accordance with Section 26.2 .~~

Statement of Problem and Substantiation for Public Input

Requirements currently exist in section 20.7, and serve no purpose here under 20.5 "Storage Arrangements."

Submitter Information Verification

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Submittal Date: Fri Mar 18 15:50:19 EDT 2022
Committee: AUT-SSD

Public Input No. 292-NFPA 13-2022 [Section No. 20.5.4]

~~**20.5.4** – Plastic Motor Vehicle Components.~~

~~Group A plastic automotive components and associated packaging material consisting of exposed, expanded Group A plastic dunnage, instrument panels, and plastic bumper fascia shall be permitted to be protected in accordance with Section 26.2 .~~

Statement of Problem and Substantiation for Public Input

This is redundant information, no additional information is provided with this statement. The information is located in 26.2, therefore there is no reason to point to a section where the information is located.

Submitter Information Verification

Submitter Full Name: William Smith
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Zip:
Submittal Date: Wed May 18 22:04:14 EDT 2022
Committee: AUT-SSD

Public Input No. 134-NFPA 13-2022 [Section No. 20.7]

20.~~7~~ 4.13 * Plastic Motor Vehicle Components.

20.~~7~~ 4 .13. 1

Group A plastic automotive components and associated packaging material consisting of exposed, expanded Group A plastic dunnage, instrument panels, and plastic bumper fascia shall be permitted to be protected as provided in Section 26.2.

20.~~7~~ 4 .13. 2

Automotive components covered in this section shall not include the storage of air bags, tires, and seats on portable racks.

Statement of Problem and Substantiation for Public Input

This section is more appropriate in the commodity classes section with the rest of the special commodities. Renumber the remaining sections

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 135-NFPA 13-2022 [Section No. 20.5.4]	

Submitter Information Verification

Submitter Full Name: Kevin Hall
Organization: American Fire Sprinkler Association
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Submittal Date: Tue Feb 15 17:05:26 EST 2022
Committee: AUT-SSD

Public Input No. 450-NFPA 13-2022 [Section No. 20.8]

20.8* – _ **Airflow Near or Below Ceiling Sprinklers.**

20.8.1 _ **Airflow Velocities Below Ceiling Sprinklers.**

20.8.1.1 Unless one of the requirements in 20.8.1.2 through 20.8.1.4 is met, the velocity of airflow between the top of storage and the ceiling sprinklers shall be arranged to be equal to or less than 5 ft/sec (1.5 m/sec).

20.8.1.2 The velocity of airflow between the top of storage and the ceiling sprinklers shall be permitted to exceed 5 ft/sec (1.5 m/sec) where flame detection at ceiling level is installed and arranged to immediately shut down the flow of air upon detection activation.

20.8.1.2 The velocity of airflow between the top of storage and the ceiling sprinklers shall be permitted to exceed 5 ft/sec (1.5 m/sec) where a flat, continuous horizontal barrier is installed a minimum of 3 ft (0.9 m) above the top of storage and below the airflow with supplemental ceiling sprinklers installed below the horizontal barrier.

20.8.1.3 The velocity of airflow between the top of storage and the ceiling sprinklers shall be permitted to exceed 5 ft/sec (1.5 m/sec) where rack storage is located below the area of excessive airflow and line-type detection is installed at the top of the storage rack within all flue spaces and arranged to immediately shut down the flow of air upon detection activation.

20.8.1.4 The velocity of airflow between the top of storage and the ceiling sprinklers shall be permitted to exceed 5 ft/sec (1.5 m/sec) where rack storage is protected with in-rack sprinklers and the maximum storage height above the top level of in-rack sprinklers is 5 ft (1.5 m).

20.8.2* **High Volume Low Speed (HVLS) Fans.**

20.8. 2. 1

–

The installation of HVLS fans in buildings equipped with sprinklers, including ESFR sprinklers, shall comply with the following:

(1) The maximum fan diameter shall be 24 ft (7.3 m).

(2) The HVLS fan shall be centered approximately between four adjacent sprinklers.

(3) The vertical clearance from the HVLS fan to sprinkler deflector shall be a minimum of 36 in. (900 mm).

(4) All HVLS fans shall be interlocked to shut down immediately upon a waterflow alarm.

20.8.2

Where a building is protected with a fire alarm system, the interlock required by 20.8.2. 1(4) shall be in accordance with the requirements of *NFPA 72* or other approved fire alarm code.

Additional Proposed Changes

File Name	Description	Approved
Airflow_Impact_on_Ceiling_Sprinklers.pdf	Presentation on Impact of Airflow on Ceiling Sprinklers	

Statement of Problem and Substantiation for Public Input

Intermediate- and Full-Scale fire testing at FM Global has demonstrate that the performance of ceiling sprinklers can be negatively impacted by the flow of air between the top of storage and the ceiling sprinklers. As a result, requirements should be introduced into this standard to help minimize the impact of ceiling airflow on sprinkler performance.

Submitter Information Verification

Submitter Full Name: Weston Baker
Organization: FM Global
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State:
Zip:
Submittal Date: Sun May 29 16:46:58 EDT 2022
Committee: AUT-SSD

FM Global

Impact of Cross-Flow Ventilation on Sprinkler Performance

Weston Baker
Benjamin Ditch

NFPA Conference and Expo
Las Vegas, June 9-12, 2014

1

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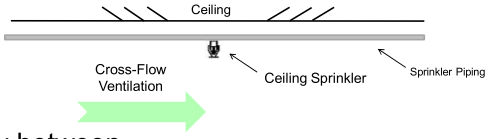
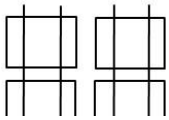
Cross-Flow Ventilation

What do we mean by “cross-flow” ventilation?



Any airflow between the top of storage and the ceiling sprinklers



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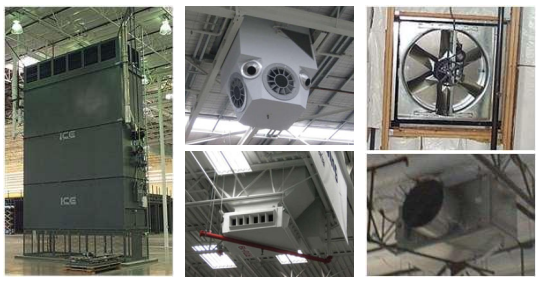
High Velocity Cross-Flow Ventilation



3

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Industry Practice

- Horizontal spacing > 100 ft (30 m)
- Airflow velocities > 30 ft/sec (9.1 m/sec)

These high velocity units typically are located low enough below the ceiling that they do not blow air at the sprinkler, but rather below it

Why is this a concern?

Let's look at an illustration demonstrating the basic principles of fire growth in a rack storage array…

4

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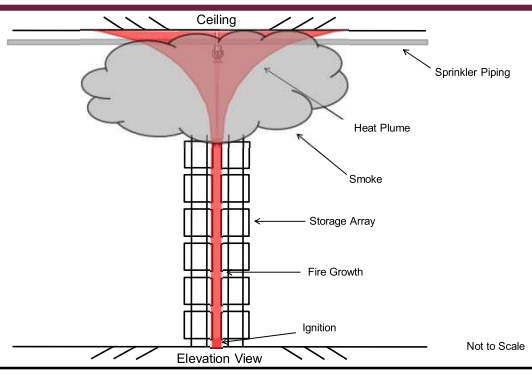

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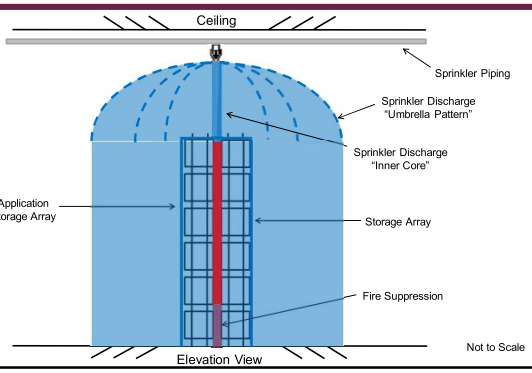

6

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Let's see how this principle works in a full-scale fire test having the following test conditions:

- 20 ft (6.1 m) high cartoned unexpanded plastic
- Double-row racks with 4 ft (1.2 m) aisle
- 30 ft (9.1 m) high ceiling
- Quick-response pendent ceiling sprinklers
- Sprinklers 160°F (70°C) nominally rated
- Applied density of 0.60 gpm/ft² (24 mm/min)
- Ignition location under 1 sprinkler

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8

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Full-Scale Fire Test

The first sprinkler opened at 39 seconds and suppressed the fire. What made this test so successful?

- Timely response of ceiling sprinkler – operated while fire still relatively small
- Water delivery was efficiently applied to fire area

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Full-Scale Fire Test

The first sprinkler opened at 39 seconds and suppressed the fire. What made this test so successful?

- Timely response of sprinkler operated while fire still relatively small
- Water delivered efficiently to fire
- Time of first sprinkler operation

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Suppression/Control Concept

Amount of water discharged by first operating sprinkler

11

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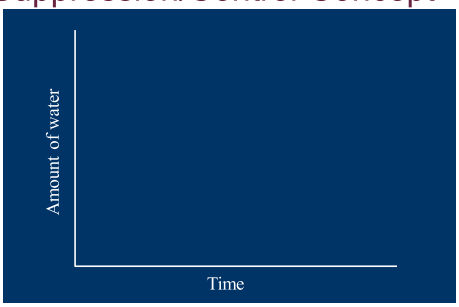
Suppression/Control Concept



Time after fire ignition

12

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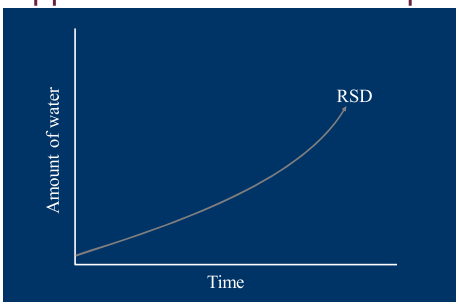
Suppression/Control Concept



Required Sprinkler Discharge (RSD): The amount of water needed from a sprinkler to control or suppress a fire

The amount of water needed for control or suppression will increase the longer it takes the first sprinkler to operate after fire ignition

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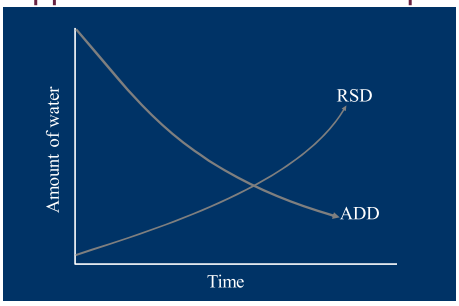
Suppression/Control Concept



Actual Delivered Density (ADD): The amount of water actually making its way down through the fire plume and engaging burning surfaces

The amount of water applied to burning surfaces will decrease the longer it takes the first sprinkler to operate after fire ignition

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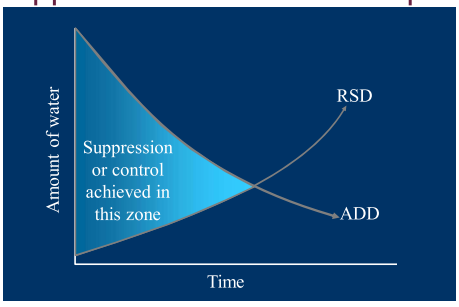
Suppression/Control Concept



Fire suppression or control achieved by:

- Timely response of sprinklers, and
- Sufficient amount of water applied in an efficient manner

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Full-Scale Fire Test

New Test Conditions:

- 20 ft (6.1 m) high cartoned unexpanded plastic
- 30 ft (9.1 m) high ceiling
- Double-row racks with 4 ft (1.2 m) aisle
- Quick-response ceiling sprinklers
- Sprinklers nominal 160°F (70°C) rated
- Applied density of 0.60 gpm/ft² (24 mm/min)
- Ignition location under 1 sprinkler

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17

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Full-Scale Fire Test

The first sprinkler opens at 1 minute 19 seconds and fails to suppress the fire. Why?

- Lack of timely response of ceiling sprinkler – operated at 79 seconds as opposed to 39 seconds
- Water delivery was not efficiently applied to fire area

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Full-Scale Fire Test

What do these two tests show us?

- The response time of ceiling sprinklers to a fire event can be the difference between a suppressed fire and a non-suppressed fire
- The efficiency of water delivery can also influence the sprinkler's ability to suppress a fire

Let's look at the rack fire illustration again, but this time with high cross-flow ventilation

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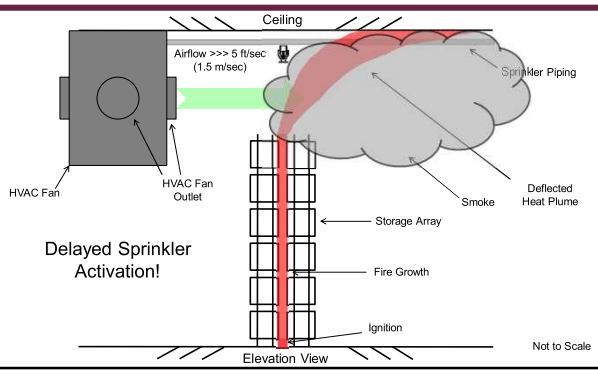

20

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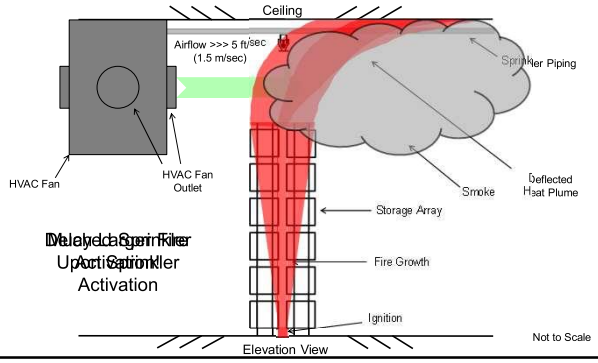

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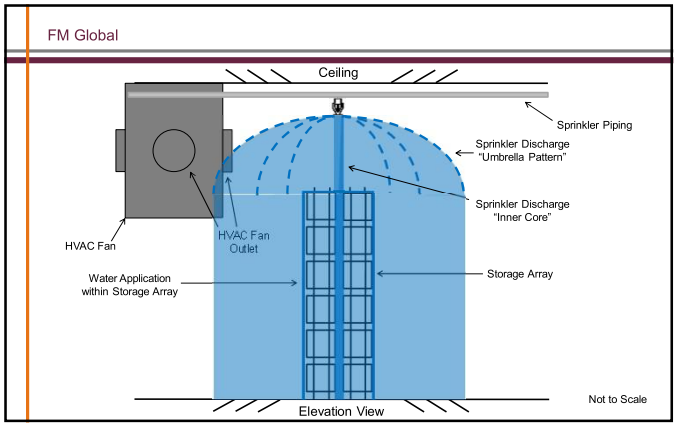
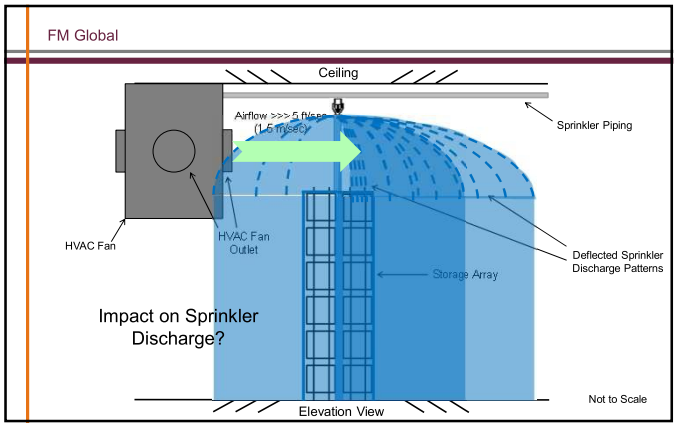
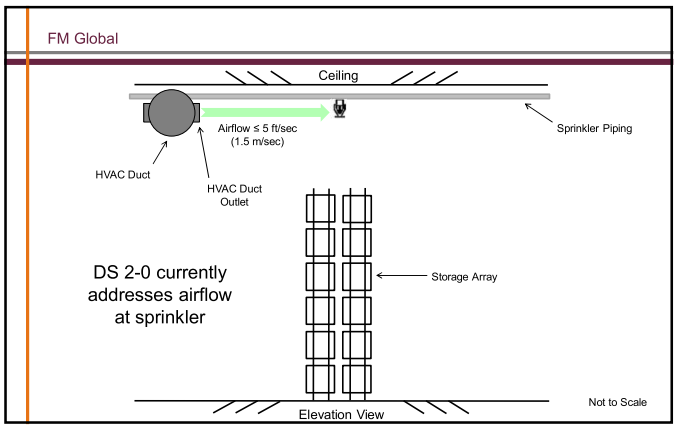

FM Global
Ceiling
Sprinkler Piping
Sprinkler Discharge "Umbrella Pattern"
Sprinkler Discharge "Inner Core"
HVAC Fan
HVAC Fan Outlet
Water Application within Storage Array
Storage Array
Not to Scale
Elevation View

22


FM Global
Ceiling
Airflow >>> 5 ft/sec (1.5 m/sec)
Sprinkler Piping
HVAC Fan
HVAC Fan Outlet
Deflected Sprinkler Discharge Patterns
Storage Array
Impact on Sprinkler Discharge?
Not to Scale
Elevation View

23


FM Global
Ceiling
Airflow ≤ 5 ft/sec (1.5 m/sec)
Sprinkler Piping
HVAC Duct
HVAC Duct Outlet
DS 2-0 currently addresses airflow at sprinkler
Storage Array
Not to Scale
Elevation View

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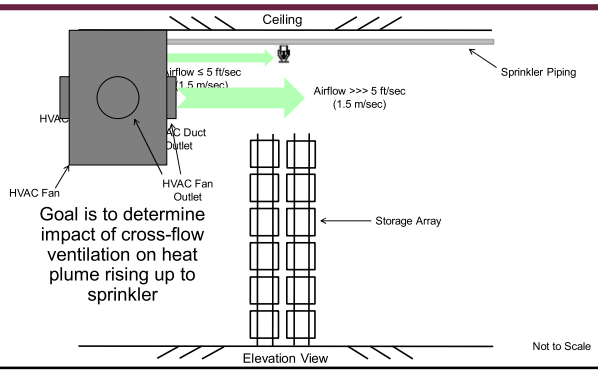

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Experimental Evaluation

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Problem Statement

- Evaluate impact on sprinkler performance from ventilation airflow directed at fire plume
- Recommend maximum airflow velocity 'beneath' a sprinkler

**No known studies on the effects of non-uniform airflow on a fire plume*

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Reduced Sprinkler Performance

1) Deflection of the fire plume
   - Delayed sprinkler operation
   - Initial sprinkler operations away from fire
2) Cooling of ceiling gas layer
   - Delayed sprinkler operation
3) Deflection of sprinkler discharge
   - Requires separate analysis and not included in project scope

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Approach

- Conduct fire test with and without cross-flow ventilation directed at a fire plume
- Estimate effect on sprinkler system performance

- Limit scope to cross flow (horizontal)
  - Vertical airflow previously studied[1,2]

[1]"High Volume/Low Speed Fan and Sprinkler Operation - Phase II," Fire Protection Research Foundation Report, 2011
[2]B. Ditch, "Impact of a High Volume Low Speed Fan on Sprinkler Performance in Rack Storage Fires," FM Global Technical Report, 2011

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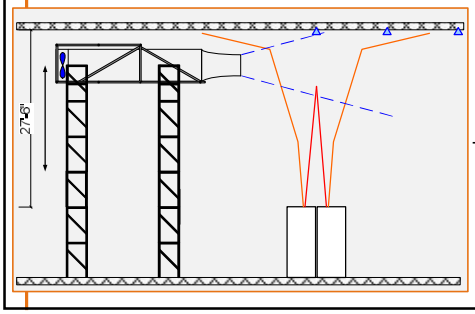
Test Schematic



Variables
1. Fire size*
2. Ceiling clearance
3. Vent clearance
4. Airflow velocity

- *Vent geometry*
- *Vent angle*
- *Airflow distribution*

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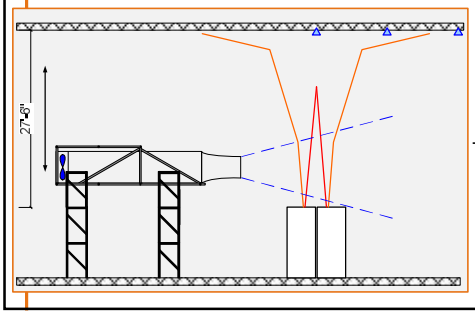
Test Schematic



Variables

1. Fire size*
2. Ceiling clearance
3. Vent clearance
4. Airflow velocity

- *Vent geometry*
- *Vent angle*
- *Airflow distribution*

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Test Conditions

Parameter	Units	Range
Ceiling clearance	ft (m)	7.5 – 27.5 (2.3 – 8.4)
Vent clearance	ft (m)	5 – 20 (1.5 – 6.1)
Fire size	MW	0 – 5
Airflow velocity	ft/s (m/s)	0 – 35 (0 – 11)

Matrix included 20 unique configurations resulting in 110+ tests

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Fire Source

- 7.5 MW ADD Apparatus
- Constructed 2011
- 0.5 – 7.5 MW
- Heptane spray
  - 9 nozzles in circle
- Fully characterized fire
- Represents rack storage

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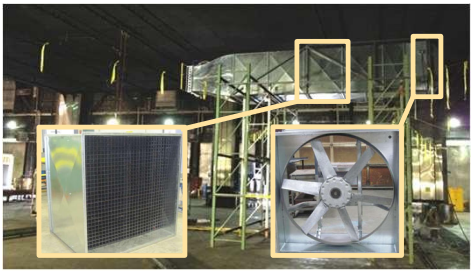
Ventilation Source



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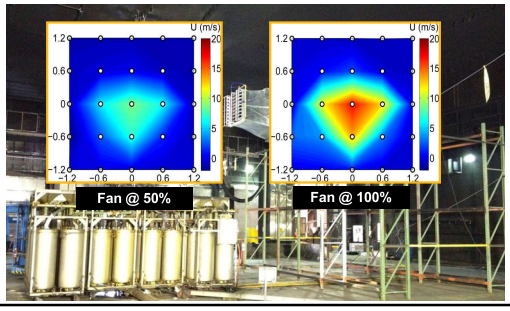
1 m/s = 3.3 ft/s

Cross-flow Velocity Characterization



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Cross-flow Magnitude

Flow Magnitude	Average Velocity	Total Momentum
-	ft/s (m/s)	lb·ft/s (N·s)
Weak	10.2 (3.1)	215 (30)
Medium	17.1 (5.2)	540 (75)
Strong	33.5 (10.2)	2,060 (285)

- Momentum conserved from vent exit to fire
  - Velocity ▼ with distance
  - Area ▲ with distance
- Momentum useful to compare different vent
- Velocity practical to measure

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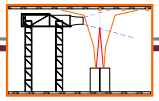
Fire Test Measurements



- Ceiling gas layer
  - 125 temperature measurements
  - 12 velocity measurements
- Sprinkler response
  - 3 sprinklers located in-line with airflow
  - Gas temperature and velocity at link elevation
  - Operation time predicted from steady-state condition

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Methodology

- For a given ceiling height and vent height
  1) Select a fire size (500 – 5,000 kW)
  2) Measure sprinkler operations with no flow
  3) Measure sprinkler operations with flow
  4) Adjust flow magnitude until no sprinklers operate
- Repeat for next ceiling / vent height

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Fire Test Examples

[1 MW, medium flow]

[5 MW, strong flow]

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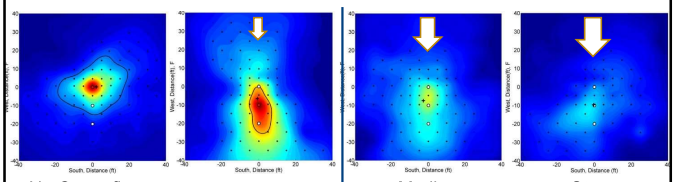
Centroid Comparison

- 1 MW fire, 30 ft (9.1 m) ceiling, 15 ft (14.6 m) vent



No Cross-flow | Weak | Medium | Strong

2 sprinkler operations | 0 sprinkler operations

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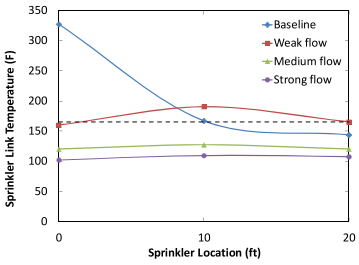
Predicted Sprinkler Response



- Operations
  - Link temp ≥ 165°F (74°C)
  - Baseline and weak flow
- No Operations
  - Link temp < 165°F (74°C)
  - Medium and strong flow

1 MW fire, 9.1 m (30 ft) ceiling, 14.6 m (15 ft) vent

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Scope of Evaluation

- Suppression-mode performance
  - Protection relies on limiting initial fire growth and small number of sprinkler operations
  - High importance on time and location of initial sprinkler operation
  - Typically quick-response (QR) sprinklers
- Control-mode performance not considered
  - Protection relies on limiting fire spread by pre-wetting and a larger number of sprinkler operations

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Evaluation Criteria

- Compare predicted sprinkler operations with and without ventilation
- Unacceptable impact on performance:
  1) Number of sprinkler operations
     - Minimum cross flow where no sprinklers operate
  2) Sprinkler operation delay
     - Time of initial sprinkler operation, regardless of location

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Predicted Sprinkler Operations

$$\frac{dT}{dt} = \frac{u^{1/2}}{RTI}(T_g - T_{link})$$

$$t_{act} = \frac{RTI}{u^{1/2}} ln\left(\frac{T_o - T_g}{T_{act} - T_g}\right)$$

- RTI = 50 (ft-s)$^{1/2}$ [28 (m-s)$^{1/2}$]
- U = gas velocity
- T_g = gas temp
- T_{link} = link temp
- T_{act} = link activation temp
- T_o = ambient temp
- t_{act} = link activation time

Based on steady-state temperature and velocity at sprinkler link

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Sprinkler Operation Delay

- Cooling of plume gases equal to increased sprinkler RTI
- Ensure protection system response consistent with QR sprinkler

- Evaluated sprinkler
  - RTI = 50 (ft-s)$^{1/2}$
- Quick-response sprinkler
  - RTI ≤ 90 (ft-s)$^{1/2}$

Baseline operation time

t_{act} = 5 s

Delayed operation time

t_{act} x (90/50) = 9 s

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Test Configurations and Results

1 ft = 0.3 m

Fire Size (kW)	Ceiling Height (ft)	Vent Height (ft)	Criteria 1 (# Operations)	Criteria 2 (Operation Delay)
500	25	15	Weak	-
	27.5	20		
1000	22.5	15	Medium	Weak
	25	15		
	27.5	20		
	30	15		
	30	20		
	32.5	25		
3000	25	15	-	Medium
	30	15		
	30	20		
	35	15		
	35	20		
	35	25		
	37.5	30		

Minimum cross-flow exceeding criteria

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Relationship to Rack Storage

Fire Size Exiting Top of Array

Storage Height [ft (m)]	Ceiling Height [ft (m)]		
	30 (9.1)	40 (12.2)	45 (13.7)
10 (3.0)	650	1000	1250
20 (6.1)	700	1100	1300
25 (7.6)	500	900	1150
30 (9.1)	-	800	1000
35 (10.7)	-	500	700
40 (12.2)	-	-	850

Using experimental data and a semi-empirical model

47

Test Configurations and Results

Fire Size (kW)	Criteria 1 (# Operations)	Criteria 2 (Operation Delay)
500	Weak	-
1000	Medium	Weak
3000	-	Medium

Minimum cross-flow exceeding criteria

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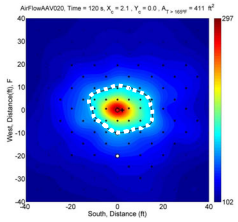
Repeatability

- 15 configurations tested three times
  - Ceiling gas layer centroid
  - Sprinkler activation area
  - Ceiling gas velocity
  - Sprinkler activation time
- Repeatability within 20%
  - Baseline
  - Cross-flow



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Summary

- Evaluated impact of ventilation on sprinkler system performance
  - Airflow direct below sprinkler only
  - Existing criteria for airflow at sprinkler not changed
- Represents rack storage
  - 110+ tests conducted
  - Wide breadth of warehouse configurations considered

50

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Summary (2)

- Ventilation can significantly reduce sprinkler system effectiveness
- Results applicable to suppression performance systems comprised of QR sprinklers
- Guidance to be included in FM Global Property Loss Prevention Data Sheets
  - Includes measurable air flow limits in a storage facility, specific to stored commodity

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Public Input No. 185-NFPA 13-2022 [Section No. 20.9.1]

20.9.1 Ceiling Slope.

Except as permitted by 20.9.1.1, the sprinkler system criteria specified in Chapters 20 through 25 shall apply to buildings with ~~ceiling slopes not exceeding 2 in 12 (16.7 percent).~~ horizontal ceilings.

20.9.1.1

The following situations shall permit storage under ~~ceilings with slope exceeding 2 in 12 (16.7 percent)~~ sloped ceilings :

(1) Where a specific section in Chapters 20 through 25 permits ~~ceiling slope in excess of 2 in 12 (16.7 percent).~~ sloped ceilings.

(2) Where storage is protected with in-rack sprinklers in accordance with one of the options in Section 25.6, provided no storage is placed above the highest level of in-rack sprinklers.

Statement of Problem and Substantiation for Public Input

This section describes horizontal and sloped ceilings which are already defined in Chapter 3.

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Public Input No. 493-NFPA 13-2022 [Section No. 20.9.1]

20.9.1 Ceiling Slope.

Except as permitted by 20.9.1.1 or 20.9.1.2 , the sprinkler system criteria specified in Chapters 20 through ~~25 shall~~ 2 6 shall apply to buildings with ceiling slopes not exceeding ~~2~~ 1 in 12 ~~(16 .7 percent).~~

20.9.1.1 Unobstructed Construction.

20.9.1.1

–

The following situations shall permit storage under ceilings with slope exceeding 2 in 12 (16.7 percent):

.1 Where the ceiling slope is greater than 1 in 12, but does not exceed 2 in 12, the ceiling sprinkler system discharge criteria shall be permitted to follow the requirements for a ceiling slope of 1 in 12.

20.9.1.1.2 Where the ceiling slope is greater than 2 in 12, but does not exceed 4 in 12, storage shall be permitted to be protected by any one of the following requirements:

(1) Where storage is protected with in-rack sprinklers in accordance with one of the options in 25.6, provided that no storage is placed above the highest level of in-rack sprinklers

(2) A horizontal false ceiling capable of withstanding an uplift force of 3 lb./ft² (14.6 kg/m²) is installed below the sloped ceiling and supplemented with ceiling sprinklers

(3) The design area for the ceiling sprinkler system is increased by 50 percent

20.9.1.1.3 Where the ceiling slope is greater than 4 in 12, storage shall be permitted to be protected by any one of the following requirements:

(1) Where storage is protected with in-rack sprinklers in accordance with one of the options in 25.6, provided that no storage is placed above the highest level of in-rack sprinklers.

(2) A horizontal false ceiling capable of withstanding an uplift force of 3 lb./ft² (14.6 kg/m²) is installed below the sloped ceiling and supplemented with ceiling sprinklers.

(3) Where a specific section in Chapters 20 through

25

26 permits ceiling slope

in excess of 2 in 12 (16.7 percent).

that exceeds 4 in 12.

20.9.1.2 Obstructed Construction.

20.9.1.2.1 Where the ceiling slope is greater than 1 in 12, but does not exceed 4 in 12, the ceiling sprinkler system design criteria shall be permitted to follow the requirements for a ceiling slope of 1 in 12.

20.9.1.2.2 Where the ceiling slope is greater than 4 in 12, storage shall be permitted to be protected by any one of the following requirements:

(1) A horizontal false ceiling capable of withstanding an uplift force of 3 lb./ft² (14.6 kg/m²) is installed below the sloped ceiling and supplemented with ceiling sprinklers

(2) Where storage is protected with in-rack sprinklers in accordance with one of the options in

Section

25.6 , provided that no storage is placed above the highest level of in-rack sprinklers

(3) Where a specific section in Chapters 20 through 26 permits ceiling slope that exceeds 4 in 12

Additional Proposed Changes

File Name	Description	Approved
Slope_CEiling_17-Chapter_20.docx	Clean version of discharge criteria for sloped ceilings over storage occupancies.	

Statement of Problem and Substantiation for Public Input

Computer simulations and full-scale fire tests as documented in the report entitled Protection of Storage Under Sloped Ceilings Phase III: Large-Scale Testing Summary and Guidance, written based on a project supported by the Fire Protection Research Foundation, have demonstrated under sloped ceilings of up to 4 in. 12 that protection of storage can be achieved. However, for ceiling slopes of 2 in 12 and greater under obstructed construction, severe channeling of heat from a fire can occur once the depth of ceiling structural members exceeds 12 in. (300 mm). In addition, for ceiling slopes greater than 2 in 12 but not exceeding 4 in 12 under unobstructed construction, the number of sprinkler operations will significantly increase compared to test results obtained under flat ceilings. As a result, the guidelines for the installation of sprinklers under both unobstructed and obstructed construction have been updated to reflect the results of both the computer simulations and full-scale fire tests.

This material was developed by the Sloped Ceiling Task Group, which was formed by the Technical Committee on Sprinkler Systems Discharge Criteria to incorporate the results of the FPRF Project on Sprinklers Under Sloped Ceilings into NFPA 13. The Task Group consisted of Ken Isman (Chair), Wes Baker, Chase Browning, Mike Joanis, Larry Frank, Joe Noble, and Abram Selim Fouad.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 476-NFPA 13-2022 [Section No. 10.2.6.1.2]	SSU-SSP location to go with the discharge criteria in Chapter 20
Public Input No. 482-NFPA 13-2022 [Section No. 11.2.4.1.2]	EC sprinkler location to go with the discharge criteria in Chapter 20
Public Input No. 485-NFPA 13-2022 [Section No. 13.2.7.1.2]	CMSA sprinkler location to go with the discharge criteria in Chapter 20
Public Input No. 489-NFPA 13-2022 [Section No. 14.2.10.1]	ESFR sprinkler location to go with the discharge criteria in Chapter 20
Public Input No. 496-NFPA 13-2022 [New Section after 28.2.4.4]	

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20.9.1 Ceiling Slope. Except as permitted by 20.9.1.1 or 20.9.1.2, the sprinkler system criteria specified in Chapters 20 through ~~25~~ 26 shall apply to buildings with ceiling slopes not exceeding ~~2~~ 1 in 12 ~~(16.7 percent)~~.

20.9.1.1 Unobstructed Construction. ~~The following situations shall permit storage under ceilings with slope exceeding 2 in 12 (16.7 percent):~~

~~(1) Where a specific section in Chapters 20 through 25 permits ceiling slope in excess of 2 in 12 (16.7 percent).~~

~~(2) Where storage is protected with in-rack sprinklers in accordance with one of the options in Section 25.6, provided no storage is placed above the highest level of in-rack sprinkler.~~

20.9.1.1.1 Where the ceiling slope is greater than 1 in 12, but does not exceed 2 in 12, the ceiling sprinkler system discharge criteria shall be permitted to follow the requirements for a ceiling slope of 1 in 12.

20.9.1.1.2 Where the ceiling slope is greater than 2 in 12, but does not exceed 4 in 12, storage shall be permitted to be protected by any one of the following requirements:

(1) Where storage is protected with in-rack sprinklers in accordance with one of the options in 25.6, provided that no storage is placed above the highest level of in-rack sprinklers

(2) A horizontal false ceiling capable of withstanding an uplift force of 3 lb./ft² (14.6 kg/m²) is installed below the sloped ceiling and supplemented with ceiling sprinklers

(3) The design area for the ceiling sprinkler system is increased by 50 percent

20.9.1.1.3 Where the ceiling slope is greater than 4 in 12, storage shall be permitted to be protected by any one of the following requirements:

(1) Where storage is protected with in-rack sprinklers in accordance with one of the options in 25.6, provided that no storage is placed above the highest level of in-rack sprinklers.

(2) A horizontal false ceiling capable of withstanding an uplift force of 3 lb./ft² (14.6 kg/m²) is installed below the sloped ceiling and supplemented with ceiling sprinklers.

(3) Where a specific section in Chapters 20 through 26 permits ceiling slope that exceeds 4 in 12.

20.9.1.2 Obstructed Construction.

20.9.1.2.1 Where the ceiling slope is greater than 1 in 12, but does not exceed 4 in 12, the ceiling sprinkler system design criteria shall be permitted to follow the requirements for a ceiling slope of 1 in 12.

20.9.1.2.2 Where the ceiling slope is greater than 4 in 12, storage shall be permitted to be protected by any one of the following requirements:

(1) A horizontal false ceiling capable of withstanding an uplift force of 3 lb./ft² (14.6 kg/m²) is installed below the sloped ceiling and supplemented with ceiling sprinklers

(2) Where storage is protected with in-rack sprinklers in accordance with one of the options in 25.6, provided that no storage is placed above the highest level of in-rack sprinklers

(3) Where a specific section in Chapters 20 through 26 permits ceiling slope that exceeds 4 in 12

Substantiation: Computer simulations and full-scale fire tests as documented in the report entitled *Protection of Storage Under Sloped Ceilings Phase III: Large-Scale Testing Summary and Guidance*, written based on a project supported by the Fire Protection Research Foundation, have demonstrated under sloped ceilings of up to 4 in. 12 that protection of storage can be achieved. However, for ceiling slopes of 2 in 12 and greater under obstructed construction, severe channeling of heat from a fire can occur once the depth of ceiling structural members exceeds 12 in. (300 mm). In addition, for ceiling slopes greater than 2 in 12 but not exceeding 4 in 12 under unobstructed construction, the number of sprinkler operations will significantly increase compared to test results obtained under flat ceilings. As a result, the guidelines for the installation of sprinklers under both unobstructed and obstructed construction have been updated to reflect the results of both the computer simulations and full-scale fire tests.

This material was developed by the Sloped Ceiling Task Group, which was formed by the Technical Committee on Sprinkler Systems Discharge Criteria to incorporate the results of the FPRF Project on Sprinklers Under Sloped Ceilings into NFPA 13. The Task Group consisted of Ken Isman (Chair), Wes Baker, Chase Browning, Mike Joanis, Larry Frank, Joe Noble, and Abram Selim Fouad.

Public Input No. 81-NFPA 13-2021 [Section No. 20.9.3]

20.9.3 Storage Height.

20.9.3.1

The sprinkler system design shall be based on the storage height that routinely or periodically exists in the building and creates the greatest water demand.

20.9.3.2

The storage height shall be calculated from the floor level to the top of the commodity at its highest level.

20.9.3.3

Where storage is placed above doors, the storage height shall be calculated from the base of storage above the door.

Statement of Problem and Substantiation for Public Input

The application of storage height is codified for storage over doors, but not standard storage arrangements. The insertion of this new section would create an enforceable requirement to determine the storage height and would be measured from the floor to the highest normal level of storage regardless of the contents of the shelves below..

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Public Input No. 136-NFPA 13-2022 [Sections 20.9.4.2, 20.9.4.3, 20.9.4.4, 20.9.4.5]

Sections 20.9.4.2, 20.9.4.3, 20.9.4.4, 20.9.4.5

~~20~~ **21 .** ~~9.4.2~~ **1.11 Clearance**

21.1.11.1

For CMDA criteria where the clearance to ceiling exceeds those identified in Table ~~20~~ 21 .~~9~~ 1 .4 11 .~~2~~ 1 , the requirements of Table ~~20~~ 21 .~~9~~ 1 .4 11 .~~3 and~~ 2 and Table ~~20~~ 21 .~~9~~ 1 .4 11 .4 ~~shall~~ 3 shall apply.

~~Table 20~~ Table 21 .~~9~~ 1 .4 11 ~~.2 Maximum~~ 1 Maximum Clearance from Top of Storage to Ceiling for CMDA Protection Criteria

Commodity	Class I to IV	Group A Plastic
Palletized, solid-piled, bin box, shelf, or back-to-back shelf storage	20 ft (6.1 m)	20 ft (6.1 m)
Rack storage up to 25 ft (7.6 m)	20 ft (6.1 m)	10 ft (3.0 m)
Rack storage >25 ft (7.6 m)	10 ft (3.0 m)	10 ft (3.0 m)

~~20~~ 21 .~~9~~ 1 .4 11 .~~3~~ 2

Protection of Class I through Class IV commodities using CMDA criteria that exceed the maximum allowable clearance in Table ~~20~~ 21 .~~9~~ 1 .4 11 .~~2~~ 1 shall be in accordance with Table ~~20~~ 21 .~~9~~ 1 .4 11 .~~3~~ 2 .

~~Table 20~~ Table 21 .~~9~~ 1 .4 11 ~~.3 Class I~~ 2 Class I Through Class IV Commodities

Storage Configuration	Where the clearance to ceiling exceeds	Protection is based upon the storage height that would result in a clearance to ceiling of…	In-rack Sprinklers*
Palletized, solid-piled, bin box, shelf, or back-to-back shelf storage	20 ft (6.1 m)	20 ft (6.1 m)	N/A
Rack storage up to and including 25 ft (7.6 m) in height	20 ft (6.1 m)	20 ft (6.1 m)	Permitted as alternative to presumed clearance of 20 ft (6.1 m)
Rack storage over 25 ft (7.6 m) in height	10 ft (3.0 m)	10 ft (3.0 m)	Permitted as alternative to presumed clearance of 10 ft (3.0 m)

*When applying the supplemental in-rack sprinkler option, the ceiling density is based upon the given storage height with an assumed acceptable clearance to ceiling. Provide one level of supplemental, quick response in-rack sprinklers located directly below the top tier of storage and at every flue space intersection.

~~20~~ 21 .~~9~~ 1 .4 11 .~~4~~ 3

Protection of plastic and rubber commodities with CMDA criteria having clearance exceeding the allowable limits of Table ~~20~~ 21 .~~9~~ 1 .4 11 .~~3~~ 1 shall be in accordance with Table ~~20~~ 21 .~~9~~ 1 .4 11 .4 3 .

~~Table 20~~ Table 21 .~~9~~ 1 .4 11 .~~4 Plastics~~ 3 Plastics and Rubber Commodities

Storage Configuration	Where the clearance to ceiling exceeds	Protection is based upon the storage height that would result in a clearance to ceiling of…	In-rack Sprinklers*
Palletized, solid-piled, bin box, shelf, or back-to-back shelf storage	20 ft (6.1 m)	20 ft (6.1 m)	N/A
Rack storage up to and including 25 ft (7.6 m) in height	10 ft (3.0 m)	10 ft (3.0 m)	Permitted as alternative to presumed clearance of 10 ft (3.0 m)
Rack storage over 25 ft (7.6 m) in height	10 ft (3.0 m)	N/A	Required

*If in-rack sprinklers are required for the actual storage height with an acceptable clearance to ceiling, in-rack sprinklers are installed as indicated by that criteria. Provide one level of supplemental, quick response in-rack sprinklers located directly below the top tier of storage and at every flue space intersection.

~~20~~ 21 .~~9~~ 1 .11. ~~4.5~~

If in-rack sprinklers are required for the actual storage height with an acceptable clearance to ceiling, in-rack sprinklers shall be installed as indicated by that criteria.

Statement of Problem and Substantiation for Public Input

These requirements are specific to CMDA sprinklers and should be relocated to the general requirements in Chapter 21 as section "21.1.11 Clearance" with the included sections renumbered accordingly.

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Public Input No. 308-NFPA 13-2022 [New Section after 20.9.5.1]

Manually operated heat or smoke vents and automatic heat or smoke vents shall not be required in building protected with Early suppression fast-response (ESFR) sprinklers and refrigerated spaces protected with Control Mode Specific Application (CMSA) sprinklers.

Statement of Problem and Substantiation for Public Input

The fire code IFC(2021) Table 3206.2 notes h & i, provides guidance on the omission of heat or smoke vents with ESFR in general and CMSA sprinklers in refrigerated spaces.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 309-NFPA 13-2022 [Section No. 20.9.5.2]	

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Public Input No. 309-NFPA 13-2022 [Section No. 20.9.5.2]

20.9.5.2

Where Early suppression fast-response (ESFR) ~~sprinklers shall not be~~ or control mode specific application (CMSA) sprinklers are used in buildings with ~~automatic~~ heat or smoke vents~~ unless the vents use a high-temperature rated,~~ , only automatic heat or smoke vents with a higher temperature rating and standard-response operating mechanism shall be used .

Statement of Problem and Substantiation for Public Input

The sensitivity concerns for CMSA Sprinklers would be similar to those of an ESFR.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 308-NFPA 13-2022 [New Section after 20.9.5.1]	

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Public Input No. 137-NFPA 13-2022 [Section No. 20.10.2]

20.10.2

The following unsprinklered combustible concealed spaces shall not require a minimum design area of sprinkler operation of 3000 ft^2 (280 m^2):

(1) ~~Noncombustible and limited-combustible concealed spaces with minimal combustible loading having no access. The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.~~

(2) ~~Noncombustible and limited-combustible concealed spaces with limited access and not permitting occupancy or storage of combustibles. The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.~~

(3) Combustible concealed spaces filled entirely with noncombustible insulation.

(4) Concealed spaces where rigid materials are used and the exposed surfaces have a flame spread index of 25 or less and the materials have been demonstrated to not propagate fire more than 10.5 ft (3.2 m) when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials,* or UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials,* extended for an additional 20 minutes in the form in which they are installed in the space.

(5) Concealed spaces in which the exposed materials are constructed entirely of fire retardant–treated wood as defined by NFPA 703.

(6) Concealed spaces over isolated small compartments not exceeding 55 ft^2 (5.1 m^2) in area.

(7) Vertical pipe chases under 10 ft^2 (0.9 m^2), provided that in multifloor buildings the chases are firestopped at each floor using materials equivalent to the floor construction. Such pipe chases shall contain no sources of ignition, piping shall be noncombustible, and pipe penetrations at each floor shall be properly sealed.

(8) Exterior columns under 10 ft^2 (0.9 m^2) in area formed by studs or wood joists, supporting exterior canopies that are fully protected with a sprinkler system.

(9) Cavities within unsprinklered wall spaces.

Statement of Problem and Substantiation for Public Input

Paren 1 and 2 are not examples of combustible concealed spaces and would not require an increase in design area regardless of the requirements of this section.

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Public Input No. 408-NFPA 13-2022 [Section No. 20.10.2]

20.10.2

The following unsprinklered combustible concealed spaces shall not require a minimum design area of sprinkler operation of 3000 ft^2 (280 m^2):

(1) Noncombustible and limited-combustible concealed spaces with minimal combustible loading having no access. The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.

(2) Noncombustible and limited-combustible concealed spaces with limited access and not permitting occupancy or storage of combustibles. The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.

(3) Combustible concealed spaces filled entirely with noncombustible insulation.

(4) Concealed spaces where rigid materials are used and the exposed surfaces have a flame spread index of 25 or less and the materials have ~~been demonstrated to not propagate fire~~ demonstrated that the flame front does not progress more than 10. ~~5 ft~~ 5 ft (3. ~~2 m) when~~ 2 m) beyond the centerline of the burners at any time during the test period when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials,* or UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials,* extended for an additional 20 minutes, in the form in which they are installed in the space.

(5) Concealed spaces in which the exposed materials are constructed entirely of fire retardant–treated wood as defined by NFPA 703.

(6) Concealed spaces over isolated small compartments not exceeding 55 ft^2 (5.1 m^2) in area.

(7) Vertical pipe chases under 10 ft^2 (0.9 m^2), provided that in multifloor buildings the chases are firestopped at each floor using materials equivalent to the floor construction. Such pipe chases shall contain no sources of ignition, piping shall be noncombustible, and pipe penetrations at each floor shall be properly sealed.

(8) Exterior columns under 10 ft^2 (0.9 m^2) in area formed by studs or wood joists, supporting exterior canopies that are fully protected with a sprinkler system.

(9) Cavities within unsprinklered wall spaces.

Statement of Problem and Substantiation for Public Input

The proposed change makes the language consistent with code language and with language in ASTM E2768. No technical change is being made but the standard describes "flame front progress" and not "fire propagation".

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 406-NFPA 13-2022 [Section No. 9.2.1.12]	
Public Input No. 407-NFPA 13-2022 [Section No. 19.2.3.1.5.2]	
Public Input No. 606-NFPA 13-2022 [Section No. 20.10.2]	
Public Input No. 606-NFPA 13-2022 [Section No. 20.10.2]	

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Public Input No. 606-NFPA 13-2022 [Section No. 20.10.2]

20.10.2

The following unsprinklered combustible concealed spaces shall not require a minimum design area of sprinkler operation of 3000 ft^2 (280 m^2):

(1) Noncombustible and limited-combustible concealed spaces with minimal combustible loading having no access. The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.

