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Cold Storage – Active Fire Protection Solutions

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Topics

- Cold Storage Market
- Sprinkler Standards
- Active Fire Protection Solutions



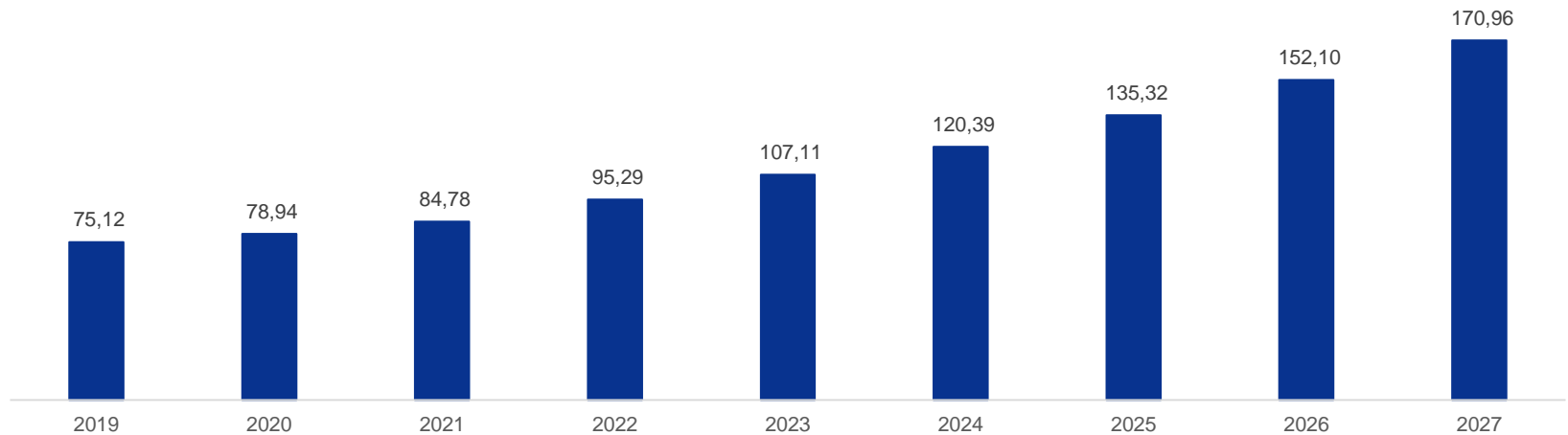
Cold Storage Market

Market size, cold storage and risk



Cold Storage Market Europe

Size of the cold chain logistics market in Europe from 2019 to 2027 (in USD B)



- The Europe Cold Storage Market is expected to witness market growth of 12.4% CAGR during 2021-2027
- Germany market to continue to dominate the European Cold Storage Market achieving a market value of \$17.7 USD B by 2027
- The UK market is poised to grow at a CAGR of 11.6% during 2021 - 2027
- Additionally, France market is expected to showcase a CAGR of 13.3% during the same period

Source: Research And Market reports, Statista, News articles

Cold Storage Products

- Food – fruit and vegetables, meat and seafood and dairy
- Botanicals - flowers and plants
- Bio-pharmaceuticals - medicines and vaccines
- Books and artwork - documents and paintings
- Cosmetics - lipstick and cologne
- Chemicals - reagents and disinfectants
- Organic textiles



Cold Storage Industry

- Restaurants and food outlets
- Supermarkets
- Food service firms
- Importers and exporters
- Frozen food producers
- Agricultural producers
- Pharmaceuticals and healthcare institutions