(2) Noncombustible and limited-combustible concealed spaces with limited access and not permitting occupancy or storage of combustibles. The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.

(3) Combustible concealed spaces filled entirely with noncombustible insulation.

(4) Concealed spaces where rigid materials are used and the exposed surfaces have a flame spread index of 25 or less and the materials have ~~been demonstrated to not propagate fire~~ demonstrated that the flame front does not progress more than 10. ~~5 ft~~ 5 ft (3. ~~2 m) when~~ 2 m) beyond the centerline of the burners at any time during the test period, when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials,* or UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials,* extended for an additional 20 minutes, in the form in which they are installed in the space.

(5) Concealed spaces where rigid materials are used and the materials comply with the requirements of ASTM E2768, *Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30 min Tunnel Test)* .

(6) Concealed spaces in which the exposed materials are constructed entirely of fire retardant–treated wood as defined by NFPA 703.

(7) Concealed spaces over isolated small compartments not exceeding 55 ft^2 (5.1 m^2) in area.

(8) Vertical pipe chases under 10 ft^2 (0.9 m^2), provided that in multifloor buildings the chases are firestopped at each floor using materials equivalent to the floor construction. Such pipe chases shall contain no sources of ignition, piping shall be noncombustible, and pipe penetrations at each floor shall be properly sealed.

(9) Exterior columns under 10 ft^2 (0.9 m^2) in area formed by studs or wood joists, supporting exterior canopies that are fully protected with a sprinkler system.

(10) Cavities within unsprinklered wall spaces.

Statement of Problem and Substantiation for Public Input

Sections 9.2.1.12 (and PI 406) and 19.2.3.1.5.2 (and PI 407) address the same issue, namely the "extended ASTM E84 test". The language proposed is the language actually used (namely describing progression of the flame front as a function of the centerline of the burners and not flame propagation). This change is proposed in PI 408. The present PI proposes additionally to reference ASTM E2768, which is the extended ASTM E84 test (for 30 minutes), consistently with the other two sections. Actually, the scope of ASTM E84 (which is a 10 minute test) states that the user must go to ASTM E2768 for the details of the 30 minute test.
This PI is basically editorial.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 406-NFPA 13-2022 [Section No. 9.2.1.12]	
Public Input No. 407-NFPA 13-2022 [Section No. 19.2.3.1.5.2]	
Public Input No. 408-NFPA 13-2022 [Section No. 20.10.2]	
Public Input No. 408-NFPA 13-2022 [Section No. 20.10.2]	

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Public Input No. 51-NFPA 13-2021 [Section No. 20.15.2.6]

20.15.2.6

Unless indicated otherwise, the minimum water supply requirements for a hydraulically designed sprinkler system shall be determined by adding the hose stream allowance from Table 20.15.2.6 to the water demand for sprinklers.

Table 20.15.2.6 Hose Stream Allowance and Water Supply Duration

~~150 120 c 60~~

Commodity	Sprinkler Type	Sprinkler Spacing Type	Number of Ceiling Sprinklers in Design Area[a]	Size of Design Area at Ceiling	Hose Stream Allowance		Water Supply Duration (minutes)
					gpm	L/min	
Class I–IV commodities, Group A plastics, idle wood pallets, and idle plastic pallets	Control mode density/area (CMDA)	Standard and extended-coverage	NA	Up to 1200 ft^2 (112 m^2)	250	950	60
				Over 1200 ft^2 (112 m^2) up to 1500 ft^2 (140 m^2)	500	1900	90
				Over 1500 ft^2 (140 m^2) up to 2600 ft^2 (240 m^2)	500	1900	120
				Over 2600 ft^2 (240 m^2)	500	1900	150
	Control mode specific application (CMSA)	Standard	Up to 12	NA	250	950	60
			Over 12 to 15	NA	500	1900	90
			Over 15 to 25	NA	500	1900	120
			Over 25	NA	500	1900	150
		Extended-coverage	Up to 6	NA	250	950	60
			Up to 8[b]	NA	250	950	60
			Over 6 to 8	NA	500	1900	90
			Over 8 to 12	NA	500	1900	120
			Over 12	NA	500	1900	150
	Early suppression fast response (ESFR)	Standard	Up to 12	NA	250	950	60
			~~Over 12 to 15~~	~~NA~~	~~500~~	~~1900~~	~~90~~
			~~Over 15 to 25~~	~~NA~~	~~500~~	~~1900~~	~~120~~
			~~Over 25~~	~~NA~~	~~500~~	~~1900~~	

Commodity	Sprinkler Type	Sprinkler Spacing Type	Number of Ceiling Sprinklers in Design Area[a]	Size of Design Area at Ceiling	Hose Stream Allowance		Water Supply Duration (minutes)			
					gpm	L/min				
---	---	---	---	---						
---	---	---	---	---						
---	---	---	---	---						
On-floor rubber tire storage up to 5 ft (1.5 m) in height	CMDA & CMSA	Standard and extended-coverage	Any	Any	250	950	120			
Rubber tire storage	CMDA	Standard and extended-coverage	NA	Up to 5000 ft^2 (465 m^2)	750	2850	180			
	CMSA	Standard	Up to 15	NA	500	1900	180			
	ESFR	Standard	Up to 12	NA	250	950	60	~~Over 12 to 20~~	~~NA~~	~~500~~
			---	---	---	---	---			
Roll paper	CMDA	Standard	NA	Up to 4000 ft^2 (370 m^2)	500	1900	120			
	CMSA	Standard	Up to 25	NA	500	1900	120			
	ESFR	Standard	~~Up to 12~~	~~NA~~	~~250~~	~~950~~	---	---	---	---
Alternative protection in accordance with Section 25.6	NA	NA	NA	NA	250	950	60			

NA: Not applicable.

[a]For CMSA and ESFR sprinklers, the additional sprinklers included in the design area for obstructions do not need to be considered in determining the total number of sprinklers in this column.

[b]Limited to a maximum of 144 ft^2 (13 m^2) per sprinkler.

[c]For storage on-tread, on-side, and laced tires in open portable steel racks or palletized portable racks, with pile height up to 25 ft (7.6 m) and building height up to 30 ft (9.1 m) with K-14.0 (K-200) or K-16.8 (K-240) ESFR sprinklers, the water supply duration is 180 minutes.

Statement of Problem and Substantiation for Public Input

There are no ESFR designs other than 12 sprinklers in the standard, the other hose allowances and durations should be removed. If an ESFR sprinkler is listed for a design area more than 12 sprinklers, then the required hose and duration needs to be in the manufacturer's data sheet.

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Public Input No. 328-NFPA 13-2022 [New Section after 20.19.1]

TITLE OF NEW CONTENT

20.19.1.1 Solid shelving requirements shall not apply to a noncombustible product stored with noncombustible storage aids including pallets, straps, containers or shelving material.

Statement of Problem and Substantiation for Public Input

The committee has been clear in stating that the load defines the shelf area so the solid shelving requirements have been applied to 20 foot long pieces of pipe on cantilever racking. This section attempts to allow a strictly noncombustible product that exceeds the 64 square feet to not be provided with in rack sprinklers at every shelf. A cantilever rack storing 20 foot long steel pipe is 80 square feet when measuring the load and sprinklers are required below every shelf. This should not be the intent of this section.

Submitter Information Verification

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Public Input No. 209-NFPA 13-2022 [Section No. 20.19.1]

20.19.1 General.

The requirements ~~in this chapter~~ of Chapter 25 for the installation of in-rack sprinklers shall apply to racks with solid shelves except as modified in this section. *(See Section C.8.)*

Statement of Problem and Substantiation for Public Input

Section 20.19 was removed from chapter 25 in the 2022 edition, however, the reference was not corrected to point to Chapter 25 instead of "the requirements in this chapter."

Submitter Information Verification

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Public Input No. 207-NFPA 13-2022 [New Section after 20.19.4.3]

20.20 Conveyors.

Sprinklers shall be arranged with respect to conveyors in accordance with one of the following:

(1) Quick-response standard spray sprinklers shall be permitted to be installed below conveyors without high-piled storage located underneath.

(2) Ceiling level sprinklers shall be installed below conveyors with high-piled storage located underneath.

(3) Additional sprinklers shall not be required below belt or similar type conveyors where the conveyor in a horizontal profile is a minimum 70 percent open.

(4) Additional sprinklers shall not be required below belt conveyors up to 4 ft (1.2 m) wide where the area below the conveyor is void of high-piled storage.

(5) Additional sprinklers shall not be required below roller conveyors where the horizontal opening between rollers equals or exceeds the width of the roller.

(6) Additional sprinklers shall not be required below roller conveyors where the area below the conveyor is void of high-piled storage.

Statement of Problem and Substantiation for Public Input

Relocated language from Chapter 14. The rules for protection below conveyors should be in General Requirements for Storage and not limited to only one of the three general protection schemes. No technical changes proposed.

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Public Input No. 506-NFPA 13-2022 [Sections 21.1.5, 21.1.6]

~~**Sections 21.1.5, 21.1.6**~~

~~**21.1.5 *** –~~

~~Unless the requirements of 21.1.6 are met, the requirements of Table 21.5.1.1 shall not apply to modifications to existing storage application systems, using sprinklers with K-factors of K-8.0 (115) or less.~~

~~**21.1.6** –~~

~~Where applying the requirements of Table 21.5.1.1 utilizing the design criteria of 0.6 gpm/ft^2 per 2000 ft^2 (24.5 mm/min per 185 m^2) to existing storage applications, the requirements of 21.1.4 shall apply.~~

Statement of Problem and Substantiation for Public Input

The requirements in Sections 21.1.5 and 21.1.6 specific to existing systems are being deleted due to a proposal to relocate these requirements into Chapter 30. See the proposal specific to Section 30.1.6.

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Public Input No. 507-NFPA 13-2022 [Section No. 21.1.10.2]

~~21.1.10.2~~ –

~~The calculations shall satisfy any single point on appropriate density/area curves for the evaluation or modification of existing systems.~~

Statement of Problem and Substantiation for Public Input

The requirements in Section 21.1.10.2 specific to existing systems are being deleted due to a proposal to relocate these requirements into Chapter 30. See the proposal specific to Section 30.4.5.2.

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Public Input No. 508-NFPA 13-2022 [Sections 21.2.2.1, 21.2.2.2]

Sections 21.2.2.1, 21.2.2.2

~~21.2.2.1 – General.~~

~~**21.2.2.1.1** –~~

~~For new systems,~~ ~~21.2.2.2~~ ~~shall be used.~~

~~**21.2.2.1.2** –~~

~~For the evaluation or modification of existing systems,~~ ~~21.2.2.3~~ ~~shall be permitted to be used.~~

~~**21.2.2.2** – New~~ 2 _ System Criteria.

21.2.2.2.1

Densities shall be selected from Table 21.2.2.2.1 with a design area of 2000 ft^2 (185 m^2).

Table 21.2.2.2.1 Sprinkler System Design Density, Storage 12 ft to 30 ft (3.7 m to 9.1 m) High [gpm/ft^2 (mm/min)]

Storage Height		Commodity Class	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler		
ft	m					
12 to 15	3.7 to 4.6	I	0.15 (6.1)	0.15 (6.1)		
				II	0.15 (6.1)	0.16 (6.5)
				III	0.20 (8.2)	0.20 (8.2)
				IV	0.21 (8.6)	0.27 (11.0)
>15 to 18	>4.6 to 5.5	I	0.15 (6.1)	0.19 (7.7)		
				II	0.15 (6.1)	0.21 (8.6)
				III	0.20 (8.2)	0.26 (10.6)
				IV	0.27 (11.0)	0.35 (14.3)
>18 to 20	>5.5 to 6.1	I	0.15 (6.1)	0.21 (8.6)		
				II	0.17 (6.9)	0.23 (9.4)
				III	0.21 (8.6)	0.29 (11.8)
				IV	0.30 (12.2)	0.39 (15.9)
>20 to 22	>6.1 to 6.7	I	0.17 (6.9)	0.23 (9.4)		
				II	0.19 (7.7)	0.25 (10.2)
				III	0.23 (9.4)	0.32 (13.0)
				IV	0.33 (13.4)	0.43 (17.5)
>22 to 25	>6.7 to 7.6	I	0.20 (8.2)	0.28 (11.4)		
				II	0.23 (9.4)	0.31 (12.6)
				III	0.28 (11.4)	0.39 (15.9)
				IV	0.41 (16.7)	0.53 (21.6)
>25 to 28	>7.6 to 8.5	I	0.25 (10.2)	0.35 (14.3)		

Storage Height		Commodity Class	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler		
ft	m					
				II	0.28 (11.4)	0.38 (15.5)
				III	0.35 (14.3)	0.48 (19.6)
				IV	0.50 (20.4)	0.64 (26.1)
>28 to 30	>8.5 to 9.1	I	0.29 (11.8)	0.40 (16.3)		
				II	0.32 (13.0)	0.44 (17.9)
				III	0.40 (16.3)	0.55 (22.4)
				IV	0.57 (23.2)	0.74 (30.2)

21.2.2.2.2

For back-to-back shelf storage greater than 12 ft (3.7 m) and up to 15 ft (4.6 m), the design density shall be taken from Table 21.2.2.2.1 for storage greater than 18 ft (5.5 m) and up to 20 ft (6.1 m) using ordinary temperature sprinklers.

Statement of Problem and Substantiation for Public Input

With the proposed relocation of the requirements for evaluating or modifying existing systems in Section 21.2.2.3 to Chapter 30, Sections 21.2.2.1, 21.2.2.1.1 and 21.2.2.1.2 are no longer applicable and can be removed. In addition, the word “New” would no longer be needed in the title of Section 21.2.2.2.

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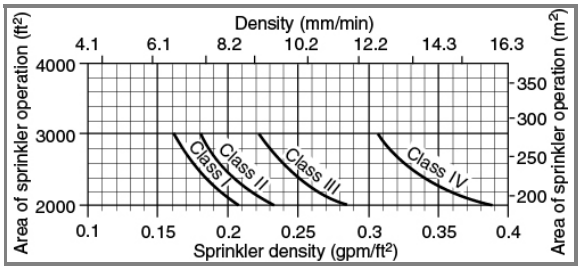
Public Input No. 509-NFPA 13-2022 [Section No. 21.2.2.3]

~~**21.2.2.3** – Evaluation or Modification of Existing Systems.~~

~~**21.2.2.3.1** –~~

~~For the evaluation or modification of existing systems, where using ordinary temperature–rated sprinklers, a single point shall be selected from the appropriate commodity curve on Figure 21.2.2.3.1 .~~

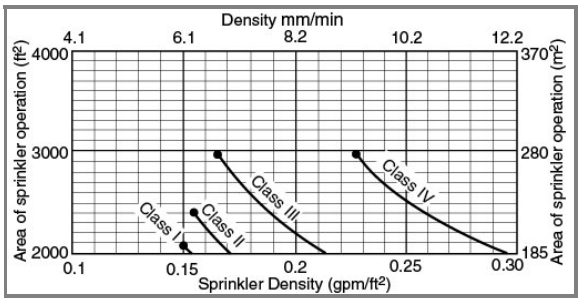
~~**Figure 21.2.2.3.1 For the Evaluation or Modification of Existing Systems, Sprinkler System Design Curves for 20 ft (6.1 m) High Storage — Ordinary Temperature–Rated Sprinklers.**~~



~~**21.2.2.3.2** –~~

~~For the evaluation or modification of existing systems, where using high temperature–rated sprinklers, a single point shall be selected from the appropriate commodity curve on Figure 21.2.2.3.2 .~~

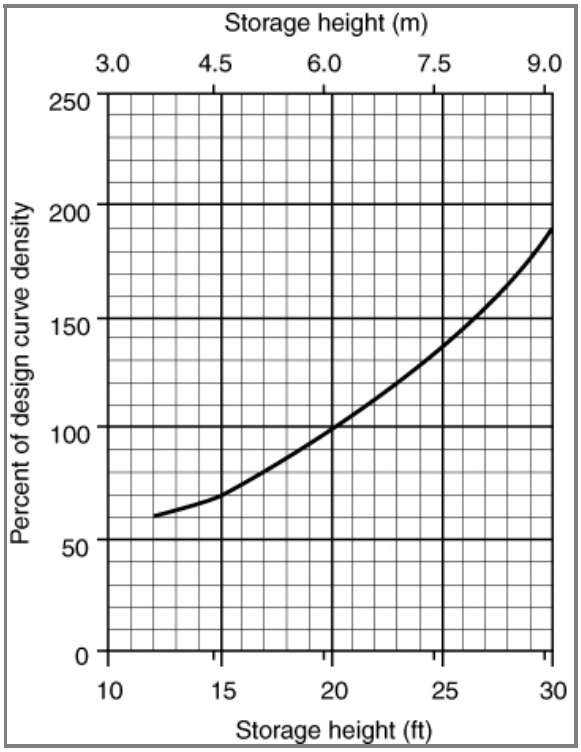
~~**Figure 21.2.2.3.2 For the Evaluation or Modification of Existing Systems, Sprinkler System Design Curves for 20 ft (6.1 m) High Storage — High Temperature–Rated Sprinklers.**~~



21.2.2.3.3 –

The densities selected in accordance with 21.2.2.3.1 or 21.2.2.3.2 shall be modified in accordance with Figure 21.2.2.3.3 without revising the design area.

Figure 21.2.2.3.3 For the Evaluation or Modification of Existing Systems, Ceiling Sprinkler Density vs. Storage Height.



21.2.2.3.4 –

In the case of metal bin boxes with face areas not exceeding 16 ft^2 (1.5 m^2) and metal closed shelves with face areas not exceeding 16 ft^2 (1.5 m^2), the area of application shall be permitted to be reduced by 33 percent, provided the minimum requirements of 21.2.2.3.5 and 21.2.2.3.6 are met.

21.2.2.3.5 –

For storage greater than 12 ft (3.7 m), the design density shall not be less than 0.15 gpm/ft^2 (6.1 mm/min), and the design area shall not be less than 2000 ft^2 (185 m^2) for wet systems or 2600 ft^2 (240 m^2) for dry systems for any commodity, class, or group.

21.2.2.3.6 –

For storage greater than 12 ft (3.7 m), the sprinkler design density for any given area of operation for a Class III or Class IV commodity, calculated in accordance with 21.2.2 , shall not be less than the density for the corresponding area of operation for ordinary hazard Group 2.

21.2.2.3.7 –

For back-to-back shelf storage, the design density shall be taken from Figure 21.2.2.3.1 for storage greater than 12 ft (3.7 m) and up to 15 ft (4.6 m) with no reduction for design density referenced in Figure 21.2.2.3.3 .

Statement of Problem and Substantiation for Public Input

The requirements in Section 21.2.2.3 are being deleted due to a proposal to relocate these requirements into Chapter 30. See the proposal specific to Section 30.4.5.2.

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Public Input No. 512-NFPA 13-2022 [Section No. 21.4.1.1]

21.4.1.1* General.

~~**21.4.1.1.1** –~~

Ceiling sprinkler water demand

~~for new systems~~

shall be determined in accordance with 21.4.1.2.2.1 for single- and double-row racks , or 21.4.1.6 and 21.4.1.3.2.1 for multiple-row racks

(See

~~Section~~

Section C.

~~14~~

14 .)

~~**21.4.1.1.2** –~~

~~Ceiling sprinkler water demand for the evaluation or modification of existing systems shall be permitted to be determined in accordance with 21.4.1.2.3 for single- and double-row racks or 21.4.1.3.1.2 and 21.4.1.3.2.2 for multiple-row racks. *(See Section C.14 .)*~~

Statement of Problem and Substantiation for Public Input

The requirements in Section 21.4.1.1.2 are being deleted due to a proposal to relocate the requirements for existing systems in Section 21.4 into Chapter 30. See the proposal specific to Section 30.4.5.3.

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Public Input No. 513-NFPA 13-2022 [Section No. 21.4.1.2.1]

21.4.1.2.1 ~~New Systems Criteria for Single- or Double-Row Rack Storage of Class I Through Class IV Commodities Stored Over 12 ft (3 . 7 m) Up to and Including 25 ft (7.6 m) in Height.~~ ~~21.4. 1.2.1.1~~

For single- or double-row racks for Class I, Class II, Class III, or Class IV commodities, encapsulated or nonencapsulated, the ceiling sprinkler water demand in terms of density [gpm/ft^2 (mm/min)] and area of sprinkler operation [ft^2 (m^2) of ceiling or roof] shall be selected from the criteria in Table 21.4.1.2.1.1(a) through Table 21.4.1.2.1.1(e) that are appropriate for each commodity and configuration and shall be modified as appropriate by 21.4.1.4.

Table 21.4.1.2.1.1(a) Single- or Double-Row Racks — Storage Height Up to and Including 15 ft (4.6 m) [gpm/ft^2 (mm/min)]

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	Aisles ft (m)	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler			
I	No	No	4 (1.2)	0.19 (7.7)	0.22 (9.0)			
						8 (2.4)	0.17 (6.9)	0.2 (8.
		Yes	No	4 (1.2)	0.33 (13.4)[a]	0.33 (13.4)[b]		
						8 (2.4)	0.28 (11.4)	0.3 (13
II	No	No	4 (1.2)	0.23 (9.4)	0.26 (10.6)			
						8 (2.4)	0.20 (8.2)	0.2 (9.
		Yes	No	4 (1.2)	0.33 (13.4)[a]	0.33 (13.4)[b]		
						8 (2.4)	0.28 (11.4)	0.3 (13
III	No	No	4 (1.2)	0.26 (10.6)	0.29 (11.8)			
						8 (2.4)	0.22 (9.0)	0.2 (10
		Yes	Yes	4 (1.2)	See Chapter 25.			
								8 (2.
IV	No	No	4 (1.2)	0.35 (14.3)	0.36 (14.7)[c]			
						8 (2.4)	0.30 (12.2)	0.3 (13
		Yes	Yes	4 (1.2)	See Chapter 25.			
								8 (2.

[a]Design area is 2400 ft^2 (220 m^2).

[b]Design area is 4000 ft^2 (370 m^2).

[c]Design area is 3000 ft^2 (280 m^2).

Table 21.4.1.2.1.1(b) Single- or Double-Row Racks —Storage Height Greater Than 15 ft (4.6 m) Up to and Including 18 ft (5.5 m) [gpm/ft^2 (mm/min)]

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	Aisles ft (m)	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	Aisles ft (m)	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler			
I	No	No	4 (1.2)	0.27 (11.0)	0.31 (12.6)			
						8 (2.4)	0.25 (10.2)	0.2 (11
		Yes	No	4 (1.2)	0.47 (19.2)[a]	0.47 (19.2)[b]		
						8 (2.4)	0.40 (16.3)	0.4 (18
II	No	No	4 (1.2)	0.32 (13.0)	0.37 (15.1)			
						8 (2.4)	0.28 (11.4)	0.3 (12
		Yes	No	4 (1.2)	0.47 (19.2)[a]	0.47 (19.2)[b]		
						8 (2.4)	0.40 (16.3)	0.4 (18
III	No	No	4 (1.2)	0.37 (15.1)	0.42 (17.1)			
						8 (2.4)	0.31 (12.6)	0.3 (14
		Yes	Yes	4 (1.2)	See Chapter 25.			8 (2.
IV	No	No	4 (1.2)	0.49 (20.0)	0.51 (20.8)[c]			
						8 (2.4)	0.42 (17.1)	0.4 (19
		Yes	Yes	4 (1.2)	See Chapter 25.			8 (2.

[a]Design area is 2400 ft^2 (220 m^2).

[b]Design area is 4000 ft^2 (370 m^2).

[c]Design area is 3000 ft^2 (280 m^2).

Table 21.4.1.2.1.1(c) Single- or Double-Row Racks — Storage Height Greater Than 18 ft (5.5 m) Up to and Including 20 ft (6.1 m) [gpm/ft^2 (mm/min)]

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	Aisles ft (m)	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler			
I	No	No	4 (1.2)	0.32 (13.0)	0.37 (15.1)			
						8 (2.4)	0.29 (11.8)	0.3 (13
		Yes	No	4 (1.2)	0.55 (22.4)[a]	0.55 (22.4)[b]		
						8 (2.4)	0.47 (19.1)	0.5 (21

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	Aisles ft (m)	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler			
II	No	No	4 (1.2)	0.38 (15.5)	0.44 (17.9)			
						8 (2.4)	0.33 (13.5)	0.3 (15
		Yes	No	4 (1.2)	0.55 (22.4)[a]	0.55 (22.4)[b]		
						8 (2.4)	0.47 (19.1)	0.5 (21
III	No	No	4 (1.2)	0.43 (17.5)	0.49 (19.9)			
						8 (2.4)	0.37 (15.1)	0.4 (17
		Yes	Yes	4 (1.2)	See Chapter 25.			
								8 (2.
IV	No	No	4 (1.2)	0.58 (23.7)	0.60 (24.5)[c]			
						8 (2.4)	0.50 (20.4)	0.5 (23
		Yes	Yes	4 (1.2)	See Chapter 25.			
								8 (2.

[a]Design area is 2400 ft^2 (220 m^2).

[b]Design area is 4000 ft^2 (370 m^2).

[c]Design area is 3000 ft^2 (280 m^2).

Table 21.4.1.2.1.1(d) Single- or Double-Row Racks — Storage Height Greater Than 20 ft (6.1 m) Up to and Including 22 ft (6.7 m) [gpm/ft^2 (mm/min)]

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	Aisles ft (m)	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler			
I	No	No	4 (1.2)	0.42 (17.1)	0.48 (19.6)			
						8 (2.4)	0.38 (15.5)	0.43 (17.5)
		Yes	Yes	4 (1.2)	See Chapter 25.			
								8 (2.4)
II	No	No	4 (1.2)	0.49 (20.0)	0.57 (23.2)			
						8 (2.4)	0.43 (17.5)	0.48 (19.6)
		Yes	Yes	4 (1.2)	See Chapter 25.			
								8 (2.4)
III	No	No	4 (1.2)	0.56 (22.8)	0.64 (26.1)			

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	Aisles ft (m)	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler		
						8 (2.4)	0.48 (19.6)	0.55 (22.4)
		Yes	Yes	4 (1.2)	See Chapter 25.		
							8 (2.4)
IV	No	No	4 (1.2)	0.75 (30.5)	0.78 (31.7)*		
						8 (2.4)	0.65 (26.5)	0.74 (30.1)
		Yes	Yes	4 (1.2)	See Chapter 25.		
							8 (2.4)

*Design area is 3000 ft^2 (280 m^2).

Table 21.4.1.2.1.1(e) Single- or Double-Row Racks — Storage Height Greater Than 22 ft (6.7 m) Up to and Including 25 ft (7.6 m) [gpm/ft^2 (mm/min)]

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	Aisles ft (m)	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler		
I	No	No	4 (1.2)	0.56 (22.8)	0.65 (26.9)		
						8 (2.4)	0.51 (20.8)	0.58 (23.6)
		Yes	Yes	4 (1.2)	See Chapter 25.		
							8 (2.4)
II	No	No	4 (1.2)	0.67 (27.3)	0.77 (31.3)		
						8 (2.4)	0.58 (23.7)	0.65 (26.5)
		Yes	Yes	4 (1.2)	See Chapter 25.		
							8 (2.4)
III	No	No	4 (1.2)	0.75 (30.5)	0.86 (34.9)		
						8 (2.4)	0.65 (26.5)	0.74 (30.1)
		Yes	Yes	4 (1.2)	See Chapter 25.		
							8 (2.4)
IV	No	Yes	4 (1.2)	See Chapter 25.			
								8 (2.4)
		Yes	Yes			4 (1.2)		
								8 (2.4)

21.4.1.2.1.2

The requirements in 21.4.1.2.1.1 shall apply to portable racks arranged in the same manner as single- or double-row racks.

21.4.1.2.1.3

Unless otherwise indicated in Table 21.4.1.2.1.1(a) through Table 21.4.1.2.1.1(e), the minimum design area shall be 2000 ft^2 (185 m^2).

Statement of Problem and Substantiation for Public Input

With the proposed relocation of Section 21.4.1.2.2 into Chapter 30, this header is no longer required.

Submitter Information Verification

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Submittal Date:	Tue May 31 13:58:33 EDT 2022
Committee:	AUT-SSD

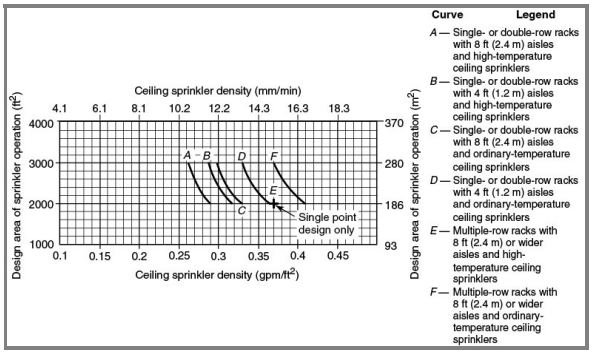
Public Input No. 515-NFPA 13-2022 [Section No. 21.4.1.2.2]

~~**21.4.1.2.2** – Evaluation or Modification of Existing Systems for Single- or Double-Row Rack Storage of Class I Through Class IV Commodities Stored Over 12 ft (3.7 m) Up to and Including 25 ft (7.6 m) in Height.~~

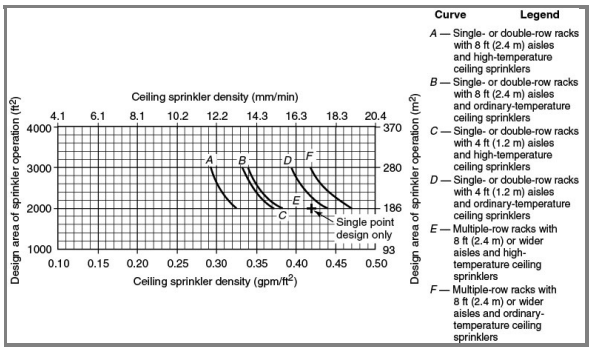
~~**21.4.1.2.2.1** * –~~

~~For single- or double-row racks for Class I, Class II, Class III, or Class IV commodities, encapsulated or nonencapsulated in single- or double-row racks, ceiling sprinkler water demand in terms of density [gpm/ft^2 (mm/min)] and area of sprinkler operation [ft^2 (m^2) of ceiling or roof] shall be selected from the density/area curves of Figure 21.4.1.2.2.1(a) through Figure 21.4.1.2.2.1(e) that are appropriate for each commodity and configuration as shown in Table 21.4.1.2.2.1 and shall be modified as appropriate by 21.4.1.7 .~~

~~**Figure 21.4.1.2.2.1(a) Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Class I Nonencapsulated Commodities — Conventional Pallets.**~~



~~**Figure 21.4.1.2.2.1(b) Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Class II Nonencapsulated Commodities — Conventional Pallets.**~~



~~**Figure 21.4.1.2.2.1(c) Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Class III Nonencapsulated Commodities — Conventional Pallets.**~~

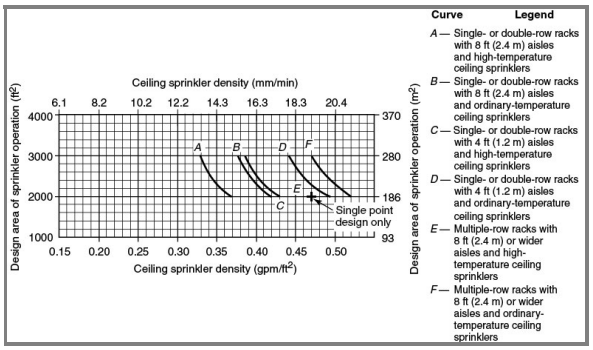


Figure 21.4.1.2.2.1(d) Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Class IV Nonencapsulated Commodities — Conventional Pallets.

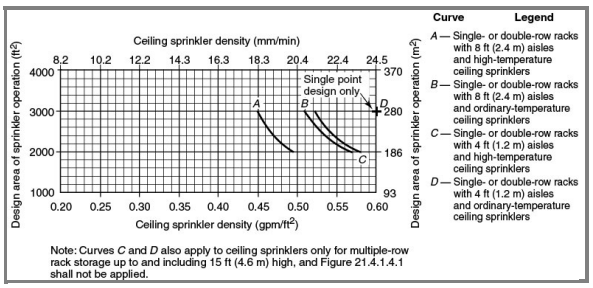


Figure 21.4.1.2.2.1(e) Single- or Double-Row Racks — 20 ft (6.1 m) High Rack Storage — Sprinkler System Design Curves — Class I and Class II Encapsulated Commodities — Conventional Pallets.

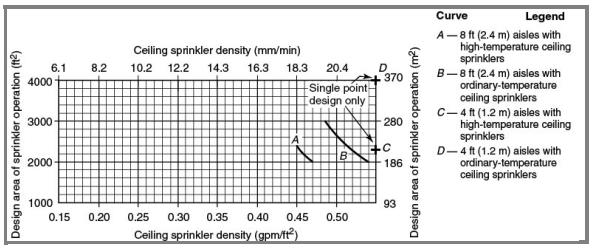


Table 21.4.1.2.2.1 Single- or Double-Row Racks — Storage Height Over 12 ft (3.7 m) Up to and Including 25 ft (7.6 m)

Height Commodity Class Encapsulated Aisles* Ceiling Sprinkler Water Demand ft m Figure Curves Apply Figure 21.4.1.7.1 Over 12 ft (3.7 m) up to and including 20 ft (6.1 m) I No 4 1.2 21.4.1.2.2.1(a) A and C Yes 8 2.4 B and D Yes 4 1.2 21.4.1.2.2.1(e) C and D Yes 8 2.4 A and B II No 4 1.2 21.4.1.2.2.1(b) C and D Yes 8 2.4 A and B Yes 4 1.2 21.4.1.2.2.1(e) C and D Yes 8 2.4 A and B III No 4 1.2 21.4.1.2.2.1(c) C and D Yes 8 2.4 A and B Yes 4 1.2 In-rack sprinklers required. See Chapter 25. NA NA 8 2.4 IV No 4 1.2 21.4.1.2.2.1(d) C and D Yes 8 2.4 A and B Yes 4 1.2 In-rack sprinklers required. See Chapter 25. NA NA 8 2.4 Over 20 ft (6.1 m) up to and including 22 ft (6.7 m) I No 4 1.2 21.4.1.2.2.1(a) A and C Yes 8 2.4 B and D Yes 4 1.2 In-rack sprinklers required. See Chapter 25. NA NA 8 2.4 II No 4 1.2 21.4.1.2.2.1(b) C and D Yes 8 2.4 A and B Yes 4 1.2 In-rack sprinklers required. See Chapter 25. NA NA 8 2.4 III No 4 1.2 21.4.1.2.2.1(c) C and D Yes 8 2.4 A and B Yes 4 1.2 In-rack sprinklers required. See Chapter 25. NA NA 8 2.4 IV No 4 1.2 21.4.1.2.2.1(d) C and D Yes 8 2.4 A and B Yes 4 1.2 In-rack sprinklers required. See Chapter 25. NA NA 8 2.4 Over 22 ft (6.7 m) up to and including 25 ft (7.6 m) I No 4 1.2 21.4.1.2.2.1(a) A and C Yes 8 2.4 B and D Yes 4 1.2 In-rack sprinklers required. See Chapter 25. NA NA 8 2.4 II No 4 1.2 21.4.1.2.2.1(b) C and D Yes 8 2.4 A and B Yes 4 1.2 In-rack sprinklers required. See Chapter 25. NA NA 8 2.4 III No 4 1.2 21.4.1.2.2.1(c) C and D Yes 8 2.4 A and B Yes 4 1.2 In-rack sprinklers required. See Chapter 25. NA NA 8 2.4 IV No 4 1.2 In-rack sprinklers required. See Chapter 25. NA NA 8 2.4 Yes 4 1.2 In-rack sprinklers required. See Chapter 25. NA NA 8 2.4

~~NA: Not applicable.~~

~~*See 21.4.1.2.3 for interpolation of aisle widths.~~

~~**21.4.1.2.2.2** –~~

~~The requirements in 21.4.1.2.2.1 shall apply to portable racks arranged in the same manner as single- or double-row racks.~~

Statement of Problem and Substantiation for Public Input

The requirements in Section 21.4.1.2.2 are being deleted due to a proposal to relocate these requirements into Chapter 30. See the proposal specific to Section 30.4.5.3.2.

Submitter Information Verification

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Committee:	AUT-SSD

Public Input No. 516-NFPA 13-2022 [Section No. 21.4.1.3.1]

21.4.1.3.1 ~~New System Criteria — Rack Depth Up to and Including 16 ft (4 . 9 m), Aisles 8 ft (2.4 m) or Wider, Storage Height Over 12 ft (3.7 m) Up to and Including 25 ft (7.6 m). 21.4. 1.3.1.1~~

For Class I, Class II, Class III, or Class IV commodities, encapsulated or nonencapsulated, ceiling sprinkler water demand in terms of density [gpm/ft^2 (mm/min)] and area of sprinkler operation [ft^2 (m^2) of ceiling or roof] shall be selected from the criteria in Table 21.4.1.3.1.1(a) through Table 21.4.1.3.1.1(e) that are appropriate for each commodity and configuration and shall be modified as appropriate by 21.4.1.4.

Table 21.4.1.3.1.1(a) Multiple-Row Racks — Rack Depth Up to and Including 16 ft (4.9 m), Aisles 8 ft (2.4 m) or Wider, Storage Height Up to and Including 15 ft (4.6 m) [gpm/ft^2 (mm/min)]

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler	
I	No	No	0.22 (9.0)	0.25 (10.2)	
	-	Yes	No	0.28 (11.4)	0.31 (12.6)
II	No	No	0.25 (10.2)	0.28 (11.4)	
	-	Yes	No	0.32 (13.0)	0.35 (14.3)
III	No	No	0.28 (11.4)	0.31 (12.6)	
	-	Yes	Yes	See Chapter 25.	
IV	No	Yes	See Chapter 25.		
	-	Yes	Yes	See Chapter 25.	

Table 21.4.1.3.1.1(b) Multiple-Row Racks — Rack Depth Up to and Including 16 ft (4.9 m), Aisles 8 ft (2.4 m) or Wider, Storage Height Above 15 ft (4.6 m) Up to and Including 18 ft (5.5 m) [gpm/ft^2 (mm/min)]

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler	
I	No	No	0.31 (12.6)	0.35 (14.3)	
	-	Yes	No	0.39 (15.9)	0.44 (17.9)
II	No	No	0.36 (14.7)	0.40 (16.3)	
	-	Yes	No	0.45 (18.3)	0.50 (20.4)
III	No	No	0.40 (16.3)	0.44 (17.9)	
	-	Yes	Yes	See Chapter 25.	
IV	No	Yes	See Chapter 25.		
	-	Yes	Yes	See Chapter 25.	

Table 21.4.1.3.1.1(c) Multiple-Row Racks — Rack Depth Up to and Including 16 ft (4.9 m), Aisles 8 ft (2.4 m) or Wider, Storage Height Above 18 ft (5.5 m) Up to and Including 20 ft (6.1 m) [gpm/ft^2 (mm/min)]

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler	
I	No	No	0.37 (15.1)	0.41 (16.7)	
	-	Yes	No	0.46 (18.7)	0.51 (20.8)
II	No	No	0.42 (17.1)	0.47 (19.2)	

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler	
	-	Yes	No	0.53 (21.6)	0.59 (24.0)
III	No	No	0.47 (19.1)	0.52 (21.2)	
	-	Yes	Yes	See Chapter 25.	
IV	No	Yes	See Chapter 25.		
	-	Yes	Yes	See Chapter 25.	

Table 21.4.1.3.1.1(d) Multiple-Row Racks — Rack Depth Up to and Including 16 ft (4.9 m), Aisles 8 ft (2.4 m) or Wider, Storage Height Above 20 ft (6.1 m) Up to and Including 22 ft (6.7 m) [gpm/ft^2 (mm/min)]

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler
I	No	No	0.48 (19.6)	0.53 (21.6)
	-	Yes	Yes	See Chapter 25.
II	No	Yes	See Chapter 25.	
	-	Yes	Yes	See Chapter 25.
III	No	Yes	See Chapter 25.	
	-	Yes	Yes	See Chapter 25.
IV	No	Yes	See Chapter 25.	
	-	Yes	Yes	See Chapter 25.

Table 21.4.1.3.1.1(e) Multiple-Row Racks — Rack Depth Up to and Including 16 ft (4.9 m), Aisles 8 ft (2.4 m) or Wider, Storage Height Above 22 ft (6.7 m) Up to and Including 25 ft (7.6 m) [gpm/ft^2 (mm/min)]

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler
I	No	No	0.65 (26.5)	0.72 (29.3)
	-	Yes	Yes	See Chapter 25.
II	No	Yes	See Chapter 25.	
	-	Yes	Yes	See Chapter 25.
III	No	Yes	See Chapter 25.	
	-	Yes	Yes	See Chapter 25.
IV	No	Yes	See Chapter 25.	
	-	Yes	Yes	See Chapter 25.

21.4.1.3.1.2

The protection criteria in accordance with 21.4.1.3.1.1 shall apply to portable racks arranged in the same manner as multiple-row racks.

21.4.1.3.1.3

Unless otherwise indicated in Table 21.4.1.3.1.1(a) through Table 21.4.1.3.1.1(e), the minimum design area shall be 2000 ft^2 (185 m^2).

Statement of Problem and Substantiation for Public Input

NOTE: With the proposed relocation of Section 21.4.1.3.2 into Chapter 30, this header is no longer required.

Justification: With the proposed relocation of Section 21.4.1.3.2 into Chapter 30, this header is no longer required.

Submitter Information Verification

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Committee:	AUT-SSD

Public Input No. 517-NFPA 13-2022 [Section No. 21.4.1.3.2]

~~**21.4.1.3.2** – Evaluation or Modification of Existing Systems — Rack Depth Up to and Including 16 ft (4.9), Aisles 8 ft (2.4) or Wider, Storage Height Over 12 ft (3.7 m) Up to and Including 25 ft (7.6 m).~~

~~**21.4.1.3.2.1** – Multiple-Row Racks — Rack Depth Up to and Including 16 ft (4.9 m) with Aisles 8 ft (2.4 m) or Wider.~~

~~For Class I, Class II, Class III, or Class IV commodities, encapsulated or nonencapsulated, ceiling sprinkler water demand in terms of density [gpm/ft^2 (mm/min)] and area of sprinkler operation [ft^2 (m^2) of ceiling or roof] shall be selected from the density/area curves of Figure 21.4.1.2.2.1(a) through Figure 21.4.1.2.2.1(e) that are appropriate for each commodity and configuration as shown in Table 21.4.1.3.2.1 and shall be modified as appropriate by 21.4.1.7 .~~

~~Table 21.4.1.3.2.1 Multiple-Row Racks — Rack Depth Up to and Including 16 ft (4.9 m), Aisles 8 ft (2.4 m) or Wider, and Storage Height Over 12 ft (3.7 m) Up to 25 ft (7.6 m)~~

~~Height Commodity Class Encapsulated Ceiling Sprinkler Water Demand Figure Curves Apply Figure 21.4.1.7.1 1.25 × Density Over 12 ft (3.7 m) up to and including 15 ft (4.6 m) I No 21.4.1.2.2.1(a) E and F Yes No Yes 21.4.1.2.2.1(a) E and F Yes II No 21.4.1.2.2.1(b) E and F Yes No Yes 21.4.1.2.2.1(b) E and F - Yes III No 21.4.1.2.2.1(c) E and F Yes No Yes In-rack sprinklers required. See Chapter 25. NA NA NA IV No In-rack sprinklers required. See Chapter 25. NA No No Yes In-rack sprinklers required. See Chapter 25. NA NA NA Over 15 ft (4.6 m) up to and including 20 ft (6.1 m) I No 21.4.1.2.2.1(a) E and F Yes No Yes 21.4.1.2.2.1(a) E and F Yes II No 21.4.1.2.2.1(b) E and F Yes No Yes 21.4.1.2.2.1(b) E and F Yes III No 21.4.1.2.2.1(c) E and F Yes No Yes In-rack sprinklers required. See Chapter 25. NA NA NA IV No Yes Over 20 ft (6.1 m) up to and including 25 ft (7.6 m) I No 21.4.1.2.2.1(a) E and F Yes No Yes In-rack sprinklers required. See Chapter 25. NA NA NA II No Yes III No Yes IV No Yes~~

~~NA: Not applicable.~~

~~**21.4.1.3.2.2** –~~

~~The protection criteria in accordance with 21.4.1.3.2.1 shall apply to portable racks arranged in the same manner as multiple-row racks.~~

Statement of Problem and Substantiation for Public Input

The requirements in Section 21.4.1.3.2 are being deleted due to a proposal to relocate these requirements into Chapter 30. See the proposal specific to Section 30.4.5.3.3.1.

Submitter Information Verification

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Committee: AUT-SSD

Public Input No. 518-NFPA 13-2022 [Section No. 21.4.1.4.1]

21.4.1.4.1 ~~New System Criteria — Rack Depth Over 16 ft (4 . 9 m) or Aisles More Narrow Than 8 ft (2.4 m), Storage Height Over 12 ft (3.7 m) Up to and Including 25 ft (7.6 m).~~ ~~21.4.~~ 1.4.1.1

For Class I, Class II, Class III, or Class IV commodities, encapsulated or nonencapsulated, storage height up to and including 15 ft. (4.6 m), the ceiling sprinkler water demand in terms of density [gpm/ft^2 (mm/min)] and area of sprinkler operation [ft^2 (m^2) of ceiling or roof] appropriate for each commodity and configuration shall be selected from Table 21.4.1.4.1.1 and shall be modified as appropriate by 21.4.1.4.

Table 21.4.1.4.1.1 Multiple-Row Racks — Rack Depth Over 16 ft (4.9 m) or Aisles Narrower Than 8 ft (2.4 m), Storage Height Up to and Including 15 ft (4.6 m)

Commodity Class	Encapsulated	In-Rack Sprinklers Mandatory	High-Temperature-Rated Sprinkler	Ordinary-Temperature-Rated Sprinkler	
I	No	No	0.22 (9.0)	0.25 (10.2)	
	-	Yes	No	0.28 (11.4)	0.31 (12.6)
II	No	No	0.25 (10.2)	0.28 (11.4)	
	-	Yes	No	0.32 (13.0)	0.35 (14.3)
III	No	No	0.28 (11.4)	0.31 (12.6)	
	-	Yes	Yes	See Chapter 25.	
IV	No	Yes	See Chapter 25.		
	-	Yes	Yes	See Chapter 25.	

21.4.1.4.1.2

Encapsulated or nonencasulated Class I through Class IV commodities stored over 15 ft (4.6 m) shall be in accordance with Chapter 25.

21.4.1.4.1.3

The protection criteria in accordance with 21.4.1.4.1.1 shall apply to portable racks arranged in the same manner as multiple-row racks.

Statement of Problem and Substantiation for Public Input

NOTE: (With the implementation of this proposal, the following sections would need to be renumbered: 21.4.1.4.1.1 becomes 21.4.1.4.1, 21.4.1.4.1.2 becomes 21.4.1.4.2, and 21.4.1.4.1.3 becomes 21.4.1.4.3.)

Justification:: With the proposed relocation of Section 21.4.1.5 into Chapter 30, this header is no longer required.

Submitter Information Verification

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Committee:	AUT-SSD

Public Input No. 519-NFPA 13-2022 [Section No. 21.4.1.5]

~~**21.4.1.5** – Evaluation or Modification of Existing Systems — Rack Depth Over 16 ft (4.9 m) or Aisles More Narrow Than 8 ft (2.4 m), Storage Height Over 12 ft (3.7 m) Up to and Including 25 ft (7.6 m).~~

~~**21.4.1.5.1** –~~

~~For Class I, Class II, Class III, or Class IV commodities, encapsulated or nonencapsulated, ceiling sprinkler water demand in terms of density [gpm/ft^2 (mm/min)] and area of sprinkler operation [ft^2 (m^2) of ceiling or roof] shall be selected from the density/area curves of Figure 21.4.1.2.2.1(a) through Figure 21.4.1.2.2.1(e) that are appropriate for each commodity and configuration as shown in Table 21.4.1.5.1 and shall be modified as appropriate by 21.4.1.7 .~~

~~Table 21.4.1.5.1 Multiple-Row Racks — Rack Depth Over 16 ft (4.9 m) or Aisles Narrower Than 8 ft (2.4 m), Storage Height Over 12 ft (3.7 m) Up to and Including 25 ft (7.6 m)~~

~~Height Commodity Class Encapsulated - - - - Ceiling Sprinkler Water Demand Figure Curves Apply Figure 21.4.1.7.1 1.25 × Density Over 12 ft (3.7 m) up to and including 15 ft (4.6 m) I No 21.4.1.2.2.1(a) E and F Yes No Yes 21.4.1.2.2.1(a) E and F Yes II No 21.4.1.2.2.1(b) E and F Yes No Yes 21.4.1.2.2.1(b) E and F Yes III No 21.4.1.2.2.1(c) E and F Yes No Yes In-rack sprinklers required. See Chapter 25. NA NA NA IV No In-rack sprinklers required. See Chapter 25. NA No No Yes In-rack sprinklers required. See Chapter 25. NA NA NA Over 15 ft (4.6 m) up to and including 20 ft (6.1 m) I No In-rack sprinklers required. See Chapter 25. NA NA NA Yes II No Yes III No Yes IV No Yes Over 20 ft (6.1 m) up to and including 25 ft (7.6 m) I No In-rack sprinklers required. See Chapter 25. NA NA NA Yes II No Yes III No Yes IV No Yes~~

~~NA: Not applicable.~~

~~**21.4.1.5.2** –~~

~~The protection criteria in accordance with 21.4.1.5.1 shall apply to portable racks arranged in the same manner as multiple-row racks.~~

Statement of Problem and Substantiation for Public Input

NOTE: (With the implementation of this proposal and the next one, the following sections would need to be renumbered: 21.4.1.6 becomes 21.4.1.5, 21.4.1.6.1 becomes 21.4.1.5.1, 21.4.1.6.2 becomes 21.4.1.5.2, 21.4.1.7 becomes 21.4.1.6, 21.4.1.7.2 becomes 21.4.1.6.1, 21.4.1.7.2.1 becomes 21.4.1.6.1.1, and 21.4.1.7.2.2 becomes 21.4.1.6.1.2.)

The requirements in Section 21.4.1.5 are being deleted due to a proposal to relocate these requirements into Chapter 30. See the proposal specific to Section 30.4.5.3.3.2.

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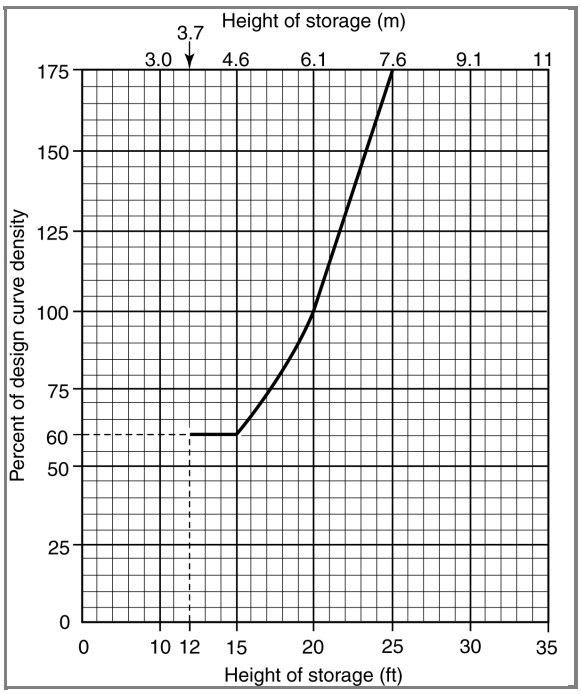
Public Input No. 520-NFPA 13-2022 [Section No. 21.4.1.7.1]

~~21.4.1.7.1~~ –

~~For the evaluation or modification of an existing system with storage height over 12 ft (3.7 m) up to and including 25 ft (7.6 m) protected with ceiling sprinklers only, densities obtained from design curves shall be adjusted in accordance with Figure 21.4.1.7.1 .~~

~~Figure 21.4.1.7.1 Evaluation or Modification of Existing System's Ceiling Sprinkler Density vs. Storage Height.~~



Statement of Problem and Substantiation for Public Input

The requirements in Section 21.4.7.1 are being deleted due to a proposal to relocate these requirements into Chapter 30. See the proposal specific to Section 30.4.5.3.4.

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Committee: AUT-SSD

Public Input No. 297-NFPA 13-2022 [New Section after 23.2.2]

Where listing limitations or installation instructions differ from the requirements of 23.2.2, the listing limitations and installation instructions shall apply.

Statement of Problem and Substantiation for Public Input

Certain ESFR sprinklers have been listed for use with differing design criteria (less than 12) and differing methods of determining the size of remote areas. Because those listings differ from this standard, designs based on those listings must be submitted as a "Performance Based Design". Inclusion of an option to install these sprinkler based on their listing, allows their use within this proscriptive standard.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 299-NFPA 13-2022 [Section No. 25.5.4.3]	
Public Input No. 300-NFPA 13-2022 [Section No. 28.2.4.4]	

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Submittal Date: Thu May 19 08:42:38 EDT 2022
Committee: AUT-SSD

Public Input No. 52-NFPA 13-2021 [New Section after 23.2.2]

23.2.3*

Where ESFR sprinklers are spaced less than the minimum distances required by 14.2.9.3 and the minimum areas required by 14.2.8.3 in accordance with 14.2.4.3, the design area shall cover a minimum of 768 sq. ft.

A.23.2.3

The design area should be determined utilizing the beam pockets as boundaries. See Figure A.28.2.4.1(c)

Statement of Problem and Substantiation for Public Input

With ESFR sprinklers permitted to be installed within the beam channels without regard to minimum spacing and area, the requirement for a minimum area of operation needs to be added back into the standard as it was in previous editions unless testing shows that the smaller area covered by these closely spaced sprinklers is effective.

Example: Solid beams, 4 ft on center, 14 in. deep. Sprinklers spaced 8 ft in the beam channel only cover 24 sq. ft and the total remote area would be 288 sq. ft.

Submitter Information Verification

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Organization: American Fire Sprinkler Association
Affiliation: American Fire Sprinkler Association
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 03 01:26:46 EDT 2021
Committee: AUT-SSD

Public Input No. 327-NFPA 13-2022 [New Section after 23.3.1]

TITLE OF NEW CONTENT

23.3.2 A k14 (k200) ESFR pendent sprinkler shall not be used to provide ceiling level protection only in a building with a height of 40 feet (12.2 m). If an existing building of 40 feet (12.2 m) has k14 (k200) ESFR ceiling sprinklers only, all sprinklers shall be replaced with an ESFR sprinkler with an appropriate k factor identified in Table 23.2.1.

Statement of Problem and Substantiation for Public Input

In 2013, the sprinkler committee eliminated the option of k14 ESFR sprinklers in a 40 foot high building. A review of the comments in the original ROP and ROC appear to state that the problem is one of excessive clearance and not storage height itself. A review of the Sprinkler Handbook states that "given a certain combination of fire ignition points between sprinklers and40 ft ceilings, the k14 ESFR sprinkler might not provide fire suppression for all storage occupancies."

We have a system that will not work and that is stated in the Handbook. It was also so significant that it warranted removing the design option from the standard but we are going to allow it to be used in existing buildings and not changed out? If the committee wishes to leave this in the standard, we should be giving the ahj/designer/ engineer some indication of why and how the system failed so that a proper understanding and risk analysis can be done. If we are not willing to do this, then we should retroactively remove the k14 in all 40 foot high buildings.

With the introduction of the existing systems chapter in 13, perhaps this should be in that section but why are we allowing an inadequate system to continue in use.

Submitter Information Verification

Submitter Full Name: Gerald Schultz
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Street Address:
City:
State:
Zip:
Submittal Date: Tue May 24 14:36:20 EDT 2022
Committee: AUT-SSD

Public Input No. 323-NFPA 13-2022 [Section No. 23.3.1]

23.3.1

Protection of palletized, solid-piled, or rack storage of Class I through Class IV and Group A commodities shall be in accordance with Table 23.3.1.

Table 23.3.1 ESFR Sprinkler Ceiling-Only Options for Solid Pile; Palletized; and Single-, Double-, and Multiple-Row Rack Storage

Commodity [a]	Maximun Storage Height	Maximum Ceiling/Roof Height	ESFR Sprinklers
—			
			- Pendent Orientation
			Minimum Operating
Pressure			
			Ppressure
-			
			psi (bar) E
—			
			- Upright Orientation
			Minimum Operating Pressure
-			
			psi (bar)
			Nominal K-Factors Nominal K-F
-	ft	m	
14			
ft	m		K14 (200)
16			
			K16 .8 (240)
25			
			K25 .2 (360)
14			
			K14 (200)
16			
			K16 .8 (240)
Class I through Class IV and cartoned			

K.22.4 (320)	K25.2 (360)							
Class I through Class IV and cartoned nonexpanded Group A plastics	20	6.1	25	7.6	50 (3.4)	35 (2.4)	25 (1.7)	15
	25	7.6	30	9.1	50 (3.4)	35 (2.4)	25 (1.7)	15
	30	9.1	35	10.7	75 (5.2)	52 (3.6)	35 (2.4)	20
	35	10.7	40	12.2				

—

52 (3.6)

—

40 (2.8)

—

—

40	12.2	45	13.7

—

—

40 (2.8)

8

7)

—

—

—

Cartoned expanded Group A plastics	20	6.1	25	7.6	50 (3.4)

— —

75 (5.2)	60 (4.1)	50 (3.4)	35 (2.4)	
25	7.6	30	9.1	50 (3.4)

—

75 (5.2)	60 (4.1)	50 (3.4)	35 (2.4)
30	9.1	35	10.7

—

— — — — —

	75 (5.2)	60 (4.1)		

35	10.7	40	12.2	

—

—————

	75 (5.2)	60 (4.1)		
40	12.2	45	13.7	

—

—————

————— ~~Exposed nonexpanded,~~

	75 (5.2)	60 (4.1)			
Exposed nonexpanded Group A plastics	20	6.1	25	7.6	50 (3.4)

————

75 (5.2)	60 (4.1)				
25	7.6	30	9.1	50 (3.4)	

————

75 (5.2)	60 (4.1)			
30	9.1	35	10.7	

—

—————

	75 (5.2)	60 (4.1)		
35	10.7	40	12.2	

—

—

75 (5.2)		

—

—

40	12.2	45	13.7

~~Chapter 25~~

Chapter 25 .

In-rack sprinklers required. See Chapter 25.	-	-	-	-	
Exposed expanded Group A plastics	20	6.1	25	7.6	

	30 (2.0) [b] or 60 (4.1) [c]			
25	7.6	30	9.1	

or 60 (4.1) [c]	-	-	-	
		~~32~~	~~9.8~~	

30	9.1	35	10.7

35	60 (4.1) b,c 10.7	40	12.2

	60 (4.1) b,c

40	12.2	45	13.7

[a]See 20.3.2 for information regarding protection of lower hazard commodities with higher hazard criteria.

[b]These options apply when all requirements in Section 27.4 are applied including vertical barriers.

[c]This option applies to palletized and solid pile storage in a closed array.

Additional Proposed Changes

File Name	Description	Approved
ESFR_table_revisions_from_Zurich.xlsx	ESFR Table 23.3.1 with proposed change as follows: 1) add maximum storage height columns, 2) delete the 32 ft. (9.8 m) ceiling height option for exposed expanded plastics, 3) add not to see Chapter 25 for K16.8 and exposed unexpanded plastics, and 4) cascade pressure options to lower storage heights or lower commodities.	

Statement of Problem and Substantiation for Public Input

Proposal to make four revisions to Table 23.3.1.

First, restore the maximum storage height columns (US and metric measures). These were in the 2019 and earlier editions and should be restored. These are the storage height used in the large-scale fire tests that support the guidance in this table. Storage above these heights should not be permitted.

Second, delete the 32 ft. (9.8 m) ceiling height row under exposed expanded plastics. All references to 32 ft. (9.8 m) high ceilings were to be removed from the table as there have been no reported large-scale fire tests conducted under a 32 ft. ceiling.

Third, add a note in the table to see Chapter 25 where K16.8 (240) sprinklers are used with exposed unexpanded plastics. Table 25.5.4.1 does include the K16.8 (240) sprinkler.

Fourth, where appropriate in the table, replace dashes with pressure options from higher storage heights or more challenging commodities at the same or higher storage height. That practice has been used in some but not all areas of the table. Concern has been raised that some authorities using the table view all dashes in the table as meaning there is no protection option available. That is not the case for all dashes.

Submitter Information Verification

Submitter Full Name: Richard Gallagher
Organization: Zurich Services Corporation
Street Address:
City:
State:
Zip:

Submittal Date:	Mon May 23 18:59:41 EDT 2022
Committee:	AUT-SSD

Commodity[a]	Maximun Storage Height		Maximum Ceiling/Roof		ESFR Sprinklers - Pendent Orientation				ESFR Sprinklers - Upright Orientation			
					Nominal K-Factors				Nominal K-Factors			
	ft	m	ft	m	K14 (200)	K16.8 (240)	K.22.4 (320)	K25.2 (360)	K14 (200)	K16.8 (240)	K.22.4 (320)	K25.2 (360)
Class I through Class IV and cartoned nonexpanded Group A plastics	20	6.1	25	7.6	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	50 (3.4)	35 (2.4)		
	25	7.6	30	9.1	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	50 (3.4)	35 (2.4)		
	30	9.1	35	10.7	75 (5.2)	52 (3.6)	35 (2.4)	20 (1.4)	75 (5.2)	52 (3.6)		
	35	10.7	40	12.2		52 (3.6)	40 (2.8)	25 (1.7)				
	40	12.2	45	13.7			40 (2.8)	40 (2.7)				
Cartoned expanded Group A plastics	20	6.1	25	7.6	50 (3.4)	35 (2.4)	75 (5.2)	60 (4.1)	50 (3.4)	35 (2.4)		
	25	7.6	30	9.1	50 (3.4)	35 (2.4)	75 (5.2)	60 (4.1)	50 (3.4)	35 (2.4)		
	30	9.1	35	10.7			75 (5.2)	60 (4.1)				
	35	10.7	40	12.2			75 (5.2)	60 (4.1)				
	40	12.2	45	13.7			75 (5.2)	60 (4.1)				
Exposed nonexpanded Group A plastics	20	6.1	25	7.6	50 (3.4)	35 (2.4)	75 (5.2)	60 (4.1)				
	25	7.6	30	9.1	50 (3.4)	35 (2.4)	75 (5.2)	60 (4.1)				
	30	9.1	35	10.7			75 (5.2)	60 (4.1)				
	35	10.7	40	12.2			75 (5.2)	60 (4.1)				
	40	12.2	45	13.7	In-rack sprinklers required. See Chapter 25.	In-rack sprinklers required. See Chapter 25.						
Exposed expanded Group A plastics	20	6.1	25	7.6				30 (2.0)[b] or 60 (4.1)[c]				
	25	7.6	30	9.1				30 (2.0)[b] or 60 (4.1)[c]				
			~~32~~	~~9.8~~								
	30	9.1	35	10.7				60 (4.1)[b,c]				
	35	10.7	40	12.2				60 (4.1)[b,c]				
	40	12.2	45	13.7								

(a) See 20.3.2 for information regarding protection of lower hazard commodities with higher hazard criteria.
(b) These options apply when all requirements in section 27.4 are applied including vertical barriers.
(c) This option applies to palletized and solid pile storage in a closed array.

Public Input No. 361-NFPA 13-2022 [Section No. 23.3.1]

23.3.1

Protection of palletized, solid-piled, or rack storage of Class I through Class IV and Group A commodities shall be in accordance with Table 23.3.1.

Table 23.3.1 ESFR Sprinkler Ceiling-Only Options for Solid Pile; Palletized; and Single-, Double-, and Multiple-Row Rack Storage

Commodity[a]	Maximum Ceiling/Roof Height		ESFR Sprinklers — Pendent Orientation Minimum Operating Pressure psi (bar)				ESFR Sprinklers — Upright Orientation Minimum Operating Pressure psi (bar)	
			Nominal K-Factors				Nominal K-Factors	
	ft	m	14 (200)	16.8 (240)	22.4 (320)	25.2 (360)	14 (200)	16.8 (240)
Class I through Class IV and cartoned nonexpanded Group A plastics	25	7.6	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	50 (3.4)	35 (2.4)
	30	9.1	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	50 (3.4)	35 (2.4)
	35	10.7	75 (5.2)	52 (3.6)	35 (2.4)	20 (1.4)	75 (5.2)	52 (3.6)
	40	12.2	—	52 (3.6)	—	25 (1.7)	—	—
	45	13.7	—	—	40 (2.8)	40 (2.8)	—	—
Cartoned expanded Group A plastics	25	7.6	50 (3.4)	35 (2.4)	—	—	50 (3.4)	35 (2.4)
	30	9.1	50 (3.4)	35 (2.4)	—	—	50 (3.4)	35 (2.4)
	35	10.7	—	—	—	—	—	—
	40	12.2	—	—	—	—	—	—
	45	13.7	—	—	—	—	—	—
Exposed nonexpanded, Group A plastics	25	7.6	50 (3.4)	35 (2.4)	—	—	—	—
	30	9.1	50 (3.4)	35 (2.4)	—	—	—	—
	35	10.7	—	—	—	—	—	—
	40	12.2	—	—	75 (5.2)	60 (4.1)	—	—
	45	13.7	In-rack sprinklers required. See Chapter 25.	—	—	—	—	—
Exposed expanded Group A plastics	25	7.6	—	—	—	—	—	—
	30	9.1	—	—	—	30 (2.0)[b]	—	—
	32	9.8	—	—	—	—	—	—
	35	10.7	—	—	—	—	—	—

Commodity[a]	Maximum Ceiling/Roof Height		ESFR Sprinklers — Pendent Orientation Minimum Operating Pressure psi (bar)				ESFR Sprinklers — Upright Orientation Minimum Operating Pressure psi (bar)	
			Nominal K-Factors				Nominal K-Factors	
	ft	m	14 (200)	16.8 (240)	22.4 (320)	25.2 (360)	14 (200)	16.8 (240)
	40	12.2	—	—	—	60 (4.1)[b,c]	—	—
	45	13.7	—	—	—	—	—	—

[a]See 20.3.2 for information regarding protection of lower hazard commodities with higher hazard criteria.

[b]These options apply when all requirements in Section 27.4 are applied including vertical barriers.

[c]This option applies to palletized and solid pile storage in a closed array.

Additional Proposed Changes

File Name	Description	Approved
K_28_and_33_criteria.doc	Revised Table 23.3.1	

Statement of Problem and Substantiation for Public Input

Revise current table for ESFR's protection to add criteria for K28 and K34 ESFR sprinklers as tested by Factory Mutual and outlined in FM Data Sheet 8-9 Table 17b with 9 and 10 flowing sprinklers.

Submitter Information Verification

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Zip:
Submittal Date: Fri May 27 09:18:50 EDT 2022
Committee: AUT-SSD

23.3.1

Protection of palletized, solid-piled, or rack storage of Class I through Class IV and Group A commodities shall be in accordance with Table 23.3.1.

Table 23.3.1 ESFR Sprinkler Ceiling-Only Options for Solid Pile; Palletized; and Single-, Double-, and Multiple-Row Rack Storage

Commodity[a]	Maximum Ceiling/Roof Height		ESFR Sprinklers — Pendent Orientation Minimum Operating Pressure psi (bar)						ESFR Sprinklers — Upright Orientation Minimum Operating Pressure psi (bar)	
			Nominal K-Factors						Nominal K-Factors	
	ft	m	14 (200)	16.8 (240)	22.4 (320)	25.2 (360)	28 (400)[b]	33.6 (480)[b]	14 (200)	16.8 (240)
Class I through Class IV and cartoned nonexpanded Group A plastics	25	7.6	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	40 (2.8)[c]	55 (3.8)[d]	50 (3.4)	35 (2.4)
	30	9.1	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	40 (2.8)[c]	55 (3.8)[d]	50 (3.4)	35 (2.4)
	35	10.7	75 (5.2)	52 (3.6)	35 (2.4)	20 (1.4)	40 (2.8)[c]	55 (3.8)[d]	75 (5.2)	52 (3.6)
	40	12.2	—	52 (3.6)	—	25 (1.7)	40 (2.8)[c]	55 (3.8)[d]	—	—
	45	13.7	—	—	40 (2.8)	40 (2.8)	40 (2.8)[c]	55 (3.8)[d]	—	—
	50	15.2	—	—	—	—	40 (2.8)[c]	55 (3.8)[d]	—	—
	55	16.8	—	—	—	—	80 (5.5)[e]	55 (3.8)[d]	—	—
Cartoned expanded Group A plastics	25	7.6	50 (3.4)	35 (2.4)	—	—	—	—	50 (3.4)	35 (2.4)
	30	9.1	50 (3.4)	35 (2.4)	—	—	—	—	50 (3.4)	35 (2.4)
	35	10.7	—	—	—	—	—	—	—	—
	40	12.2	—	—	—	—	—	—	—	—
	45	13.7	—	—	—	—	—	—	—	—
Exposed nonexpanded, Group A plastics	25	7.6	50 (3.4)	35 (2.4)	—	—	—	—	—	—
	30	9.1	50 (3.4)	35 (2.4)	—	—	—	—	—	—
	35	10.7	—	—	—	—	—	—	—	—
	40	12.2	—	—	75 (5.2)	60 (4.1)	—	—	—	—
	45	13.7	In-rack sprinklers required. See Chapter 25.	—	—	—	—	—	—	—
Exposed expanded Group A plastics	25	7.6	—	—	—	—	—	—	—	—
	30	9.1	—	—	—	30 (2.0)[b,f]	—	—	—	—
	32	9.8	—	—	—	—	—	—	—	—
	35	10.7	—	—	—	—	—	—	—	—

Commodity[a]	Maximum Ceiling/Roof Height		ESFR Sprinklers — Pendent Orientation Minimum Operating Pressure psi (bar)						ESFR Sprinklers — Upright Orientation Minimum Operating Pressure psi (bar)	
			Nominal K-Factors						Nominal K-Factors	
	ft	m	14 (200)	16.8 (240)	22.4 (320)	25.2 (360)	**28 (400)[b]**	**33.6 (480)[b]**	14 (200)	16.8 (240)
	40	12.2	—	—	—	60 (4.1)[b,c,f,g]	—	—	—	—
	45	13.7	—	—	—	—	—	—	—	—

[a] See 20.3.2 for information regarding protection of lower hazard commodities with higher hazard criteria.

[b] Limited to single- and double-row rack storage without solid shelves.

[c] The number of design sprinklers is 10 and the minimum aisle width is 6 ft (1.8 m).

[d] The number of design sprinklers is 9 and the minimum aisle width is 6 ft (1.8 m). The maximum vertical distance from ceiling to sprinkler thermal element is 17 in. (425 mm).

[e] The number of design sprinklers is 9 and the minimum aisle width is 8 ft (2.4 m).

[b,f] These options apply when all requirements in Section 27.4 are applied including vertical barriers.

[c,g] This option applies to palletized and solid-piled storage in a closed array.

Public Input No. 411-NFPA 13-2022 [Section No. 23.3.1]

23.3.1

Protection of palletized, solid-piled, or rack storage of Class I through Class IV and Group A commodities shall be in accordance with Table 23.3.1.

Table 23.3.1 ESFR Sprinkler Ceiling-Only Options for Solid Pile; Palletized; and Single-, Double-, and Multiple-Row Rack Storage

Commodity[a]	Maximum Ceiling/Roof Height		ESFR Sprinklers — Pendent Orientation Minimum Operating Pressure psi (bar)				ESFR Sprinklers — Upright Orientation Minimum Operating Pressure psi (bar)	
			Nominal K-Factors				Nominal K-Factors	
	ft	m	14 (200)	16.8 (240)	22.4 (320)	25.2 (360)	14 (200)	16.8 (240)
Class I through Class IV and cartoned nonexpanded Group A plastics	25	7.6	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	50 (3.4)	35 (2.4)
	30	9.1	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	50 (3.4)	35 (2.4)
	35	10.7	75 (5.2)	52 (3.6)	35 (2.4)	20 (1.4)	75 (5.2)	52 (3.6)
	40	12.2	—	52 (3.6)	—	25 (1.7)	—	—
	45	13.7	—	—	40 (2.8)	40 (2.8)	—	—
Cartoned expanded Group A plastics	25	7.6	50 (3.4)	35 (2.4)	—	—	50 (3.4)	35 (2.4)
	30	9.1	50 (3.4)	35 (2.4)	—	—	50 (3.4)	35 (2.4)
	35	10.7	—	—	—	—	—	—
	40	12.2	—	—	—	—	—	—
	45	13.7	—	—	—	—	—	—
Exposed nonexpanded, Group A plastics	25	7.6	50 (3.4)	35 (2.4)	—	—	—	—
	30	9.1	50 (3.4)	35 (2.4)	—	—	—	—
	35	10.7	—	—	—	—	—	—
	40	12.2	—	—	75 (5.2)	60 (4.1)	—	—
	45	13.7	In-rack sprinklers required. See Chapter 25.	—	—	—	—	—
Exposed expanded Group A plastics	25	7.6	—	—	—	—	—	—
	30	9.1	—	—	—	30 (2.0)[b]	—	—
	32	9.8	—	—	—	—	—	—
	35	10.7	—	—	—	—	—	—

Commodity[a]	Maximum Ceiling/Roof Height		ESFR Sprinklers — Pendent Orientation Minimum Operating Pressure psi (bar)				ESFR Sprinklers — Upright Orientation Minimum Operating Pressure psi (bar)	
			Nominal K-Factors				Nominal K-Factors	
	ft	m	14 (200)	16.8 (240)	22.4 (320)	25.2 (360)	14 (200)	16.8 (240)
	40	12.2	—	—	—	60 (4.1)[b,c]	—	—
	45	13.7	—	—	—	—	—	—

[a]See 20.3.2 for information regarding protection of lower hazard commodities with higher hazard criteria.

[b]These options apply when all requirements in Section 27.4 are applied including vertical barriers.

[c]This option applies to palletized and solid pile storage in a closed array.

Additional Proposed Changes

File Name	Description	Approved
New_Column_for_Table_23.3.1.docx	New Storage Height Column for Table 23.3.1	

Statement of Problem and Substantiation for Public Input

The maximum storage height is necessary to maintain consistency with the laboratory fire testing and the other design criteria tables referenced in NFPA 13.

Submitter Information Verification

Submitter Full Name: Kerry Bell
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Sun May 29 12:24:07 EDT 2022
Committee: AUT-SSD

After the Maximum Ceiling/Roof Height column in Table 23.3.1, add a new column entitled “Maximum Storage Height” which references storage height values that are 5 ft (1.5 m) less than the maximum celling height values.

Public Input No. 452-NFPA 13-2022 [Section No. 23.3.1]

23.3.1

Protection of palletized, solid-piled, or rack storage of Class I through Class IV and Group A commodities shall be in accordance with Table 23.3.1.

Table 23.3.1 ESFR Sprinkler Ceiling-Only Options for Solid Pile; Palletized; and Single-, Double-, and Multiple-Row Rack Storage

Commodity[a]	Maximum Ceiling/Roof Height		ESFR Sprinklers — Pendent Orientation Minimum Operating Pressure psi (bar)				ESFR Sprinklers — Upright Orientation Minimum Operating Pressure psi (bar)	
			Nominal K-Factors				Nominal K-Factors	
	ft	m	14 (200)	16.8 (240)	22.4 (320)	25.2 (360)	14 (200)	16.8 (240)
Class I through Class IV and cartoned nonexpanded Group A plastics	25	7.6	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	50 (3.4)	35 (2.4)
	30	9.1	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	50 (3.4)	35 (2.4)
	35	10.7	75 (5.2)	52 (3.6)	35 (2.4)	20 (1.4)	75 (5.2)	52 (3.6)
	40	12.2	—	52 (3.6)	—	25 (1.7)	—	—
	45	13.7	—	—	~~40 (2.8)~~	~~40 (2.8)~~		
Cartoned expanded Group A plastics	25	7.6	50 (3.4)	35 (2.4)	—	—	50 (3.4)	35 (2.4)
	30	9.1	50 (3.4)	35 (2.4)	—	—	50 (3.4)	35 (2.4)
	35	10.7	—	—	—	—	—	—
	40	12.2	—	—	—	—	—	—
	45	13.7	—	—	—	—	—	—
Exposed nonexpanded, Group A plastics	25	7.6	50 (3.4)	35 (2.4)	—	—	—	—
	30	9.1	50 (3.4)	35 (2.4)	—	—	—	—
	35	10.7	—	—	—	—	—	—
	40	12.2	—	—	75 (5.2)	60 (4.1)	—	—
	45	13.7	In-rack sprinklers required. See Chapter 25.	—	—	—	—	—
Exposed expanded Group A plastics	25	7.6	—	—	—	—	—	—
	30	9.1	—	—	—	30 (2.0)[b]	—	—
	32	9.8	—	—	—	—	—	—

Commodity[a]	Maximum Ceiling/Roof Height		ESFR Sprinklers — Pendent Orientation Minimum Operating Pressure psi (bar)				ESFR Sprinklers — Upright Orientation Minimum Operating Pressure psi (bar)	
			Nominal K-Factors				Nominal K-Factors	
	ft	m	14 (200)	16.8 (240)	22.4 (320)	25.2 (360)	14 (200)	16.8 (240)
	35	10.7	—	—	—	—	—	—
	40	12.2	—	—	—	60 (4.1)[b,c]	—	—
	45	13.7	—	—	—	—	—	—

[a]See 20.3.2 for information regarding protection of lower hazard commodities with higher hazard criteria.

[b]These options apply when all requirements in Section 27.4 are applied including vertical barriers.

[c]This option applies to palletized and solid pile storage in a closed array.

Statement of Problem and Substantiation for Public Input

Full-scale fire testing at FM Global has indicated that ESFR sprinklers may not be able to prevent unacceptable horizontal flame spread when (1) ceiling heights are higher than 40 ft (12.2 m), (2) aisle widths are only 4 ft (1.2 m) wide, and (3) the ceiling sprinklers are installed on their normal spacing and location below the underside of the ceiling. Documentation regarding the full-scale fire tests will be forth-coming.

Submitter Information Verification

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Submittal Date: Sun May 29 17:01:20 EDT 2022
Committee: AUT-SSD

Public Input No. 492-NFPA 13-2022 [Section No. 23.3.1]

23.3.1

Protection of palletized, solid-piled, or rack storage of Class I through Class IV and Group A commodities shall be in accordance with Table 23.3.1.

Table 23.3.1 ESFR Sprinkler Ceiling-Only Options for Solid Pile; Palletized; and Single-, Double-, and Multiple-Row Rack Storage

Commodity[a]	Maximum Ceiling/Roof Height		ESFR Sprinklers — Pendent Orientation Minimum Operating Pressure psi (bar)				ESFR Sprinklers — Upright Orientation Minimum Operating Pressure psi (bar)	
			Nominal K-Factors				Nominal K-Factors	
	ft	m	14 (200)	16.8 (240)	22.4 (320)	25.2 (360)	14 (200)	16.8 (240)
Class I through Class IV and cartoned nonexpanded Group A plastics	25	7.6	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	50 (3.4)	35 (2.4)
	30	9.1	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	50 (3.4)	35 (2.4)
	35	10.7	75 (5.2)	52 (3.6)	35 (2.4)	20 (1.4)	75 (5.2)	52 (3.6)
	40	12.2	—	52 (3.6)	—	25 (1.7)	—	—
	45	13.7	—	—	40 (2.8)	40 (2.8)	—	—
Cartoned expanded Group A plastics	25	7.6	50 (3.4)	35 (2.4)	—	—	50 (3.4)	35 (2.4)
	30	9.1	50 (3.4)	35 (2.4)	—	—	50 (3.4)	35 (2.4)
	35	10.7	—	—	—	—	—	—
	40	12.2	—	—	—	—	—	—
	45	13.7	—	—	—	—	—	—
Exposed nonexpanded, Group A plastics	25	7.6	50 (3.4)	35 (2.4)	—	—	—	—
	30	9.1	50 (3.4)	35 (2.4)	—	—	—	—
	35	10.7	—	—	—	—	—	—
	40	12.2	—	—	75 (5.2)	60 (4.1)	—	—
	45	13.7	In-rack sprinklers required. See Chapter 25.	—	—	—	—	—
Exposed expanded Group A plastics	25	7.6	—	—	—	—	—	—
	30	9.1	—	—	—	30 (2.0)[b]	—	—
	32	9.8	—	—	—	—	—	—

Commodity[a]	Maximum Ceiling/Roof Height		ESFR Sprinklers — Pendent Orientation Minimum Operating Pressure psi (bar)				ESFR Sprinklers — Upright Orientation Minimum Operating Pressure psi (bar)	
			Nominal K-Factors				Nominal K-Factors	
	ft	m	14 (200)	16.8 (240)	22.4 (320)	25.2 (360)	14 (200)	16.8 (240)
	35	10.7	—	—	—	—	—	—
	40	12.2	—	—	—	60 (4.1)[b,c]	—	—
	45	13.7	—	—	—	—	—	—

[a]See 20.3.2 for information regarding protection of lower hazard commodities with higher hazard criteria.

[b]These options apply when all requirements in Section 27.4 are applied including vertical barriers.

[c]This option applies to palletized and solid pile storage in a closed array.

Update table to include 55 foot and 50 foot building height criteria from FM 8-9 (Interim Revision January 2022) Table 17b for 33.6, 28.0, 25.2, and 22.4 k-factor sprinkler, including a design basis less than 12 sprinklers.

Statement of Problem and Substantiation for Public Input

FM 8-9 (Interim Revision January 2022) Table 17b includes updated criteria for 33.6, 28.0, 25.2, and 22.4 k-factor sprinklers which includes extended ceiling heights and a design basis less than 12 sprinklers.

Submitter Information Verification

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Submittal Date: Tue May 31 11:59:23 EDT 2022
Committee: AUT-SSD

Public Input No. 552-NFPA 13-2022 [Section No. 23.3.1]

23.3.1

Protection of palletized, solid-piled, or rack storage of Class I through Class IV and Group A commodities shall be in accordance with Table 23.3.1.

Table 23.3.1 ESFR Sprinkler Ceiling-Only Options for Solid Pile; Palletized; and Single-, Double-, and Multiple-Row Rack Storage

Commodity[a]	Maximum Ceiling/Roof Height		ESFR Sprinklers — Pendent Orientation Minimum Operating Pressure psi (bar)				ESFR Sprinklers — Upright Orientation Minimum Operating Pressure psi (bar)	
			Nominal K-Factors				Nominal K-Factors	
	ft	m	14 (200)	16.8 (240)	22.4 (320)	25.2 (360)	14 (200)	16.8 (240)
Class I through Class IV and cartoned nonexpanded Group A plastics	25	7.6	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	50 (3.4)	35 (2.4)
	30	9.1	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)	50 (3.4)	35 (2.4)
	35	10.7	75 (5.2)	52 (3.6)	35 (2.4)	20 (1.4)	75 (5.2)	52 (3.6)
	40	12.2	—	52 (3.6)	—	25 (1.7)	—	—
	45	13.7	—	—	40 (2.8)	40 (2.8)	—	—
Cartoned expanded Group A plastics	25	7.6	50 (3.4)	35 (2.4)	—	—	50 (3.4)	35 (2.4)
	30	9.1	50 (3.4)	35 (2.4)	—	—	50 (3.4)	35 (2.4)
	35	10.7	—	—	—	—	—	—
	40	12.2	—	—	—	—	—	—
	45	13.7	—	—	—	—	—	—
Exposed nonexpanded, Group A plastics	25	7.6	50 (3.4)	35 (2.4)	—	—	—	—
	30	9.1	50 (3.4)	35 (2.4)	—	—	—	—
	35	10.7	—	—	—	—	—	—
	40	12.2	—	—	75 (5.2)	60 (4.1)	—	—
	45	13.7	In-rack sprinklers required. See Chapter 25.	—	—	—	—	—
Exposed expanded Group A plastics	25	7.6	—	—	—	—	—	—
	30	9.1	—	—	—	30 (2.0)[b]	—	—
	32	9.8	—	—	—	—	—	—
	35	10.7	—	—	—	—	—	—

Commodity[a]	Maximum Ceiling/Roof Height		ESFR Sprinklers — Pendent Orientation Minimum Operating Pressure psi (bar)				ESFR Sprinklers — Upright Orientation Minimum Operating Pressure psi (bar)	
			Nominal K-Factors				Nominal K-Factors	
	ft	m	14 (200)	16.8 (240)	22.4 (320)	25.2 (360)	14 (200)	16.8 (240)
	40	12.2	—	—	—	60 (4.1)[b,c]	—	—
	45	13.7	—	—	—	—	—	—

[a]See 20.3.2 for information regarding protection of lower hazard commodities with higher hazard criteria.

[b]These options apply when all requirements in Section 27.4 are applied including vertical barriers.

[c]This option applies to palletized and solid pile storage in a closed array.

Statement of Problem and Substantiation for Public Input

The reference in note b) is incorrect. It should be 23.4, not 27.4

Submitter Information Verification

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Submittal Date: Tue May 31 18:06:40 EDT 2022
Committee: AUT-SSD

Public Input No. 409-NFPA 13-2022 [Section No. 24.2.1]

24.2.1

Protection of palletized and solid-piled storage of Class I through Class IV and cartoned nonexpanded plastic commodities shall be permitted to be protected in accordance with Table 24.2.1.

Table 24.2.1 Extended Coverage, CMSA [K-factor 25.2 (360)] Sprinkler Design Criteria for Palletized and Solid-Piled Storage of Class I Through Class IV and Cartoned Nonexpanded Plastic Commodities

Storage Arrangement	Commodity Class	Maximum Storage Height		Maximum Ceiling/Roof Height		K-Factor/ Orientation	Type of System	Number of Design Sprinklers	Mi Op Pr
		ft	m	ft	m				
Palletized and solid-~~piled~~ piled1	Class I through Class IV, encapsulated and nonencapsulated, and cartoned nonexpanded plastics	20	6.1	30	9.1	25.2 (360) Upright/ pendent	Wet	6	3 (2
		20	6.1	30	9.1	25.2 (360) Upright/ pendent	Wet	6	3 (2
		25	7.6	30	9.1	25.2 (360) Upright/ pendent	Wet	6	3 (2
		25	7.6	30	9.1	25.2 (360) Upright/ pendent	Wet	6	3 (2
		25	7.6	35	10.7	25.2 (360) Upright/ pendent	Wet	8	4 (2

Storage Arrangement	Commodity Class	Maximum Storage Height		Maximum Ceiling/Roof Height		K-Factor/ Orientation	Type of System	Number of Design Sprinklers	Mi Op Pr
		ft	m	ft	m				
		25	7.6	35	10.7	25.2 (360) Upright	Wet	8	4 (2
		30	9.1	35	10.7	25.2 (360) Upright/ pendent	Wet	8	4 (2
		30	9.1	35	10.7	25.2 (360) Upright	Wet	8	4 (2

Additional Proposed Changes

File Name	Description	Approved
Tables_24.2.1_and_24.3.1_Revisions.docx	Note to Tables 24.2.1 and 24.3.1	

Statement of Problem and Substantiation for Public Input

The performance of extended coverage sprinklers during fire testing is particularly sensitive to a low clearance test condition. The 5 ft clearance value appears to be consistent with the fire test data that was submitted to support this design criteria.

Submitter Information Verification

Submitter Full Name: Kerry Bell
Organization: UL LLC
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City:
State:
Zip:
Submittal Date: Sun May 29 12:06:33 EDT 2022
Committee: AUT-SSD

Add Note 1 to bottom of Tables 24.2.1 and 24.3.1 indicating the following: “A minimum clearance of 5 ft. (1.5 m) shall be provided from sprinkler deflector to the top of storage.”

Public Input No. 410-NFPA 13-2022 [Section No. 24.3.1]

24.3.1

Protection of single-, double-, and multiple-row racks without solid shelves of Class I through Class IV and cartoned nonexpanded plastic commodities shall be permitted to be protected in accordance with Table 24.3.1.

Table 24.3.1 Extended Coverage, CMSA [K-Factor 25.2 (360)] Sprinkler Design Criteria for Single-, Double-, and Multiple-Row Racks Without Solid Shelves of Class I Through Class IV and Cartoned Nonexpanded Plastic Commodities

Storage Arrangement	Commodity Class	Maximum Storage Height		Maximum Ceiling/Roof Height		K-Factor/ Orientation	Type of System	Number of Design Sprinklers	Mi Op Pr
		ft	m	ft	m				
Single-, double-, and multiple-row racks without solid shelves (no open-top containers)1	Class I through Class IV, encapsulated and nonencapsulated, and cartoned nonexpanded plastics	20	6.1	30	9.1	25.2 (360) Upright/ pendent	Wet	6	3 (2
		20	6.1	30	9.1	25.2 (360) Upright/ pendent	Wet	6	3 (2
		25	7.6	30	9.1	25.2 (360) Upright/ pendent	Wet	6	3 (2
		25	7.6	30	9.1	25.2 (360) Upright/ pendent	Wet	6	3 (2
		25	7.6	35	10.7	25.2 (360) Upright/ pendent	Wet	8	4 (2

Storage Arrangement	Commodity Class	Maximum Storage Height		Maximum Ceiling/Roof Height		K-Factor/ Orientation	Type of System	Number of Design Sprinklers	Mi Op Pr
		ft	m	ft	m				
		25	7.6	35	10.7	25.2 (360) Upright	Wet	8	4 (2
		30	9.1	35	10.7	25.2 (360) Upright/ pendent	Wet	8	4 (2
		30	9.1	35	10.7	25.2 (360) Upright	Wet	8	4 (2

Additional Proposed Changes

File Name	Description	Approved
Tables_24.2.1_and_24.3.1_Revisions.docx	Note to Table 24.2.1 and 24.3.1	

Statement of Problem and Substantiation for Public Input

The performance of extended coverage sprinklers during fire testing is particularly sensitive to a low clearance test condition. The 5 ft clearance value appears to be consistent with the fire test data that was submitted to support this design criteria.

Submitter Information Verification

Submitter Full Name: Kerry Bell
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City:
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Zip:
Submittal Date: Sun May 29 12:20:03 EDT 2022
Committee: AUT-SSD

Add Note 1 to bottom of Tables 24.2.1 and 24.3.1 indicating the following: “A minimum clearance of 5 ft. (1.5 m) shall be provided from sprinkler deflector to the top of storage.”

Public Input No. 98-NFPA 13-2021 [Section No. 24.3.2]

24.3.2

Protection of Class I through Class IV and cartoned nonexpanded plastic commodities stored on single-, double-, or multiple-row racks without solid shelves or solid-piled, palletized, storage arrangements shall be permitted to be protected in accordance with Table 24.3.2~~(a) or Table 24 .3.2(b)~~ .

Table 24.3.2~~(a) CMSA~~ 2 CMSA K-25.2 (K-360) ~~Upright~~ Standard Coverage Sprinkler Design Criteria for Single-, Double-, and Multiple-Row Racks Without Solid Shelves and Solid-Piled, Palletized Storage Arrangement of Class I Through IV and Cartoned Nonexpanded Plastic Commodities

Storage Arrangement	Commodity Class	Maximum Storage Height		Maximum Ceiling/Roof Height		K-Factor/Orientation	System Type	Num of De Sprin
		ft	m	ft	m			
Solid-piled, palletized, and single-, double-, and multiple-row racks without solid shelves (no open-top containers)	Class I–IV encapsulated and nonencapsulated, and cartoned nonexpanded plastics	25	7.6	30	9.1	25.2 (360) Upright	Wet	12

~~Table 24.3.2(b) CMSA K-~~

25.2 (

~~K-~~

360) Pendent

~~Standard Coverage Sprinkler Design Criteria for Single-, Double-, and Multiple-Row Racks Without Solid Shelves and Solid-Piled, Palletized Storage Arrangement of Class I Through IV and Cartoned Nonexpanded Plastic Commodities Solid-piled, palletized, and single-, double-, and multiple-row racks without solid shelves (no open-top containers) Class I–IV encapsulated and nonencapsulated, and cartoned nonexpanded plastics 25 7.6 30 9.1 25.2 (360) Pendent Wet 12 15 psi~~

~~Storage Arrangement Commodity Class Maximum Storage Height Maximum Ceiling/Roof Height K-Factor/Orientation System Type Number of Design Sprinklers Minimum Operating Pressure Sprinkler Linear Spacing Sprinkler Area Spacing ft m ft m Min Max Min Max~~

15 psi

(1.0 bar)

~~8 ft~~

~~(2.4 m) 12 ft~~

~~(3.7 m) 80 ft 2~~

~~(7.5 m 2) 100 ft 2~~

~~(9.0 m 2)~~

Additional Proposed Changes

File Name	Description	Approved
Screen_Shot_2021-12-02_at_9.27.09_AM.png	New Table	

Statement of Problem and Substantiation for Public Input

The current format with two tables is difficult to immediately distinguish that one is for uprights and the other is for pendents. By combining the tables together, the criteria is easier to decipher and follows the format seen in previous chapters.

TerraView did not represent the changes, so please reference the attached screenshot of the combined table.

Submitter Information Verification

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Submittal Date: Thu Dec 02 09:22:40 EST 2021
Committee: AUT-SSD

24.3.2

Protection of Class I through Class IV and cartoned nonexpanded plastic commodities stored on single-, double-, or multiple-row racks without solid shelves or solid-piled, palletized, storage arrangements shall be permitted to be protected in accordance with Table 24.3.2.

Table 24.3.2 CMSA K-25.2 (K-360) Standard Coverage Sprinkler Design Criteria for Single-, Double-, and Multiple-Row Racks Without Solid Shelves and Solid-Piled, Palletized Storage Arrangement of Class I Through IV and Cartoned Nonexpanded Plastic Commodities

Storage Arrangement	Commodity Class	Maximum Storage Height		Maximum Ceiling/Roof Height		K-Factor/Orientation	System Type	Number of Design Sprinklers	Minimum Operating Pressure	Sprinkler Linear Spacing		Sprinkler Area Spacing	
		ft	m	ft	m					Min	Max	Min	Max
Solid-piled, palletized, and single-, double-, and multiple-row racks without solid shelves (no open-top containers)	Class I–IV encapsulated and nonencapsulated, and cartoned nonexpanded plastics	25	7.6	30	9.1	25.2 (360) Upright	Wet	12	20 psi (1.4 bar)	8 ft (2.4 m)	12 ft (3.7 m)	80 ft^2 (7.4 m^2)	100 ft^2 (9.0 m^2)
						25.2 (360) Pendent			15 psi (1.0 bar)				

Public Input No. 588-NFPA 13-2022 [Section No. 24.4.1 [Excluding any Sub-Sections]]

The minimum water supply requirements for a hydraulically designed sprinkler system shall be determined by adding the hose stream allowance from the listed hose stream from the manufacturer or Table 20.15.2.6, which ever is greater, to the water supply for sprinklers obtained from this chapter.

Statement of Problem and Substantiation for Public Input

Some of the designs in chapter 24 have higher Hose Stream allowances then the Hose Stream allowances in Table 20.15.2.6.

Submitter Information Verification

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Submittal Date: Wed Jun 01 13:26:19 EDT 2022
Committee: AUT-SSD

Public Input No. 589-NFPA 13-2022 [Section No. 24.4.1.1]

24.4.1.1

The water supply requirements for a hydraulically designed sprinkler system shall be available for the minimum duration specified in the sprinkler manufacturer's water suppy duration or Table 20.15.2.6, which ever is greater . _

Statement of Problem and Substantiation for Public Input

Some of the design options in chapter 24 have higher water supply durations then the water supply durations in Table 20.15.2.6.

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Public Input No. 593-NFPA 13-2022 [New Section after 24.5.1]

TITLE OF NEW CONTENT

24.5.2 Obstructed Obstruction. Under obstructed construction, the sprinkler deflector shall be located in accordance with one of the following arrangements:

(1) Install with the deflectors located at a minimum of 6 in. (150 mm) and a maximum of 12 in. (300 mm) from the ceiling.

(2) Installed with the deflectors within the horizontal planes 1 in to 6 in (25 mm to 150 mm) below wood joist, composite wood joist, solid obstructed noncombustible or solid obstructed limited combustible construction, to a maximum distance of 22 in. (550 mm) below the ceiling/roof or deck.

(3) Install with deflectors of sprinklers under concrete tee construction with stems spaced less than 7 ft 6 in. (2.3 m) but more than 3 ft (900 mm) on center, to a maximum depth of 18 in (XXmm), located at or above a horizontal plane 1 in. (25 mm) below the bottom of the stem of the tees and in compliance with Table 13.2.8.1.2 (a) or table 13.2.8.1.2 (b).

Statement of Problem and Substantiation for Public Input

Chapter 24 criteria is based on testing specifically at FM Global. As far as I am aware all testing has been under a smooth flat ceiling. If you follow the installation criteria for CMSA sprinklers for sprinkler placement rules, the "Concrete Tee" allowance can be utilized for the designs in accordance with chapter 24. This seems excessive, to allow for sprinklers to be located 36" below the deck and be able to use the associated sprinkler designs set forth in chapter 24. Since all this testing was completed at FM Global, I believe it makes sense to align the criteria closer to what is allowed in FM 2-0, basically limiting the depth of any obstructed construction to a depth of 18". Anything over that would require sprinklers in every channel.

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Public Input No. 523-NFPA 13-2022 [Section No. 25.1.2]

25.1.2 Chapter Organization.

This chapter is organized as follows:

(1) Section 25.1 contains general requirements for the entire chapter.

(2) Section 25.2 contains requirements for the protection of miscellaneous and low-piled rack storage using in-rack sprinklers.