Types of Cold Storage



Refrigerated cold storage
0 to 10 °C



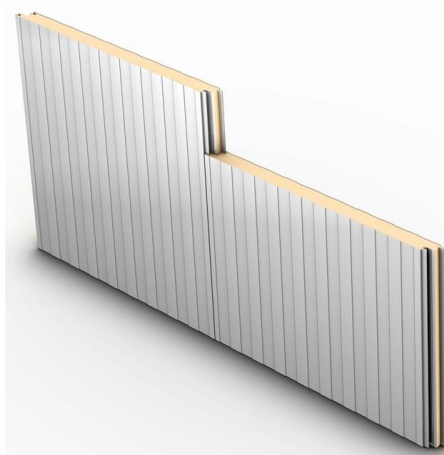
Frozen cold storage
- 30 to 0 °C

Preserving the integrity and shelf life of products

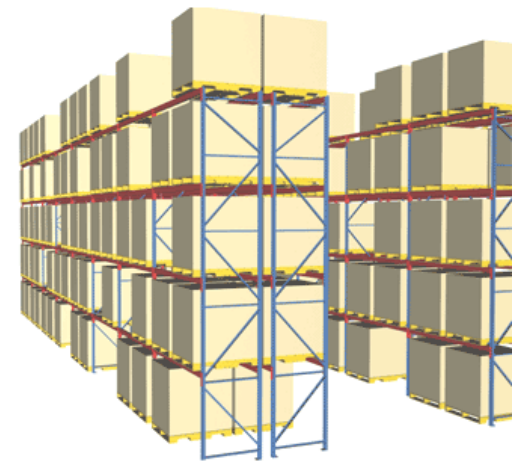
Fire Hazards/ Concerns within Cold Storage Facility



Stored package



Insulated panels



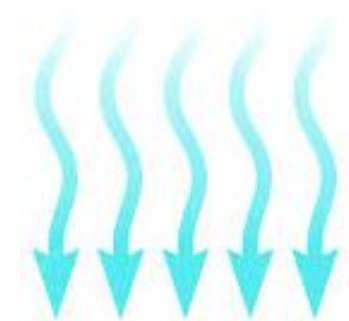
Storage configuration



Equipment



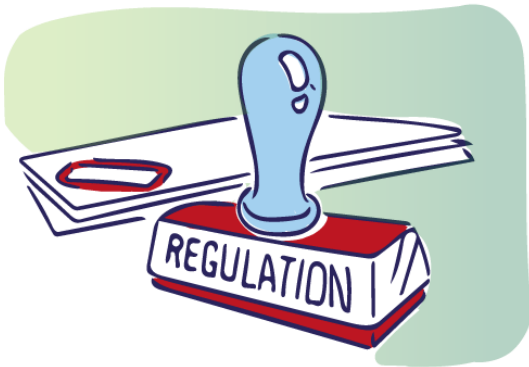
Picking



Dry air

Sprinkler Standards

NFPA13 and NFPA25




Questions to answer

- Active fire protection required/ desired?
- Commodity classification?
- Building height?
- Storage height?
- Storage configuration?
- Type of active fire protection?
- Standard?



NFPA13 Commodity Classification



Class or Group	Class or Group Material
Class I	Essentially non-combustible products in corrugated cartons on combustible pallets
Class II	Class I products in slatted wooden crates, solid wooden boxes or multiple thickness paperboard cartons with or without pallets
Class III	Wood, paper, natural fiber cloth or Group C plastics with or without pallets. May contain a limited amount (till 5% by weight of unexpanded plastic or till 5% by volume of expanded plastics) of Group A or Group B plastics
Class IV	Class I, II or III commodities in corrugated cartons with appreciable amounts (5-15% by weight, or 5-25% by volume) of Group A plastics or when exposed, a limited amount (5 - 15% by weight) of unexpanded Group A plastics.
Plastics	Cartoned Unexpanded Group A Plastic
	Cartoned Expanded Group A Plastic
	Exposed Unexpanded Group A Plastic
	Exposed Expanded Group A Plastic

NFPA13 Commodity Classification



Class 1



Class 2



Class 3



Class 4



Cartoned Unexpanded



Cartoned Expanded



Exposed Unexpanded



Exposed Expanded

NFPA13 (2022 edition)

16.4 Protection of Piping.

16.4.1 Protection of Piping Against Freezing.

16.4.1.1* Where any portion of a system is subject to freezing and the temperatures cannot be reliably maintained at or above 40°F (4°C), the system shall be installed as a dry pipe or preaction system.

16.4.1.1.2 The requirements of 16.4.1.1 shall not apply where alternate methods of freeze prevention are provided in accordance with one of the methods described in 16.4.1.2 through 16.4.1.4.2.

16.4.1.2 Unheated areas shall be permitted to be protected by antifreeze systems or by other systems specifically listed for the purpose.

16.4.1.4 Listed heat-tracing systems shall be permitted in accordance with 16.4.1.4.1 and 16.4.1.4.2.



NFPA13 (2022 edition)

8.6.2* Antifreeze Solutions.

8.6.2.1* Except as permitted in 8.6.2.2, antifreeze solutions shall be listed for use in sprinkler systems.

3.2.3* Listed.

Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

4.7 Air, Nitrogen, or Other Approved Gas.

Where air is used to charge, maintain, or supervise sprinkler systems, nitrogen or other approved gas shall also be permitted to be used.

NFPA13 (2022 edition)

8.2.6.9* Nitrogen Supply for Increased C Value.

8.2.6.9.1 Where nitrogen is used to allow for increased C value in accordance with Table 28.2.4.8.1, the nitrogen supply shall be in accordance with 8.2.6.9.2 through 8.2.6.9.6.

8.2.6.9.2 Nitrogen shall be from a listed nitrogen generator permanently installed.

8.2.6.9.3 The generator shall be capable of supplying and maintaining at least 98 percent nitrogen concentration throughout the system at a minimum leakage rate of 1.5 psi (0.1 bar) per hour.

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

NFPA25 (2023 edition)

13.4.3.2.2

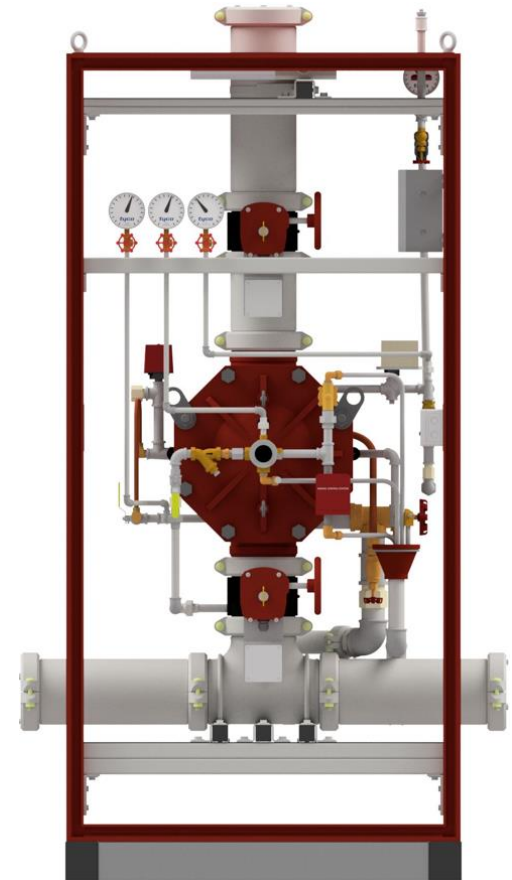
Except for preaction systems covered by 13.4.3.2.5, every 3 years the preaction valve shall be trip tested with the control valve fully open.

13.4.3.2.5

Precision valves protecting freezers shall be trip tested in a manner that does not introduce moisture into the piping in the freezer.

3.5.1* Control Valve.

A valve controlling flow to water-based fire protection systems.