(3) Section 25.3 contains requirements for in-rack sprinkler protection in combination with CMDA ceiling-level sprinklers.

(4) Section 25.4 contains requirements for in-rack sprinkler protection in combination with CMSA ceiling-level sprinklers.

(5) Section 25.5 contains requirements for in-rack sprinkler protection in combination with ESFR ceiling-level sprinklers.

(6) Section 25.6 contains requirements for in-rack sprinkler protection independent of ceiling-level sprinklers.

(7) ~~Section 25.7 contains requirements for the evaluation or modification of existing protection for miscellaneous and low-piled rack storage using in-rack sprinklers.~~

(8) ~~Section 25.8 contains requirements for the evaluation or modification of existing protection for CMDA ceiling-level sprinkler rack storage protection of Class I through Class IV commodities over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) using in-rack sprinklers.~~

Statement of Problem and Substantiation for Public Input

The information provided in Sections 25.1.2(7) and 25.1.2(8) is being deleted due to a proposal to relocate the requirements in Sections 25.7 and 25.8 into Chapter 30. See the proposals specific to Section 30.4.6.

Submitter Information Verification

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Committee:	AUT-SSD

Public Input No. 169-NFPA 13-2022 [New Section after 25.1.4.2.3]

25.1.4.2.4 Sectional Valve Accessibility

Sectional valves shall be accessible.

Statement of Problem and Substantiation for Public Input

NFPA 13 does not include a definition for sectional valves. Recently, there was disagreement between two parties at a construction site where in-rack sprinklers required a sectional valve per 24.1.2.3. One party cited the NFPA 13 Handbook that illustrated the in-rack sectional valve between the second and third shelf which they believe means the valve does not need to be accessible from the floor. The standard does state control valves shall be accessible. Because the standard does not define a sectional valve as a control valve, then the installer can state the sectional valve can be installed at any height. This could result in the valve being high in elevation and require a ladder or lift to reach the valve. If the committee believes the sectional valve needs to be in an accessible location, then provide in the standard. Note that control valves are required to be in an accessible location per section 16.9.3.3.1.

Submitter Information Verification

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Submittal Date: Sun Feb 27 11:58:58 EST 2022
Committee: AUT-SSD

Public Input No. 293-NFPA 13-2022 [New Section after 25.1.7.7]

25.1.7.7.1

Where rack storage of commodities other than class I through class IV is up to and including 25 ft (7.6 m), in-rack sprinklers shall be a minimum 3 in. (75 mm) radially from the side of rack uprights.

Statement of Problem and Substantiation for Public Input

The current language addresses sprinkler location in regard to the rack upright for class I through class IV commodities up to 25 ft in height and for all commodities above 25 ft in height (in section 25.1.7.8). There is a gap for commodities such as group A plastics in racks less than or equal to 25 ft in height. Adding this section clarifies that a 3 in. minimum shall be applied.

Submitter Information Verification

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Submittal Date: Wed May 18 22:22:02 EDT 2022
Committee: AUT-SSD

Public Input No. 177-NFPA 13-2022 [Section No. 25.2.1.4.3]

25.2.1.4.3

The sprinkler system criteria specified in this chapter for miscellaneous storage shall ~~not be limited to a ceiling slope of 2 in 12 (16.7 percent).~~ be permitted for both horizontal and sloped ceilings.

Statement of Problem and Substantiation for Public Input

Clarifies language to explicitly permit sloped ceilings. Current language redefines sloped ceilings and should just refer to horizontal and sloped ceilings as they are defined terms.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 178-NFPA 13-2022 [Section No. 25.2.2.4.2]	
Public Input No. 178-NFPA 13-2022 [Section No. 25.2.2.4.2]	
Public Input No. 179-NFPA 13-2022 [Section No. 25.7.1.4.3]	
Public Input No. 180-NFPA 13-2022 [Section No. 25.7.2.4.2]	

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Public Input No. 178-NFPA 13-2022 [Section No. 25.2.2.4.2]

25.2.2.4.2

The sprinkler system criteria specified in this chapter for low-piled storage shall ~~not be limited to a ceiling slope of 2 in 12 (16.7 percent).~~ be permitted for both horizontal and sloped ceilings.

Statement of Problem and Substantiation for Public Input

Clarifies language to explicitly permit sloped ceilings. Current language redefines sloped ceilings and should just refer to horizontal and sloped ceilings as they are defined terms.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 177-NFPA 13-2022 [Section No. 25.2.1.4.3]	
Public Input No. 177-NFPA 13-2022 [Section No. 25.2.1.4.3]	
Public Input No. 179-NFPA 13-2022 [Section No. 25.7.1.4.3]	
Public Input No. 180-NFPA 13-2022 [Section No. 25.7.2.4.2]	

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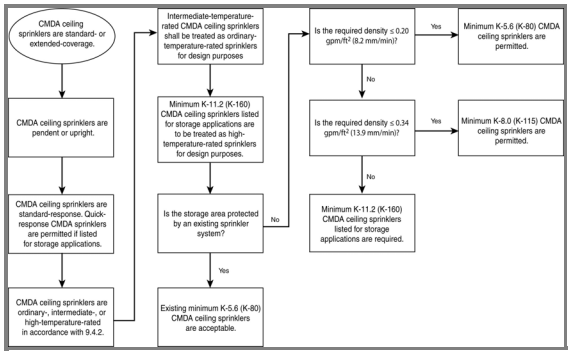
Public Input No. 230-NFPA 13-2022 [Section No. 25.3.1.3]

25.3.1.3 CMDA Ceiling-Level Sprinkler Characteristics.

CMDA Ceiling-level sprinkler characteristics in combination with in-rack sprinklers shall be in accordance with Figure 25.3.1.3.

Figure 25.3.1.3 CMDA Ceiling-Level Sprinkler Characteristics in Combination with In-Rack Sprinklers.



Additional Proposed Changes

File Name	Description	Approved
Public_Input_-_2022_NFPA_13_-_Chapter_25_-_K-11.2_Image_.JPG	K-11.2 permitted to be used as high-temp	

Statement of Problem and Substantiation for Public Input

The new Figure 25.3.1.3 is within 25.3.1 (general to all IRAS with CMDA) and has a section stating any K-11.2 sprinklers listed for storage ‘are to be’ treated as high-temperature for design purposes. Believe the term her is ‘can be’ versus ‘are to be’.

Note, section 25.3.2 is for rack storage up to 25 feet and the ceiling level densities located on Table 25.3.2.1.2.1(A)(a-d) have lower densities for high temperature sprinklers (no conflict here); However, section 25.3.3 is for rack storage over 25 feet in height and the numerous figures in this section have higher sprinkler densities for high temperature sprinklers and lower densities for ordinary-temperature sprinklers. Therefore, providing an ordinary temperature, K-11.2 sprinkler, would require using a higher than necessary density for rack storage over 25 feet when implementing the new Figure 25.3.1.3.

Previous editions: The 2016 edition section 12.6.9 stated 'Ordinary- and intermediate-temperature sprinklers with K-factors of K-11.2 or larger, where listed for storage, shall be permitted to use densities for high temperature sprinklers’

This section carried over to 2019 in two sections, 21.1.9 for protection of high piled storage using CMDA and into section 25.2.3.1.9 for CMDA with IRAS. The section 21.1.9 remains in place for 2022, however it has been removed for CMDA with IRAS. The new 2022 Figure 25.3.1.3 has provided guidance for this area. Is it the intent to penalize using K-11.2 and larger sprinklers for design purposes when using CMDA and IRAS protection for storage over 25 feet?

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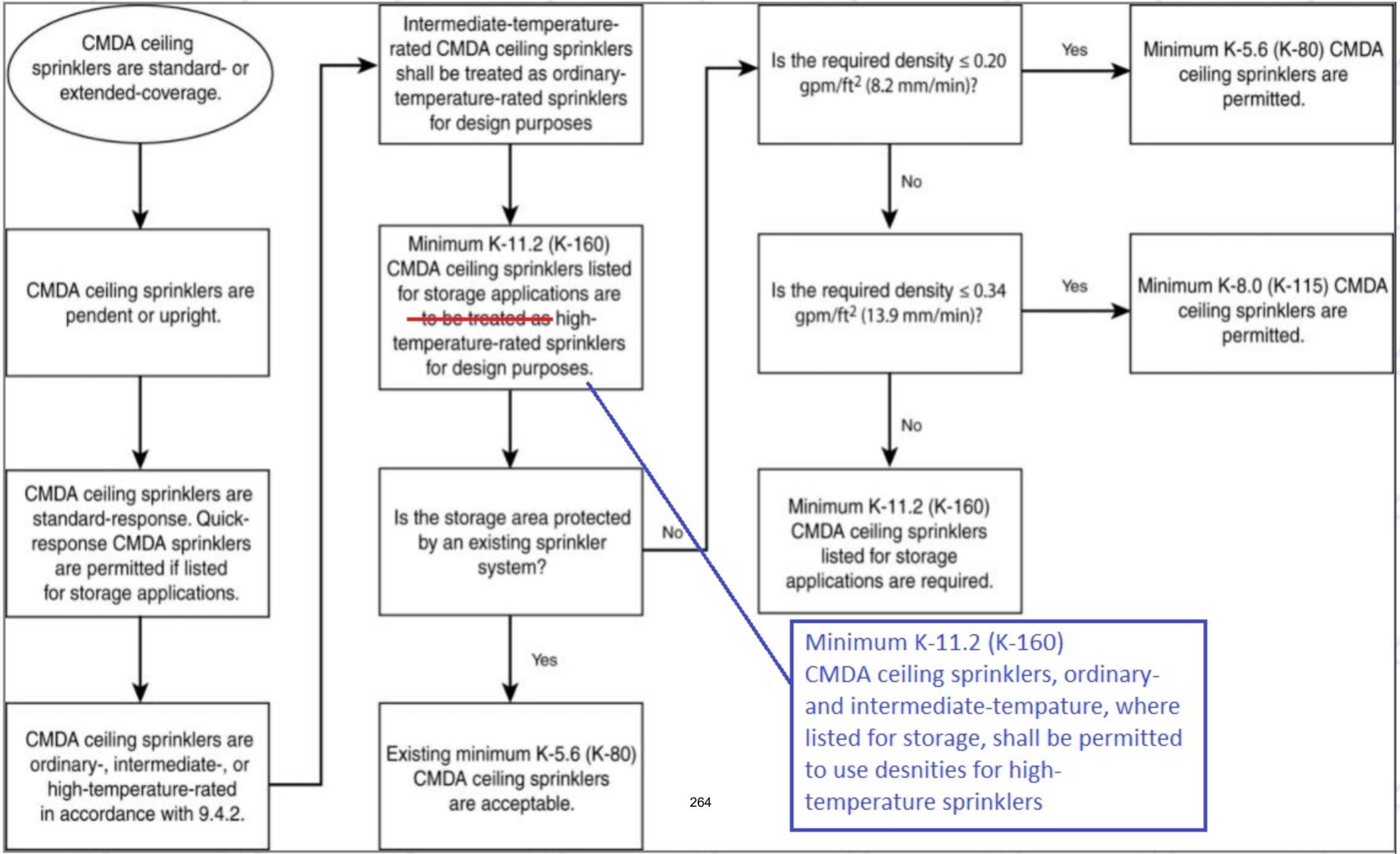
CMDA ceiling sprinklers are standard- or extended-coverage.
CMDA ceiling sprinklers are pendent or upright.
CMDA ceiling sprinklers are standard-response. Quick-response CMDA sprinklers are permitted if listed for storage applications.
CMDA ceiling sprinklers are ordinary-, intermediate-, or high-temperature-rated in accordance with 9.4.2.
Intermediate-temperature-rated CMDA ceiling sprinklers shall be treated as ordinary-temperature-rated sprinklers for design purposes
Minimum K-11.2 (K-160) CMDA ceiling sprinklers listed for storage applications are ~~to be treated as~~ high-temperature-rated sprinklers for design purposes.
Is the storage area protected by an existing sprinkler system?
Yes
Existing minimum K-5.6 (K-80) CMDA ceiling sprinklers are acceptable.
No
Is the required density ≤ 0.20 gpm/ft² (8.2 mm/min)?
Yes
Minimum K-5.6 (K-80) CMDA ceiling sprinklers are permitted.
No
Is the required density ≤ 0.34 gpm/ft² (13.9 mm/min)?
Yes
Minimum K-8.0 (K-115) CMDA ceiling sprinklers are permitted.
No
Minimum K-11.2 (K-160) CMDA ceiling sprinklers listed for storage applications are required.
Minimum K-11.2 (K-160) CMDA ceiling sprinklers, ordinary- and intermediate-tempature, where listed for storage, shall be permitted to use desnities for high-temperature sprinklers

Public Input No. 326-NFPA 13-2022 [Section No. 25.5.4.1]

25.5.4.1

Where rack storage of encapsulated or nonencapsulated Class I, Class II, Class III, Class IV, or Group A plastic commodities will be protected by one or more levels of in-rack sprinklers, the ceiling-level sprinkler design in terms of minimum operating pressure [psi (bar)] and the number of ceiling-level sprinklers shall be in accordance with Table 25.5.4.1.

Table 25.5.4.1 ESFR Ceiling-Level Sprinkler Design Criteria for Rack Storage of Encapsulated or Nonencapsulated Class I Through Class IV and Nonexpanded, Cartoned or Exposed, Group A Plastic Commodities Supplemented with In-Rack Sprinklers

Storage Arrangement	Commodity Classification	Maximum Storage Height		Maximum Ceiling Height		K-Factor/Orientation	No. of Ceiling Sprinklers in the Design	No. of Require IRAS Levels
		ft	m	ft	m			
Single-, double-, and multiple-row racks (no open-top containers)	Class I, Class II, Class III, Class IV, and nonexpanded (cartoned and exposed) Group A plastics	40	12.2	45	13.7	14.0 (200) Pendent	12	One lev
						16.8 (240) Pendent		
						22.4 (320)	12	One lev
						Pendent	12	One lev
						25.2 (360)	12	One lev
						Pendent		

Statement of Problem and Substantiation for Public Input

Although the format came out different, all that is trying to be accomplished is to allow the use of k22.4 and k25.2 to protect the commodity identified by providing the same density provided by the k14 and the k16.8. I have been involved in projects where I have had to change out the k25.2 ESFR sprinklers which has become an industry standard with a k14 or a k16.8 to meet this section. This allows the bigger sprinkler to remain in place and provides the same overall density

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Public Input No. 299-NFPA 13-2022 [Section No. 25.5.4.3]

25.5.4.3

The design area applicable to the ceiling-level design options listed in Table 25.5.4.1 shall ~~consist of the most hydraulically demanding area of 12 sprinklers, consisting of four sprinklers on each of the three branch lines.~~ comply with Section 23.2.2 and 23.2.3.

Statement of Problem and Substantiation for Public Input

This section should be tied back to Chapter 23 and inclusion of ceiling design criteria in this section is redundant.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 297-NFPA 13-2022 [New Section after 23.2.2]	
Public Input No. 300-NFPA 13-2022 [Section No. 28.2.4.4]	

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Public Input No. 553-NFPA 13-2022 [Section No. 25.6.2.3.1]

25.6.2.3.1

The maximum horizontal distance between in-rack sprinklers shall be in accordance with Table 25.6.2.3.1 in combination with Figure 25.6.2.3.1(a) through Figure 25.6.2.3.1(f).

Table 25.6.2.3.1 Maximum Horizontal Spacing of In-Rack Sprinklers

Rack Type	Option 1	Option 2a and Option 2b	Option 3
Single-row racks	5 ft (1.5 m)	4.5 ft (1.4 m)	10 ft (3.0 m)
	[See Figure 25.6.2.3.1(a).]	*[See Figure 25.6.2.3.1(b), Figure 25.6.2.3.1(c), and Figure 25.6.2.3.1(d).]*	*[See Figure 25.6.2.3.1(e)and Figure 25.6.2.3.1(f).]*
Double-row racks	5 ft (1.5 m) at each rack face	4.5 ft (1.4 m) at each rack face*	Not required at the rack face
	10 ft (3.0 m) within the longitudinal flue space	4.5 ft (1.4 m) within the longitudinal flue space	10 ft (3.0 m) within the longitudinal flue space
	[See Figure 25.6.2.3.1(a).]	*[See Figure 25.6.2.3.1(b), Figure 25.6.2.3.1(c), and Figure 25.6.2.3.1(d).]*	*[See Figure 25.6.2.3.1(e)and Figure 25.6.2.3.1(f).]*
Multiple-row racks	5 ft (1.5 m) at each rack face and at each alternating rack bay	8 ft 6 in. (2.6 m) at each rack face 4.5 ft (1.4 m) in-between rack faces	10 ft (3.0 m) at each rack face
			10 ft (3.0 m) in-between rack faces
	10 ft (3.0 m) between in-rack sprinkler at every other rack bay	*[See Figure 25.6.2.3.1(b), Figure 25.6.2.3.1(c), and Figure 25.6.2.3.1(d).]*	*[See Figure 25.6.2.3.1(e) and Figure 25.6.2.3.1(f).]*
	[See Figure 25.6.2.3.1(a).]		

Note: Option 1, Option 2a, Option 2b, and Option 3 are in reference to those listed in Table 25.6.2.2.

*The maximum horizontal distance between in-rack sprinklers is permitted to be increased to 8.5 ft (2.6 m) when the maximum distance between transverse flue spaces does not exceed 4.25 ft (1.3 m).

Figure 25.6.2.3.1(a) In-Rack Sprinkler Arrangements for Class I through Class IV and Group A Plastic Commodities.

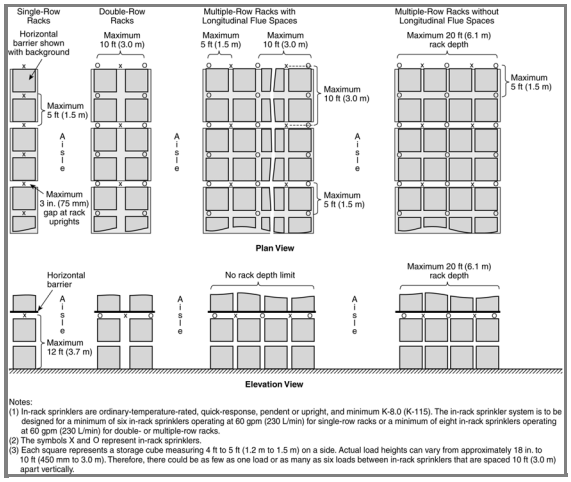


Figure 25.6.2.3.1(b) In-Rack Sprinkler Arrangements for Class I through Class IV and Cartoned Group A Plastic Commodities, Maximum 30 ft (9.1 m) Vertical Increments.

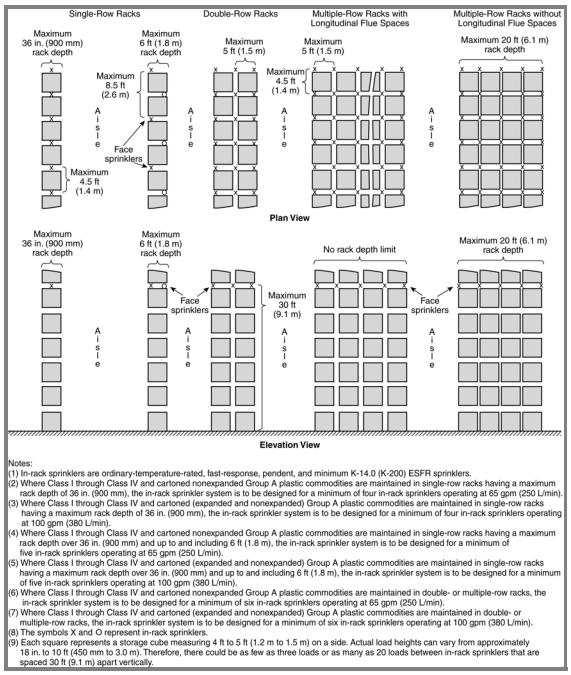


Figure 25.6.2.3.1(c) In-Rack Sprinkler Arrangements for Class I through Class IV and Group A Plastic Commodities, Maximum 30 ft (9.1 m) Vertical Increments.

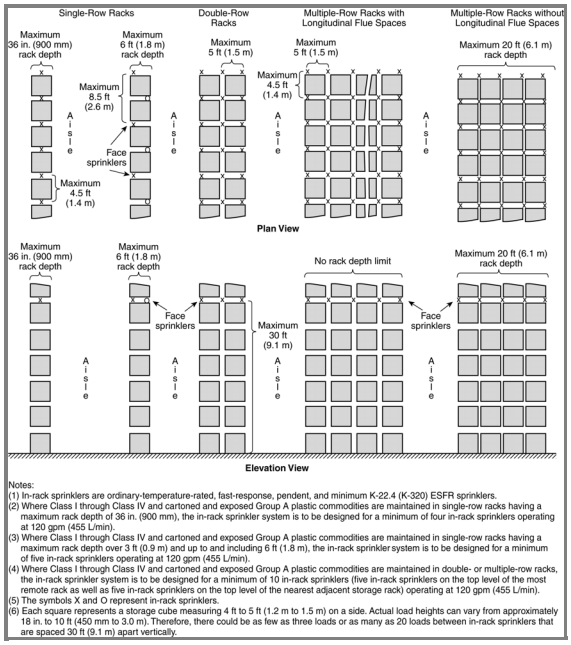
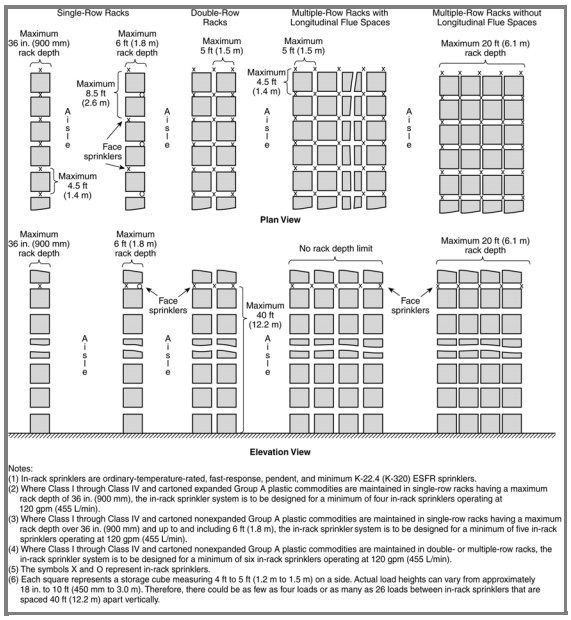
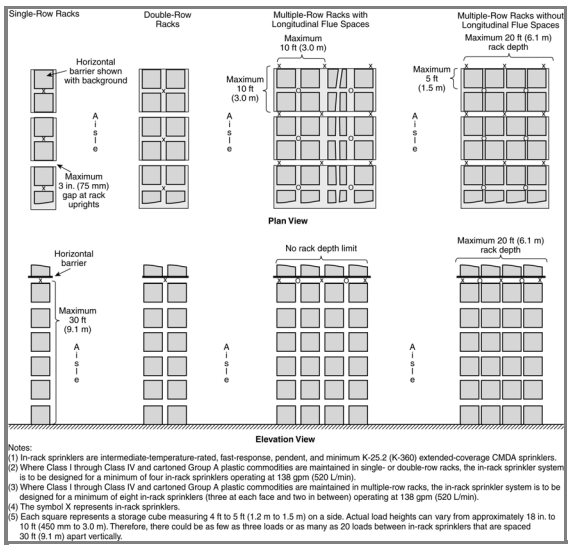


Figure 25.6.2.3.1(d) In-Rack Sprinkler Arrangements for Class I through Class IV and Cartoned Group A Plastic Commodities, Maximum 40 ft (12.2 m) Vertical Increments.



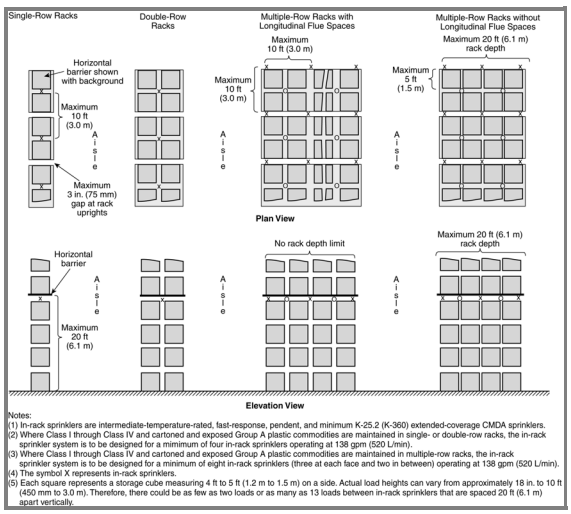
Notes:
(1) In-rack sprinklers are ordinary-temperature-rated, fast-response, pendent, and minimum K-22.4 (K-320) ESFR sprinklers.
(2) Where Class I through Class IV and cartoned expanded Group A plastic commodities are maintained in single-row racks having a maximum rack depth of 36 in. (900 mm), the in-rack sprinkler system is to be designed for a minimum of four in-rack sprinklers operating at 120 gpm (455 L/min).
(3) Where Class I through Class IV and cartoned nonexpanded Group A plastic commodities are maintained in single-row racks having a maximum rack depth over 36 in. (900 mm) and up to and including 6 ft (1.8 m), the in-rack sprinkler system is to be designed for a minimum of five in-rack sprinklers operating at 120 gpm (455 L/min).
(4) Where Class I through Class IV and cartoned nonexpanded Group A plastic commodities are maintained in double- or multiple-row racks, the in-rack sprinkler system is to be designed for a minimum of six in-rack sprinklers operating at 120 gpm (455 L/min).
(5) The symbols X and O represent in-rack sprinklers.
(6) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side. Actual load heights can vary from approximately 18 in. to 10 ft (450 mm to 3.0 m). Therefore, there could be as few as four loads or as many as 26 loads between in-rack sprinklers that are spaced 40 ft (12.2 m) apart vertically.

Figure 25.6.2.3.1(e) In-Rack Sprinkler Arrangements for Class I through Class IV and Cartoned Group A Plastic Commodities, Maximum 30 ft (9.1 m) Vertical Increments.



Notes:
(1) In-rack sprinklers are intermediate-temperature-rated, fast-response, pendent, and minimum K-25.2 (K-360) extended-coverage CMDA sprinklers.
(2) Where Class I through Class IV and cartoned Group A plastic commodities are maintained in single- or double-row racks, the in-rack sprinkler system is to be designed for a minimum of four in-rack sprinklers operating at 138 gpm (520 L/min).
(3) Where Class I through Class IV and cartoned Group A plastic commodities are maintained in multiple-row racks, the in-rack sprinkler system is to be designed for a minimum of eight in-rack sprinklers (three at each face and two in between) operating at 138 gpm (520 L/min).
(4) The symbol X represents in-rack sprinklers.
(5) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side. Actual load heights can vary from approximately 18 in. to 10 ft (450 mm to 3.0 m). Therefore, there could be as few as three loads or as many as 20 loads between in-rack sprinklers that are spaced 30 ft (9.1 m) apart vertically.

Figure 25.6.2.3.1(f) In-Rack Sprinkler Arrangements for Class I through Class IV and Group A Plastic Commodities, Maximum 20 ft (6.1 m) Vertical Increments.



Notes:
(1) In-rack sprinklers are intermediate-temperature-rated, fast-response, pendent, and minimum K-25.2 (K-360) extended-coverage CMDA sprinklers.
(2) Where Class I through Class IV and cartoned and exposed Group A plastic commodities are maintained in single- or double-row racks, the in-rack sprinkler system is to be designed for a minimum of four in-rack sprinklers operating at 138 gpm (520 L/min).
(3) Where Class I through Class IV and cartoned and exposed Group A plastic commodities are maintained in multiple-row racks, the in-rack sprinkler system is to be designed for a minimum of eight in-rack sprinklers (three at each face and two in between) operating at 138 gpm (520 L/min).
(4) The symbol X represents in-rack sprinklers.
(5) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side. Actual load heights can vary from approximately 18 in. to 10 ft (450 mm to 3.0 m). Therefore, there could be as few as two loads or as many as 13 loads between in-rack sprinklers that are spaced 20 ft (6.1 m) apart vertically.

Statement of Problem and Substantiation for Public Input

The figures for option 2a) and 2b) have no longer the options for less wide double racks found in the 2019 edition (i.e. with face sprinklers onlu in every other transverse flue).

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Public Input No. 456-NFPA 13-2022 [Section No. 25.6.3.1]

25.6.3.1 In-Rack Sprinkler System Requirements.

Regardless of the number of in-rack sprinkler levels installed, the in-rack sprinkler system design, in terms of the number of operating sprinklers at a minimum flow from the most remote in-rack sprinkler, shall be in accordance with Table 25.6.3.1.

Table 25.6.3.1 In-Rack Sprinkler System Design for Options 1, 2a, 2b, and 3

IRAS Option	Commodity Hazard	Maximum In-Rack Sprinkler Vertical Interval ft (m)	In-Rack Sprinkler K-factor	In-Rack Sprinkler System Design, No. of IRAS @ Minimum Flow, gpm (L/min)			
				Single-Row Racks up to 3 ft (0.9 m) Deep	Single-Row Racks over 3 ft (0.9 m) and up to 6 ft (1.8 m) Deep	Double-Row Racks	Multiple-Row Racks[a]
1	Class I–IV and Group A plastic (Cartoned and exposed) commodities	12 (3.7)	Minimum K-8.0 (K-115)	6 @ 60 (227)	6 @ 60 (227)	8 @ 60 (227)	8 @ 60 (227)
2a	Class I–IV and cartoned nonexpanded Group A plastics	30 (9.1)	Minimum K-14.0 (K-200) Pendent ESFR	4 @ 65 (250)	5 @ 65 (250)	6 @ 65 (250)	6 @ 65 (250)
2a	~~Cartoned expanded~~ Class I-IV, cartoned Group A plastics (~~Also~~ both nonexpanded and expanded) , ~~Class I–IV~~ and ~~cartoned~~ exposed nonexpanded Group A plastics ~~)~~	30 (9.1)	Minimum K-14.0 (K-200) pendent ESFR	4 @ 100 (380)	5 @ 100 (380)	6 @ 100 (380)	6 @ 100 (380)
2b	~~Exposed group A plastic commodities (Also, class I–IV and cartoned~~ Class I- IV, and Group A plastics (nonexpanded and expanded as well as cartoned and exposed)	30 (9.1)	Minimum K-22.4 (K-320) pendent ESFR	4 @ 120 (455)	5 @ 120 (455)	5 and 5~~b~~ a @ 120 (455)	5 and 5~~b~~ @ a @ 120 (455)
2b	Class I–IV and cartoned nonexpanded Group A plastics	40 (12.2)	Minimum K-22.4 (K-320) pendent ESFR	4 @ 120 (455)	5 @ 120 (455)	6 @ 120 (455)	6 @ 120 (455)

IRAS Option	Commodity Hazard	Maximum In-Rack Sprinkler Vertical Interval ft (m)	In-Rack Sprinkler K-factor	In-Rack Sprinkler System Design, No. of IRAS @ Minimum Flow, gpm (L/min)			
				Single-Row Racks up to 3 ft (0.9 m) Deep	Single-Row Racks over 3 ft (0.9 m) and up to 6 ft (1.8 m) Deep	Double-Row Racks	Multiple-Row Racks[a]
3	Class I–IV and cartoned (Nonexpanded and expanded) Group A plastic commodities	30 (9.1)	K25.2 (K-360) pendent extended coverage	4 @ 138 (520)	4 @ 138 (520)	4 @ 138 (520)	8[c] - [b] - @ 138 (520)
3	Exposed group A plastic commodities (Also, Class I–IV and cartoned Group A plastics)	20 (6.1)	K25.2 (K-360) pendent extended coverage	4 @ 138 (520)	4 @ 138 (520)	4 @ 138 (520)	8[c] - [b] - @ 138 (520)

Notes: Option 1, Option 2a, Option 2b, and Option 3 are in reference to those listed in Table 25.6.2.2.

[a] ~~For maximum rack depths of 16 ft (4.9 m) for Option 2 and Option 3.~~ [b] This represents five sprinklers in the most remote rack as well as five sprinklers in the nearest adjacent rack when exposed expanded Group A plastics are being protected .

[c] [b] This represents three sprinklers at each rack face and the two sprinklers in-between them.

Statement of Problem and Substantiation for Public Input

This table is being modified since fire jump across the aisle only occurred with testing of exposed expanded Group A plastics. In addition, now that open racking for multiple-row rack is permitted for up to 20 ft or more, depending on the flues provided, it no longer needs to be limited to 16 ft.

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Public Input No. 102-NFPA 13-2021 [Section No. 25.6.3.2]

25.6.3.2 Ceiling-Level Sprinkler System Requirements.

25.6.3.2.1*

Where in-rack sprinklers are in accordance with Section 25.6, the top level of in-rack sprinklers shall be considered a floor for design purposes of the ceiling sprinkler system.

25.6.3.2.2

The ceiling-level sprinkler system shall be in accordance with the guidelines outlined in Chapters 20, 21, 22, or 23, depending on the commodity hazard and the ceiling-level sprinkler, except as modified in Section 25.6.

25.6.3.2.3

Where there is no storage above the highest level of in-rack sprinklers, the ceiling-level sprinklers system shall be in accordance with Chapter 19 and not consider the contents of the racking structure.

Statement of Problem and Substantiation for Public Input

Section 20.9.1.1 permits the ceiling level sprinklers for storage applications to be installed in sloped ceilings as long as an alternate design approach is utilized where the racking structure is protected with in-rack sprinklers and there is no storage above the highest level of in-racks. There is guidance in this section for how to protect storage above the highest level, but no guidance when there is not storage.

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Public Input No. 524-NFPA 13-2022 [Section No. 25.7]

~~**25.7** – Evaluation or Modification of Existing Protection for Miscellaneous and Low-Piled Rack Storage Using In-Rack Sprinklers.~~

~~**25.7.1** – Miscellaneous Rack Storage.~~

~~**25.7.1.1** – Scope.~~

~~This section shall apply to miscellaneous rack storage up to and including 12 ft (3.7 m) in height of Class I through Class IV commodities, Group A plastic commodities and rubber tires.~~

~~**25.7.1.2** – In-Rack Sprinkler Design for Miscellaneous Storage.~~

~~Where in-rack sprinklers are installed in accordance with Section 25.3 to protect miscellaneous rack storage of Class I through Class IV commodities, Group A plastic commodities, and rubber tires up to and including 12 ft (3.7 m) in height, the in-rack sprinkler design shall be based on the hydraulically most demanding four adjacent in-rack sprinklers using a minimum flow of 22 gpm (83 L/min) from the hydraulically most remote in-rack sprinkler.~~

~~**25.7.1.3** – Horizontal Spacing of In-Rack Sprinklers for Miscellaneous Storage.~~

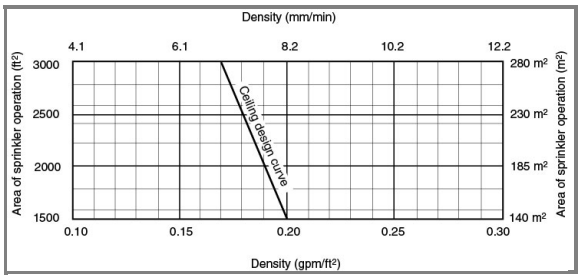
~~The maximum allowable horizontal spacing of in-rack sprinklers is 10 ft (3.0 m).~~

~~**25.7.1.4** – Ceiling Sprinkler Design in Combination with In-Rack Sprinklers for Miscellaneous Storage.~~

~~**25.7.1.4.1** –~~

~~Where in-rack sprinklers are installed in accordance with this chapter to protect miscellaneous rack storage of Class I through Class IV commodities, Group A plastic commodities, and rubber tires up to and including 12 ft (3.7 m) in height under a maximum 32 ft (9.8 m) high ceiling, the ceiling-level sprinkler design criteria shall be in accordance with Figure 25.7.1.4.1 .~~

~~Figure 25.7.1.4.1 CMDA Ceiling-Level Sprinkler Design Criteria for Miscellaneous Storage Protected with One Level of In-Rack Sprinklers.~~



~~**25.7.1.4.2** –~~

~~Installation criteria as permitted by this standard and design criteria and modifiers as permitted by the density/area method of Section 19.1 for ordinary hazard Group 2 occupancies shall be applicable.~~

~~**25.7.1.4.3** –~~

~~The sprinkler system criteria specified in this chapter for miscellaneous storage shall not be limited to a ceiling slope of 2 in 12 (16.7 percent).~~

~~**25.7.1.5** – Hose Connections.~~

~~Hose connections shall not be required for the protection of miscellaneous storage.~~

~~**25.7.2** – Low-Piled Rack Storage.~~

25.7.2.1 – Scope.

This section shall apply to any of the following situations:

(1) Rack storage of Class I through Class IV commodities up to and including 12 ft (3.7 m) in height

(2)* Rack storage of Group A plastic commodities up to and including 5 ft (1.5 m) in height

25.7.2.2 – In-Rack Sprinkler Design for Low-Piled Storage.

Where in-rack sprinklers are installed in accordance with Section 25.3 to protect low-piled rack storage of Class I through Class IV commodities up to and including 12 ft (3.7 m) in height and low-piled rack storage of Group A plastic commodities up to and including 5 ft (1.5 m) in height, the in-rack sprinkler design shall be based on the hydraulically most demanding four adjacent in-rack sprinklers using a minimum flow of 22 gpm (83 L/min) from the hydraulically most remote in-rack sprinkler.

25.7.2.3 – Horizontal Spacing of In-Rack Sprinklers for Low-Piled Storage.

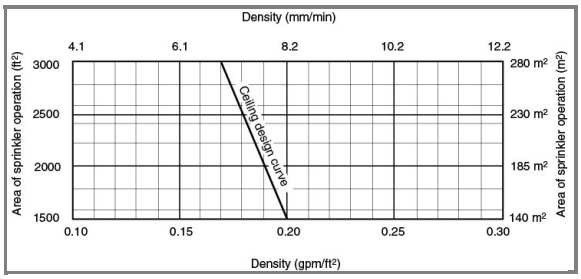
The maximum allowable horizontal spacing of in-rack sprinklers is 10 ft (3.0 m).

25.7.2.4 – Ceiling Sprinkler Design in Combination with In-Rack Sprinklers for Low-Piled Storage.

25.7.2.4.1 –

Where in-rack sprinklers are installed in accordance with Section 25.3 to protect low-piled rack storage of Class I through Class IV and Group A plastic commodities that does not meet the definition of miscellaneous storage, the ceiling-level design shall be in accordance with Figure 25.7.2.4.1 .

Figure 25.7.2.4.1 CMDA Ceiling-Level Sprinkler Design Criteria for Low-Piled Storage Protected with One Level of In-Rack Sprinklers.



25.7.2.4.2 –

The sprinkler system criteria specified in this chapter for low-piled storage shall not be limited to a ceiling slope of 2 in 12 (16.7 percent).

25.7.2.5 – Ceiling Sprinkler Design in Combination with In-Rack Sprinklers for Low-Piled Storage with Solid Shelves.

25.7.2.5.1 –

For low-piled rack storage with solid shelves of Class I through Class IV commodities up to and including 12 ft (3.7 m) in height that does not meet the definition of miscellaneous storage, the ceiling-level sprinkler design shall be permitted to be in accordance with Figure 25.7.2.4.1 where the in-rack sprinklers are installed in accordance with Section 20.19 .

25.7.2.5.2 –

For low-piled rack storage with solid shelves of Group A plastic commodities up to and including 5 ft (1.5 m) in height that does not meet the definition of miscellaneous storage, the ceiling-level sprinkler design shall be permitted to be in accordance with Figure 25.7.2.4.1 where the in-rack sprinklers are installed in accordance with Section 20.19 .

Statement of Problem and Substantiation for Public Input

Section 25.7 applies to existing systems and thus should be included in Chapter 30, which is specific to existing systems. See the proposal specific to Section 30.4.6, which proposes to simply relocate Section 25.7 to a new Section 30.4.6 and renumber the new section accordingly.

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Committee:	AUT-SSD

Public Input No. 179-NFPA 13-2022 [Section No. 25.7.1.4.3]

25.7.1.4.3

The sprinkler system criteria specified in this chapter for miscellaneous storage shall ~~not be limited to a ceiling slope of 2 in 12 (16.7 percent).~~ be permitted for both horizontal and sloped ceilings.

Statement of Problem and Substantiation for Public Input

Clarifies language to explicitly permit sloped ceilings. Current language redefines sloped ceilings and should just refer to horizontal and sloped ceilings as they are defined terms.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 177-NFPA 13-2022 [Section No. 25.2.1.4.3]	
Public Input No. 178-NFPA 13-2022 [Section No. 25.2.2.4.2]	
Public Input No. 180-NFPA 13-2022 [Section No. 25.7.2.4.2]	

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Committee: AUT-SSD

Public Input No. 180-NFPA 13-2022 [Section No. 25.7.2.4.2]

25.7.2.4.2

The sprinkler system criteria specified in this chapter for low-piled storage shall ~~not be limited to a ceiling slope of 2 in 12 (16.7 percent).~~ be permitted for both horizontal and sloped ceilings.

Statement of Problem and Substantiation for Public Input

Clarifies language to explicitly permit sloped ceilings. Current language redefines sloped ceilings and should just refer to horizontal and sloped ceilings as they are defined terms.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 177-NFPA 13-2022 [Section No. 25.2.1.4.3]	
Public Input No. 178-NFPA 13-2022 [Section No. 25.2.2.4.2]	
Public Input No. 179-NFPA 13-2022 [Section No. 25.7.1.4.3]	

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Committee: AUT-SSD

Public Input No. 525-NFPA 13-2022 [Section No. 25.8]

~~**25.8** – Evaluation or Modification of Existing CMDA Ceiling-Level Sprinkler Rack Storage Protection of Class I through Class IV Commodities Over 12 ft (3.7 m) and Up to and Including 25 ft (7.6 m) in Height Using In-Rack Sprinklers.~~

~~**25.8.1** – General.~~

~~**25.8.1.1** – In-Rack Sprinkler Protection in Combination with CMDA Ceiling-Level Sprinklers.~~

~~**25.8.1.1.1** –~~

~~Unless indicated otherwise, the guidelines from Section 25.1 for in-rack sprinklers shall apply to Section 25.8 .~~

~~**25.8.1.1.2** –~~

~~The in-rack sprinkler system design, in terms of number of operating sprinklers at a minimum flow from the most remote in-rack sprinkler, in combination with CMDA ceiling-level sprinklers shall be in accordance with Table 25.8.1.1.2 .~~

~~Table 25.8.1.1.2 Design Criteria for In-Rack Sprinklers in Combination with CMDA Ceiling-Level Sprinklers for Class I through Class IV Commodities Stored Over 12 ft (3.7 m) and Up to and Including 25 ft (7.6 m)~~

~~Commodity Classification Rack Type No. of IRAS Levels IRAS Design, No. of IRAS @ gpm (L/min) Class I, Class II or Class III Open 1 6 @ 22 (83) More than 1 10 (5 in-rack sprinklers on top 2 in-rack sprinkler levels) @ 22 (83) Solid shelves 1 6 @ 30 (114) More than 1 10 (5 in-rack sprinklers on top 2 in-rack sprinkler levels) @ 30 (114) Class IV Open 1 8 @ 22 (83) More than 1 10 (5 in-rack sprinklers on top 2 in-rack sprinkler levels) @ 22 (83) Solid shelves 1 8 @ 30 (114) More than 1 14 (7 in-rack sprinklers on top 2 in-rack sprinkler levels) @ 30 (114)~~

~~**25.8.1.2** – CMDA Ceiling-Level Sprinkler Protection in Combination with In-Rack Sprinklers.~~

~~**25.8.1.2.1** –~~

~~Unless indicated otherwise, the guidelines from Section 25.1 for CMDA ceiling-level sprinklers shall apply to Section 25.8 .~~

~~**25.8.1.2.2** –~~

~~CMDA ceiling-level sprinkler design criteria, in combination with in-rack sprinklers, for rack storage over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height of Class I through Class IV commodities shall be in accordance with the following:~~

(1) ~~For the storage of exposed nonencapsulated Class I, Class II, Class III, or Class IV commodities, see 25.8.2.2~~

(2) ~~For the storage of exposed encapsulated, or cartoned (nonencapsulated or encapsulated) Class I, Class II, Class III, or Class IV commodities, see 25.8.3.2~~

~~**25.8.1.2.3** –~~

~~The use of quick-response CMDA sprinklers for storage applications shall be permitted when listed for such use.~~

~~**25.8.1.2.4** –~~

~~The water supply for sprinklers only shall be determined from the density/area requirements of this chapter.~~

~~**25.8.1.2.5** –~~

~~The calculations shall satisfy any single point on appropriate density/area curves.~~

25.8.1.2.6 –

The ceiling-level sprinkler system design area shall meet the requirements of 28.2.4.2.1 .

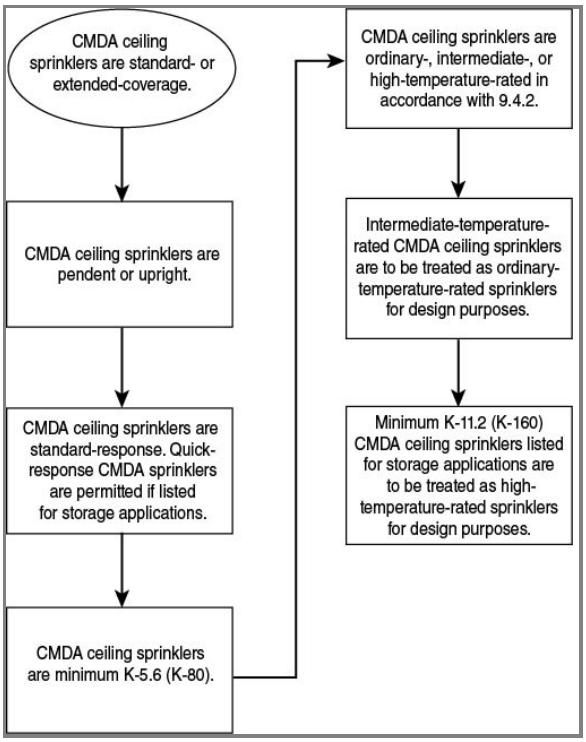
25.8.1.2.7 –

The minimum design density shall not be less than 0.15 gpm/ft ^{2} (6.1 mm/min) after all adjustments are made.

25.8.1.2.8 – CMDA Ceiling-Level Sprinkler Characteristics.

CMDA Ceiling-level sprinkler characteristics in combination with in-rack sprinklers shall be in accordance with Figure 25.8.1.2.8 .

Figure 25.8.1.2.8 CMDA Ceiling-Level Sprinkler Characteristics in Combination with In-Rack Sprinklers.



25.8.2 – Exposed Nonencapsulated Class I, Class II, Class III, or Class IV Commodities Stored Up to and Including 25 ft (7.6 m) in Height.

25.8.2.1 * – In-Rack Sprinkler Arrangements and Designs for Exposed Nonencapsulated Class I, Class II, Class III, or Class IV Commodities Stored Up to and Including 25 ft (7.6 m) in Height.

25.8.2.1.1 –

Where rack storage of exposed nonencapsulated Class I through Class IV commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height will be protected by in-rack sprinklers, the following levels of in-rack sprinklers shall be required:

(1) One level of in-rack sprinklers where Class I through Class IV commodities are stored in single- or double-row racks up to and including 25 ft (7.6 m)

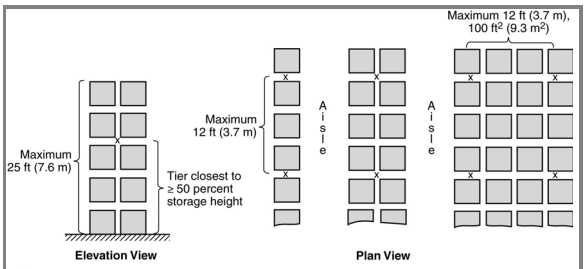
(2) One level of in-rack sprinklers where Class IV commodities are stored in multiple-row racks up to and including 20 ft (6.1 m)

(3) Two levels of in-rack sprinklers where Class IV commodities are stored in multiple-row racks over 20 ft (6.1 m) and up to and including 25 ft (7.6 m)

25.8.2.1.2 –

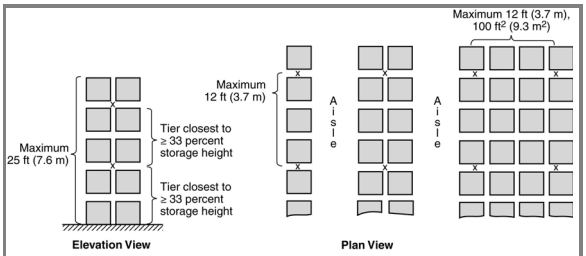
Where rack storage of exposed nonencapsulated Class I or Class II commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height will be protected by in-rack sprinklers, in-rack sprinkler arrangements and designs shall be selected from Figure 25.8.2.1.2(a) through Figure 25.8.2.1.2(c) . *(See Section 20.19 for racks with solid shelving.)*

Figure 25.8.2.1.2(a) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class I or Class II Commodities Stored to a Maximum Height of 25 ft (7.6 m) with One Level of In-Rack Sprinklers.