Active Fire Protection Solutions

Sprinkler Solutions NFPA13



Cold Storage Warehouse Construction



Box in Box

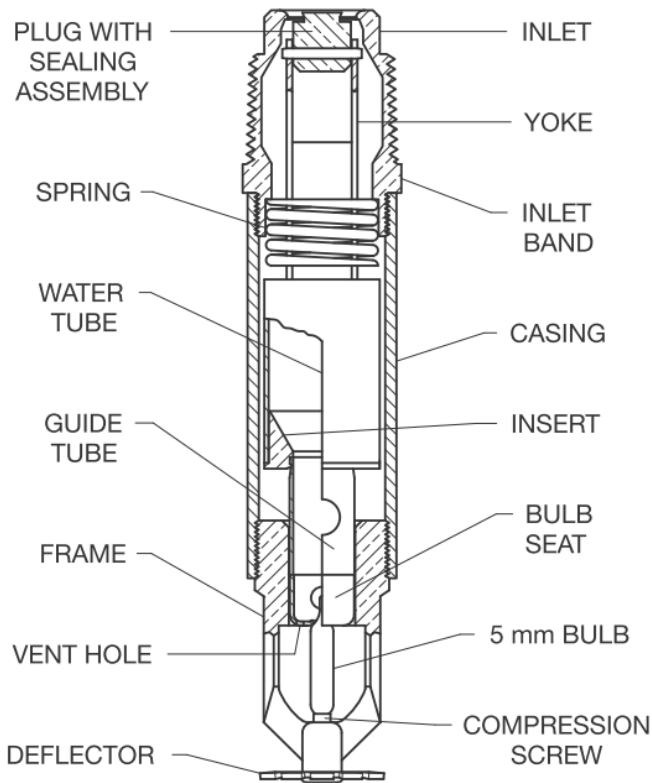


Stand Alone

Box in Box >> Dry Sprinklers >> NFPA13

3.3.215.4.4* Dry Sprinkler.

A sprinkler secured in an extension nipple that has a seal at the inlet end to prevent water from entering the nipple until the sprinkler operates.



Box in Box >> Dry Sprinklers >> NFPA13

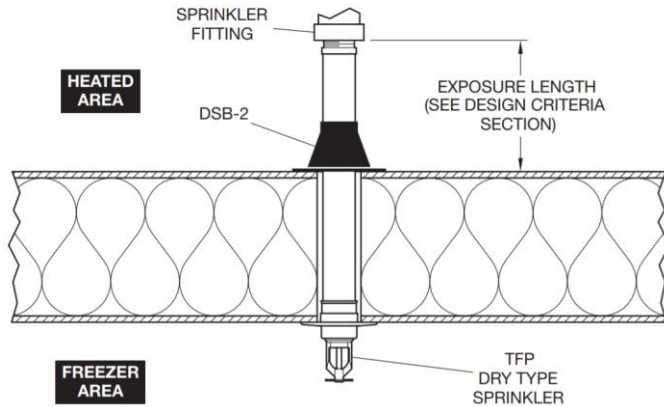


Table 15.3.1(b) Exposed Barrel Lengths for Dry Sprinklers (Metric Units)

Ambient Temperature Exposed to Discharge End of Sprinkler (°C)	Minimum Exposed Barrel Length when Exposed to 4°C (mm)	Minimum Exposed Barrel Length when Exposed to 10°C (mm)	Minimum Exposed Barrel Length when Exposed to 16°C (mm)
4	0	0	0
-1	0	0	0
-7	100	0	0
-12	200	25	0
-18	300	75	0
-23	350	100	25
-29	350	150	75
-34	400	200	100
-40	450	200	100
-46	500	250	150
-51	500	250	150

Box in Box >> Dry Sprinklers >> NFPA13

Dry pendent sprinklers for cold storage protection are available with the following k-factors: K80, K115, K160, K200, K240 and K360