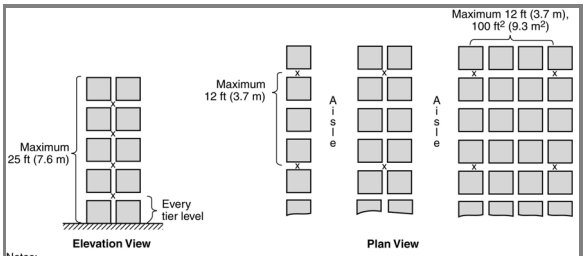
Notes:
(1) See 25.8.2.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of six (6) in-rack sprinklers operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

Figure 25.8.2.1.2(b) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class I or Class II Commodities Stored to a Maximum Height of 25 ft (7.6 m) with More Than One Level of In-Rack Sprinklers (Not at Each Tier Level).



Notes:
(1) See 25.8.2.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of ten (10) in-rack sprinklers [five (5) in-rack sprinklers on the top two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

Figure 25.8.2.1.2(c) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class I or Class II Commodities Stored to a Maximum Height of 25 ft (7.6 m) with In-Rack Sprinklers at Each Tier Level.



Notes:
(1) See 25.8.2.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of ten (10) in-rack sprinklers [five (5) in-rack sprinklers on top two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

25.8.2.1.3 –

Where rack storage of exposed nonencapsulated Class III commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height will be protected by in-rack sprinklers, in-rack sprinkler arrangements and designs shall be selected from Figure 25.8.2.1.3(a) through Figure 25.8.2.1.3(c) . *(See Section 20.19 for racks with solid shelving.)*

Figure 25.8.2.1.3(a) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class III Commodities Stored to a Maximum Height of 25 ft (7.6 m) with One Level of In-Rack Sprinklers.

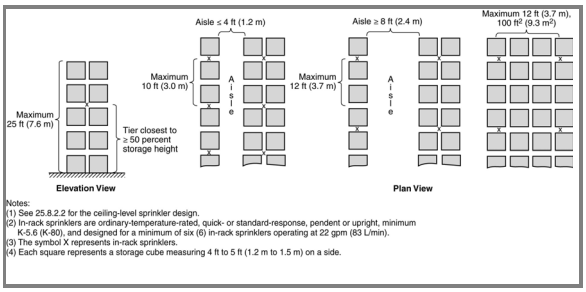


Figure 25.8.2.1.3(b) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class III Commodities Stored to a Maximum Height of 25 ft (7.6 m) with More Than One Level of In-Rack Sprinklers (Not at Each Tier Level).

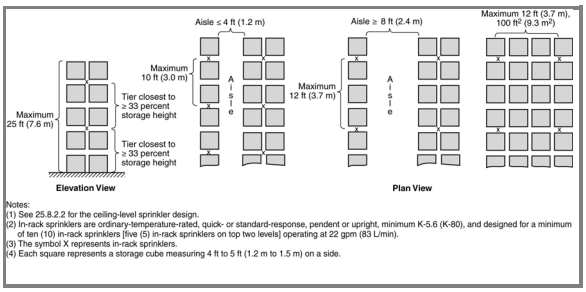
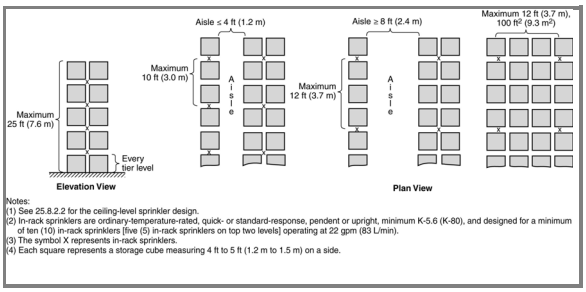


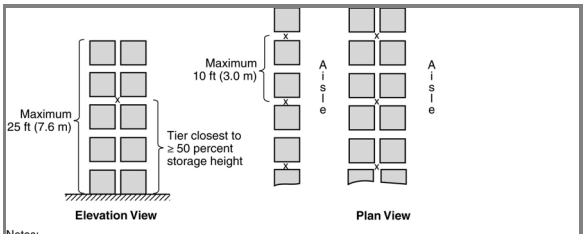
Figure 25.8.2.1.3(c) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class III Commodities Stored to a Maximum Height of 25 ft (7.6 m) with In-Rack Sprinklers at Each Tier Level.



25.8.2.1.4 –

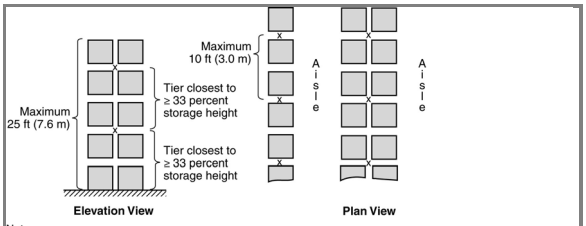
Where rack storage of exposed nonencapsulated Class IV commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height in single- and double-row racks will be protected by in-rack sprinklers, in-rack sprinkler arrangements and designs shall be selected from Figure 25.8.2.1.4(a) through Figure 25.8.2.1.4(c) . *(See Section 20.19 for racks with solid shelving.)*

Figure 25.8.2.1.4(a) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class IV Commodities Stored to a Maximum Height of 25 ft (7.6 m) in Single- and Double-Row Racks with One Level of In-Rack Sprinklers.



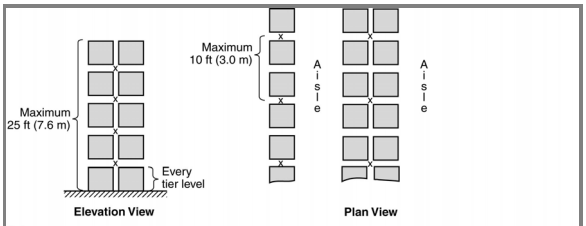
Notes:
(1) See 25.8.2.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of eight (8) in-rack sprinklers operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

Figure 25.8.2.1.4(b) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class IV Commodities Stored to a Maximum Height of 25 ft (7.6 m) in Single- and Double-Row Racks with More Than One Level of In-Rack Sprinklers (Not at Each Tier Level).



Notes:
(1) See 25.8.2.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of 14 in-rack sprinklers [seven (7) in-rack sprinklers on top two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

Figure 25.8.2.1.4(c) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class IV Commodities Stored to a Maximum Height of 25 ft (7.6 m) in Single- and Double-Row Racks with In-Rack Sprinklers at Each Tier Level.

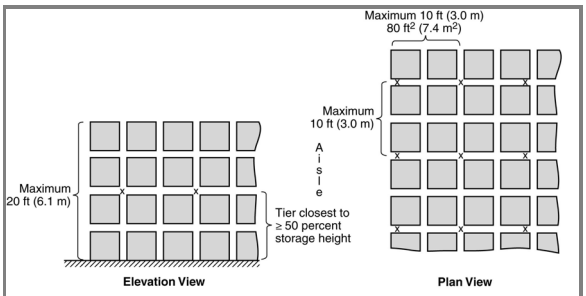


Notes:
(1) See 25.8.2.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of 14 in-rack sprinklers [seven (7) in-rack sprinklers on top two leves] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

25.8.2.1.5 –

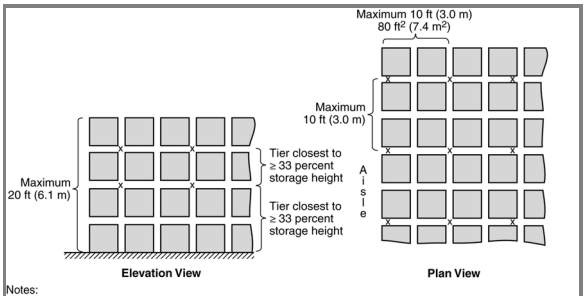
Where rack storage of exposed nonencapsulated Class IV commodities stored over 12 ft (3.7 m) and up to and including 20 ft (6.1 m) in height in multiple-row racks will be protected by in-rack sprinklers, in-rack sprinkler arrangements and designs shall be selected from Figure 25.8.2.1.5(a) through Figure 25.8.2.1.5(c) . *(See Section 20.19 for racks with solid shelving.)*

Figure 25.8.2.1.5(a) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class IV Commodities Stored to a Maximum Height of 20 ft (6.1 m) in Multiple-Row Racks with One Level of In-Rack Sprinklers.



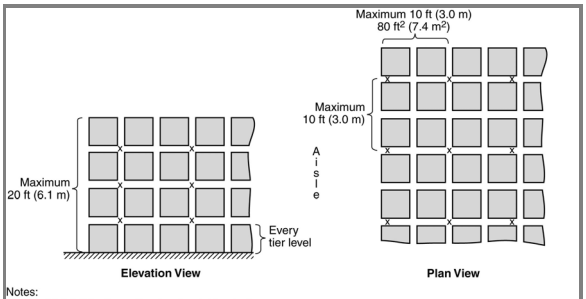
Notes:
(1) See 25.8.2.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of eight (8) in-rack sprinklers operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

Figure 25.8.2.1.5(b) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class IV Commodities Stored to a Maximum Height of 20 ft (6.1 m) in Multiple-Row Racks with More Than One Level of In-Rack Sprinklers.



Notes:
(1) See 25.8.2.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of 14 in-rack sprinklers [seven (7) in-rack sprinklers on top two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

Figure 25.8.2.1.5(c) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class IV Commodities Stored to a Maximum Height of 20 ft (6.1 m) in Multiple-Row Racks with In-Rack Sprinklers at Each Tier Level.

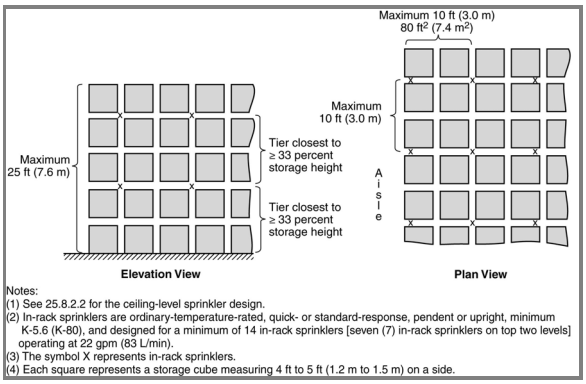


Notes:
(1) See 25.8.2.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of 14 in-rack sprinklers [seven (7) in-rack sprinklers on top two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

25.8.2.1.6 –

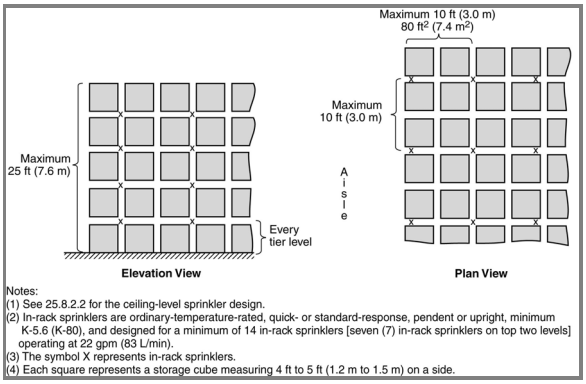
Where rack storage of exposed nonencapsulated Class IV commodities stored over 20 ft (6.1 m) and up to and including 25 ft (7.6 m) in height in multiple-row racks will be protected by in-rack sprinklers, in-rack sprinkler arrangements and designs shall be selected from Figure 25.8.2.1.6(a) or Figure 25.8.2.1.6(b) . *(See Section 20.19 for racks with solid shelving.)*

Figure 25.8.2.1.6(a) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class IV Commodities Stored Over 20 ft (6.1 m) and Up to a Maximum Height of 25 ft (7.6 m) in Multiple-Row Racks with Two Levels of In-Rack Sprinklers.



Notes:
(1) See 25.8.2.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of 14 in-rack sprinklers [seven (7) in-rack sprinklers on top two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

Figure 25.8.2.1.6(b) In-Rack Sprinkler Arrangements for Exposed Nonencapsulated Class IV Commodities Stored Over 20 ft (6.1 m) and Up to a Maximum Height of 25 ft (7.6 m) in Multiple-Row Racks with In-Rack Sprinklers at Each Tier Level.



Notes:
(1) See 25.8.2.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of 14 in-rack sprinklers [seven (7) in-rack sprinklers on top two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

25.8.2.2 – CMDA Ceiling-Level Sprinkler Designs for Exposed Nonencapsulated Class I, Class II, Class III, or Class IV Commodities Stored Up to and Including 25 ft (7.6 m) in Height in Combination with In-Rack Sprinklers.

25.8.2.2.1 * –

For single-, double-, and multiple-row rack storage of exposed nonencapsulated Class I through Class IV commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height, the ceiling-level sprinkler design in terms of density [gpm/ft ^{2} (mm/min)] over an area of ceiling-level sprinkler operation [ft ^{2} (186 m ^{2})], with the provision of in-rack sprinklers, shall be determined from Table 25.8.2.2.1 and Figure 25.8.2.2.1(a) through Figure 25.8.2.2.1(d) .

Table 25.8.2.2.1 Determining Appropriate Ceiling-Level Protection Criteria Figure and Curve for Rack Storage of Exposed Nonencapsulated Class I through Class IV Commodities Stored Over 12 ft (3.7 m) and Up to and Including 25 ft (7.6 m)

Commodity Maximum Storage Height Storage Arrangement Aisle Width ft (m) Minimum No. of In-Rack Sprinkler Levels Required Appropriate Figure and Curve Figure Ceiling Sprinkler Temperature Rating High Ordinary or Intermediate Class I Over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) Single- and double-row racks 8 (2.4) 1 level 25.8.2.2.1(a) A B 4 (1.2) C D Multiple-row racks Any C D Class II Over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) Single- and double-row racks 8 (2.4) 1 level 25.8.2.2.1(b) A B 4 (1.2) C D Multiple-row

racks Any C D Class III Over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) Single- and double-row racks 8 (2.4) 1 level 25.8.2.2.1(c) A B 4 (1.2) C D Multiple-row racks Any C D Class IV Over 12 ft (3.7 m) and up to and including 20 ft (6.1 m) Single- and double-row racks 8 (2.4) 1 level 25.8.2.2.1(d) A B 4 (1.2) C D Multiple-row racks Any C D Over 20 ft (6.1 m) and up to and including 25 ft (7.6 m) Single- and double-row racks 8 (2.4) 1 level 25.8.2.2.1(d) A B 4 (1.2) C D Multiple-row racks Any 2 levels C D

Figure 25.8.2.2.1(a) CMDA Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Exposed Nonencapsulated Class I Commodities — Conventional Pallets.

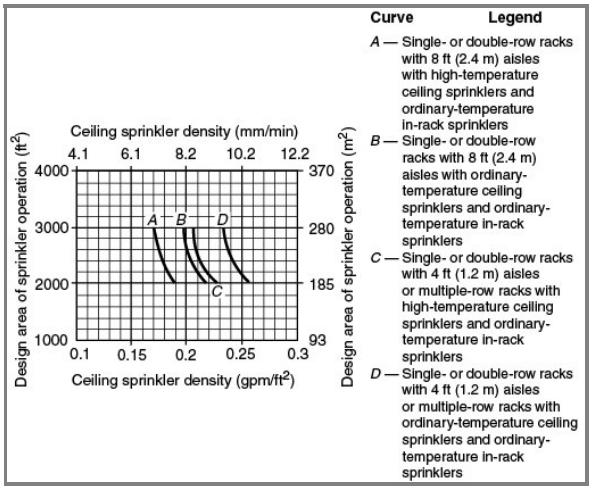


Figure 25.8.2.2.1(b) CMDA Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Exposed Nonencapsulated Class II Commodities — Conventional Pallets.

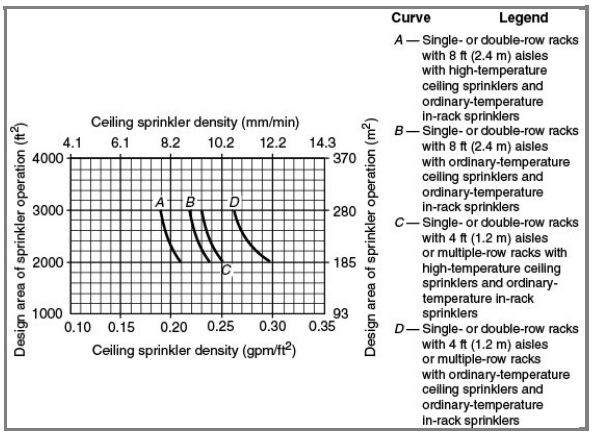


Figure 25.8.2.2.1(c) CMDA Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Exposed Nonencapsulated Class III Commodities — Conventional Pallets.

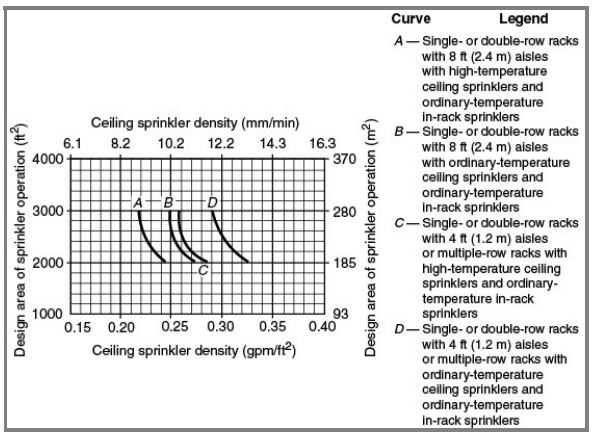
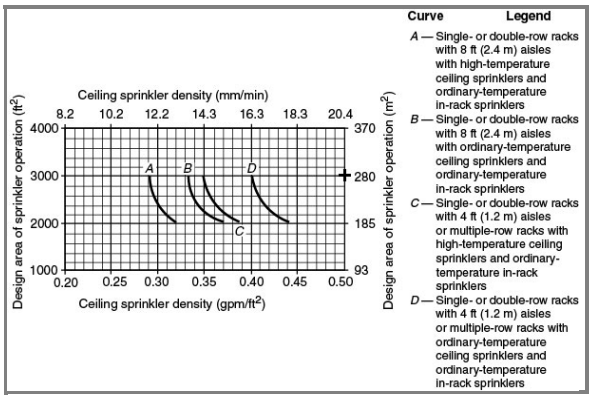


Figure 25.8.2.2.1(d) CMDA Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Exposed Nonencapsulated Class IV Commodities — Conventional Pallets.



25.8.2.2.2 * ~~– Ceiling-Level Sprinkler Density Adjustments.~~

25.8.2.2.2.1 * ~~–~~

~~Design densities obtained from the appropriate figure and curve specified in Table 25.8.2.2.1 for single- and double-row racks shall be selected to correspond to aisle width as follows *(See Section C.15 .)* :~~

(1) ~~The density given for 8 ft (2.4 m) wide aisles shall be applied to aisles wider than 8 ft (2.4 m).~~

(2) ~~For aisle widths between 4 ft (1.2 m) and 8 ft (2.4 m), the rules for 4 ft (1.2 m) aisle width shall be used or direct linear interpolation between the densities shall be permitted.~~

(3) ~~The density given for 4 ft (1.2 m) wide aisles shall be applied to aisles narrower than 4 ft (1.2 m) down to 3~~ **1** ~~/~~ **2** ~~ft (1.1 m).~~

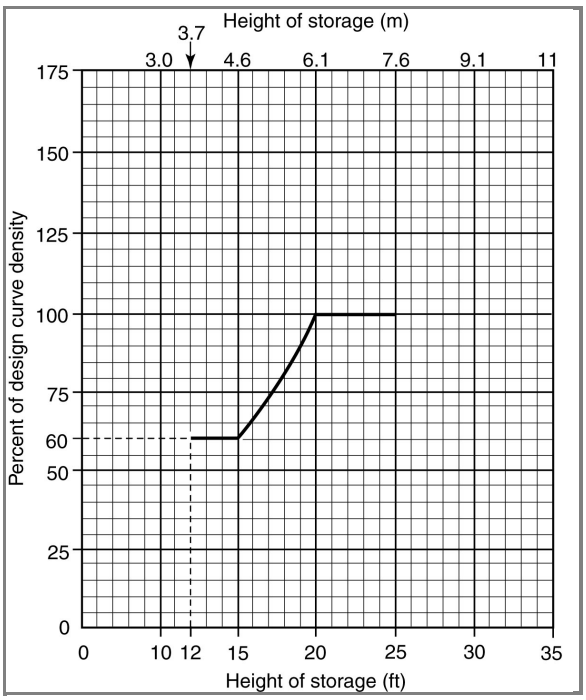
(4) ~~Where aisles are narrower than 3~~ **1** ~~/~~ **2** ~~ft (1.1 m), racks shall be considered to be multiple-row racks.~~

25.8.2.2.2.2 * ~~– Density Adjustment.~~

(A) –

The ceiling-level sprinkler design criteria in terms of density [gpm/ft^2 (mm/min)] and area of sprinkler operation [ft^2 (m^2) of ceiling or roof] obtained from the appropriate density/area curves of Figure 25.8.2.2.1(a) through Figure 25.8.2.2.1(d) shall be modified as appropriate by Figure 25.8.2.2.2.2(A) for storage height.

Figure 25.8.2.2.2.2(A) Allowable Adjustments to CMDA Ceiling-Level Sprinkler Densities Due to Storage Height Up to 25 ft (7.6 m).



(B) –

Paragraph 25.8.2.2.2.2(A) shall apply to portable racks arranged in the same manner as single-, double-, or multiple-row racks. *(See Section C.14 .)*

25.8.2.2.2.3 –

Where in-rack sprinklers are being installed within racks of Class I through Class IV commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height protected with CMDA sprinklers at ceiling level along with the minimum number of required in-rack sprinkler levels, densities obtained from design curves shall be adjusted in accordance with Figure 25.8.2.2.2.2(A) .

25.8.2.2.2.4 –

Where in-rack sprinklers are being installed within racks of Class I through Class IV commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height protected with CMDA sprinklers at ceiling level along with more than one level of in-rack sprinklers (not in every tier), densities obtained from design curves adjusted in accordance with Figure 25.8.2.2.2.2(A) shall be permitted to be reduced an additional 20 percent as indicated in Table 25.8.2.2.2.4 .

Table 25.8.2.2.2.4 Adjustment to Ceiling-Level Sprinkler Density Due to Storage Height and In-Rack Sprinklers

Storage Height Apply Figure 25.8.2.2.2.2(A)? In-Rack Sprinklers Levels Installed Permitted Ceiling-Level Sprinkler Density Adjustment Due to In-Rack Sprinklers Over 12 ft (3.7 m) and up to and including 20 ft (6.1 m) Yes Minimum required None More than required but not at each tier level Reduce density 20 percent from that indicated for minimum required levels of in-rack sprinklers Each tier level Reduce density 40 percent from that indicated for minimum required levels of in-rack sprinklers Over 20 ft (6.1 m) and up to and including 25 ft (7.6 m) No Minimum required None More than required but not at each tier level Reduce density 20 percent from that

indicated for minimum required levels of in-rack sprinklers Each tier level Reduce density 40 percent from that indicated for minimum required levels of in-rack sprinklers

25.8.2.2.2.5 * –

Where in-rack sprinklers are being installed within racks of Class I through Class IV commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height protected with CMDA sprinklers at ceiling level along with in-rack sprinklers at each tier level, densities obtained from design curves and adjusted in accordance with Figure 25.8.2.2.2.2(A) shall be permitted to be reduced an additional 40 percent as indicated in Table 25.8.2.2.2.4 .

25.8.2.2.3 – Excessive Clearance from Top of Storage.

25.8.2.2.3.1 –

The ceiling-level sprinkler design obtained from the appropriate figure and curve specified in Table 25.8.2.2.1 shall be based on a maximum clearance from top of storage to ceiling of 20 ft (6.1 m).

25.8.2.2.3.2 –

Where the clearance of 25.8.2.2.3.1 exceeds 20 ft (6.1 m), one of the following two options shall be implemented:

(1) The ceiling design shall be determined from the appropriate figure and curve specified in Table 25.8.2.2.1 using a theoretical storage height that does not exceed 25 ft (7.6 m) and results in a clearance to ceiling of 20 ft (6.1 m).

(2) If not already provided, the in-rack sprinkler arrangement shall be supplemented with one level of quick-response in-rack sprinklers located directly below the top tier level of storage and at every flue space intersection.

25.8.3 – Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class I, Class II, Class III, or Class IV Commodities Stored Up to and Including 25 ft (7.6 m) in Height.

25.8.3.1 * – In-Rack Sprinkler Arrangements and Designs for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class I, Class II, Class III, or Class IV Commodities Stored Up to and Including 25 ft (7.6 m) in Height.

25.8.3.1.1 –

Where rack storage of exposed encapsulated or cartoned (nonencapsulated or encapsulated) Class I through Class IV commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height will be protected by in-rack sprinklers, the following levels of in-rack sprinklers shall be required:

(1) One level of in-rack sprinklers where Class I through Class IV commodities are stored in single- or double-row racks up to and including 25 ft (7.6 m)

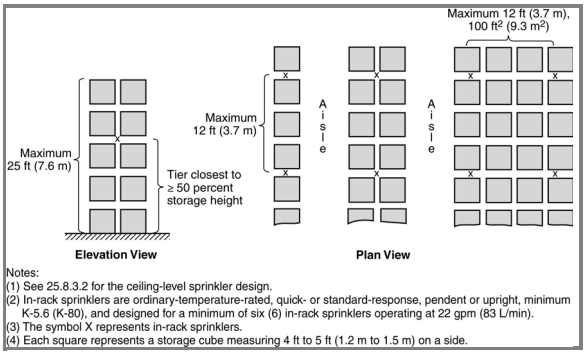
(2) One level of in-rack sprinklers where Class IV commodities are stored in multiple-row racks up to and including 20 ft (6.1 m)

(3) Two levels of in-rack sprinklers where Class IV commodities are stored in multiple-row racks over 20 ft (6.1 m) and up to and including 25 ft (7.6 m)

25.8.3.1.2 –

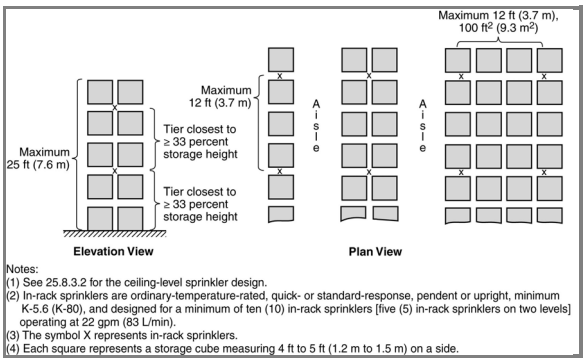
Where rack storage of exposed encapsulated or cartoned (nonencapsulated or encapsulated) Class I or Class II commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height will be protected by in-rack sprinklers, in-rack sprinkler arrangements and designs shall be selected from Figure 25.8.3.1.2(a) through Figure 25.8.3.1.2(c) . *(See Section 20.19 for racks with solid shelving.)*

Figure 25.8.3.1.2(a) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class I or Class II Commodities Stored to a Maximum Height of 25 ft (7.6 m) with One Level of In-Rack Sprinklers.



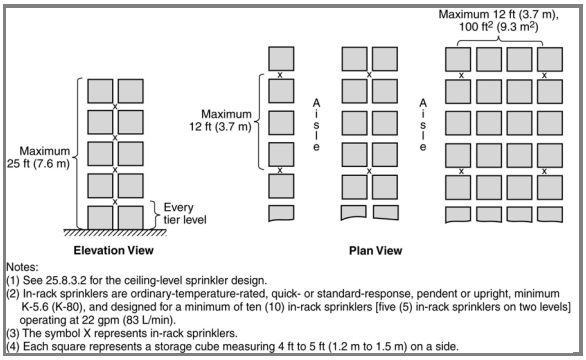
Notes:
(1) See 25.8.3.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of six (6) in-rack sprinklers operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

Figure 25.8.3.1.2(b) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class I or Class II Commodities Stored to a Maximum Height of 25 ft (7.6 m) with More Than One Level of In-Rack Sprinklers (Not at Each Tier Level).



Notes:
(1) See 25.8.3.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of ten (10) in-rack sprinklers [five (5) in-rack sprinklers on two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

Figure 25.8.3.1.2(c) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class I or Class II Commodities Stored to a Maximum Height of 25 ft (7.6 m) with In-Rack Sprinklers at Each Tier Level.



Notes:
(1) See 25.8.3.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of ten (10) in-rack sprinklers [five (5) in-rack sprinklers on two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

25.8.3.1.3 –

Where rack storage of exposed encapsulated or cartoned (nonencapsulated or encapsulated) Class III commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height will be protected by in-rack sprinklers, in-rack sprinkler arrangements and designs shall be selected from 25.8.3.1.3(a) through 25.8.3.1.3(c) . *(See Section 20.19 for racks with solid shelving.)*

Figure 25.8.3.1.3(a) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class III Commodities Stored to a Maximum Height of 25 ft (7.6 m) with One Level of In-Rack Sprinklers.

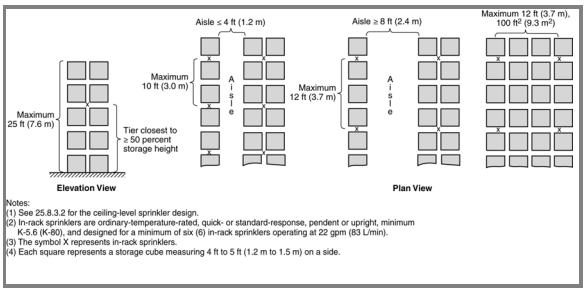


Figure 25.8.3.1.3(b) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class III Commodities Stored to a Maximum Height of 25 ft (7.6 m) with More Than One Level of In-Rack Sprinklers (Not at Each Tier Level).

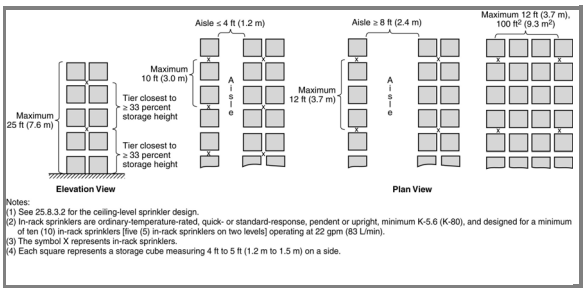
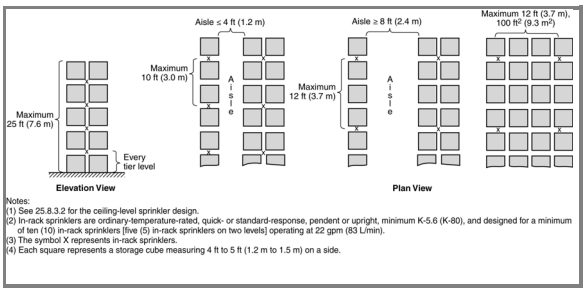


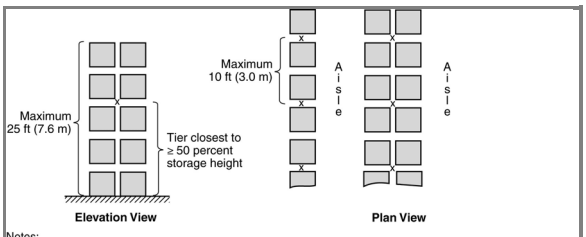
Figure 25.8.3.1.3(c) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class III Commodities Stored to a Maximum Height of 25 ft (7.6 m) with In-Rack Sprinklers at Each Tier Level.



25.8.3.1.4 –

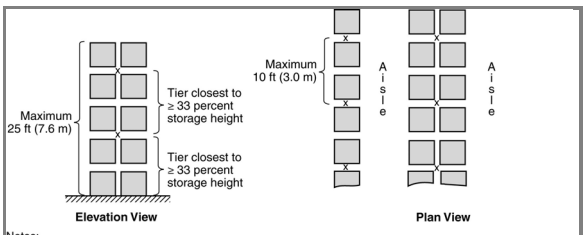
Where rack storage of exposed encapsulated or cartoned (nonencapsulated or encapsulated) Class IV commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height in single- and double-row racks will be protected by in-rack sprinklers, in-rack sprinkler arrangements and designs shall be selected from Figure 25.8.3.1.4(a) through Figure 25.8.3.1.4(c) . *(See Section 20.19 for racks with solid shelving.)*

Figure 25.8.3.1.4(a) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class IV Commodities Stored to a Maximum Height of 25 ft (7.6 m) in Single- and Double-Row Racks with One Level of In-Rack Sprinklers.



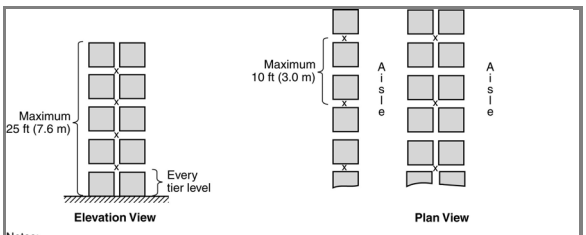
Notes:
(1) See 25.8.3.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of eight (8) in-rack sprinklers operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

Figure 25.8.3.1.4(b) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class IV Commodities Stored to a Maximum Height of 25 ft (7.6 m) in Single- and Double-Row Racks with More Than One Level of In-Rack Sprinklers (Not at Each Tier Level).



Notes:
(1) See 25.8.3.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of 14 in-rack [seven (7) in-rack sprinklers on top two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

Figure 25.8.3.1.4(c) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class IV Commodities Stored to a Maximum Height of 25 ft (7.6 m) in Single- and Double-Row Racks with In-Rack Sprinklers at Each Tier Level.

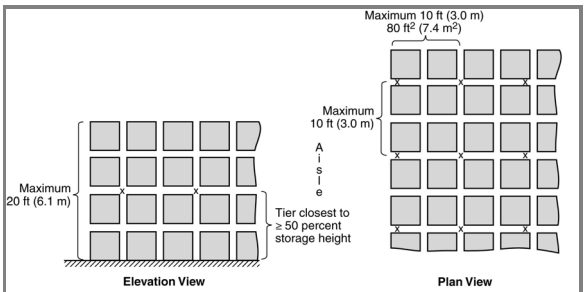


Notes:
(1) See 25.8.3.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of 14 in-rack [seven (7) in-rack sprinklers on top two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

~~25.8.3.1.5~~ –

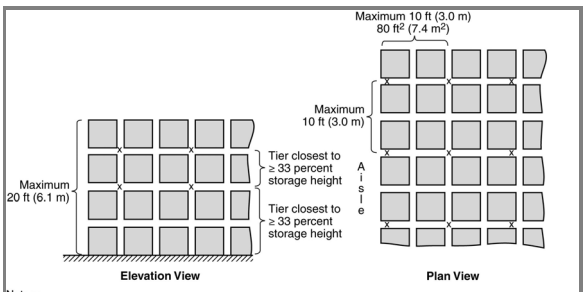
~~Where rack storage of exposed encapsulated or cartoned (nonencapsulated or encapsulated) Class IV commodities stored over 12 ft (3.7 m) and up to and including 20 ft (6.1 m) in height in multiple-row racks will be protected by in-rack sprinklers, in-rack sprinkler arrangements and designs shall be selected from Figure 25.8.3.1.5(a) through Figure 25.8.3.1.5(c) . *(See Section 20.19 for racks with solid shelving.)*~~

~~Figure 25.8.3.1.5(a) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class IV Commodities Stored to a Maximum Height of 20 ft (6.1 m) in Multiple-Row Racks with One Level of In-Rack Sprinklers.~~



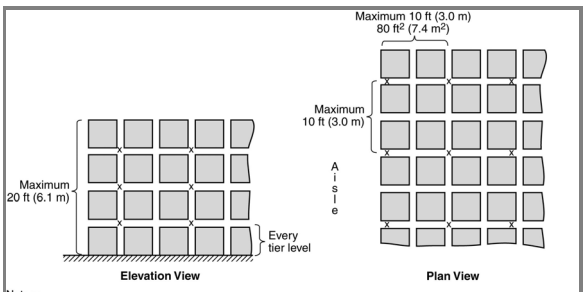
Notes:
(1) See 25.8.3.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of eight in-rack sprinklers operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

~~Figure 25.8.3.1.5(b) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class IV Commodities Stored to a Maximum Height of 20 ft (6.1 m) in Multiple-Row Racks with More Than One Level of In-Rack Sprinklers.~~



Notes:
(1) See 25.8.3.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of 14 in-rack sprinklers [seven (7) in-rack sprinklers on top two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

~~Figure 25.8.3.1.5(c) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class IV Commodities Stored to a Maximum Height of 20 ft (6.1 m) in Multiple-Row Racks with In-Rack Sprinklers at Each Tier Level.~~

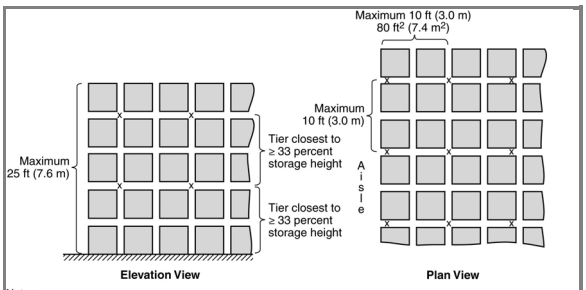


Notes:
(1) See 25.8.3.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of 14 in-rack sprinklers [seven (7) in-rack sprinklers on top two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

25.8.3.1.6 –

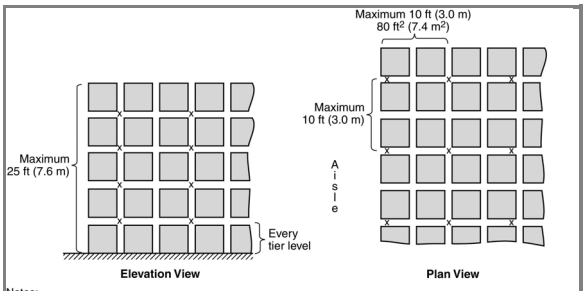
Where rack storage of exposed encapsulated or cartoned (nonencapsulated or encapsulated) Class IV commodities stored over 20 ft (6.1 m) and up to and including 25 ft (7.6 m) in height in multiple-row racks will be protected by in-rack sprinklers, in-rack sprinkler arrangements and designs shall be selected from Figure 25.8.3.1.6(a) or Figure 25.8.3.1.6(b) . *(See Section 20.19 for racks with solid shelving.)*

Figure 25.8.3.1.6(a) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class IV Commodities Stored Over 20 ft (6.1 m) and Up to a Maximum Height of 25 ft (7.6 m) in Multiple-Row Racks with Two Levels of In-Rack Sprinklers.



Notes:
(1) See 25.8.3.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of 14 in-rack sprinklers [seven (7) in-rack sprinklers on top two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

Figure 25.8.3.1.6(b) In-Rack Sprinkler Arrangements for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class IV Commodities Stored Over 20 ft (6.1 m) and Up to a Maximum Height of 25 ft (7.6 m) in Multiple-Row Racks with In-Rack Sprinklers at Each Tier Level.



Notes:
(1) See 25.8.3.2 for the ceiling-level sprinkler design.
(2) In-rack sprinklers are ordinary-temperature-rated, quick- or standard-response, pendent or upright, minimum K-5.6 (K-80), and designed for a minimum of 14 in-rack sprinklers [seven (7) in-rack sprinklers on top two levels] operating at 22 gpm (83 L/min).
(3) The symbol X represents in-rack sprinklers.
(4) Each square represents a storage cube measuring 4 ft to 5 ft (1.2 m to 1.5 m) on a side.

25.8.3.2 – CMDA Ceiling-Level Sprinkler Designs for Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class I, Class II, Class III, or Class IV Commodities Stored Up to and Including 25 ft (7.6 m) in Height in Combination with In-Rack Sprinklers.

25.8.3.2.1 * –

For single-, double-, and multiple-row rack storage of exposed encapsulated or cartoned (nonencapsulated or encapsulated) Class I through Class IV commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height, the ceiling-level sprinkler design in terms of density [gpm/ft ^{2} (mm/min)] over an area of ceiling-level sprinkler operation [ft ^{2} (186 m ^{2})], with the provision of in-rack sprinklers, shall be determined from Table 25.8.3.2.1 and Figure 25.8.3.2.1(a) through Figure 25.8.3.2.1(g) .

Table 25.8.3.2.1 Determining Appropriate Ceiling-Level Protection Criteria Figure and Curve for Rack Storage of Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class I Through Class IV Commodities Stored Over 12 ft (3.7 m) and Up to and Including 25 ft (7.6 m)

Commodity Maximum Storage Height Storage Arrangement Aisle Width

ft (m) Minimum No. of In-Rack Sprinkler Levels Required Appropriate Figure and Curve Density Multiplier Figure Ceiling Sprinkler Temperature Rating High Ordinary or Intermediate Class I Over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) Single- and double-row racks 8 (2.4) 1 level 25.8.3.2.1(e) A B 1.0 4 (1.2) C D Multiple-row racks Any 25.8.3.2.1(a) C D 1.25 Class II Over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) Single- and double-row racks 8 (2.4) 1 level 25.8.3.2.1(e) A B 1.0 4 (1.2) C D Multiple-row racks Any 25.8.3.2.1(b) C D 1.25 Class III Over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) Single- and double-row racks 8 (2.4) 1 level 25.8.3.2.1(f) A B 1.0 4 (1.2) C D Multiple-row racks Any 25.8.3.2.1(c) C D 1.25 Class IV Over 12 ft (3.7 m) and up to and including 20 ft (6.1 m) Single- and double-row racks 8 (2.4) 1 level 25.8.3.2.1(g) A B 1.0 4 (1.2) C D Multiple-row racks Any 25.8.3.2.1(d) A B 1.5 Over 20 ft (6.1 m) and up to and including 25 ft (7.6 m) Single- and double-row racks 8 (2.4) 1 level 25.8.3.2.1(g) A B 1.0 4 (1.2) C D Multiple-row racks Any 2 levels 25.8.3.2.1(d) A B 1.5

Figure 25.8.3.2.1(a) CMDA Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class I Commodities in Multiple-Row Racks — Conventional Pallets.

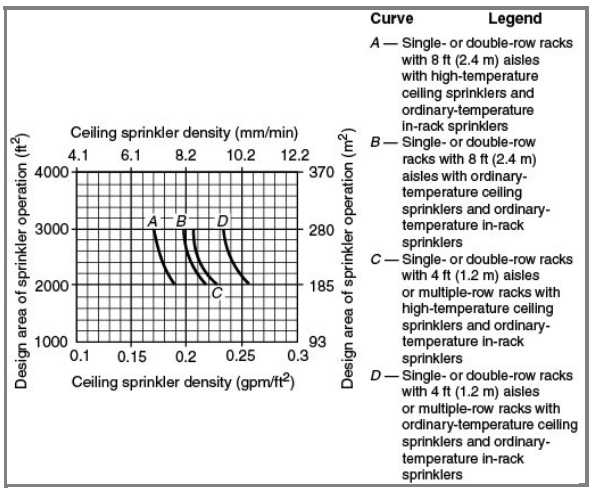


Figure 25.8.3.2.1(b) CMDA Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class II Commodities in Multiple-Row Racks — Conventional Pallets.

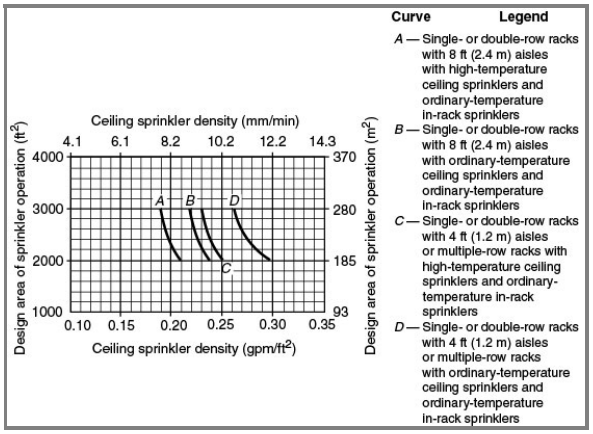


Figure 25.8.3.2.1(c) CMDA Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class III Commodities in Multiple-Row Racks — Conventional Pallets.

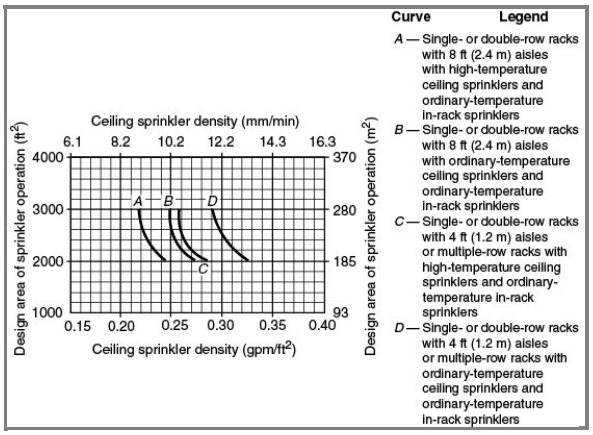


Figure 25.8.3.2.1(d) CMDA Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class IV Commodities in Multiple-Row Racks — Conventional Pallets.

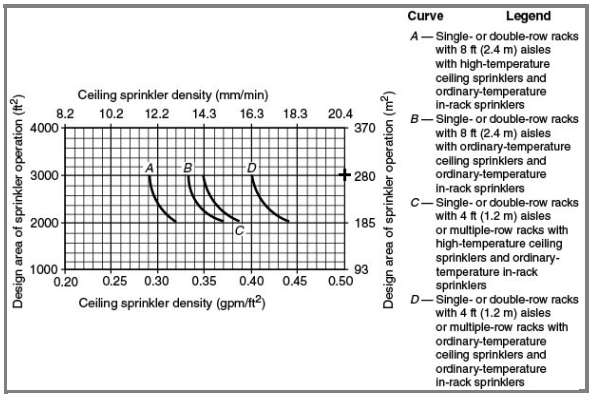


Figure 25.8.3.2.1(e) CMDA Sprinkler System Design Curves — Single- or Double-Row Racks — 20 ft (6.1 m) High Rack Storage — Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class I and Class II Commodities — Conventional Pallets.

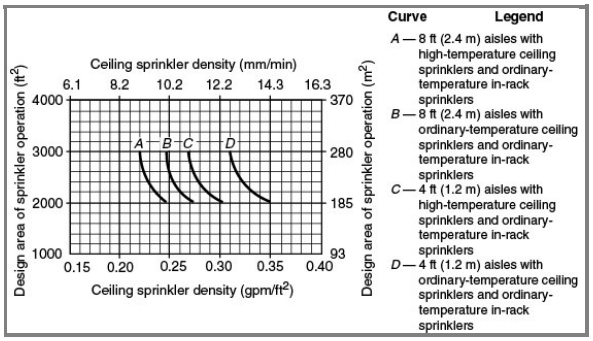
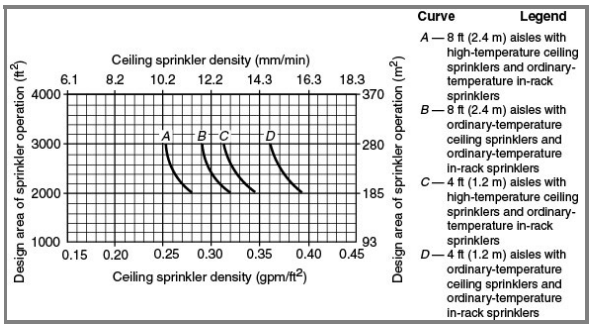
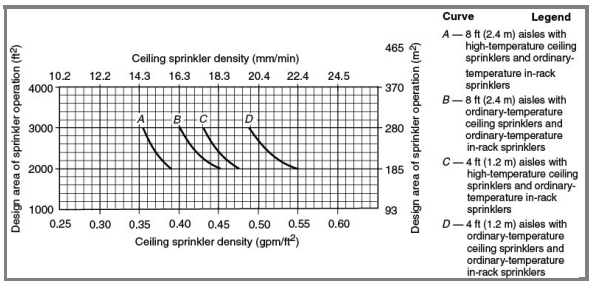


Figure 25.8.3.2.1(f) CMDA Sprinkler System Design Curves — Single- or Double-Row Racks — 20 ft (6.1 m) High Rack Storage — Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class III Commodities — Conventional Pallets.



~~Figure 25.8.3.2.1(g) CMDA Sprinkler System Design Curves — Single- or Double-Row Racks — 20 ft (6.1 m) High Rack Storage — Exposed Encapsulated or Cartoned (Nonencapsulated or Encapsulated) Class IV Commodities — Conventional Pallets.~~



~~25.8.3.2.2 *~~ ~~– Ceiling-Level Sprinkler Density Adjustments.~~

~~25.8.3.2.2.1 *~~ ~~–~~

~~Design densities obtained from the appropriate figure and curve specified in Table 25.8.3.2.1 for single- and double-row racks shall be selected to correspond to aisle width as follows *(see Section C.15.)*:~~

(1) ~~The density given for 8 ft (2.4 m) wide aisles shall be applied to aisles wider than 8 ft (2.4 m).~~

(2) ~~For aisle widths between 4 ft (1.2 m) and 8 ft (2.4 m), the rules for 4 ft (1.2 m) aisle width shall be used, or direct linear interpolation between the densities shall be permitted.~~

(3) ~~The density given for 4 ft (1.2 m) wide aisles shall be applied to aisles narrower than 4 ft (1.2 m) down to 3 1/2 ft (1.1 m).~~

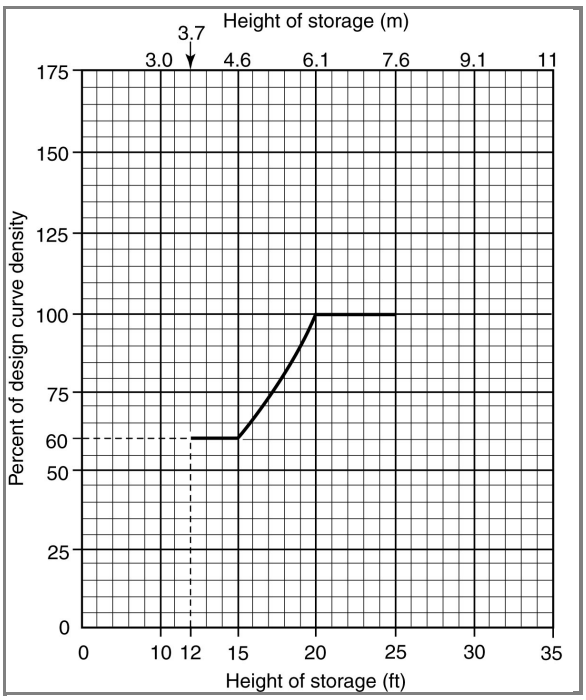
(4) ~~Where aisles are narrower than 3 1/2 ft (1.1 m), racks shall be considered to be multiple-row racks.~~

~~25.8.3.2.2.2 *~~ ~~–~~

(A) –

The ceiling-level sprinkler design criteria in terms of density [gpm/ft^2 (mm/min)] and area of sprinkler operation [ft^2 (m^2) of ceiling or roof] obtained from the appropriate density/area curves of Figure 25.8.3.2.1(a) through Figure 25.8.3.2.1(d) shall be modified as appropriate by Figure 25.8.3.2.2.2(A) for storage height.

Figure 25.8.3.2.2.2(A) Allowable Adjustments to CMDA Ceiling-Level Sprinkler Densities Due to Storage Height Up to 25 ft (7.6 m).



(B) –

Paragraph 25.8.3.2.2.2(A) shall apply to portable racks arranged in the same manner as single-, double- or multiple-row racks. *(See Section C.14 .)*

25.8.3.2.2.3 –

Where in-rack sprinklers are being installed within racks of Class I through Class IV commodities stored over 12 ft (3.7 m) up to and including 25 ft (7.6 m) in height protected with CMDA sprinklers at ceiling level along with the minimum number of required in-rack sprinkler levels, densities obtained from design curves shall be adjusted in accordance with Figure 25.8.3.2.2.2(A) and then be multiplied by the density multiplier indicated in Table 25.8.3.2.1 .

25.8.3.2.2.4 –

Where in-rack sprinklers are being installed within racks of Class I through Class IV commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height protected with CMDA sprinklers at ceiling level along with more than one level of in-rack sprinklers (not in every tier), densities obtained from design curves adjusted in accordance with Figure 25.8.3.2.2.2(A) and then multiplied by the density multiplier indicated in Table 25.8.3.2.1 shall be permitted to be reduced an additional 20 percent as indicated in Table 25.8.3.2.2.4 .

Table 25.8.3.2.2.4 Adjustment to Ceiling-Level Sprinkler Density Due to Storage Height and In-Rack Sprinklers

Storage Height	Apply Figure 25.8.3.2.2.2(A)?	In-Rack Sprinklers Levels Installed	Permitted Ceiling-Level Sprinkler Density Adjustment Due to In-Rack Sprinklers
Over 12 ft (3.7 m) and up to and including 20 ft (6.1 m)	Yes	Minimum required	None
		More than required but not at each tier level	Reduce density 20 percent from that indicated for minimum required levels of in-rack sprinklers
		Each tier level	Reduce density 40 percent from that indicated for minimum required levels of in-rack sprinklers
Over 20 (6.1) and up to and including 25 (7.6)	No	Minimum	

required None More than required but not at each tier level Reduce density 20 percent from that indicated for minimum required levels of in-rack sprinklers Each tier level Reduce density 40 percent from that indicated for minimum required levels of in-rack sprinklers

25.8.3.2.2.5 * –

Where in-rack sprinklers are being installed within racks of Class I through Class IV commodities stored over 12 ft (3.7 m) and up to and including 25 ft (7.6 m) in height protected with CMDA sprinklers at ceiling level along with in-rack sprinklers at each tier level, densities obtained from design curves and adjusted in accordance with Figure 25.8.3.2.2.2(A) shall be permitted to be reduced an additional 40 percent as indicated in Table 25.8.3.2.2.4 .

25.8.3.2.3 – Excessive Clearance from Top of Storage.

25.8.3.2.3.1 –

The ceiling-level sprinkler design obtained from the appropriate figure and curve specified in Table 25.8.3.2.1 shall be based on a maximum clearance from top of storage to ceiling of 20 ft (6.1 m).

25.8.3.2.3.2 –

Where the clearance of 25.8.3.2.3.1 exceeds 20 ft (6.1 m), one of the following two options shall be implemented:

(1) The ceiling design shall be determined from the appropriate figure and curve specified in Table 25.8.3.2.1 using a theoretical storage height that does not exceed 25 ft (7.6 m) and results in a clearance to ceiling of 20 ft (6.1 m).

(2) If not already provided, the in-rack sprinkler arrangement shall be supplemented with one level of quick-response in-rack sprinklers located directly below the top tier level of storage and at every flue space intersection.

Statement of Problem and Substantiation for Public Input

Section 25.8 applies to existing systems and thus should be included in Chapter 30, which is specific to existing systems. See the proposal specific to Section 30.4.7. Note, however, that the proposal for Section 30.4.7 is to only keep the parts of Section 25.8 that are different than 25.3 and refer the user to 25.1 and 25.3 except for the requirements provided in 30.4.7.

Submitter Information Verification

Submitter Full Name:	Elley Klausbruckner
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Affiliation:	On behalf of NFPA 13 Discharge (Existing Systems/Chapter 30 Subcommittee)
Street Address:	
City:	
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Submittal Date:	Tue May 31 15:14:26 EDT 2022
Committee:	AUT-SSD

Public Input No. 390-NFPA 13-2022 [New Section after 26.1]

TITLE OF NEW CONTENT

26.10 Protection of Automatic Storage Systems

26.10.1 - use appropriate information from FM Global Property Loss

Data Sheet 8-34

.

Statement of Problem and Substantiation for Public Input

NFPA 13 needs to provide guidance on Automatic Storage Retrieval Systems. Full scale data is difficult since many test programs are proprietary and confidential to the users. FM has done many tests and provides guidance on the protection criteria known today. I understand that data is the norm for changes submitted - however other changes in the past followed FM guidelines without the full scale data which is confidential to FM.
A task group would be necessary to draft mandatory language in accordance with the Manual of Style.

Submitter Information Verification

Submitter Full Name: James Golinveaux
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City:
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Submittal Date: Fri May 27 13:52:52 EDT 2022
Committee: AUT-SSD

Public Input No. 457-NFPA 13-2022 [Section No. 26.4.1.3]

26.4.1.3

A wet pipe system that is designed to provide K-14.0 (200) ESFR sprinklers operating at a minimum of 50 psi (3.4 bar), K-16.8 (240) ESFR sprinklers operating at a minimum of 32 psi (2.2 bar), or K-25.2 (360) ESFR sprinklers operating at a minimum of 15 psi (1.0 bar) shall be permitted to protect single- and double-row racks with slatted rack shelving where all of the following conditions are met:

(1) The protected commodities shall be limited to Class I through Class IV, Group B plastics, Group C plastics, cartoned (expanded and nonexpanded) Group A plastics, and exposed (nonexpanded) Group A plastics.

(2) Slats in slatted rack shelving shall be a minimum nominal 2 in. (50 mm) thick by maximum nominal 6 in. (150 mm) wide with the slats held in place by spacers that maintain a minimum 2 in. (50 mm) opening between each slat.

(3) Longitudinal flue spaces ~~shall not be required~~ at least 6 in. (150 mm) wide shall be provided for double-row racks .

(4) Transverse flue spaces at least 3 in. (75 mm) wide shall be provided at least every 10 ft (3.0 m) horizontally.

(5) The aisle widths shall be at least 7½ ft (2.3 m).

(6) The maximum roof height shall be 30 ft (9.1 m).

(7) The maximum storage height shall be 20 ft (6.1 m).

(8) Solid plywood or similar materials shall not be placed on the slatted shelves so that they block the 2 in. (50 mm) spaces between slats, nor shall they be placed on the wire mesh shelves.

(9) There shall be no slatted shelf levels in the rack above 12 ft (3.7 m) and open rack shelving using wire mesh shall be permitted for shelf levels above 12 ft (3.7 m).

Statement of Problem and Substantiation for Public Input

It is not clear whether the design indicated in this section was based on the test criteria outlined in Section C.20 or not. If it was, then the proposed modifications are needed to replicate the test conditions.

Submitter Information Verification

Submitter Full Name: Weston Baker
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Submittal Date: Sun May 29 17:39:11 EDT 2022
Committee: AUT-SSD

Public Input No. 458-NFPA 13-2022 [Section No. 26.6.6.4.1.1]

26.6.6.4.1.1

For single-row racks, in-rack sprinklers shall be installed in the transverse ~~flue~~ flues at each catwalk level and staggered vertically . Where only one catwalk has been installed, the in-rack sprinkler arrangement shown for one side of the double-row rack of Figure 26.6.6.4 shall be installed .

Statement of Problem and Substantiation for Public Input

The assumption for this design is that there is always at least two catwalks so that both sides of the face of the single-row rack are protected. If there only happens to be a single catwalk, then the current in-rack sprinkler arrangement would have an in-rack sprinkler arrangement that does not match the intent of how half of the rack in a double-row rack is protected. This proposal will address this scenario.

Submitter Information Verification

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Submittal Date: Sun May 29 17:44:26 EDT 2022
Committee: AUT-SSD

Public Input No. 459-NFPA 13-2022 [Section No. 26.6.6.4.2.1]

26.6.6.4.2.1

For double- and multiple-row racks, in-rack sprinklers shall be installed in the transverse flues at each catwalk level and ~~shall be~~ staggered vertically. Where only one catwalk has been installed, both the "X" and "triangle" in-rack sprinklers shown within the double-row rack of Figure 26.6.6.4 shall be installed.

Statement of Problem and Substantiation for Public Input

The assumption with this current in-rack sprinkler arrangement is that two catwalks will always be installed. However, if only one catwalk is installed, then only one half of the rack structural is protected with in-rack sprinklers, which is not the intent for this storage arrangement.

Submitter Information Verification

Submitter Full Name: Weston Baker
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Submittal Date: Sun May 29 17:48:07 EDT 2022
Committee: AUT-SSD

Public Input No. 225-NFPA 13-2022 [Section No. 27.2]

27.2– Ignitible (Flammable and Combustible) Liquids.

Fire sprinkler systems for the protection of ignitible (flammable and combustible) liquids shall be designed and installed in accordance with this standard and NFPA 30.

Statement of Problem and Substantiation for Public Input

Updates flammable and combustible liquid terminology in accordance with the NFPA 30 nomenclature.

Submitter Information Verification

Submitter Full Name: Kevin Hall
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Affiliation: American Fire Sprinkler Association
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Submittal Date: Wed Mar 23 12:54:39 EDT 2022
Committee: AUT-SSD

Public Input No. 226-NFPA 13-2022 [Section No. 27.6]

27.6 Dipping, Coating, and Printing Processes Using Ignitible (Flammable or Combustible) Liquids.

Fire sprinkler systems for the protection of dipping, coating, and printing processes using ignitible (flammable or combustible) liquids shall be designed and installed in accordance with this standard and NFPA 34.

Statement of Problem and Substantiation for Public Input

Updates flammable and combustible liquid terminology in accordance with the NFPA 30 nomenclature

Submitter Information Verification

Submitter Full Name: Kevin Hall
Organization: American Fire Sprinkler Association
Affiliation: American Fire Sprinkler Association
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Zip:
Submittal Date: Wed Mar 23 12:56:12 EDT 2022
Committee: AUT-SSD

Public Input No. 191-NFPA 13-2022 [Section No. 28.1.3 [Excluding any Sub-Sections]]

Working plans shall be drawn to an indicated scale, on sheets of uniform size, with a plan of each floor, and shall show those items from the following list that pertain to the design of the system:

(1) Name and address of building being protected

(2) Name, telephone number, and address of installing contractor

(3) Point of compass and graphic scale indications on drawings and details as applicable

(4) Full height cross section or schematic diagram showing floor, ceiling, roof heights, architectural features and general piping and sprinkler locations.

(5) Location of all partitions that extend to or are within a minimum of 18 in. (450 mm) to the finished ceiling or exposed deck above

(6) Location of all fire-rated partitions, fire barriers, draft stops, and draft curtains

(7) Identification of all rooms and spaces, regardless of occupancy or use

(8) Identification and labeling of all spaces, above and below ceilings, where sprinklers will be omitted, including appropriate citation of the section(s) of this standard for such omission(s)

(9) Location of all fixtures, diffusers, lights, and devices installed in or mounted to the ceiling structure, regardless of the ceiling type (i.e., finished or exposed to structure)

(10) Label finished or exposed ceiling heights for each space, including those that are sloped greater than 2 in 12 (16.7 percent)

(11)* Location and identification of major mechanical, plumbing, and electrical equipment installed above or below the ceiling spaces if sprinkler protection is being provided for those areas

(12)* Location and identification of all major structural members, and identification and labeling of construction types (i.e., obstructed or unobstructed) for each space or portion thereof in the building, as applicable

(13)* Location and identification of concealed spaces, regardless of combustibility, and of architectural and/or structural features not shown or easily identifiable in the floor plan or reflected ceiling plan views

(14) Water source(s) supply information, including the following:

- (a) Location
- (b) Type
- (c) Size
- (d) Dimensions
- (e) Capacity
- (f) Configuration
- (g) Elevation
- (h) Static pressure
- (i) Flow rate
- (j) Residual pressure
- (k) Flow test locations, dates, and sources (i.e., city or private)
- (l) Any adjustments from the raw data required by the engineer of record (i.e., owner's certificate) or the water authority, if applicable

(15) Information from the owner's certificate required by Section 4.2, including the edition of this standard being used

(16) Identification and labeling of design criteria for each room and/or space as shown on building plan, including the following:

(a) Hazard classification associated with each room or space

(b) Identification and location of all rooms and spaces intended for storage, including the following:

i. Commodity classification

ii. * Storage type and configuration

iii. Height of storage for each dedicated room or space

iv. Type of packaging to be used

(17) Identification and labeling of all sprinkler systems, including type and overall area protected by each system

(18) Location and labeling for the size, dimension, elevation, and type of all major sprinkler system components, including the following *(see 28.1.3.1)*:

(a) Pipe, fittings, valves, and test and drain locations

(b) Sprinkler legend, per system, including the following:

i. Orientation

ii. Finish

iii. Manufacturer

iv. Model

v. SIN number

vi. K-factor

vii. Temperature rating

viii. Response type

ix. Quantity of each

x. If extended coverage or residential type, spacing utilized for this application

(c) Manufacturer, model, length, maximum number of bends, and minimum bend radius and corresponding K-factor applied to flexible sprinkler hose

(19) Location and labeling of all system flushing, forward flow, water flow alarm, and test and drain locations

(20) Location and labeling of sprinkler system riser(s) and,if applicable, standpipe location(s)

(21) Location and labeling of fire department connections

(22) Location and labeling of hydraulic calculation information, including the following:

(a) Graphic indication of each area of operation, including a description of any allowed density or area modifications applied

(b) Labeling of all node locations that correspond to each hydraulic calculation

(23) Location and labeling of seismic system components, including the following:

(a) Zones of influence

(b) Bracing and restraint assemblies

(c) Flexible couplings and penetration clearances

(d) Maximum spacing of components

(e) Design angle category(ies)

(24) Sprinkler system details and information for other system components necessary for the complete installation, including the following:

(a) Hanger and/or hanger assemblies intended to be used throughout

(b) Total system volume for dryand double interlock preaction systems

(c) Hydraulic calculation summary information, including the following:

i. Method of calculation

ii. Total water and pressure required

iii. Hose demand

(d) Special information, settings, or values required for ongoing inspection, testing, and maintenance and system use, including the following:

i. Pressure regulating device features and means for conducting a flow test

ii. Dry pipe, preaction, and/or deluge systems

iii. Information regarding antifreeze solution used

Statement of Problem and Substantiation for Public Input

Reinstate this requirement for fire sprinkler plans. Without an elevation diagram, the 2D sprinkler plan information is poorly presented. Quite often, the roof or ceiling height is needed especially determining where to place the high point air release. We question contractors on architectural features inside the buildings and the planner has no clue. Some buildings would require multiple full height cross sections due to complexity of the architecture. The general pipe layout should be shown on this elevation diagram. This is necessary for the fitter and fire inspector. This would show if the piping is below or within (bar joists) the structural members. Fire inspectors are running into sprinkler fitters forced to ad-lib installations due to lack of direction and pre-planning. Sometimes they get it right. Quite often, fire inspectors are required to make field decisions where the fitter and the layout planner should flush out those issues per the standard.

Submitter Information Verification

Submitter Full Name: Thomas Wellen
Organization: McKinney Fire Department
Street Address:
City:
State:
Zip:
Submittal Date: Thu Mar 03 10:39:40 EST 2022
Committee: AUT-SSD

Public Input No. 355-NFPA 13-2022 [Section No. 28.1.3 [Excluding any Sub-Sections]]

Working plans shall be drawn to an indicated scale, on sheets of uniform size, with a plan of each floor, and shall show those items from the following list that pertain to the design of the system:

(1) Name and address of building being protected

(2) Name, telephone number, and address of installing contractor

(3) Point of compass and graphic scale indications on drawings and details as applicable

(4) Location of all partitions that extend to or are within a minimum of 18 in. (450 mm) to the finished ceiling or exposed deck above

(5) Location of all fire-rated partitions, fire barriers, draft stops, and draft curtains

(6) Identification of all rooms and spaces, regardless of occupancy or use

(7) Identification and labeling of all spaces, above and below ceilings, where sprinklers will be omitted, including appropriate citation of the section(s) of this standard for such omission(s)

(8) Location of all fixtures, diffusers, lights, and devices installed in or mounted to the ceiling structure, regardless of the ceiling type (i.e., finished or exposed to structure)

(9) Label finished or exposed ceiling heights for each space, including those that are sloped greater than 2 in 12 (16.7 percent)

(10) Location and identification of major mechanical, plumbing, and electrical equipment installed above or below the ceiling spaces if sprinkler protection is being provided for those areas

(11) Location and identification of all major structural members, and identification and labeling of construction types (i.e., obstructed or unobstructed) for each space or portion thereof in the building, as applicable

(12) Location and identification of concealed spaces, regardless of combustibility, and of architectural and/or structural features not shown or easily identifiable in the floor plan or reflected ceiling plan views

(13) Water source(s) supply information, including the following:

- (a) Location
- (b) Type
- (c) Size
- (d) Dimensions
- (e) Capacity
- (f) Configuration
- (g) Elevation
- (h) Static pressure
- (i) Flow rate
- (j) Residual pressure
- (k) Flow test locations, dates, and sources (i.e., city or private)
- (l) Any adjustments from the raw data required by the engineer of record (i.e., owner's certificate) or the water authority, if applicable
- (m) For private service mains:

(14) Size of city main in street and whether dead end or circulating; if dead end, direction and distance to nearest circulating main; and city main test results and system elevation relative to test hydrant.

(15) Private fire service main sizes, lengths, locations, weights, materials, point of connection to city main; the sizes, types and locations of valves, valve indicators,

regulators, meters, and valve pits; and the depth that the top of the pipe is laid below grade.

(16) Information from the owner's certificate required by Section 4.2, including the edition of this standard being used

(17) Identification and labeling of design criteria for each room and/or space as shown on building plan, including the following:

(a) Hazard classification associated with each room or space

(b) Identification and location of all rooms and spaces intended for storage, including the following:

i. Commodity classification

ii. * Storage type and configuration

iii. Height of storage for each dedicated room or space

iv. Type of packaging to be used

(18) Identification and labeling of all sprinkler systems, including type and overall area protected by each system

(19) Location and labeling for the size, dimension, elevation, and type of all major sprinkler system components, including the following *(see 28.1.3.1)*:

(a) Pipe, fittings, valves, and test and drain locations

(b) Sprinkler legend, per system, including the following:

i. Orientation

ii. Finish

iii. Manufacturer

iv. Model

v. SIN number

vi. K-factor

vii. Temperature rating

viii. Response type

ix. Quantity of each

x. If extended coverage or residential type, spacing utilized for this application

(c) Manufacturer, model, length, maximum number of bends, and minimum bend radius and corresponding K-factor applied to flexible sprinkler hose

(20) Location and labeling of all system flushing, forward flow, water flow alarm, and test and drain locations

(21) Location and labeling of sprinkler system riser(s) and,if applicable, standpipe location(s)

(22) Location and labeling of fire department connections

(23) Location and labeling of hydraulic calculation information, including the following:

(a) Graphic indication of each area of operation, including a description of any allowed density or area modifications applied

(b) Labeling of all node locations that correspond to each hydraulic calculation

(24) Location and labeling of seismic system components, including the following:

(a) Zones of influence

(b) Bracing and restraint assemblies

(c) Flexible couplings and penetration clearances

(d) Maximum spacing of components

(e) Design angle category(ies)

(25) Sprinkler system details and information for other system components necessary for the complete installation, including the following:

(a) Hanger and/or hanger assemblies intended to be used throughout

(b) Total system volume for dryand double interlock preaction systems

(c) Hydraulic calculation summary information, including the following:

i. Method of calculation

ii. Total water and pressure required

iii. Hose demand

(d) Special information, settings, or values required for ongoing inspection, testing, and maintenance and system use, including the following:

i. Pressure regulating device features and means for conducting a flow test

ii. Dry pipe, preaction, and/or deluge systems

iii. Information regarding antifreeze solution used

Statement of Problem and Substantiation for Public Input

This information was removed during the working plans rewrite last cycle. The NFSA Engineering and Standards Committee was part of that task group, and the change was not intentional. This information should be returned to the standard.

Submitter Information Verification

Submitter Full Name: Michael Joanis
Organization: National Fire Sprinkler Association
Affiliation: The NFSA Engineering and Standards Committee
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 27 08:18:40 EDT 2022
Committee: AUT-SSD

Public Input No. 53-NFPA 13-2021 [Section No. 28.1.3 [Excluding any Sub-Sections]]

Working plans shall be drawn to an indicated scale, on sheets of uniform size, with a plan of each floor, and shall show those items from the following list that pertain to the design of the system:

(1) Name and address of building being protected

(2) Name, telephone number, and address of installing contractor

(3) Point of compass and graphic scale indications on drawings and details as applicable

(4) Location of all partitions that extend to or are within a minimum of 18 in. (450 mm) to the finished ceiling or exposed deck above

(5) Location of all fire-rated partitions, fire barriers, draft stops, and draft curtains

(6) Identification of all rooms and spaces, regardless of occupancy or use

(7) Identification and labeling of all spaces, above and below ceilings, where sprinklers will be omitted, including appropriate citation of the section(s) of this standard for such omission(s)

(8) Location of all fixtures, diffusers, lights, and devices installed in or mounted to the ceiling structure, regardless of the ceiling type (i.e., finished or exposed to structure)

(9) Label finished or exposed ceiling heights for each space, including those that are sloped greater than 2 in 12 (16.7 percent)

(10)* Location and identification of major mechanical, plumbing, and electrical equipment installed above or below the ceiling spaces if sprinkler protection is being provided for those areas

(11)* Location and identification of all major structural members, and identification and labeling of construction types (i.e., obstructed or unobstructed) for each space or portion thereof in the building, as applicable

(12)* Location and identification of concealed spaces, regardless of combustibility, and of architectural and/or structural features not shown or easily identifiable in the floor plan or reflected ceiling plan views

(13) Water source(s) supply information, including the following:

- (a) Location
- (b) Type
- (c) Size
- (d) Dimensions
- (e) Capacity
- (f) Configuration
- (g) Elevation
- (h) Static pressure
- (i) Flow rate
- (j) Residual pressure
- (k) Flow test locations, dates, and sources (i.e., city or private)
- (l) Any adjustments from the raw data required by the engineer of record (i.e., owner's certificate) or the water authority, if applicable

(14) Information from the owner's certificate required by Section 4.2, including the edition of this standard being used

(15) Identification and labeling of design criteria for each room and/or space as shown on building plan, including the following:

- (a) Hazard classification associated with each room or space
- (b) Identification and location of all rooms and spaces intended for storage, including the

following:

i. Commodity classification

ii. * Storage type and configuration

iii. Height of storage for each dedicated room or space

iv. Type of packaging to be used

(16) Identification and labeling of all sprinkler systems, including type and overall area protected by each system

(17) Location and labeling for the size, dimension, elevation, and type of all major sprinkler system components, including the following *(see 28.1.3.1)*:

(a) Pipe, fittings, valves, and test and drain locations

(b) Sprinkler legend, per system, including the following:

i. Orientation

ii. Finish

iii. Manufacturer

iv. Model

v. SIN number

vi. K-factor

vii. Temperature rating

viii. Response type

ix. Quantity of each

x. If extended coverage or residential type, spacing utilized for this application

xi. Sprinkler wrench model number

(c) Manufacturer, model, length, maximum number of bends, and minimum bend radius and corresponding K-factor applied to flexible sprinkler hose

(18) Location and labeling of all system flushing, forward flow, water flow alarm, and test and drain locations

(19) Location and labeling of sprinkler system riser(s) and,if applicable, standpipe location(s)

(20) Location and labeling of fire department connections

(21) Location and labeling of hydraulic calculation information, including the following:

(a) Graphic indication of each area of operation, including a description of any allowed density or area modifications applied

(b) Labeling of all node locations that correspond to each hydraulic calculation

(22) Location and labeling of seismic system components, including the following:

(a) Zones of influence

(b) Bracing and restraint assemblies

(c) Flexible couplings and penetration clearances

(d) Maximum spacing of components

(e) Design angle category(ies)

(23) Sprinkler system details and information for other system components necessary for the complete installation, including the following:

(a) Hanger and/or hanger assemblies intended to be used throughout

(b) Total system volume for ~~dryand~~ dry and double interlock preaction systems

(c) Hydraulic calculation summary information, including the following:

i. Method of calculation

ii. Total water and pressure required

iii. Hose demand

(d) Special information, settings, or values required for ongoing inspection, testing, and maintenance and system use, including the following:

i. Pressure regulating device features and means for conducting a flow test

ii. Dry pipe, preaction, and/or deluge systems

iii. Location of all low point drains

iv. Information regarding antifreeze solution used

Statement of Problem and Substantiation for Public Input

There is a proposal for the sprinkler wrench model number to be included on the list at the head box and should be required to be included on the list that is posted near or on the spare sprinkler cabinet and needs to be identified on the working plans as well

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 37-NFPA 13-2021 [Section No. 16.2.7.7.1]	

Submitter Information Verification

Submitter Full Name: Kevin Hall
Organization: American Fire Sprinkler Association
Affiliation: American Fire Sprinkler Association
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 03 01:32:01 EDT 2021
Committee: AUT-SSD

Public Input No. 365-NFPA 13-2022 [New Section after 28.2]

28.2

28.2 * Approved Storage Floor Plan.

An approved storage floor plan that documents the permissible use of the storage area, based on the occupancy classification and the design basis of the automatic sprinkler system, shall be provided and mounted in an approved location.

Statement of Problem and Substantiation for Public Input

Correlate NFPA 1 and IFC requirements for a storage plan with with NFPA 13.

Submitter Information Verification

Submitter Full Name: Michael Joanis
Organization: National Fire Sprinkler Association
Affiliation: NFSA Engineering and Standards Committee
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 27 10:01:17 EDT 2022
Committee: AUT-SSD

Public Input No. 101-NFPA 13-2021 [New Section after 28.2.1.6]

TITLE OF NEW CONTENT

28.2.1.7 Where the water supply does not include a fire pump, the hydraulic calculations shall include a pressure safety factor equal or greater to 10 percent of the water supply pressure available at the design flow at the hydraulic node assigned to the system main drain.

28.2.1.8 Where the water supply includes a fire pump, the hydraulic calculations shall include a pressure safety factor equal or greater to either 10 percent of the water supply pressure available at the design flow at the hydraulic node assigned to the system main drain, or 5 percent of the fire pump pressure rating at the design flow at the hydraulic node assigned to the fire pump discharge.

Statement of Problem and Substantiation for Public Input

NFPA 25 Section 13.2.3.3 allows the water supply pressure to degrade by 10 percent at the main drain without additional investigation. Similarly, NFPA 25 Section 8.3.2.1.2.2 allows fire pumps that have degraded delivered pressures up to 5 percent below the rated pump pressure to remain in service without further investigation. Each allowed degradation has a negative effect on the pressures calculated to be delivered to the fire sprinkler system. The proposed code change would require that the initial design incorporate minimum pressure safety factors to accommodate situations where the water supply and/or fire pump remains in service after the degradation has started, while maintaining minimum NFPA 13 prescribed design.

Submitter Information Verification

Submitter Full Name: Stephen Digiovanni
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Street Address:
City:
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Zip:
Submittal Date: Mon Dec 06 20:21:19 EST 2021
Committee: AUT-SSD

Public Input No. 494-NFPA 13-2022 [Section No. 28.2.4.2]

28.2.4.2 Density/Area Method.

28.2.4.2.1*

Where the design is based on the density/area method, the design area shall be a rectangular area having a dimension parallel to the branch lines in accordance with one of the following:

(1) For unobstructed construction with ceiling or roof slopes greater than to 2 in 12, the dimension parallel to the branch line shall be at least 1.4 times the square root of the area of sprinkler operation *(A)* used, which shall permit the inclusion of sprinklers on both sides of the cross main.

(2) For non-solid obstructed construction with ceiling or roof slopes greater than 2 in 12, the dimension parallel to the branch line shall be at least 1.4 times the square root of the area of sprinkler operation (A) used, which shall permit the inclusion of sprinklers on both sides of the cross main.

(3) For solid obstructed construction with ceiling or roof slopes greater than 4 in 12, the dimension parallel to the branch line shall be at least 1.4 times the square root of the area of sprinkler operation (A) used, which shall permit the inclusion of sprinklers on both sides of the cross main.

(4) For all other situations, the dimension parallel to the branch line shall be at least 1.2 times the square root of the area of sprinkler operation (A) used, which shall permit the inclusion of sprinklers on both sides of the cross main.

28.2.4.2.2

Any fractional sprinkler shall be carried to the next higher whole sprinkler.

28.2.4.2.3

In systems having branch lines with an insufficient number of sprinklers to fulfill the 1.2 or 1.4 requirement, the design area shall be extended to include sprinklers on adjacent branch lines supplied by the same cross main.

28.2.4.2.4*

Where the available floor area for a specific area/density design criteria, including any extension of area as required by 19.1.2 and Section 20.13, is less than the required minimum design area, the design area shall be permitted to only include those sprinklers within the available design area.

28.2.4.2.5*

Where the total design discharge from the operating sprinklers is less than the minimum required discharge determined by multiplying the required design density times the required minimum design area, an additional flow shall be added at the point of common connection closest to the source to increase the overall demand, not including hose stream allowance, to the minimum required discharge.

28.2.4.2.6*

Where a sprinkler's assigned area of discharge is defined by the presence of a full-height wall assembly, the area on the opposite side of the wall of the flowing sprinkler shall not be counted towards the total design area.

Statement of Problem and Substantiation for Public Input

Based on the FPRF Sloped Ceiling Project, we know that the design area is going to get larger for

certain situations. When that happens, the reasonable worst-case for sprinklers opening along a branch line needs to be re-evaluated, especially in the situation where the branch lines run up the slope. But even in the situation where the branch lines are perpendicular to the slope, the shape factor needs to change for unobstructed construction and obstructed construction where the heat can get out of the channels formed by the non-solid structural members.

While this concept was discussed by the Slope Ceiling Task Group, exact language was not agreed upon in time for the Public Input deadline, so this change is being submitted in my name only so that the committee can consider it.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 491-NFPA 13-2022 [Section No. 19.2.3.2.4]	Discharge criteria that increases the design area
Public Input No. 495-NFPA 13-2022 [Section No. 28.2.4.3]	

Submitter Information Verification

Submitter Full Name: Kenneth Isman
Organization: University of Maryland
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 31 12:13:07 EDT 2022
Committee: AUT-SSD

Public Input No. 88-NFPA 13-2021 [Section No. 28.2.4.2]

28.2.4.2 Density/Area Method.

28.2.4.2.1*

Where the design is based on the density/area method, the design area shall be a rectangular area having a dimension parallel to the branch lines at least 1.2 times the square root of the area of sprinkler operation *(A)* used, which shall permit the inclusion of sprinklers on both sides of the cross main.

28.2.4.2.2

Any fractional sprinkler shall be carried to the next higher whole sprinkler.

28.2.4.2.3

In systems having branch lines with an insufficient number of sprinklers to fulfill the 1.2 requirement, the design area shall be extended to include sprinklers on adjacent branch lines supplied by the same cross main.

28.2.4.2.4

For tree and looped systems where additional sprinklers are carried over to the next branch line, the sprinklers closest to the cross main within the dimension required by 28.2.4.2.1 shall be selected.

28.2.4.2.5

For gridded systems where additional sprinklers are carried over to the next branch line, any adjacent sprinklers within the dimension required by 28.2.4.2.1 shall be permitted to be selected.

28.2.4.2.6 *

Where the available floor area for a specific area/density design criteria, including any extension of area as required by 19.1.2 and Section 20.13, is less than the required minimum design area, the design area shall be permitted to only include those sprinklers within the available design area.

28.2.4.2.5 7 *

Where the total design discharge from the operating sprinklers is less than the minimum required discharge determined by multiplying the required design density times the required minimum design area, an additional flow shall be added at the point of common connection closest to the source to increase the overall demand, not including hose stream allowance, to the minimum required discharge.

28.2.4.2.6 8 *

Where a sprinkler's assigned area of discharge is defined by the presence of a full-height wall assembly, the area on the opposite side of the wall of the flowing sprinkler shall not be counted towards the total design area.

Statement of Problem and Substantiation for Public Input

This guidance has been in the annex for numerous edition of the standard and is still one of the more frequent design procedures that has to be explained to layout technicians. The reason that the sprinkler closest to the riser is selected is because it will be more demanding when the system actually operates. Because it is closer to the riser, there is more available pressure at that sprinkler which will lead to more flow [Q=k*sqrt(P)]. Additionally, if the sprinkler at the end of the line is selected, there would be more friction loss through the entire branch line to get back to the cross main with the same

flow. This would create a smaller equivalent K-Factor and a lesser demand when it gets balanced hydraulically. This needs to be a requirement and not a suggestion.

Submitter Information Verification

Submitter Full Name: Kevin Hall
Organization: American Fire Sprinkler Association
Affiliation: American Fire Sprinkler Association
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 16 17:03:29 EST 2021
Committee: AUT-SSD

Public Input No. 372-NFPA 13-2022 [Section No. 28.2.4.2.5]

~~28.2.4.2.5~~ * –

~~Where the total design discharge from the operating sprinklers is less than the minimum required discharge determined by multiplying the required design density times the required minimum design area, an additional flow shall be added at the point of common connection closest to the source to increase the overall demand, not including hose stream allowance, to the minimum required discharge.~~

Statement of Problem and Substantiation for Public Input

The addition of "phantom flow" is not required to provide the required minimum design density to control a fire or provide a required safety factor.

Submitter Information Verification

Submitter Full Name: Michael Joanis
Organization: National Fire Sprinkler Association
Affiliation: NFSA Engineering and Standards Committee
Street Address:
City:
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Zip:
Submittal Date: Fri May 27 10:41:13 EDT 2022
Committee: AUT-SSD

Public Input No. 495-NFPA 13-2022 [Section No. 28.2.4.3]

28.2.4.3 CMSA Sprinkler Method.

28.2.4.3.1

For CMSA sprinklers, the design area shall be a rectangular area having a dimension parallel to the branch lines ~~at least 1.2 times the square root of the area protected by the number of sprinklers to be included in the design area. The design area protected by the number of sprinklers to be used by the 1.2 rule shall be based on the maximum allowable area per sprinkler.~~ determined in accordance with section 28.2.4.2 with the design area (A) being calculated by multiplying the required number of sprinklers by the actual floor area covered by those sprinklers.

28.2.4.3.2

Any fractional sprinkler shall be carried to the next higher whole sprinkler.

28.2.4.3.3

In systems having branch lines with an insufficient number of sprinklers to fulfill the 1.2 or 1.4 requirement, the design area shall be extended to include sprinklers on adjacent branch lines supplied by the same cross main.

Statement of Problem and Substantiation for Public Input

There are two issues being addressed here. The first is with respect to the changes regarding sloped ceilings and the shape of the design area. This should be consistent with CMDA sprinklers.

The second concept is that the design area should be based on the actual installation of the sprinklers, not the theoretical maximum to which sprinklers can be installed. For example, if I am protecting palletized storage under a non-combustible unobstructed ceiling, and place my CMSA sprinklers on a 10 x 10 spacing, and there are 15 sprinklers in my design area, I should be taking the square root of 1500 (15 x 10 x 10) to determine the number of sprinklers on a branch line in my design area, not 1950 (15 x 130) just because Table 13.2.5.2.1 allows a 130 sq ft spacing. The issue is where the heat is going and potentially opening sprinklers, not the theoretical spacing that sprinklers are permitted to use. The actual installed area should not used, not the theoretical maximum area.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 494-NFPA 13-2022 [Section No. 28.2.4.2]	

Submitter Information Verification

Submitter Full Name: Kenneth Isman
Organization: University of Maryland
Street Address:
City:
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Zip:
Submittal Date: Tue May 31 12:33:20 EDT 2022
Committee: AUT-SSD

Public Input No. 496-NFPA 13-2022 [New Section after 28.2.4.4]

28.2.4.4.1

Where the design area was increased beyond 12 sprinklers due to the slope of the ceiling or roof, the design area shall be calculated in accordance with 28.2.4.2 with the design area (A) being the number of sprinklers multiplied by the actual floor area covered by those sprinklers.

Statement of Problem and Substantiation for Public Input

The material submitted by the Slope Ceiling Task Group allows for the use of ESFR sprinklers under a sloped ceiling or roof with unobstructed construction and some obstructed construction as long as an increase in sprinklers is factored into the discharge criteria. When such an increase occurs, NFPA 13 needs rules to discuss the shape of the design area (most important of which is the number of sprinklers to include on the branch line in the design area).

While the Slope Ceiling Task Group discussed the issue, they were not able to develop specific language for a Public Input prior to the deadline, so this change was submitted for the sake of discussion.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 493-NFPA 13-2022 [Section No. 20.9.1]	Discharge criteria that allows ESFR sprinklers, but requires more than 12 sprinklers in the design area

Submitter Information Verification

Submitter Full Name: Kenneth Isman
Organization: University of Maryland
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 31 12:46:10 EDT 2022
Committee: AUT-SSD

Public Input No. 300-NFPA 13-2022 [Section No. 28.2.4.4]

28.2.4.4 ESFR Sprinkler Method.

For ESFR sprinklers, the design area shall ~~consist of the most hydraulically demanding area of 12 sprinklers, consisting of 4 sprinklers on each of three branch lines, unless other specific numbers of design sprinklers are required in other sections of this standard.~~ be in accordance with Section 23.2.2, 23.2.3, and 25.5.3.3.

Statement of Problem and Substantiation for Public Input

This modification adds ESFR designs incorporating in-rack sprinklers into chapter 28.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 297-NFPA 13-2022 [New Section after 23.2.2]	
Public Input No. 299-NFPA 13-2022 [Section No. 25.5.4.3]	

Submitter Information Verification

Submitter Full Name: Mark Fessenden
Organization: Johnson Controls
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 19 09:24:36 EDT 2022
Committee: AUT-SSD

Public Input No. 431-NFPA 13-2022 [Section No. 28.2.4.7.3]

~~**28.2.4.7.3** * –~~

~~The requirements of 28.2.4.7.1 and 28.2.4.7.1.1 to include every sprinkler in the design area shall not apply where sprinklers are provided above and below obstructions.~~

~~**28.2.4.7.3.1** –~~

~~Sprinklers under the obstruction shall not be required to be included in the hydraulic calculation of the ceiling sprinklers.~~

~~**28.2.4.7.3.2** –~~

~~Where the piping to sprinklers under obstructions follows the same sizing pattern as the branch lines, no additional hydraulic calculations shall be required for sprinklers under obstructions.~~

Statement of Problem and Substantiation for Public Input

With the implementation of the proposed requirements in new Section 19.5, these sections are no longer needed.

Submitter Information Verification

Submitter Full Name: Weston Baker
Organization: FM Global
Street Address:
City:
State:
Zip:
Submittal Date: Sun May 29 14:49:35 EDT 2022
Committee: AUT-SSD

Public Input No. 231-NFPA 13-2022 [Section No. 28.2.4.8.1]

28.2.4.8.1

Pipe friction loss shall be calculated in accordance with the Hazen–Williams formula with *C* values from Table 28.2.4.8.1, as follows:

(1) Pipe, fittings, and devices such as valves, meters, flow switches in pipes 2 in. (50 mm) or less in size, and strainers shall be included, and elevation changes that affect the sprinkler discharge shall be calculated.

(2) Tie-in drain piping shall not be included in the hydraulic calculations.

(3) Losses for a tee or a cross shall be calculated where flow direction change occurs based on the equivalent pipe length of the piping segment in which the fitting is included.

(4) The tee at the top of a riser nipple shall be included in the branch line, the tee at the base of a riser nipple shall be included in the riser nipple, and the tee or cross at a cross main–feed main junction shall be included in the cross main.

(5) Losses for straight-through flow in a tee or cross shall not be included.

(6) The loss of reducing elbows based on the equivalent length value of the smallest outlet shall be calculated.

(7) The equivalent length value for the standard elbow on any abrupt 90-degree turn, such as the screw-type pattern, shall be used.

(8) The equivalent length value for a fitting with a bushing shall be the same as for a similarly sized and configured reducing fitting.

(9) The equivalent length value for the long-turn elbow on any sweeping 90-degree turn, such as a flanged, welded, or mechanical joint-elbow type, shall be used. *(See Table 28.2.3.1.1.)*

(10) Losses shall be permitted to be excluded for tapered reducers.

(11) Losses shall be permitted to be excluded for a fitting with or without a bushing, directly connected to a sprinkler, except for flexible sprinkler hose fittings, and as required in 28.2.3.1.2 and 28.2.3.4.

(12) Losses for flexible hose fittings shall be based upon the maximum bends referenced in the listing for the hose length.

(13) Losses through a pressure-reducing valve shall be included based on the normal inlet pressure condition, and pressure loss data from the manufacturer's literature shall be used.

(14) In new systems, an increased *C* value of 120 shall be permitted where nitrogen is provided in accordance with 8.2.6.9.

Table 28.2.4.8.1 Hazen–Williams *C* Values

Pipe or Tube	*C* Value*
Unlined cast or ductile iron	100
Black steel (dry systems including preaction)	100
Black steel (wet systems including deluge)	120
Black steel (dry system including preaction) using nitrogen†	120
Galvanized steel (dry systems including preaction)	100
Galvanized steel (wet systems including deluge)	120
Galvanized steel (dry systems including preaction) using nitrogen†	120
Plastic all (listed)	150
Cement-lined cast- or ductile iron	140
Copper tube, brass or stainless steel	150
Asbestos cement	140
Concrete	140

*The authority having jurisdiction is permitted to allow other *C* values.

†Nitrogen supply shall be installed in accordance with 8.2.6.9.

Statement of Problem and Substantiation for Public Input

Flexible sprinkler hose fittings have a significant pressure loss that needs to be included in the system's hydraulic calculation.

Submitter Information Verification

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Submittal Date: Fri Apr 01 08:02:54 EDT 2022
Committee: AUT-SSD

Public Input No. 349-NFPA 13-2022 [Section No. 28.2.4.8.1]

28.2.4.8.1

Pipe friction loss shall be calculated in accordance with the Hazen–Williams formula with *C* values from Table 28.2.4.8.1, as follows:

(1) Pipe, fittings, and devices such as valves, meters, flow switches in pipes 2 in. (50 mm) or less in size, and strainers shall be included, and elevation changes that affect the sprinkler discharge shall be calculated.

(2) Tie-in drain piping shall not be included in the hydraulic calculations.

(3) Losses for a tee or a cross shall be calculated where flow direction change occurs based on the equivalent pipe length of the piping segment in which the fitting is included.

(4) The tee at the top of a riser nipple shall be included in the branch line, the tee at the base of a riser nipple shall be included in the riser nipple, and the tee or cross at a cross main–feed main junction shall be included in the cross main.

(5) Losses for straight-through flow in a tee or cross shall not be included.

(6) The loss of reducing elbows based on the equivalent length value of the smallest outlet shall be calculated.

(7) The equivalent length value for the standard elbow on any abrupt 90-degree turn, such as the screw-type pattern, shall be used.

(8) The equivalent length value for a fitting with a bushing shall be the same as for a similarly sized and configured reducing fitting.

(9) The equivalent length value for the long-turn elbow on any sweeping 90-degree turn, such as a flanged, welded, or mechanical joint-elbow type, shall be used. *(See Table 28.2.3.1.1.)*

(10) Losses shall be permitted to be excluded for tapered reducers.

(11) Losses shall be permitted to be excluded for a fitting with or without a bushing, directly connected to a sprinkler, except as required in 28.2.3.1.2 and 28.2.3.4.

(12) Losses through a pressure-reducing valve shall be included based on the normal inlet pressure condition, and pressure loss data from the manufacturer's literature shall be used.

(13) In new systems, an increased *C* value of 120 shall be permitted where nitrogen is provided in accordance with 8.2.6.9.

(14) (14) In new systems, an increased C value of 120 shall be permitted where VpCI is provided in accordance with 8.2.6.10.

Table 28.2.4.8.1 Hazen–Williams *C* Values

Pipe or Tube	*C* Value*
Unlined cast or ductile iron	100
Black steel (dry systems including preaction)	100
Black steel (wet systems including deluge)	120
Black steel (dry system including preaction) using nitrogen†	120
Black steel (dry system including preaction) using VpCI*	**120**
Galvanized steel (dry systems including preaction)	100
Galvanized steel (wet systems including deluge)	120
Galvanized steel (dry systems including preaction) using nitrogen†	120
Galvanized steel (dry systems including preaction) using VpCI*	**120**
Plastic all (listed)	150
Cement-lined cast- or ductile iron	140

Pipe or Tube	*C* Value*
Copper tube, brass or stainless steel	150
Asbestos cement	140
Concrete	140

*The authority having jurisdiction is permitted to allow other *C* values.

†Nitrogen supply shall be installed in accordance with 8.2.6.9.

*** VPCI used in air supply shall be installed in accordance with 8.2.6.10.**

Statement of Problem and Substantiation for Public Input

A new line (14) has been added to 28.2.4.8.1 for the use of a C value of 120 for VpCI due to its effectiveness in controlling corrosion. Two lines have been added to Table 28.2.4.8.1 for black steel dry pipe and preaction systems using VpCI and galvanized steel dry pipe and preaction systems using VpCI. Adds a note to Table 28.2.4.8.1.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 338-NFPA 13-2022 [New Section after 3.3.236]	
Public Input No. 340-NFPA 13-2022 [Section No. 5.1.4.2.2]	
Public Input No. 341-NFPA 13-2022 [Section No. 5.1.4]	
Public Input No. 342-NFPA 13-2022 [Section No. 5.1.4.3]	
Public Input No. 343-NFPA 13-2022 [Section No. 5.1.4]	
Public Input No. 345-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 346-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 347-NFPA 13-2022 [New Section after 8.5]	
Public Input No. 348-NFPA 13-2022 [Section No. 7.8]	
Public Input No. 350-NFPA 13-2022 [New Section after 8.2.6.9]	
Public Input No. 345-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 346-NFPA 13-2022 [Section No. 16.4.2]	
Public Input No. 350-NFPA 13-2022 [New Section after 8.2.6.9]	

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Committee: AUT-SSD

Public Input No. 55-NFPA 13-2021 [Section No. 28.2.4.12]

28.2.4.12 Maximum Operating Pressure.

For sprinklers in extra hazard occupancies ~~, palletized, solid-piled, bin box, back-to-back shelf storage, shelf storage, or rack storage~~ or designed in accordance with Chapters 20 through 26 , the maximum operating pressure of any sprinkler shall be 175 psi (12 bar).