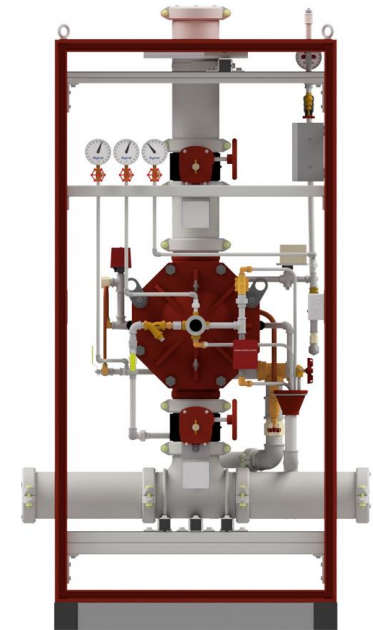
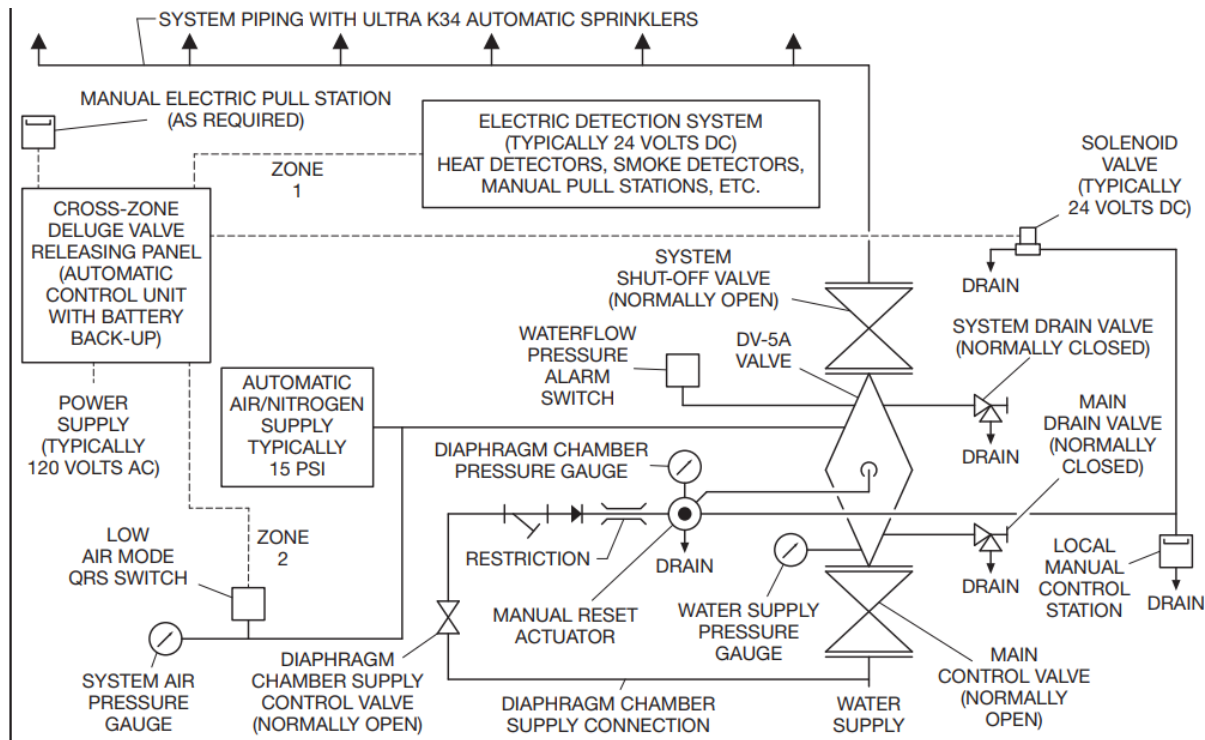


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Table 23.3.1 ESFR Sprinkler Ceiling-Only Options for Solid Pile; Palletized; and Single-, Double-, and Multiple-Row Rack Storage

ESFR Sprinklers – Pendent Orientation Minimum Operating Pressure psi (bar)						
Commodity ^a	Maximum Ceiling/Roof Height		Nominal K-Factors			
	ft	m	14 (200)	16.8 (240)	22.4 (320)	25.2 (360)
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)
	30	9.1	50 (3.4)	35 (2.4)	25 (1.7)	15 (1.0)
	35	10.7	75 (5.2)	52 (3.6)	35 (2.4)	20 (1.4)
	40	12.2	—	52 (3.6)	—	25 (1.7)
	45	13.7	—	—	40 (2.8)	40 (2.8)

Stand Alone >> Dry System >> NFPA13



	Detection		Sprinkler
NI	X	OR	X
SI	X		
DI	X	AND	X

NFPA13 2022 Definition Preaction Sprinkler System

- 3.3.216.9* Preaction Sprinkler System. A sprinkler system employing automatic sprinklers that are attached to a piping system that contains air that might or might not be under pressure, with a supplemental detection system installed in the same areas as the sprinklers.
- 8.3.2.1 Preaction systems shall be one of the following types:
 - (1) A single interlock system, which admits water to sprinkler piping upon operation of detection devices
 - (2) A non-interlock system, which admits water to sprinkler piping upon operation of detection devices or automatic sprinklers
 - (3) A double interlock system, which admits water to sprinkler piping upon operation of both detection devices and automatic sprinklers



Stand Alone >> Dry System >> NFPA13

- System type: Dry
- Commodity class: III
- Storage arrangement: Open rack storage
- Chapter 21 - Protection of High Piled Storage Using Control Mode Density Area (CMDA) Sprinklers
- Chapter 22 - CMSA Requirements for Storage Applications
- Chapter 23 - ESFR Requirements for Storage Applications

Ceiling-only Sprinkler Protection		
Sprinkler category	Maximum ceiling height	Maximum storage height
CMDA	13,7 meters	7,6 meters
CMSA	9,1 meters	6,1 meters
ESFR	Not allowed	Not allowed

- 14.2.2 ESFR sprinklers shall be used only in wet pipe systems unless specifically listed for use in dry systems or pre-action systems.