Statement of Problem and Substantiation for Public Input

This section should only point to the storage design chapters. Sprinklers installed to meet the requirements of miscellaneous or low-piled storage should be permitted to exceed 175 psi if they are rated for such pressures.

Submitter Information Verification

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Submittal Date: Wed Nov 03 01:38:07 EDT 2021
Committee: AUT-SSD

Public Input No. 54-NFPA 13-2021 [Sections 28.4.2, 28.4.3, 28.4.4]

Sections 28.4.2, 28.4.3, 28.4.4

28.4.2 * – Summary Sheet.

The summary sheet shall contain the following information, where applicable:

(1) Date

(2) Location

(3) Name of owner and occupant

(4) Building number or other identification

(5) Description of hazard (for storage applications, the commodity classification, storage height, and rack configuration shall be included)

(6) Name and address of contractor or designer

(7) Name of approving agency

(8) System design requirements, as follows:

(9) Design area of water application, ft^2 (m^2).

(10) Minimum rate of water application (density), gpm/ft^2 (mm/min). Where sprinklers are listed with minimum water application in gpm (L/min) or pressure in psi (bar), the minimum rate of water application shall be indicated in gpm (L/min) or pressure, psi (bar).

(11) Area per sprinkler, ft^2 (m^2).

(12) Total water requirements as calculated, including allowance for inside hose, outside hydrants, and water curtain and exposure sprinklers

(13) Allowance for in-rack sprinklers, gpm (L/min)

(14) Limitations (dimension, flow, and pressure) on extended coverage or other listed special sprinklers

28.4.3 * – Detailed Worksheets.

Detailed worksheets or computer printout sheets shall contain the following information:

(1) Sheet number

(2) Sprinkler description and discharge constant (*K*)

(3) Hydraulic reference points

(4) Flow in gpm (L/min)

(5) Pipe size

(6) Pipe lengths, center-to-center of fittings

(7) Equivalent pipe lengths for fittings and devices

(8) Friction loss in psi/ft (bar/m) of pipe

(9) Total friction loss between reference points

(10) In-rack sprinkler demand balanced to ceiling demand

(11) Elevation head in psi (bar) between reference points

(12) Required pressure in psi (bar) at each reference point

(13) Velocity pressure and normal pressure if included in calculations

(14) Notes to indicate starting points or reference to other sheets or to clarify data shown

(15)* Diagram to accompany gridded system calculations to indicate flow quantities and directions for lines with sprinklers operating in the remote area

(16) Combined K-factor calculations for sprinklers on drops, armovers, or sprigs where calculations do not begin at the sprinkler

28.4.4 * – Graph Sheet.

A graphic representation of the complete hydraulic calculation shall be plotted on semiexponential graph paper ($Q^{1.85}$) and shall include the following:

(1) Water supply curve

(2) Sprinkler system demand

(3) Hose allowance (where applicable)

(4) In-rack sprinkler demand (where applicable)

Statement of Problem and Substantiation for Public Input

Redundant and conflicting requirements. See 28.4.5.2, 28.4.5.3, and 28.4.5.6

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Submittal Date:	Wed Nov 03 01:35:45 EDT 2021
Committee:	AUT-SSD

Public Input No. 75-NFPA 13-2021 [Section No. 28.5.1.2]

28.5.1.2

Sprinkler systems having sprinklers with K-factors other than 5.6 nominal, listed piping material other than that covered in Table 7.3.1.1, listed fittings other than that covered in Table 7.4.1, extra hazard Group 1 and Group 2 systems, and exposure protection systems shall be hydraulically calculated.

Statement of Problem and Substantiation for Public Input

Pipe schedule systems should only be permitted when standard pattern fittings are used due to the different friction loss data for listed fittings.

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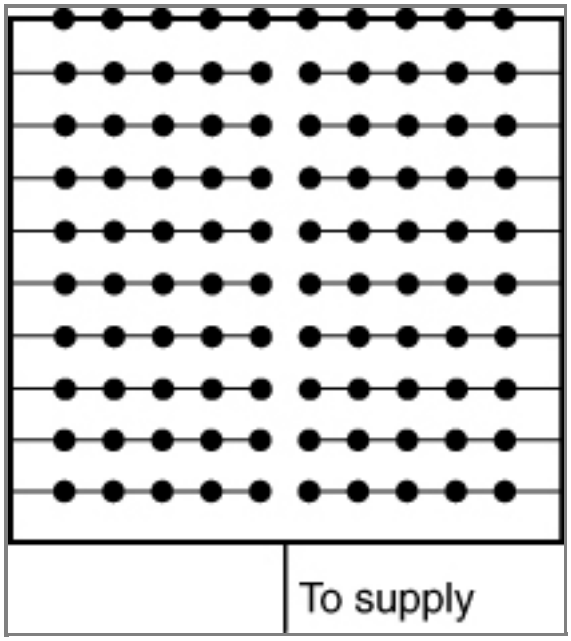
Committee: AUT-SSD

Public Input No. 16-NFPA 13-2021 [Section No. A.3.3.216.6]

A.3.3.216.6 Looped Sprinkler System.

See Figure A.3.3.216.6. (AUT-SSD)

Figure A.3.3.216.6 Looped System.



Statement of Problem and Substantiation for Public Input

The sprinklers shown installed on the top branch line does not meet the definition of a looped system and is not a good example to be provided in the annex. If the sprinklers shown on the top pipe are removed, then the diagram will be accurate

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Public Input No. 392-NFPA 13-2022 [New Section after A.4.2]

A.4.2 (3)

Where a waterflow test was conducted to provide the water supply information, the raw data from the test should be evaluated to determine if an adjustment is appropriate. The evaluation should be based on knowledge of the water supply and engineering judgment, taking into account daily and seasonal fluctuations, not extreme conditions.

The evaluation can be based on information from the water supply authority, testing, modeling, the fire or building department, or knowledge of the water supply from having worked previously in the jurisdiction. Depending on how much the pressure changes over time at any given location, an adjustment may or may not be appropriate. For mature water supplies (ones where new development in the vicinity is unlikely due to the fact that available property has already been fully developed) with fairly stable water usage, or where the waterflow test was conducted at a time of low pressure already, a very small adjustment, or no adjustment at all may be appropriate. For situations where the waterflow test was performed at a time of low demand when it is known that higher demands occur at other times of day or other times of the year, then a larger adjustment would be appropriate.

The evaluation to determine whether an adjustment should be made, and the size of such an adjustment if one is needed should take into account the following variables, which will be applicable to different degrees depending on how and when the test was conducted:

a) Maximum daily use of the water supply

b) Peak hour demand of the water supply

c) Water supply degradation due to planned development

d) Time of day the test was conducted

e) Time of year the test was conducted

f) Elevation of the test location compared to the building where the sprinkler system will be installed

g) Elevation of the water supply at the time of the test

h) How close the flow generated during the test was to the system demand

There is no single specific adjustment that can be applied to every water supply that would be appropriate for every sprinkler system. The design professional needs to work in conjunction with the authority having jurisdiction to determine an appropriate adjustment. Where an authority having jurisdiction has already determined a specific buffer between test results and the demand of the sprinkler system, there is no intent to add an additional safety factor or safety margin due to this requirement. Instead, the buffer mandated by the authority having jurisdiction serves the purpose of this adjustment.

If an adjustment is determined to be appropriate, it should be applied to the waterflow test data prior to comparison with the sprinkler system demand.

Where the water supply information was obtained from another approved method instead of a waterflow test, that method should take into account daily and seasonal fluctuations, not extreme conditions. It is important to note that adjustments are not intended to handle extreme or catastrophic conditions such as water main breaks. Such extreme conditions are accounted for in NFPA 25 with impairment procedures to follow when systems are out of service.

In the absence of information from the design professional and the authority having jurisdiction, it would

be appropriate to make an adjustment to the raw data from a flow test by either obtaining information from the water utility or using an arbitrary adjustment. The value to use for an arbitrary adjustment should be determined through a conversation with the authority having jurisdiction.

Statement of Problem and Substantiation for Public Input

The topic of water supply adjustments has been discussed over past several cycles without achieving consensus throughout the entire NFPA 13 cycle. NITMAM were submitted during the 2019 and 2022 code cycles. This public input is being submitted by the Water Supply Task Group which was appointed by the SSD and SSI committees. This language reached consensus within the task group.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 391-NFPA 13-2022 [Section No. 4.2]	
Public Input No. 393-NFPA 13-2022 [Section No. A.5.2.2]	
Public Input No. 394-NFPA 13-2022 [New Section after 5.2.2]	
Public Input No. 395-NFPA 13-2022 [New Section after A.5.2.2.2]	
Public Input No. 391-NFPA 13-2022 [Section No. 4.2]	
Public Input No. 393-NFPA 13-2022 [Section No. A.5.2.2]	
Public Input No. 394-NFPA 13-2022 [New Section after 5.2.2]	
Public Input No. 395-NFPA 13-2022 [New Section after A.5.2.2.2]	

Submitter Information Verification

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Submittal Date: Fri May 27 14:47:45 EDT 2022
Committee: AUT-SSD

Public Input No. 600-NFPA 13-2022 [New Section after A.4.2]

A.4.2 (3)

Where a waterflow test was conducted to provide the water supply information, the raw data from the test should be evaluated to determine if an adjustment is appropriate. The evaluation should be based on knowledge of the water supply and engineering judgment, taking into account daily and seasonal fluctuations, not extreme conditions.

The evaluation can be based on information from the water supply authority, testing, modeling, the fire or building department, or knowledge of the water supply from having worked previously in the jurisdiction. Depending on how much the pressure changes over time at any given location, an adjustment may or may not be appropriate. For mature water supplies (ones where new development in the vicinity is unlikely due to the fact that available property has already been fully developed) with fairly stable water usage, or where the waterflow test was conducted at a time of low pressure already, a very small adjustment, or no adjustment at all may be appropriate. For situations where the waterflow test was performed at a time of low demand when it is known that higher demands occur at other times of day or other times of the year, then a larger adjustment would be appropriate.

The evaluation to determine whether an adjustment should be made, and the size of such an adjustment if one is needed should take into account the following variables, which will be applicable to different degrees depending on how and when the test was conducted:

a) Maximum daily use of the water supply

b) Peak hour demand of the water supply

c) Water supply degradation due to planned development

d) Time of day the test was conducted

e) Time of year the test was conducted

f) Elevation of the test location compared to the building where the sprinkler system will be installed

g) Elevation of the water supply at the time of the test

h) How close the flow generated during the test was to the system demand

There is no single specific adjustment that can be applied to every water supply that would be appropriate for every sprinkler system. The design professional needs to work in conjunction with the authority having jurisdiction to determine an appropriate adjustment. Where an authority having jurisdiction has already determined a specific buffer between test results and the demand of the sprinkler system, there is no intent to add an additional safety factor or safety margin due to this requirement. Instead, the buffer mandated by the authority having jurisdiction serves the purpose of this adjustment.

If an adjustment is determined to be appropriate, it should be applied to the waterflow test data prior to comparison with the sprinkler system demand.

It is important to note that adjustments are not intended to handle extreme or catastrophic conditions such as water main breaks. Such extreme conditions are accounted for in NFPA 25 with impairment procedures to follow when systems are out of service.

Where the water supply information was obtained from another approved method instead of a waterflow test, that method should take into account daily and seasonal fluctuations, not extreme conditions. It is important to note that adjustments are not intended to handle extreme or catastrophic conditions such as water main breaks. Such extreme conditions are accounted for in NFPA 25 with impairment procedures to follow when systems are out of service.

In the absence of information from the design professional and the authority having jurisdiction, it would be appropriate to make an adjustment to the raw data from a flow test by either obtaining information from the water utility or using an arbitrary adjustment. The value to use for an arbitrary

adjustment should be determined through a conversation with the authority having jurisdiction.

Statement of Problem and Substantiation for Public Input

This language on water supply evaluations mirror those submitted by the Water Supply Task Group

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 598-NFPA 13-2022 [Section No. 4.2]	
Public Input No. 601-NFPA 13-2022 [Section No. A.5.2.2]	
Public Input No. 602-NFPA 13-2022 [New Section after 5.2.2.2]	
Public Input No. 603-NFPA 13-2022 [Section No. A.5.2.2.2]	
Public Input No. 605-NFPA 13-2022 [New Section after A.5.2.2.2]	

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Committee: AUT-SSD

Public Input No. 314-NFPA 13-2022 [Section No. A.4.3.3.1]

A.4.3.3.1

Ordinary hazard (Group 1) occupancies include occupancies having uses and conditions similar to the following:

(1) Automobile showrooms
(2) Bakeries
(3) Beverage manufacturing
(4) Canneries
(5) Dairy products manufacturing and processing
(6) Electric Fire Pump Room
(7) Electronic plants
(8) Glass and glass products manufacturing
(9) Laundries
(10) Restaurant service areas
(11) Porte cocheres
(12) Mechanical rooms

Statement of Problem and Substantiation for Public Input

Adds "electric fire pump room" as an example of an OH2 occupancy as required by NFPA 20 section 4.14.1.4

Submitter Information Verification

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Submittal Date: Sun May 22 00:52:55 EDT 2022
Committee: AUT-SSD

Public Input No. 364-NFPA 13-2022 [Section No. A.4.3.3.2]

A.4.3.3.2

Ordinary hazard (Group 2) occupancies include occupancies having uses and conditions similar to the following:

(1) Agricultural facilities

(2) ~~Automobile parking garages~~

(3)

(4) Barns and stables

(5) Cereal mills

(6) Chemical plants — ordinary

(7) Confectionery products

(8) Distilleries

(9) Dry cleaners

(10) Exterior loading docks (Note that exterior loading docks only used for loading and unloading of ordinary combustibles should be classified as OH2. For the handling of flammable and combustible liquidsor hazardous materials, or where utilized for storage, exterior and interior loading docks should be protected based upon the actual occupancy and the materials handled on the dock, as if the materials were actually stored in that configuration.)

(11) Feed mills

(12) Horse stables

(13) Leather goods manufacturing

(14) Libraries — large stack room areas

(15) Machine shops

(16) Metal working

(17) Mercantile

(18) Paper and pulp mills

(19) Paper process plants

(20) Piers and wharves

(21) Plastics fabrication, including blow molding, extruding, and machining; excluding operations using combustible hydraulic fluids

(22) Post offices

(23) Printing and publishing

(24) Racetrack stable/kennel areas, including those stable/kennel areas, barns, and associated buildings at state, county, and local fairgrounds

(25) Repair garages

(26) Resin application area

(27) Stages

(28) Textile manufacturing

(29) Tire manufacturing

(30) Tobacco products manufacturing

(31) Wood machining

(32) Wood product assembly

Statement of Problem and Substantiation for Public Input

Research regarding the appropriate hazard classification and design density for automobile parking is ongoing. Pending future research reports the hazard classification and design density for automobile parking may require modification. Placeholder to review and include the results of future research in the standard to define the appropriate hazard classification for automobile parking.

Submitter Information Verification

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Submittal Date: Fri May 27 09:49:00 EDT 2022
Committee: AUT-SSD

Public Input No. 596-NFPA 13-2022 [Section No. A.4.3.3.2]

A.4.3.3.2

Ordinary hazard (Group 2) occupancies include occupancies having uses and conditions similar to the following:

(1) Agricultural facilities

(2) Automobile and electric bicycle parking garages

(3) Barns and stables

(4) Cereal mills

(5) Chemical plants — ordinary

(6) Confectionery products

(7) Distilleries

(8) Dry cleaners

(9) Exterior loading docks (Note that exterior loading docks only used for loading and unloading of ordinary combustibles should be classified as OH2. For the handling of flammable and combustible liquidsor hazardous materials, or where utilized for storage, exterior and interior loading docks should be protected based upon the actual occupancy and the materials handled on the dock, as if the materials were actually stored in that configuration.)

(10) Feed mills

(11) Horse stables

(12) Leather goods manufacturing

(13) Libraries — large stack room areas

(14) Machine shops

(15) Metal working

(16) Mercantile

(17) Paper and pulp mills

(18) Paper process plants

(19) Piers and wharves

(20) Plastics fabrication, including blow molding, extruding, and machining; excluding operations using combustible hydraulic fluids

(21) Post offices

(22) Printing and publishing

(23) Racetrack stable/kennel areas, including those stable/kennel areas, barns, and associated buildings at state, county, and local fairgrounds

(24) Repair garages

(25) Resin application area

(26) Stages

(27) Textile manufacturing

(28) Tire manufacturing

(29) Tobacco products manufacturing

(30) Wood machining

(31) Wood product assembly

Statement of Problem and Substantiation for Public Input

Electric bicycles are an increasingly popular hazard that is unaddressed.

Submitter Information Verification

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Submittal Date: Wed Jun 01 15:04:48 EDT 2022
Committee: AUT-SSD

Public Input No. 533-NFPA 13-2022 [New Section after A.4.3.5]

A.4.3.5.(10)
Fire Pump Buildings or Rooms with Diesel Engines

Statement of Problem and Substantiation for Public Input

This proposal would align with the current requirements in NFPA 20 (2022 Edition) in section 4.14.1.3 Fire Pump Buildings or Rooms with Diesel Engines.

Submitter Information Verification

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Submittal Date: Tue May 31 16:10:00 EDT 2022
Committee: AUT-SSD

Public Input No. 64-NFPA 13-2021 [Section No. A.4.3.5]

A.4.3.5

Extra hazard (Group 2) occupancies include occupancies having uses and conditions similar to the following:

(1) Asphalt saturating

(2) Diesel fire pump room

(3) Flammable liquids spraying

(4) Flow coating

(5) Manufactured home or modular building assemblies (where finished enclosure is present and has combustible interiors)

(6) Open oil quenching

(7) Plastics manufacturing

(8) Solvent cleaning

(9) Varnish and paint dipping

(10) Car stackers and car lift systems with 2 cars stacked vertically

Statement of Problem and Substantiation for Public Input

"Diesel fire pump room" is added as an example of an EH2 occupancy as required by NFPA 20

Submitter Information Verification

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Submittal Date: Wed Nov 03 02:03:58 EDT 2021
Committee: AUT-SSD

Public Input No. 393-NFPA 13-2022 [Section No. A.5.2.2]

A.5.2.2

Care should be taken in making water tests to be used in designing or evaluating the capability of sprinkler systems. The water supply tested should be representative of the supply that might be available at the time of a fire. For example, testing of public water supplies should be done at times of normal demand on the system. Public water supplies are likely to fluctuate widely from season to season and even within a 24-hour period. Allowance should be made for seasonal or daily fluctuations~~, for drought conditions, for possibility of interruption by flood, or for ice conditions in winter~~ . Testing of water supplies also normally used for industrial use should be done while water is being drawn for industrial use. The range of industrial-use demand should be taken into account. In special situations where the domestic water demand could significantly reduce the sprinkler water supply, an increase in the size of the pipe supplying both the domestic and sprinkler water can be justified. Where adjustments are appropriate, the adjustments should be made by the AHJ prior to the development of the working plans by the contractor.

Future changes in water supplies should be considered. For example, a large, established, urban supply is not likely to change greatly within a few years. However, the supply in a growing suburban industrial park might deteriorate quite rapidly as greater numbers of plants draw more water.

Dead-end mains should be avoided, if possible, by arranging for mains supplied from both directions. When private fire service mains are connected to dead-end public mains, each situation should be examined to determine if it is practical to request the water utility to loop the mains in order to obtain a more reliable supply.

Testing of Water Supply. To determine the value of public water as a supply for automatic sprinkler systems, it is generally necessary to make a flow test to determine how much water can be discharged at a residual pressure at a rate sufficient to give the required residual pressure under the roof (with the volume flow hydraulically translated to the base of the riser) — that is, a pressure head represented by the height of the building plus the required residual pressure.

The proper method of conducting this test is to use two hydrants in the vicinity of the property. The static pressure should be measured on the hydrant in front of or nearest to the property and the water allowed to flow from the hydrant next nearest the property, preferably the one farthest from the source of supply if the main is fed only one way. The residual pressure will be that indicated at the hydrant where water is not flowing.

Referring to Figure A.5.2.2, the method of conducting the flow tests is as follows:

(1) Attach the gauge to the hydrant *(A)* and obtain static pressure.

(2) Either attach a second gauge to the hydrant *(B)* or use the pitot tube at the outlet. Have hydrant *(B)* opened wide and read pressure at both hydrants.

(3) Use the pressure at *(B)* to compute the gallons flowing and read the gauge on *(A)* to determine the residual pressure or that which will be available on the top line of sprinklers in the property.

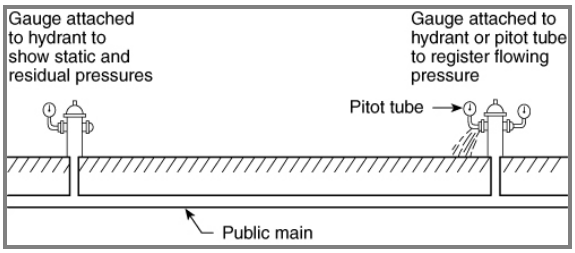
Water pressure in pounds per square inch for a given height in feet equals height multiplied by 0.433.

In making flow tests, whether from hydrants or from nozzles attached to hose, always measure the size of the orifice. While hydrant outlets are usually 2½ in. (65 mm), they are sometimes smaller and occasionally larger. Underwriters Laboratories play pipe is 1⅛ in. (28.6 mm) and 1¾ in. (44.5 mm) with the tip removed, but occasionally nozzles will be 1 in. (25.4 mm) or 1¼ in. (31.8 mm), and with the tip removed the opening can be only 1½ in. (38.1 mm).

The pitot tube should be held approximately one-half the diameter of the hydrant or nozzle opening away from the opening. It should be held in the center of the stream, except that in using hydrant outlets the stream should be explored to ascertain the average pressure.

For further information on water supply testing, see NFPA 291.

Figure A.5.2.2 Method of Conducting Flow Tests.



Statement of Problem and Substantiation for Public Input

The topic of water supply adjustments has been discussed over past several cycles without achieving consensus throughout the entire NFPA 13 cycle. NITMAM were submitted during the 2019 and 2022 code cycles. This public input is being submitted by the Water Supply Task Group which was appointed by the SSD and SSI committees. This language reached consensus within the task group.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 391-NFPA 13-2022 [Section No. 4.2]	
Public Input No. 392-NFPA 13-2022 [New Section after A.4.2]	
Public Input No. 391-NFPA 13-2022 [Section No. 4.2]	
Public Input No. 392-NFPA 13-2022 [New Section after A.4.2]	
Public Input No. 394-NFPA 13-2022 [New Section after 5.2.2]	
Public Input No. 395-NFPA 13-2022 [New Section after A.5.2.2.2]	

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Public Input No. 601-NFPA 13-2022 [Section No. A.5.2.2]

A.5.2.2

Care should be taken in making water tests to be used in designing or evaluating the capability of sprinkler systems. The water supply tested should be representative of the supply that might be available at the time of a fire. For example, testing of public water supplies should be done at times of normal demand on the system. Public water supplies are likely to fluctuate widely from season to season and even within a 24-hour period. Allowance should be made for seasonal or daily fluctuations~~, for drought conditions, for possibility of interruption by flood, or for ice conditions in winter~~ . Testing of water supplies also normally used for industrial use should be done while water is being drawn for industrial use. The range of industrial-use demand should be taken into account. In special situations where the domestic water demand could significantly reduce the sprinkler water supply, an increase in the size of the pipe supplying both the domestic and sprinkler water can be justified. Where adjustments are appropriate, the adjustments should be made by the AHJ prior to the development of the working plans by the contractor.

Future changes in water supplies should be considered. For example, a large, established, urban supply is not likely to change greatly within a few years. However, the supply in a growing suburban industrial park might deteriorate quite rapidly as greater numbers of plants draw more water.

Dead-end mains should be avoided, if possible, by arranging for mains supplied from both directions. When private fire service mains are connected to dead-end public mains, each situation should be examined to determine if it is practical to request the water utility to loop the mains in order to obtain a more reliable supply.

Testing of Water Supply. To determine the value of public water as a supply for automatic sprinkler systems, it is generally necessary to make a flow test to determine how much water can be discharged at a residual pressure at a rate sufficient to give the required residual pressure under the roof (with the volume flow hydraulically translated to the base of the riser) — that is, a pressure head represented by the height of the building plus the required residual pressure.

The proper method of conducting this test is to use two hydrants in the vicinity of the property. The static pressure should be measured on the hydrant in front of or nearest to the property and the water allowed to flow from the hydrant next nearest the property, preferably the one farthest from the source of supply if the main is fed only one way. The residual pressure will be that indicated at the hydrant where water is not flowing.

Referring to Figure A.5.2.2, the method of conducting the flow tests is as follows:

(1) Attach the gauge to the hydrant *(A)* and obtain static pressure.

(2) Either attach a second gauge to the hydrant *(B)* or use the pitot tube at the outlet. Have hydrant *(B)* opened wide and read pressure at both hydrants.

(3) Use the pressure at *(B)* to compute the gallons flowing and read the gauge on *(A)* to determine the residual pressure or that which will be available on the top line of sprinklers in the property.

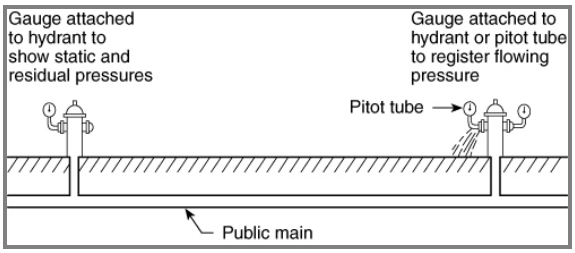
Water pressure in pounds per square inch for a given height in feet equals height multiplied by 0.433.

In making flow tests, whether from hydrants or from nozzles attached to hose, always measure the size of the orifice. While hydrant outlets are usually 2½ in. (65 mm), they are sometimes smaller and occasionally larger. Underwriters Laboratories play pipe is 1⅛ in. (28.6 mm) and 1¾ in. (44.5 mm) with the tip removed, but occasionally nozzles will be 1 in. (25.4 mm) or 1¼ in. (31.8 mm), and with the tip removed the opening can be only 1½ in. (38.1 mm).

The pitot tube should be held approximately one-half the diameter of the hydrant or nozzle opening away from the opening. It should be held in the center of the stream, except that in using hydrant outlets the stream should be explored to ascertain the average pressure.

For further information on water supply testing, see NFPA 291.

Figure A.5.2.2 Method of Conducting Flow Tests.



Statement of Problem and Substantiation for Public Input

This language on water supply evaluations mirror those submitted by the Water Supply Task Group

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 598-NFPA 13-2022 [Section No. 4.2]	
Public Input No. 600-NFPA 13-2022 [New Section after A.4.2]	
Public Input No. 602-NFPA 13-2022 [New Section after 5.2.2.2]	
Public Input No. 603-NFPA 13-2022 [Section No. A.5.2.2.2]	
Public Input No. 605-NFPA 13-2022 [New Section after A.5.2.2.2]	

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Public Input No. 395-NFPA 13-2022 [New Section after A.5.2.2.2]

A.5.2.2.3

It is important to note that not all water supplies have a linear relationship of flow to pressure. As flow demand increases, additional water can be provided into the system through multiple pumps, causing complex geometries to the pressure and flow relationship at any given point in the system. Creating multiple flow conditions during a test and getting as close as possible to the sprinkler system demand will help in gaining a complete understanding of the water supply.

Statement of Problem and Substantiation for Public Input

The topic of water supply adjustments has been discussed over past several cycles without achieving consensus throughout the entire NFPA 13 cycle. NITMAM were submitted during the 2019 and 2022 code cycles. This public input is being submitted by the Water Supply Task Group which was appointed by the SSD and SSI committees. This language reached consensus within the task group.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 391-NFPA 13-2022 [Section No. 4.2]	
Public Input No. 392-NFPA 13-2022 [New Section after A.4.2]	
Public Input No. 393-NFPA 13-2022 [Section No. A.5.2.2]	
Public Input No. 394-NFPA 13-2022 [New Section after 5.2.2]	
Public Input No. 391-NFPA 13-2022 [Section No. 4.2]	
Public Input No. 392-NFPA 13-2022 [New Section after A.4.2]	
Public Input No. 394-NFPA 13-2022 [New Section after 5.2.2]	

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Public Input No. 605-NFPA 13-2022 [New Section after A.5.2.2.2]

A.5.2.2.3

It is important to note that not all water supplies have a linear relationship of flow to pressure. As flow demand increases, additional water can be provided into the system through multiple pumps, causing complex geometries to the pressure and flow relationship at any given point in the system. Creating multiple flow conditions during a test and getting as close as possible to the sprinkler system demand will help in gaining a complete understanding of the water supply.

Statement of Problem and Substantiation for Public Input

This language on water supply evaluations mirror those submitted by the Water Supply Task Group.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 598-NFPA 13-2022 [Section No. 4.2]	
Public Input No. 600-NFPA 13-2022 [New Section after A.4.2]	
Public Input No. 601-NFPA 13-2022 [Section No. A.5.2.2]	
Public Input No. 603-NFPA 13-2022 [Section No. A.5.2.2.2]	
Public Input No. 602-NFPA 13-2022 [New Section after 5.2.2.2]	

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Committee: AUT-SSD

Public Input No. 603-NFPA 13-2022 [Section No. A.5.2.2.2]

A.5.2.2.2

An adjustment to the waterflow test data to account for daily and seasonal fluctuations, ~~possible interruption by flood or ice conditions,~~ large simultaneous industrial use, future demand on the water supply system, or any other condition that could affect the water supply should be made as appropriate.

Statement of Problem and Substantiation for Public Input

This change to A.5.2.2.2 mirrors that change agree to the by the Water Supply Task Group on A.5.2.2. This section should also be revised to clarify that flood and ice conditions are not a consideration.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 598-NFPA 13-2022 [Section No. 4.2]	
Public Input No. 600-NFPA 13-2022 [New Section after A.4.2]	
Public Input No. 601-NFPA 13-2022 [Section No. A.5.2.2]	
Public Input No. 602-NFPA 13-2022 [New Section after 5.2.2.2]	
Public Input No. 605-NFPA 13-2022 [New Section after A.5.2.2.2]	

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Committee: AUT-SSD

Public Input No. 321-NFPA 13-2022 [New Section after A.19.2.3.1.5.2(10)]

A.19.2.3.2.5

Full-scale fire testing has demonstrated that the protection needed for Ordinary Hazard Group 1 and Group 2 occupancies is greater than the protection indicated in Table 19.2.3.1.1. See Table C.27 for fire test data specific to Ordinary Hazard Group 1 and Group 2 type occupancies where the ceiling heights exceed 30 ft (9.1 m).

A.19.2.3.2.5.1.1 The full-scale fire testing applicable to the requirements of this section did not include the use of sidewall sprinklers. As a result, sidewall sprinklers are not currently allowed for the protection of Ordinary Hazard Group 1 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

A.19.2.3.2.5.1.2 The full-scale fire testing applicable to the requirements of this section demonstrated that sprinklers with a K-factor of K-8.0 (K-115) were not effective in providing fire control for a simulated Ordinary Hazard Group 2 occupancy with the ceiling height greater than 30 ft (9.1 m), whereas sprinklers with a minimum K-factor of K-11.2 (K-160) were effective at providing fire control. As a result, sprinklers with a K-factor less than K-11.2 (K-160) are not currently allowed for the protection of Ordinary Hazard Group 2 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

A.19.2.3.2.5.1.3 The full-scale fire testing applicable to the requirements of this section did not include the use of extended-coverage sprinklers with a K-factor of less than K-25.2 (K-360). Testing at FM Global, however has demonstrated that upright extended-coverage sprinklers with a K-factor of K-11.2 (K-160) and K-14.0 (K-200) can be effective for Ordinary Hazard Group 1 and 2 occupancies where the ceiling height is greater than 30 ft (9.1 m), whereas the testing at FM Global did not demonstrate this for the pendent version of these extended-coverage sprinklers. As a result, pendent extended-coverage sprinklers with K-factors of K-22.4 or less are not currently allowed for the protection of Ordinary Hazard Group 2 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

A.19.2.3.2.5.1.4 The full-scale fire testing applicable to the requirements of this section demonstrated that for standard-coverage sprinklers, the use of quick-response sprinklers provided an acceptable level of fire control for simulated Ordinary Hazard Group 2 occupancy hazards. As a result, quick-response standard-coverage sprinklers with K-factors of K-11.2 (K-160) or greater are required for the protection of Ordinary Hazard Group 2 occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

A.19.2.3.2.5.2.1 The results of Test Nos. 1 and 2 listed in Table C.27 demonstrate that standard-response K-5.6 (K-80) and K-8.0 (K-115) sprinklers can provide fire control for a simulated Ordinary Hazard Group 1 storage array under a 58 ft. (17.7 m) high ceiling using a 0.15 gpm/ft² (6.1 mm/min) density. However, the number of sprinklers that operated resulted in a design area larger than that specified in Table 19.2.3.1.1 coupled with significant sprinkler skipping for both tests. As a result, the design areas in Table 19.2.3.1.1 are being increased, while maintaining the same design density, to account for the test results.

A.19.2.3.2.5.2.2 The results of Test No. 9 listed in Table C.27 demonstrated that standard-response K-8.0 (K-115) sprinklers can provide fire control for a simulated Ordinary Hazard Group 2 storage array under a 40 ft (12.2 m) high ceiling using a 0.37 gpm/ft² (15.1 mm/min) density. However, with 12 sprinklers operating during this test, it demonstrated that a density of 0.37 gpm/ft² (15.1 mm/min) is more applicable than the density of 0.20 gpm/ft² (8.1 mm/min) that is provided in Table 19.2.3.1.1 and therefore has been given as the design density for this

ceiling height. In addition, the results from Test Nos. 6, 7, and 11 listed in Table C.27 suggest that the use of a K-11.2 (K-160) sprinkler will provide better fire control, as suggested by the requirements given in 21.1.4, even though this is not a storage occupancy.

A.19.2.3.2.5.2.3 The results of Test Nos. 6 and 7 listed in Table C.27 demonstrated that quick-response K-11.2 (K-160) sprinklers can provide fire control for a simulated Ordinary Hazard Group 2 storage array under a 60 ft (18.3 m) high ceiling using a 0.45 gpm/ft² (18.3 mm/min) density. However, with 13 and 16 sprinklers operating during these two tests, it demonstrated that a density of 0.45 gpm/ft² (18.3 mm/min) is more applicable than the density of 0.20 gpm/ft² (8.1 mm/min) that is provided in Table 19.2.3.1.1 coupled with a design area greater than the 1,500 ft² (140 m²) given in Table 19.2.3.1.1. As a result, the original design density of 0.20 gpm/ft² (8.1 mm/min) has been increased to 0.45 gpm/ft² (18.3 mm/min) and the design area of 1,500 ft² (140 m²) has been increased by 30 percent. The 30 percent increase to the design area, however, was not applied to the K-25.2 (K-360) extended-coverage sprinkler due to the very positive results (only 1 sprinkler operated) obtained with it during Test 8 listed in Table C.27.

A.19.2.3.2.5.2.4 The test data listed in Table C.27 does not include any tests representing simulated occupancy hazards for either Extra Hazard Group 1 or Extra Hazard Group 2. However, based on the results from the test data listed in Table C.27, the minimum design density requirements of 0.30 gpm/ft² (12.2 mm/min) for Extra Hazard Group 1, and 0.40 gpm/ft² (16.3 mm/min) for Extra Hazard Group 2 are both now less than the 0.45 gpm/ft² (18.3 mm/min) design density required for Ordinary Hazard Group 2. Therefore, the minimum design density for both Extra Hazard Group 1 and Extra Hazard Group 2 has been increased to 0.45 gpm/ft² (18.3 mm/min), while maintaining the same required design area.

Additional Proposed Changes

File Name	Description	Approved
Clean_Copy_of_High_Ceiling_Clearance_Draft_Proposed_Language_WCB_13-May-2022_Rev_B.docx	Word file containing the work of the High Clearance Task Group that developed a new section 19.2.3.2.5 along with related annex paragraphs; and revised paragraphs 10.3.2(3), 19.2.3.2.6, and 19.2.3.2.7.	

Statement of Problem and Substantiation for Public Input

This relates to a new section 19.2.3.2.5.

Historically the ceiling sprinkler system designs indicated in Table 19.2.3.1.1 have applied to buildings of any ceiling height. Full-scale fire tests involving storage occupancies have demonstrated that ceiling heights can impact not only the ceiling sprinkler system designs, but also the allowable ceiling

sprinklers to be used. When ceiling heights and clearances between the top of storage and the ceiling increase, so does the fire hazard, thus resulting in the need for increased flow and pressure from the ceiling sprinklers. The increase in fire hazard can also render some types of sprinklers ineffective due to either their limited droplet sizes or their ability to respond to a fire in a timely manner.

Test data obtained from three separate public sources has suggested that this same affect can impact the sprinkler protection used for occupancies that are not considered storage. Test data that was publicly available simulated occupancy hazards applicable to both Ordinary Hazard Group 1 as well as Occupancy Hazard Group 2 with ceiling heights over 30 ft (9.1 m) and up to a maximum ceiling height of 60 ft (18.3 m). The results of these tests suggest that the design densities and design areas indicated in Table 19.2.3.1.1 for Ordinary and Extra Hazard occupancies may not be effective and should be increased for ceiling heights over 30 ft (9.1 m).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 317-NFPA 13-2022 [New Section after 19.2.3.2.4]	A proposed new section 19.2.3.2.5 with guidance for ceilings over 30 ft.
Public Input No. 318-NFPA 13-2022 [Section No. 19.2.3.2.6]	A proposed revision to 19.2.3.2.6 to avoid an operating area reduction for high-temperature sprinklers when ceilings are over 30 ft. and to align with a proposed new section 19.2.3.2.5.
Public Input No. 319-NFPA 13-2022 [Section No. 19.2.3.2.7]	A proposed revision to 19.2.3.2.7 to avoid an operating area reduction for K11.2 (160) or larger sprinklers in EH1 or EH2 occupancies where ceilings are over 30 ft. and to align with a proposed new section 19.2.3.2.5.
Public Input No. 320-NFPA 13-2022 [Section No. 10.3.2 [Excluding any Sub-Sections]]	A proposed revision to 10.3.2(3) to avoid sidewall sprinklers in ordinary hazard areas where ceilings are over 30 ft. and to align with a proposed new section 19.2.3.2.5.
Public Input No. 322-NFPA 13-2022 [New Section after C.26]	A proposed new section C.27 to capture fire test data related to the high ceiling guidance proposed in the new 19.2.3.2.5.
Public Input No. 317-NFPA 13-2022 [New Section after 19.2.3.2.4]	
Public Input No. 318-NFPA 13-2022 [Section No. 19.2.3.2.6]	
Public Input No. 319-NFPA 13-2022 [Section No. 19.2.3.2.7]	
Public Input No. 320-NFPA 13-2022 [Section No. 10.3.2 [Excluding any Sub-Sections]]	
Public Input No. 322-NFPA 13-2022 [New Section after C.26]	

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Committee:	AUT-SSD

19.2.3.2.5* Ceiling Heights Over 30 ft (9.1 m). Where sprinklers are installed in areas with ceiling heights that are greater than 30 ft (9.1 m) but do not exceed 60 ft (18.3 m) above the finished floor, the requirements from 19.2 shall apply except as modified in 19.2.3.2.5 and summarized in Table 19.2.3.2.5.

Table 19.2.3.2.5 Summary of Requirements for Ceiling Heights Over 30 ft (9.1 m)

Ceiling height ft (m)	Occupancy hazard	Sprinkler coverage	Nominal Sprinkler K-factor US (metric)	Sprinkler response	Sprinkler orientation	Minimum sprinkler density gpm/ft^2 (mm/min)	Increase to design area obtained from Table 19.2.3.1.1
Over 30 and up to 40 (Over 9.1 and up to 12.2)	OH1	Standard or extended	Minimum 5.6 (80)	SR or QR	Upright or pendent	Per Table 19.2.3.1.1	30% increase
	OH2	Standard	Minimum 11.2 (160)	SR or QR	Upright or pendent	0.37 (15.1)	None
		Extended	11.2 (160) or 14.0 (200)	SR or QR	Upright	0.37 (15.1)	None
			Minimum 25.2 (360)	SR or QR	Upright or Pendent	0.37 (15.1)	None
	EH1 & EH2	Standard	Minimum 16.8 (240)	SR	Upright or pendent	0.45 (18.3)	None
		Extended	Minimum 25.2 (360)	SR	Upright or pendent	0.45 (18.3)	None
Over 40 and up to 60 (Over 12.2 and up to 18.3)	OH1	Standard or extended	Minimum 5.6 (80)	SR or QR	Upright or pendent	Per Table 19.2.3.1.1	30% increase
	OH2	Standard	Minimum11.2 (160)	QR	Upright or Pendent	0.45 (18.3)	30% increase
		Extended	11.2 (160) or 14.0 (200)	SR or QR	Upright	0.45 (18.3)	30% increase
			Minimum 25.2 (360)	SR or QR	Upright or Pendent	0.45 (18.3)	None
	EH1 & EH2	Standard	Minimum 16.8 (240)	SR	Upright or Pendent	0.45 (18.3)	None
		Extended	Minimum 25.2 (360)	SR	Upright or Pendent	0.45 (18.3)	None

A.19.2.3.2.5 Full-scale fire testing has demonstrated that the protection needed for Ordinary Hazard Group 1 and Group 2 occupancies is greater than the protection indicated in Table 19.2.3.1.1. See Table C.27 for fire test data specific to Ordinary Hazard Group 1 and Group 2 type occupancies where the ceiling heights exceed 30 ft (9.1 m).

C.27 [19.2.3.2.5] Publicly available full-scale fire testing for simulated Ordinary Hazard Group 1 and Group 2 type occupancies were used to establish the requirements of Section 19.2.3.2.5 and are available in the following three separate documents:

(1) Nam, Soonil; Antonio Braga; Hsiang-Cheng Kung; and Joan M. A. Troup. "Fire Protection for Non-Storage Occupancies with High Ceiling Clearances". Fire Safety Science – Proceedings of the 7th International Symposium, International Association for Fire Safety Science, 2002, pp. 493-504. Web. Web accessed 20220425. www.iafss.org/publications/fss/7/493/view/fss_7-493.pdf
(2) Nam, S. "Fire Protection at High Ceiling Clearance Facilities". International Association for Fire Safety Science. 2007. Web. Web accessed 20220425. www.iafss.org/publications/aofst/7/84/view/aofst_7-84.pdf
(3) Thomas, Peter. "Sprinkler Protection of Non-storage Occupancies with High Ceiling Clearance". Suppression-Detection Conference, NFPA Fire Protection Research Foundation, 2014. Web. Web accessed 20220425. https://www.nfpa.org/-/media/Files/News-and-Research/Resources/Research-Foundation/Symposia/2014-supdet/2014-papers/SUPDET2014Thomas.ashx?la=en

Table C.27 summarizes selected data from these reports.

Table C.27 Full-Scale Test Data for High Ceilings over Non-Storage Occupancies

Test No.	Test Sponsored By	Research Report Date and Test Number	Test Commodity	Storage Height ft (m)	Aisle Width Between Main and Target Arrays ft (m)	Occupancy Hazard Classification	Ceiling Height ft (m)	Sprinkler K-Factor	Sprinkler Temperature Rating °F (°C)	Sprinkler RTI Rating	Sprinkler Orientation	Sprinkler Spacing ft (m)	Sprinkler Density gpm/ft² (mm/min)	Ignition Location	No. of Operating Sprinklers	Test Results
1	FM Global	2002 Test 2 and 2007 Test 1	Class II	~ 8 (2.3)	DNA	OH 1	58 (17.7)	K5.6 (K80)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.15 (6)	Under 1 Sprinkler	17	P
2	FM Global	2002 Test 1 and 2007 Test 2	Class II	~ 8 (2.3)	DNA	OH 1	58 (17.7)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	15	P
3	FM Global	2007 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	OH 2	60 (18.3)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	20	F
4	FM Global	2007 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	OH 2	60 (18.3)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Under 1 Sprinkler	19	F
5	FM Global	2002 Test 3 and 2007 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	58 (17.7)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	26	F
6	FM Global	2002 Test 4 and 2007 Test 6	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K11.2 (K160)	155 (68)	Quick-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Under 1 Sprinkler	16	P
7	FM Global	2007 Test 7	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K11.2 (K160)	155 (68)	Quick-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Among 4 Sprinklers	13	P
8	FM Global	2002 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K25.2EC (K360EC)	165 (74)	Quick-Response	Upright	20 x 20 (6.1 x 6.1)	0.45 (18)	Under 1 Sprinkler	1	P
9	Victaulic Sprinkler	2014 Test 1	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	40 (12)	K8.0 (K115)	155 (68)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	0.37 (15)	Under 1 Sprinkler	12	F
10	Victaulic Sprinkler	2014 Test 2	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	52 (16)	K8.0 (K115)	155 (68)	Quick-Response	Pendent	10 x 10 (3.0 x 3.0)	0.50 (20)	Under 1 Sprinkler	3	F
11	Victaulic Sprinkler	2014 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	52 (16)	K11.2 (K160)	165 (74)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	0.58 (23)	Under 1 Sprinkler	1	F
12	Victaulic Sprinkler	2014 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18)	K25.2 (K360)	160 (71)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	1.00 (40)	Under 1 Sprinkler	1	F
13	Victaulic Sprinkler	2014 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18)	K25.2 (K360)	160 (71)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	1.00 (40)	Among 4 Sprinklers	3	P

19.2.3.2.5.1 Sprinklers for Ceiling Heights Over 30 ft (9.1 m)

19.2.3.2.5.1.1 Sidewall sprinklers shall not be permitted for use in Ordinary Hazard Group 1 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.1 The full-scale fire testing applicable to the requirements of this section did not include the use of sidewall sprinklers. As a result, sidewall sprinklers are not currently allowed for the protection of Ordinary Hazard Group 1 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.2 Sprinklers having a nominal K-factor less than K-11.2 (K-160) shall not be permitted for use in Ordinary Hazard Group 2 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.2 The full-scale fire testing applicable to the requirements of this section demonstrated that sprinklers with a K-factor of K-8.0 (K-115) were not effective in providing fire control for a simulated Ordinary Hazard Group 2 occupancy with the ceiling height greater than 30 ft (9.1 m), whereas sprinklers with a minimum K-factor of K-11.2 (K-160) were effective at providing fire control. As a result, sprinklers with a K-factor less than K-11.2 (K-160) are not currently allowed for the protection of Ordinary Hazard Group 2 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.3 Extended-coverage pendent sprinklers having a nominal K-factor of K-22.4 (K-320) or less shall not be permitted for use in Ordinary Hazard Group 2 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.3 The full-scale fire testing applicable to the requirements of this section did not include the use of extended-coverage sprinklers with a K-factor of less than K-25.2 (K-360). Testing at FM Global, however has demonstrated that upright extended-coverage sprinklers with a K-factor of K-11.2 (K-160) and K-14.0 (K-200) can be effective for Ordinary Hazard Group 1 and 2 occupancies where the ceiling height is greater than 30 ft (9.1 m), whereas the testing at FM Global did not demonstrate this for the pendent version of these extended-coverage sprinklers. As a result, pendent extended-coverage sprinklers with K-factors of K-22.4 or less are not currently allowed for the protection of Ordinary Hazard Group 2 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.4 Standard-response standard-coverage sprinklers shall not be permitted for use in Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft (12.2 m).

A.19.2.3.2.5.1.4 The full-scale fire testing applicable to the requirements of this section demonstrated that for standard-coverage sprinklers, the use of quick-response sprinklers provided an acceptable level of fire control for simulated Ordinary Hazard Group 2 occupancy hazards. As a result, quick-response standard-coverage sprinklers with K-factors of K-11.2 (K-160) or greater are required for the protection of Ordinary Hazard Group 2 occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.2 Sprinkler Designs for Ceiling Heights Over 30 ft (9.1 m)

19.2.3.2.5.2.1* For Ordinary Hazard Group 1 occupancies where the ceiling height is greater than 30 ft (9.1 m) but does not exceed 60 ft (18.3 m), the design areas obtained from Table 19.2.3.1.1 shall be increased by 30 percent.

A.19.2.3.2.5.2.1 The results of Test Nos. 1 and 2 listed in Table C.27 demonstrate that standard-response K-5.6 (K-80) and K-8.0 (K-115) sprinklers can provide fire control for a simulated Ordinary Hazard Group 1 storage array under a 58 ft. (17.7 m) high ceiling using a 0.15 gpm/ft² (6.1 mm/min) density. However, the number of sprinklers that operated resulted in a design area larger than that specified in Table 19.2.3.1.1 coupled with significant sprinkler skipping for both tests. As a result, the design areas in Table 19.2.3.1.1 are being increased, while maintaining the same design density, to account for the test results.

19.2.3.2.5.2.2* For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 30 ft. (9.1 m) but does not exceed 40 ft. (12.2 m), the ceiling sprinkler system shall use a minimum density of 0.37 gpm/ft² (15.1 mm/min) in combination with the design area obtained from Table 19.2.3.1.1.

A.19.2.3.2.5.2.2 The results of Test No. 9 listed in Table C.27 demonstrated that standard-response K-8.0 (K-115) sprinklers can provide fire control for a simulated Ordinary Hazard Group 2 storage array under a 40 ft (12.2 m) high ceiling using a 0.37 gpm/ft² (15.1 mm/min) density. However, with 12 sprinklers operating during this test, it demonstrated that a density of 0.37 gpm/ft² (15.1 mm/min) is more applicable than the density of 0.20 gpm/ft² (8.1 mm/min) that is provided in Table 19.2.3.1.1 and therefore has been given as the design density for this ceiling height. In addition, the results from Test Nos. 6, 7, and 11 listed in Table C.27 suggest that the use of a K-11.2 (K-160) sprinkler will provide better fire control, as suggested by the requirements given in 21.1.4, even though this is not a storage occupancy.

19.2.3.2.5.2.3* For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft. (12.2 m) but does not exceed 60 ft. (18.3 m), the ceiling sprinkler system shall:

(1) Use a minimum density of 0.45 gpm/ft² (18.3 mm/min), and

(2) Increase the design areas obtained from Table 19.2.3.1.1 by 30 percent

(3) The design areas from Table 19.2.3.1.1 shall be permitted, without a 30 percent increase, where an extended-coverage sprinkler having a minimum nominal K-factor of K-25.2 (K-360) is used

A.19.2.3.2.5.2.3 The results of Test Nos. 6 and 7 listed in Table C.27 demonstrated that quick-response K-11.2 (K-160) sprinklers can provide fire control for a simulated Ordinary Hazard Group 2 storage array under a 60 ft (18.3 m) high ceiling using a 0.45 gpm/ft² (18.3 mm/min) density. However, with 13 and 16 sprinklers operating during these two tests, it demonstrated that a density of 0.45 gpm/ft² (18.3 mm/min) is more applicable than the density of 0.20 gpm/ft² (8.1 mm/min) that is provided in Table 19.2.3.1.1 coupled with a design area greater than the 1,500 ft² (140 m²) given in Table 19.2.3.1.1. As a result, the original design density of 0.20 gpm/ft² (8.1 mm/min) has been increased to 0.45 gpm/ft² (18.3 mm/min) and the design area of 1,500 ft² (140 m²) has been increased by 30 percent. The 30 percent increase to the design area, however, was not applied to the K-25.2 (K-360) extended-coverage sprinkler due to the very positive results (only 1 sprinkler operated) obtained with it during Test 8 listed in Table C.27.

19.2.3.2.5.2.4* For Extra Hazard Groups 1 and 2 occupancies where the ceiling height is greater than 30 ft (9.1 m) but does not exceed 60 ft. (18.3 m), the ceiling sprinkler system shall use a minimum density of 0.45 gpm/ft² (18.3 mm/min) in combination with the design areas obtained from Table 19.2.3.1.1.

A.19.2.3.2.5.2.4 The test data listed in Table C.27 does not include any tests representing simulated occupancy hazards for either Extra Hazard Group 1 or Extra Hazard Group 2. However, based on the results from the test data listed in Table C.27, the minimum design density requirements of 0.30 gpm/ft² (12.2 mm/min) for Extra Hazard Group 1, and 0.40 gpm/ft² (16.3 mm/min) for Extra Hazard Group 2 are both now less than the 0.45 gpm/ft² (18.3 mm/min) design density required for Ordinary Hazard Group 2. Therefore, the minimum design density for both Extra Hazard Group 1 and Extra Hazard Group 2 has been increased to 0.45 gpm/ft² (18.3 mm/min), while maintaining the same required design area.

Revise the following existing paragraphs

10.3.2(3) In ordinary hazard occupancies with smooth, flat ceilings <u>not exceeding 30 ft (9.1 m) in height</u>, where specifically listed for such use.

19.2.3.2.6 High-Temperature Sprinklers. <u>For ceilings not exceeding 30 ft. (9.1 m) in height</u> where high-temperature sprinklers are used for extra hazard occupancies, the area of sprinkler operation shall be permitted to be reduced by 25 percent without revising the density, but not to less than 2000 ft² (185 m²).

19.2.3.2.7 <u>For ceilings not exceeding 30 ft. (9.1 m) in height</u> where K-11.2 (160) or larger sprinklers are used with Extra Hazard Group 1 or Extra Hazard Group 2 design curves and 19.2.3.1.1, the design area shall be permitted to be reduced by 25 percent but not below 2000 ft² (185 m²), regardless of temperature rating.

Substantiation:

Historically the ceiling sprinkler system designs indicated in Table 19.2.3.1.1 have applied to buildings of any ceiling height. Full-scale fire tests involving storage occupancies have demonstrated that ceiling heights can impact not only the ceiling sprinkler system designs, but also the allowable ceiling sprinklers to be used. When ceiling heights and clearances between the top of storage and the ceiling increase, so does the fire hazard, thus resulting in the need for increased flow and pressure from the ceiling sprinklers. The increase in fire hazard can also render some types of sprinklers ineffective due to either their limited droplet sizes or their ability to respond to a fire in a timely manner.

Test data obtained from three separate public sources has suggested that this same affect can impact the sprinkler protection used for occupancies that are not considered storage. Test data that was publicly available simulated occupancy hazards applicable to both Ordinary Hazard Group 1 as well as Occupancy Hazard Group 2 with ceiling heights over 30 ft (9.1 m) and up to a maximum ceiling height of 60 ft (18.3 m). The results of these tests suggest that the design densities and design areas indicated in Table 19.2.3.1.1 for Ordinary and Extra Hazard occupancies may not be effective and should be increased for ceiling heights over 30 ft (9.1 m).

Public Input No. 50-NFPA 13-2021 [Section No. A.19.3.1.2.1]

A.19.3.1.2.1 ~~—~~ 2 __

In order for the minimum eight sprinkler requirement for the size of the remote area to not be extended to the adjacent area, the qualifying concealed space must be separated by the entire fire-rated assembly. Such assemblies often have combustible structural members separating the exterior membranes that can create a concealed combustible space that can qualify for omitting sprinkler protection. If the fire-rated assembly is the qualifying concealed space, an interior fire would greatly reduce the assigned fire-rated duration.

Statement of Problem and Substantiation for Public Input

The annex note to 19.3.1.2.1 explaining when the 8 sprinkler requirement is more appropriate to be associated with 19.3.1.2.2

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Public Input No. 369-NFPA 13-2022 [New Section after A.20.2.1]

A.20.1

A.20.1 When sprinklers are being tested at a laboratory for the purposes of determining sprinkler discharge criteria for a specific hazard, and when that testing is expected to be submitted to a consensus committee for adoption into a code or standard, the entity sponsoring the testing should request that the laboratory provide them with a report or test data that documents how the tests were conducted and what the results of the tests were, but not include proprietary product design information. About the sprinkler. The following information should be included for each test in the report or data package:

(1) Material(s) being used as the fuel for the fire.

(2) Dimensional details of test commodity and storage arrangement.

(3) Nominal height of the stored commodity above the floor.

(4) Nominal clearance between the top of storage and the ceiling.

(5) Model designation of the sprinkler or Sprinkler Identification Number (SIN)

(6) K-factor of sprinkler.

(7) Temperature rating and response characteristic of sprinkler.

(8) Distance of the sprinkler deflector (or thermal element) below the ceiling.

(9) Orientation of the sprinkler (upright, pendent, horizontal).

(10) Obstructions to sprinklers (if any) including the branch line piping for upright sprinklers.

(11) Water pressure at sprinkler or flow from sprinkler during test.

(12) Sprinkler spacing.

(13) Fire location with respect to upright and pendent sprinkler(s). Typical test locations might be (note that tests are not required in all locations):

(a) Under one sprinkler.

(b) Between two sprinklers on the same branch line.

(c) Between four sprinklers.

(d) At a dry spot in the sprinkler's spray pattern as identified in flow testing.

(14) Fire location with respect to sidewall sprinkler(s). Test locations that should be considered include the following (note that tests are not required in all locations):

(a) At the most remote location from a single sprinkler.

(b) Centered between two sprinklers at the far point of the coverage area.

(c) Centered between four sprinklers when sprinklers are on opposite walls spraying into a room or space.

(d) Directly underneath and behind a single sprinkler.

(e) On the same wall as the sprinklers, centered between two sprinklers.

(f) At a dry spot in the sprinkler's spray pattern as identified in flow testing.

(15) Fire test results. Examples of successful test criteria are:

(1) The fire does not show evidence of sustained combustion at the far ends of the main test array.

(2) The fuel is not completely consumed.

(3) The fire does not show evidence of sustained combustion at the outer edges of the target arrays.

(4) The average one-minute temperature of a simulated steel structural member installed near the ceiling above ignition does not exceed 1000 ˚ F (538 ˚ C) or the ceiling temperatures are controlled so that they were below a predetermined limit.

(5) Sprinklers do not operate at the edge of the protection array.

(16) Number of sprinklers that opened during the test, where they were in relation to the fire and what time they opened after ignition.

(17) Gas temperatures above ignition and near each installed sprinkler.

(18) Description of area or commodity damaged by fire.

(19) Other test conditions or parameters or observations that would help the consensus committee come to a decision or limitation on the use of the sprinkler based on this test program.

(20) The entity sponsoring the tests is responsible for proposing appropriate limits to the installation requirements and hazards that their sprinkler can protect based on the parameters of the fire tests and the results of those tests. This recommendation needs to include the number of sprinklers that would be appropriate for the design area and the minimum discharge (pressure or flow) necessary from each sprinkler. The number of sprinklers appropriate for the design area should take into account the number of sprinklers that opened in the worst-case fire test with an appropriate safety factor applied (typically 1.5) to account for variables not considered during the test program. An appropriate minimum number of sprinklers may be applied depending on the hazard being protected.

Statement of Problem and Substantiation for Public Input

Annex language to outline the information that should be included for each test in a report or data package that provides guidance for when sprinklers tested at a laboratory for the purposes of determining sprinkler discharge criteria for a specific hazard, and when that testing is expected to be submitted to a consensus committee for adoption into a code or standard, the entity sponsoring the testing should request that the laboratory provide them with a report or test data that documents how the tests were conducted and what the results of the tests were, but not include proprietary product design information about the sprinkler.

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Public Input No. 222-NFPA 13-2022 [Section No. A.20.4.3]

A.20.4.3

See Table A.20.4.3.

Table A.20.4.3 Examples of Class III Commodities

Product Heading	Product	
Film Rolls, Including Photographic	Film; 35 mm metal film cartridges in polyethylene cans; cartoned	
	-	Photographic paper; sheets; bagged in polyethylene; cartoned
Flammable/Combustible Liquids	Aerosol; Level 1	
Food Products — Frozen	Frozen foods; plastic trays	
Food Products — Non-Frozen	Butter (stick or whipped spread) or margarine (up to 50 percent oil)	
	-	Dry foods (such as baked goods, candy, cereals, cheese, chocolate, cocoa, coffee, grains, granular sugar, nuts, etc.); bagged or cartoned
	-	Meat; fresh; plastic trays
Furniture and Bedding	Furniture; wood (doors, windows, cabinets, etc.); no plastic coverings or foam cushioning	
	-	Box spring; standard (minimal plastic materials)
Housing Materials/Appliances	Appliances; no appreciable plastic exterior trim (interior of unit can have appreciable plastic)	
	-	Roofing shingles; asphalt-coated fiberglass
Miscellaneous	Charcoal; standard (non-mineral spirit impregnated); bagged	
	-	Leather; finished products (e.g., shoes, jackets, gloves, bags, luggage, belts)
	-	Shock absorbers; plastic dust cover
	-	Tobacco products; cartoned
Paper Products	Cartons (i.e., cardboard flats); corrugated; unassembled in neat piles	
	-	Cellulosic paper products; nonwax-coated (e.g., books, cardboard games, cartoned tissue products, magazines, newspapers, paper cups, paper plates, paper towels, plastic-coated paper food containers, stationery)

Product Heading	Product	
	-	Rolled; medium or heavyweight; in storage racks or on-side
	-	Tissue products; plastic-wrapped; cartoned
Plastic/Rubber	Melamine (melamine formaldehyde)	
	-	PCTFE (polychlorotrifluoroethylene)
	-	Phenolic
	-	PTFE (polytetrafluoroethylene)
	-	PVC (polyvinyl chloride) products, up to 20 percent plasticizer
	-	PVC resins; bagged
	-	PVDC (polyvinylidene chloride)
	-	PVDF (polyvinylidene fluoride)
	-	Urea (urea formaldehyde)
Textile Materials/Products	Cloth; natural fibers; baled	
	-	Clothing; natural fibers (e.g., wool, cotton) and viscose
	-	Cotton; cartoned
	-	Diapers; cotton or linen
-	~~Fabric; synthetic (except rayon and nylon); up to 50/50 blend~~	
-	~~Thread or yarn; synthetic (except rayon and nylon); up to 50/50 blend; wood or paper spools~~	
Wire/Cable/Spools	Spools; wood; empty	
Wood Products	Wood products (e.g., fiberboard, lumber, particle board, plywood, pressboard with smooth ends and edges); unbundled or non-solid blocks	
	-	Wood products (e.g., toothpicks, clothespins and hangers)

Statement of Problem and Substantiation for Public Input

The two commodities are proposed to be deleted as they contradict the upgraded commodity classification as shown in Table A.20.4(b)

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Public Input No. 570-NFPA 13-2022 [Section No. A.24.1]

A.24.1

The intent of this chapter is to provide protection options for the commodity hazards and storage arrangements outlined in Chapters 20 through 25 based on the characteristics of the sprinkler, such as K-factor, orientation, RTI rating, sprinkler spacing type and temperature rating, and using a design format of number of sprinklers at a minimum operating pressure. The protection options offered in this chapter will be based on the results of full-scale fire testing, as outlined in A.24.2 or A.24.3, while incorporating a minimum 50 percent safety factor into the number of sprinklers provided in the design. The intent of this chapter is to offer protection options using sprinklers having a nominal K-factor of 11.2 (160) or higher. Nothing in this chapter is intended to limit the development and use of equivalency or new technology applications under the provisions of 1.5 or 1.7.

Statement of Problem and Substantiation for Public Input

The development of equivalent protection schemes and new technology are intended to allow the extension of the development of such beyond the limits of the current provisions of the Standard. The added language is intended to make it clear that Chapter 24 is not intended to restrict the development of such.

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Public Input No. 77-NFPA 13-2021 [Section No. A.25.3.3.1.1.6(A)]

~~A.25.3.3.1.1.6(A)~~ —

~~Where the clearance to ceiling exceeds 10 ft (3.0 m) with CMDA ceiling-level sprinklers protecting exposed nonencapsulated Class I, Class II, Class III, or Class IV commodities, a horizontal barrier should be installed above storage with one level of in-rack sprinklers under the barrier.~~

Statement of Problem and Substantiation for Public Input

The annex is supposed to contain explanatory material. This annex section contains what is worded similar to a code requirement and completely changes the application of Section 25.3.3.1.1.6. Using the world 'should' instead of 'shall' does nothing to alleviate the confusion of the reader who can't figure out if they need to provide a single level of in-racks under the top level of storage as detailed in base code, or a barrier with in-racks above the top of the storage as detailed in the annex, or both. This section should be removed or re-worded to clarify the intent of the committee regarding the use of barriers and be worded as explanatory material and not as a code requirement.

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Public Input No. 366-NFPA 13-2022 [New Section after A.28.1]

A.28.2

A.28.2 The plan should be of sufficient size to be legible. Typical content to be included on the floor plan might include, but not be limited to, the following:

(1) Locations, dimensions, and height limits of piled, palletized, and rack storage

(2) Commodity classification permitted to be stored in each area

(3) Required clearances between top of storage and sprinkler deflectors

(4) Required clearances between top of storage and ceiling

(5) Aisle dimensions between storage arrays

(6) Location of any required fire department access doors

(7) Location of valves controlling ceiling and in-rack sprinkler water supplies

Statement of Problem and Substantiation for Public Input

Correlate NFPA 1 and IFC requirement for storage floor plan with NFPA 13.

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Public Input No. 529-NFPA 13-2022 [Section No. A.28.1]

A.28.1

Preliminary plans should be submitted for review to the authority having jurisdiction prior to the development of working plans *[see Figure A.28.1(a)]*. The preliminary plans can be part of the construction documents submitted in order to obtain a building permit. However, working drawings in accordance with Section 28.1 should be submitted and approved prior to the installation of system equipment. Preliminary plans should include as much information as is required to provide a clear representation of the hazard to be protected, the system design concept, the proposed water supply configuration, and the building construction information pertinent to the system layout and detailing.

The owner's information certificate, shown in Figure A.28.1(b), should be used to obtain a declaration of the intended use of the occupancy to be protected.

Drawings that accompany the certificate should include the following:

(1) Name of owner and occupant

(2) Location, including street address

(3) Point of compass

(4) Construction and occupancy of each building

(5) Building height in feet

(6) Waterflow test information and, if a waterflow test of the city main is available, indicate the following:

(7) Date and time of the test

(8) Name of party that conducted the test

(9) Location of the hydrants where the flow was taken and where static and residual pressure readings were recorded *(see A.5.2.2)*

(10) Size and configuration of mains supplying the hydrants

(11) Size and number of open hydrant butts that flood

(12) Results of the test

(13) Building features such as combustible concealed spaces, floor openings, areas subject to freezing, and areas from which it is intended to omit sprinkler protection

(14) Proposed location and approximate size, if a water supply employing pumps or tanks is contemplated

(15) Name and address of party submitting the preliminary plans

(16) Tentative location of major piping, including mains underground, risers, overhead mains, and fire department connections

Figure A.28.1(a) Typical Preliminary Plan.

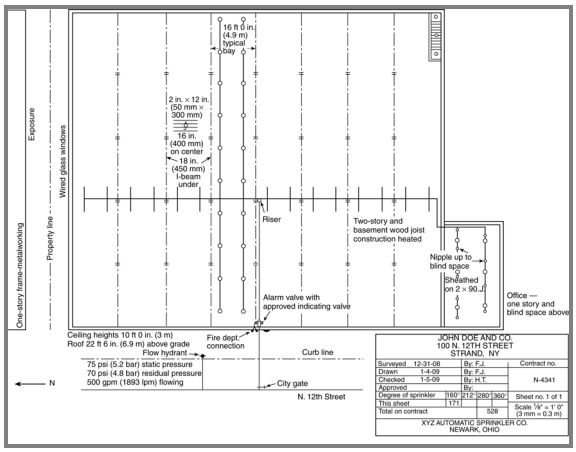
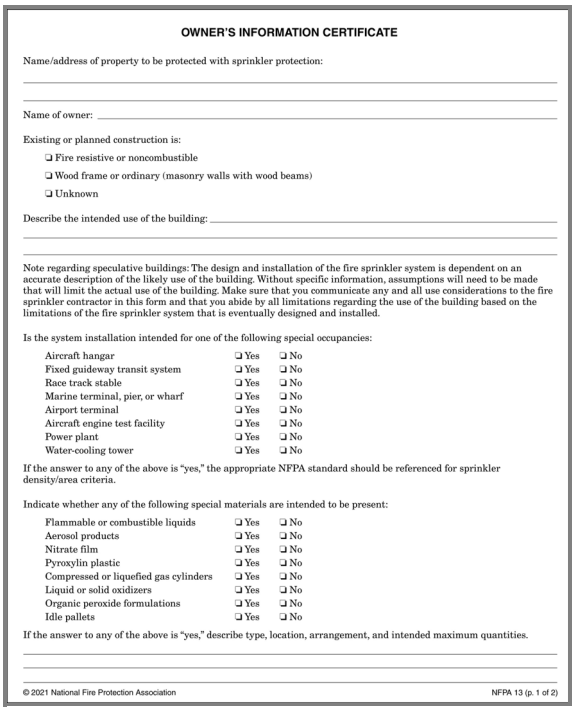


Figure A.28.1(b) Owner's Information Certificate.

Correlate Figure A.28.1(b) Owner's Information Certificate with PI-391. This Public Input (submitted from the water supply task group) seeks to change section 4.2 (3) to read as follows:

*(3) * Determine and confirm the water supply including any necessary adjustments.*

The example form should have similar language.



OWNER'S INFORMATION CERTIFICATE

Name/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 guideway 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 plant	❑ 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
Nitrate film	❑ Yes	❑ No
Pyroxylin plastic	❑ Yes	❑ No
Compressed or liquefied gas cylinders	❑ Yes	❑ No
Liquid or solid oxidizers	❑ Yes	❑ No
Organic peroxide formulations	❑ Yes	❑ No
Idle pallets	❑ Yes	❑ No

If the answer to any of the above is "yes," describe type, location, arrangement, and intended maximum quantities.

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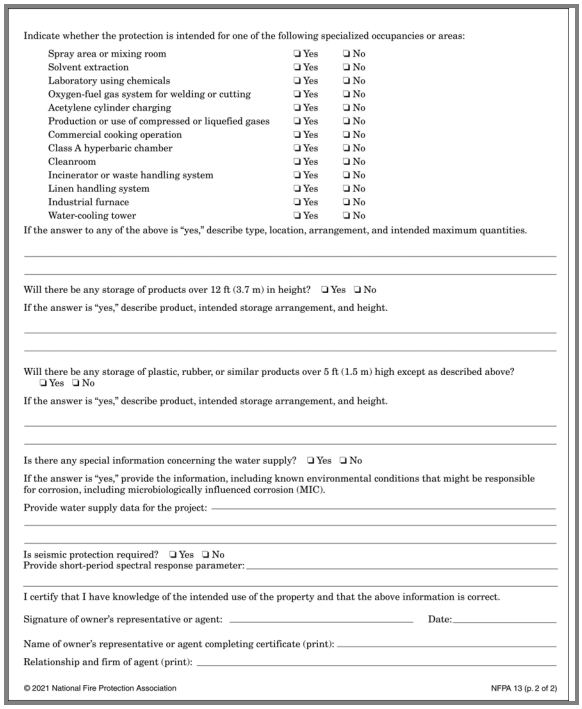

Indicate whether the protection is intended for one of the following specialized occupancies or areas:

Spray area or mixing room	❑ Yes	❑ No
Solvent extraction	❑ Yes	❑ No
Laboratory using chemicals	❑ Yes	❑ No
Oxygen-fuel gas system for welding or cutting	❑ Yes	❑ No
Acetylene cylinder charging	❑ Yes	❑ No
Production or use of compressed or liquefied gases	❑ Yes	❑ No
Commercial cooking operation	❑ Yes	❑ No
Class A hyperbaric chamber	❑ Yes	❑ No
Cleanroom	❑ Yes	❑ No
Incinerator or waste handling system	❑ Yes	❑ No
Linen handling system	❑ Yes	❑ No
Industrial furnace	❑ Yes	❑ No
Water-cooling tower	❑ Yes	❑ No

If the answer to any of the above is "yes," describe type, location, arrangement, and intended maximum quantities.

Will there be any storage of products over 12 ft (3.7 m) in height? ❑ Yes ❑ No

If the answer is "yes," describe product, intended storage arrangement, and height.

Will there be any storage of plastic, rubber, or similar products over 5 ft (1.5 m) high except as described above? ❑ Yes ❑ No

If the answer is "yes," describe product, intended storage arrangement, and height.

Is there any special information concerning the water supply? ❑ Yes ❑ No

If the answer is "yes," provide the information, including known environmental conditions that might be responsible for corrosion, including microbiologically influenced corrosion (MIC).

Provide water supply data for the project:

Is seismic protection required? ❑ Yes ❑ No
Provide short-period spectral response parameter:

I certify that I have knowledge of the intended use of the property and that the above information is correct.

Signature of owner's representative or agent: Date:

Name of owner's representative or agent completing certificate (print):

Relationship and firm of agent (print):

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Statement of Problem and Substantiation for Public Input

The water supply task group has submitted a public input (PI-391) to revise section 4.2 (3) to read as follows:

(3) * Determine and confirm the water supply including any necessary adjustments.

This example form needs to have have similar language.

Submitter Information Verification

Submitter Full Name: Roland Asp
Organization: National Fire Sprinkler Association
Affiliation: NFSA Engineering and Standards Committee.
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 31 15:49:44 EDT 2022
Committee: AUT-SSD

Public Input No. 322-NFPA 13-2022 [New Section after C.26]

C.27 [19.2.3.2.5]

Publicly available full-scale fire testing for simulated Ordinary Hazard Group 1 and Group 2 type occupancies were used to establish the requirements of Section 19.2.3.2.5 and are available in the following three separate documents:

(1) Nam, Soonil; Antonio Braga; Hsiang-Cheng Kung; and Joan M. A. Troup. "Fire Protection for Non-Storage Occupancies with High Ceiling Clearances". Fire Safety Science – Proceedings of the 7 th International Symposium , International Association for Fire Safety Science, 2002, pp. 493-504. Web. Web accessed 20220425. www.iafss.org/publications/fss/7/493/view/fss_7-493.pdf

(2) Nam, S. "Fire Protection at High Ceiling Clearance Facilities". International Association for Fire Safety Science. 2007. Web. Web accessed 20220425. www.iafss.org/publications/aofst/7/84/view/aofst_7-84.pdf

(3) Thomas, Peter. "Sprinkler Protection of Non-storage Occupancies with High Ceiling Clearance". Suppression-Detection Conference , NFPA Fire Protection Research Foundation, 2014. Web. Web accessed 20220425. https://www.nfpa.org/-/media/Files/News-and-Research/Resources/Research-Foundation/Symposia/2014-supdet/2014-papers/SUPDET2014Thomas.ashx?la=en

Table C.27 summarizes selected data from these reports.

Table C.27 Full-Scale Test Data for High Ceilings over Non-Storage Occupancies

Test No.	Test Sponsored By	Research Report Date and Test Number	Test Commodity	Storage Height ft (m)	Aisle Width Between Main and Target Arrays ft (m)	Cl
1	FM Global	2002 Test 2 and 2007 Test 1	Class II	~ 8 (2.3)	DNA	
2	FM Global	2002 Test 1 and 2007 Test 2	Class II	~ 8 (2.3)	DNA	
3	FM Global	2007 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	
4	FM Global	2007 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	
5	FM Global	2002 Test 3 and 2007 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	

6	FM Global	2002 Test 4 and 2007 Test 6	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	
7	FM Global	2007 Test 7	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	
8	FM Global	2002 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	
9	Victaulic Sprinkler	2014 Test 1	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	
10	Victaulic Sprinkler	2014 Test 2	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	
11	Victaulic Sprinkler	2014 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	
12	Victaulic Sprinkler	2014 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	
13	Victaulic Sprinkler	2014 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	

Additional Proposed Changes

File Name	Description	Approved
Clean_Copy_of_High_Ceiling_Clearance_Draft_Proposed_Language_WCB_13-May-2022_Rev_B.docx	Word file containing the work of the High Clearance Task Group that developed a new section 19.2.3.2.5 along with related annex paragraphs; and revised paragraphs 10.3.2(3), 19.2.3.2.6, and 19.2.3.2.7.	
Table_C.27_Full_Scale_Test_Data_for_High_Ceiling_Clearance_over_Non-Storage_Occupancies_20220512.xlsx	Excel file for Table C.27.	

Statement of Problem and Substantiation for Public Input

This relates to a new Section 19.2.3.2.5.

Historically the ceiling sprinkler system designs indicated in Table 19.2.3.1.1 have applied to buildings of any ceiling height. Full-scale fire tests involving storage occupancies have demonstrated that ceiling heights can impact not only the ceiling sprinkler system designs, but also the allowable ceiling sprinklers to be used. When ceiling heights and clearances between the top of storage and the ceiling increase, so does the fire hazard, thus resulting in the need for increased flow and pressure from the ceiling sprinklers. The increase in fire hazard can also render some types of sprinklers ineffective due to either their limited droplet sizes or their ability to respond to a fire in a timely manner.

Test data obtained from three separate public sources has suggested that this same affect can impact the sprinkler protection used for occupancies that are not considered storage. Test data that was publicly available simulated occupancy hazards applicable to both Ordinary Hazard Group 1 as well as Occupancy Hazard Group 2 with ceiling heights over 30 ft (9.1 m) and up to a maximum ceiling height of 60 ft (18.3 m). The results of these tests suggest that the design densities and design areas indicated in Table 19.2.3.1.1 for Ordinary and Extra Hazard occupancies may not be effective and should be increased for ceiling heights over 30 ft (9.1 m).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 317-NFPA 13-2022 [New Section after 19.2.3.2.4]	A proposed new section 19.2.3.2.5 with guidance for ceilings over 30 ft.
Public Input No. 318-NFPA 13-2022 [Section No. 19.2.3.2.6]	A proposed revision to 19.2.3.2.6 to avoid an operating area reduction for high-temperature sprinklers when ceilings are over 30 ft. and to align with a proposed new section 19.2.3.2.5.
Public Input No. 319-NFPA 13-2022 [Section No. 19.2.3.2.7]	A proposed revision to 19.2.3.2.7 to avoid an operating area reduction for K11.2 (160) or larger sprinklers in EH1 or EH2 occupancies where ceilings are over 30 ft. and to align with a proposed new section 19.2.3.2.5.
Public Input No. 320-NFPA 13-2022 [Section No. 10.3.2 [Excluding any Sub-Sections]]	A proposed revision to 10.3.2(3) to avoid sidewall sprinklers in ordinary hazard areas where ceilings are over 30 ft. and to align with a proposed new section 19.2.3.2.5.
Public Input No. 321-NFPA 13-2022 [New Section after A.19.2.3.1.5.2(10)]	Proposed new annex sections related to the proposed new 19.2.3.2.5.

Submitter Information Verification

Submitter Full Name: Richard Gallagher
Organization: Zurich Services Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 23 17:54:22 EDT 2022
Committee: AUT-SSD

19.2.3.2.5* Ceiling Heights Over 30 ft (9.1 m). Where sprinklers are installed in areas with ceiling heights that are greater than 30 ft (9.1 m) but do not exceed 60 ft (18.3 m) above the finished floor, the requirements from 19.2 shall apply except as modified in 19.2.3.2.5 and summarized in Table 19.2.3.2.5.

Table 19.2.3.2.5 Summary of Requirements for Ceiling Heights Over 30 ft (9.1 m)

Ceiling height ft (m)	Occupancy hazard	Sprinkler coverage	Nominal Sprinkler K-factor US (metric)	Sprinkler response	Sprinkler orientation	Minimum sprinkler density gpm/ft^2 (mm/min)	Increase to design area obtained from Table 19.2.3.1.1
Over 30 and up to 40 (Over 9.1 and up to 12.2)	OH1	Standard or extended	Minimum 5.6 (80)	SR or QR	Upright or pendent	Per Table 19.2.3.1.1	30% increase
	OH2	Standard	Minimum 11.2 (160)	SR or QR	Upright or pendent	0.37 (15.1)	None
		Extended	11.2 (160) or 14.0 (200)	SR or QR	Upright	0.37 (15.1)	None
			Minimum 25.2 (360)	SR or QR	Upright or Pendent	0.37 (15.1)	None
	EH1 & EH2	Standard	Minimum 16.8 (240)	SR	Upright or pendent	0.45 (18.3)	None
		Extended	Minimum 25.2 (360)	SR	Upright or pendent	0.45 (18.3)	None
Over 40 and up to 60 (Over 12.2 and up to 18.3)	OH1	Standard or extended	Minimum 5.6 (80)	SR or QR	Upright or pendent	Per Table 19.2.3.1.1	30% increase
	OH2	Standard	Minimum11.2 (160)	QR	Upright or Pendent	0.45 (18.3)	30% increase
		Extended	11.2 (160) or 14.0 (200)	SR or QR	Upright	0.45 (18.3)	30% increase
			Minimum 25.2 (360)	SR or QR	Upright or Pendent	0.45 (18.3)	None
	EH1 & EH2	Standard	Minimum 16.8 (240)	SR	Upright or Pendent	0.45 (18.3)	None
		Extended	Minimum 25.2 (360)	SR	Upright or Pendent	0.45 (18.3)	None

A.19.2.3.2.5 Full-scale fire testing has demonstrated that the protection needed for Ordinary Hazard Group 1 and Group 2 occupancies is greater than the protection indicated in Table 19.2.3.1.1. See Table C.27 for fire test data specific to Ordinary Hazard Group 1 and Group 2 type occupancies where the ceiling heights exceed 30 ft (9.1 m).

C.27 [19.2.3.2.5] Publicly available full-scale fire testing for simulated Ordinary Hazard Group 1 and Group 2 type occupancies were used to establish the requirements of Section 19.2.3.2.5 and are available in the following three separate documents:

(1) Nam, Soonil; Antonio Braga; Hsiang-Cheng Kung; and Joan M. A. Troup. "Fire Protection for Non-Storage Occupancies with High Ceiling Clearances". Fire Safety Science – Proceedings of the 7th International Symposium, International Association for Fire Safety Science, 2002, pp. 493-504. Web. Web accessed 20220425. www.iafss.org/publications/fss/7/493/view/fss_7-493.pdf
(2) Nam, S. "Fire Protection at High Ceiling Clearance Facilities". International Association for Fire Safety Science. 2007. Web. Web accessed 20220425. www.iafss.org/publications/aofst/7/84/view/aofst_7-84.pdf
(3) Thomas, Peter. "Sprinkler Protection of Non-storage Occupancies with High Ceiling Clearance". Suppression-Detection Conference, NFPA Fire Protection Research Foundation, 2014. Web. Web accessed 20220425. https://www.nfpa.org/-/media/Files/News-and-Research/Resources/Research-Foundation/Symposia/2014-supdet/2014-papers/SUPDET2014Thomas.ashx?la=en

Table C.27 summarizes selected data from these reports.

Table C.27 Full-Scale Test Data for High Ceilings over Non-Storage Occupancies

Test No.	Test Sponsored By	Research Report Date and Test Number	Test Commodity	Storage Height ft (m)	Aisle Width Between Main and Target Arrays ft (m)	Occupancy Hazard Classification	Ceiling Height ft (m)	Sprinkler K-Factor	Sprinkler Temperature Rating °F (°C)	Sprinkler RTI Rating	Sprinkler Orientation	Sprinkler Spacing ft (m)	Sprinkler Density gpm/ft² (mm/min)	Ignition Location	No. of Operating Sprinklers	Test Results
1	FM Global	2002 Test 2 and 2007 Test 1	Class II	~ 8 (2.3)	DNA	OH 1	58 (17.7)	K5.6 (K80)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.15 (6)	Under 1 Sprinkler	17	P
2	FM Global	2002 Test 1 and 2007 Test 2	Class II	~ 8 (2.3)	DNA	OH 1	58 (17.7)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	15	P
3	FM Global	2007 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	OH 2	60 (18.3)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	20	F
4	FM Global	2007 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	OH 2	60 (18.3)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Under 1 Sprinkler	19	F
5	FM Global	2002 Test 3 and 2007 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	58 (17.7)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	26	F
6	FM Global	2002 Test 4 and 2007 Test 6	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K11.2 (K160)	155 (68)	Quick-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Under 1 Sprinkler	16	P
7	FM Global	2007 Test 7	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K11.2 (K160)	155 (68)	Quick-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Among 4 Sprinklers	13	P
8	FM Global	2002 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K25.2EC (K360EC)	165 (74)	Quick-Response	Upright	20 x 20 (6.1 x 6.1)	0.45 (18)	Under 1 Sprinkler	1	P
9	Victaulic Sprinkler	2014 Test 1	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	40 (12)	K8.0 (K115)	155 (68)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	0.37 (15)	Under 1 Sprinkler	12	F
10	Victaulic Sprinkler	2014 Test 2	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	52 (16)	K8.0 (K115)	155 (68)	Quick-Response	Pendent	10 x 10 (3.0 x 3.0)	0.50 (20)	Under 1 Sprinkler	3	F
11	Victaulic Sprinkler	2014 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	52 (16)	K11.2 (K160)	165 (74)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	0.58 (23)	Under 1 Sprinkler	1	F
12	Victaulic Sprinkler	2014 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18)	K25.2 (K360)	160 (71)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	1.00 (40)	Under 1 Sprinkler	1	F
13	Victaulic Sprinkler	2014 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18)	K25.2 (K360)	160 (71)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	1.00 (40)	Among 4 Sprinklers	3	P

19.2.3.2.5.1 Sprinklers for Ceiling Heights Over 30 ft (9.1 m)

19.2.3.2.5.1.1 Sidewall sprinklers shall not be permitted for use in Ordinary Hazard Group 1 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.1 The full-scale fire testing applicable to the requirements of this section did not include the use of sidewall sprinklers. As a result, sidewall sprinklers are not currently allowed for the protection of Ordinary Hazard Group 1 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.2 Sprinklers having a nominal K-factor less than K-11.2 (K-160) shall not be permitted for use in Ordinary Hazard Group 2 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.2 The full-scale fire testing applicable to the requirements of this section demonstrated that sprinklers with a K-factor of K-8.0 (K-115) were not effective in providing fire control for a simulated Ordinary Hazard Group 2 occupancy with the ceiling height greater than 30 ft (9.1 m), whereas sprinklers with a minimum K-factor of K-11.2 (K-160) were effective at providing fire control. As a result, sprinklers with a K-factor less than K-11.2 (K-160) are not currently allowed for the protection of Ordinary Hazard Group 2 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.3 Extended-coverage pendent sprinklers having a nominal K-factor of K-22.4 (K-320) or less shall not be permitted for use in Ordinary Hazard Group 2 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

A.19.2.3.2.5.1.3 The full-scale fire testing applicable to the requirements of this section did not include the use of extended-coverage sprinklers with a K-factor of less than K-25.2 (K-360). Testing at FM Global, however has demonstrated that upright extended-coverage sprinklers with a K-factor of K-11.2 (K-160) and K-14.0 (K-200) can be effective for Ordinary Hazard Group 1 and 2 occupancies where the ceiling height is greater than 30 ft (9.1 m), whereas the testing at FM Global did not demonstrate this for the pendent version of these extended-coverage sprinklers. As a result, pendent extended-coverage sprinklers with K-factors of K-22.4 or less are not currently allowed for the protection of Ordinary Hazard Group 2 or greater occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.1.4 Standard-response standard-coverage sprinklers shall not be permitted for use in Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft (12.2 m).

A.19.2.3.2.5.1.4 The full-scale fire testing applicable to the requirements of this section demonstrated that for standard-coverage sprinklers, the use of quick-response sprinklers provided an acceptable level of fire control for simulated Ordinary Hazard Group 2 occupancy hazards. As a result, quick-response standard-coverage sprinklers with K-factors of K-11.2 (K-160) or greater are required for the protection of Ordinary Hazard Group 2 occupancy hazards where the ceiling height exceeds 30 ft (9.1 m).

19.2.3.2.5.2 Sprinkler Designs for Ceiling Heights Over 30 ft (9.1 m)

19.2.3.2.5.2.1* For Ordinary Hazard Group 1 occupancies where the ceiling height is greater than 30 ft (9.1 m) but does not exceed 60 ft (18.3 m), the design areas obtained from Table 19.2.3.1.1 shall be increased by 30 percent.

A.19.2.3.2.5.2.1 The results of Test Nos. 1 and 2 listed in Table C.27 demonstrate that standard-response K-5.6 (K-80) and K-8.0 (K-115) sprinklers can provide fire control for a simulated Ordinary Hazard Group 1 storage array under a 58 ft. (17.7 m) high ceiling using a 0.15 gpm/ft² (6.1 mm/min) density. However, the number of sprinklers that operated resulted in a design area larger than that specified in Table 19.2.3.1.1 coupled with significant sprinkler skipping for both tests. As a result, the design areas in Table 19.2.3.1.1 are being increased, while maintaining the same design density, to account for the test results.

19.2.3.2.5.2.2* For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 30 ft. (9.1 m) but does not exceed 40 ft. (12.2 m), the ceiling sprinkler system shall use a minimum density of 0.37 gpm/ft² (15.1 mm/min) in combination with the design area obtained from Table 19.2.3.1.1.

A.19.2.3.2.5.2.2 The results of Test No. 9 listed in Table C.27 demonstrated that standard-response K-8.0 (K-115) sprinklers can provide fire control for a simulated Ordinary Hazard Group 2 storage array under a 40 ft (12.2 m) high ceiling using a 0.37 gpm/ft² (15.1 mm/min) density. However, with 12 sprinklers operating during this test, it demonstrated that a density of 0.37 gpm/ft² (15.1 mm/min) is more applicable than the density of 0.20 gpm/ft² (8.1 mm/min) that is provided in Table 19.2.3.1.1 and therefore has been given as the design density for this ceiling height. In addition, the results from Test Nos. 6, 7, and 11 listed in Table C.27 suggest that the use of a K-11.2 (K-160) sprinkler will provide better fire control, as suggested by the requirements given in 21.1.4, even though this is not a storage occupancy.

19.2.3.2.5.2.3* For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft. (12.2 m) but does not exceed 60 ft. (18.3 m), the ceiling sprinkler system shall:

(1) Use a minimum density of 0.45 gpm/ft² (18.3 mm/min), and

(2) Increase the design areas obtained from Table 19.2.3.1.1 by 30 percent

(3) The design areas from Table 19.2.3.1.1 shall be permitted, without a 30 percent increase, where an extended-coverage sprinkler having a minimum nominal K-factor of K-25.2 (K-360) is used

A.19.2.3.2.5.2.3 The results of Test Nos. 6 and 7 listed in Table C.27 demonstrated that quick-response K-11.2 (K-160) sprinklers can provide fire control for a simulated Ordinary Hazard Group 2 storage array under a 60 ft (18.3 m) high ceiling using a 0.45 gpm/ft² (18.3 mm/min) density. However, with 13 and 16 sprinklers operating during these two tests, it demonstrated that a density of 0.45 gpm/ft² (18.3 mm/min) is more applicable than the density of 0.20 gpm/ft² (8.1 mm/min) that is provided in Table 19.2.3.1.1 coupled with a design area greater than the 1,500 ft² (140 m²) given in Table 19.2.3.1.1. As a result, the original design density of 0.20 gpm/ft² (8.1 mm/min) has been increased to 0.45 gpm/ft² (18.3 mm/min) and the design area of 1,500 ft² (140 m²) has been increased by 30 percent. The 30 percent increase to the design area, however, was not applied to the K-25.2 (K-360) extended-coverage sprinkler due to the very positive results (only 1 sprinkler operated) obtained with it during Test 8 listed in Table C.27.

19.2.3.2.5.2.4* For Extra Hazard Groups 1 and 2 occupancies where the ceiling height is greater than 30 ft (9.1 m) but does not exceed 60 ft. (18.3 m), the ceiling sprinkler system shall use a minimum density of 0.45 gpm/ft² (18.3 mm/min) in combination with the design areas obtained from Table 19.2.3.1.1.

A.19.2.3.2.5.2.4 The test data listed in Table C.27 does not include any tests representing simulated occupancy hazards for either Extra Hazard Group 1 or Extra Hazard Group 2. However, based on the results from the test data listed in Table C.27, the minimum design density requirements of 0.30 gpm/ft² (12.2 mm/min) for Extra Hazard Group 1, and 0.40 gpm/ft² (16.3 mm/min) for Extra Hazard Group 2 are both now less than the 0.45 gpm/ft² (18.3 mm/min) design density required for Ordinary Hazard Group 2. Therefore, the minimum design density for both Extra Hazard Group 1 and Extra Hazard Group 2 has been increased to 0.45 gpm/ft² (18.3 mm/min), while maintaining the same required design area.

Revise the following existing paragraphs

10.3.2(3) In ordinary hazard occupancies with smooth, flat ceilings <u>not exceeding 30 ft (9.1 m) in height</u>, where specifically listed for such use.

19.2.3.2.6 High-Temperature Sprinklers. <u>For ceilings not exceeding 30 ft. (9.1 m) in height</u> where high-temperature sprinklers are used for extra hazard occupancies, the area of sprinkler operation shall be permitted to be reduced by 25 percent without revising the density, but not to less than 2000 ft² (185 m²).

19.2.3.2.7 <u>For ceilings not exceeding 30 ft. (9.1 m) in height</u> where K-11.2 (160) or larger sprinklers are used with Extra Hazard Group 1 or Extra Hazard Group 2 design curves and 19.2.3.1.1, the design area shall be permitted to be reduced by 25 percent but not below 2000 ft² (185 m²), regardless of temperature rating.

Substantiation:

Historically the ceiling sprinkler system designs indicated in Table 19.2.3.1.1 have applied to buildings of any ceiling height. Full-scale fire tests involving storage occupancies have demonstrated that ceiling heights can impact not only the ceiling sprinkler system designs, but also the allowable ceiling sprinklers to be used. When ceiling heights and clearances between the top of storage and the ceiling increase, so does the fire hazard, thus resulting in the need for increased flow and pressure from the ceiling sprinklers. The increase in fire hazard can also render some types of sprinklers ineffective due to either their limited droplet sizes or their ability to respond to a fire in a timely manner.

Test data obtained from three separate public sources has suggested that this same affect can impact the sprinkler protection used for occupancies that are not considered storage. Test data that was publicly available simulated occupancy hazards applicable to both Ordinary Hazard Group 1 as well as Occupancy Hazard Group 2 with ceiling heights over 30 ft (9.1 m) and up to a maximum ceiling height of 60 ft (18.3 m). The results of these tests suggest that the design densities and design areas indicated in Table 19.2.3.1.1 for Ordinary and Extra Hazard occupancies may not be effective and should be increased for ceiling heights over 30 ft (9.1 m).

Table C.27 Full-Scale Test Data for High Ceiling Clearance over Non-Storage Occupancies

Test No.	Test Sponsored By	Research Report Date and Test Number	Test Commodity	Storage Height ft (m)	Aisle Width Between Main and Target Arrays ft (m)	Occupancy Hazard Classification	Ceiling Height ft (m)	Sprinkler K-Factor	Sprinkler Temperature Rating °F (°C)	Sprinkler RTI Rating	Sprinkler Orientation	Sprinkler Spacing ft (m)	Sprinkler Density gpm/ft² (mm/min)	Ignition Location	No. of Operating Sprinklers	Test Results
1	FM Global	2002 Test 2 and 2007 Test 1	Class II	~ 8 (2.3)	DNA	OH 1	58 (17.7)	K5.6 (K80)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.15 (6)	Under 1 Sprinkler	17	P
2	FM Global	2002 Test 1 and 2007 Test 2	Class II	~ 8 (2.3)	DNA	OH 1	58 (17.7)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	15	P
3	FM Global	2007 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	OH 2	60 (18.3)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	20	F
4	FM Global	2007 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	DNA	OH 2	60 (18.3)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Under 1 Sprinkler	19	F
5	FM Global	2002 Test 3 and 2007 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	58 (17.7)	K8.0 (K115)	165 (74)	Standard-Response	Upright	10 x 10 (3.0 x 3.0)	0.30 (12)	Under 1 Sprinkler	26	F
6	FM Global	2002 Test 4 and 2007 Test 6	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K11.2 (K160)	155 (68)	Quick-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Under 1 Sprinkler	16	P
7	FM Global	2007 Test 7	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K11.2 (K160)	155 (68)	Quick-Response	Upright	10 x 10 (3.0 x 3.0)	0.45 (18)	Among 4 Sprinklers	13	P
8	FM Global	2002 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18.3)	K25.2EC (K360EC)	165 (74)	Quick-Response	Upright	20 x 20 (6.1 x 6.1)	0.45 (18)	Under 1 Sprinkler	1	P
9	Victaulic Sprinkler	2014 Test 1	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	40 (12)	K8.0 (K115)	155 (68)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	0.37 (15)	Under 1 Sprinkler	12	F
10	Victaulic Sprinkler	2014 Test 2	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	52 (16)	K8.0 (K115)	155 (68)	Quick-Response	Pendent	10 x 10 (3.0 x 3.0)	0.50 (20)	Under 1 Sprinkler	3	F
11	Victaulic Sprinkler	2014 Test 3	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	52 (16)	K11.2 (K160)	165 (74)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	0.58 (23)	Under 1 Sprinkler	1	F
12	Victaulic Sprinkler	2014 Test 4	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18)	K25.2 (K360)	160 (71)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	1.00 (40)	Under 1 Sprinkler	1	F
13	Victaulic Sprinkler	2014 Test 5	Cartoned Nonexpanded Group A Plastics	~ 6 (1.7)	5 (1.5)	OH 2	60 (18)	K25.2 (K360)	160 (71)	Standard-Response	Pendent	10 x 10 (3.0 x 3.0)	1.00 (40)	Among 4 Sprinklers	3	P