Stand Alone >> Dry System >> NFPA13



- System type: Dry
- Commodity class: III
- Storage arrangement: Open rack storage
- Chapter 24 - Alternative Sprinkler System Designs for Chapters 20 Through 25

Pin Header

Table 24.3.3 Standard Response Upright Sprinkler Design Criteria for Open Rack Storage of Class I Through Class III Commodities (Using High-Temperature-Rated Sprinklers)

Storage Arrangement	Commodity Class	Maximum Storage Height		Maximum Ceiling/Roof Height		K-Factor
		ft	m	ft	m	
Rack storage without solid shelves (no open-top containers)	Class I, Class II, or Class III	35	10.7	40	12.2	25.2 (360)
		40	12.2	45	13.7	25.2 (360)
		45	13.7	50	15.2	33.6 (480)
		50	15.2	55	16.7	33.6 (480)

*25-second water delivery time maximum.

†20-second water delivery time maximum.

- Activation temperature glass bulb sprinkler: 141 C

Stand Alone >> Dry System >> NFPA13

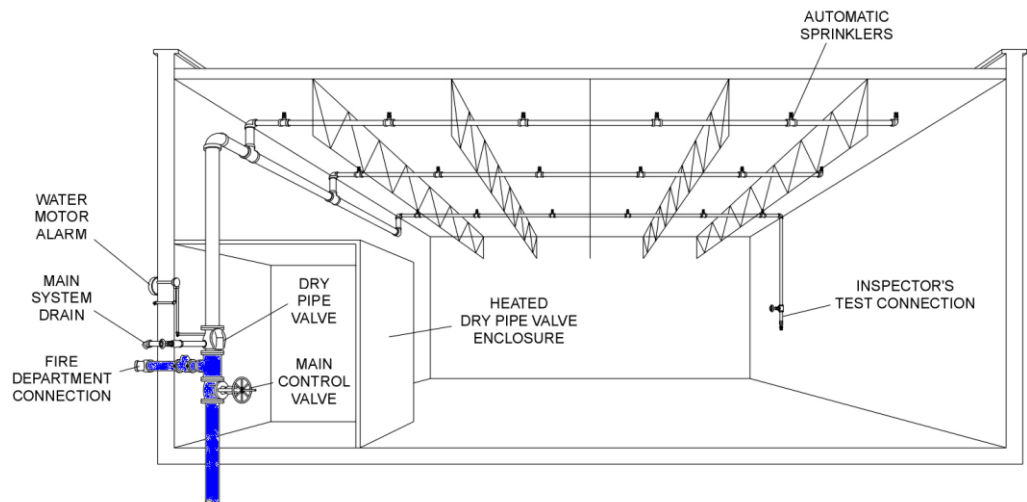
8.2.3* Size of Systems.

8.2.3.2 System size shall be such that initial water is discharged from the system test connection in not more than 60 seconds, starting at the normal air pressure on the system and at the time of fully opened inspection test connection.

8.2.3.6.2 The calculation program and method shall be listed by a nationally recognized testing laboratory.

Software SprinkFDT

- Predict the water delivery time in engineering phase
- UL listed
- Dry and pre-action systems



Stand Alone >> Dry System >> PBD >> NFPA13

- *1.5 Equivalency.*
- *Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.*

Tyco Quell system in combination with Ultra K17 sprinkler

- Double Interlock Preaction or dry system for the protection of:
- Commodity Class II & Class III:
 - Building height: 14,6
 - Storage height: 12,2
- Commodity Class cartoned unexpanded plastics:
 - Building height: 10,7
 - Storage height: 9,1



Stand Alone >> Dry System >> NFPA13

Recommend the use of nitrogen:

- Extend the lifetime of the system
- Feed the system with dry air
- Increased C value for friction loss





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