



Plan Review Flushing and Hydrostatic testing Pump acceptance



Plan Review Requirements

Overview FM Plan Review

1.Valued Service

- Help greenlight project plans
- Make sure exposures are minimized in the project phase

2.Opportunity for solutions

- Experts check the plans for relevant risk factors
- Formulate recommendations and discuss solutions early

3.Centralized Department

- planreview1@fm.com (will disappear)
- PlanReviewSupport@fm.com

4.Lead Time: 14 days

5.Prevent Delays:

- Clear and complete documents, all necessary info in a single submittal
- In case there is missing info, the review is put on hold and back in the queue
- Don't forget name, address and index number

Submission of Initial Plans

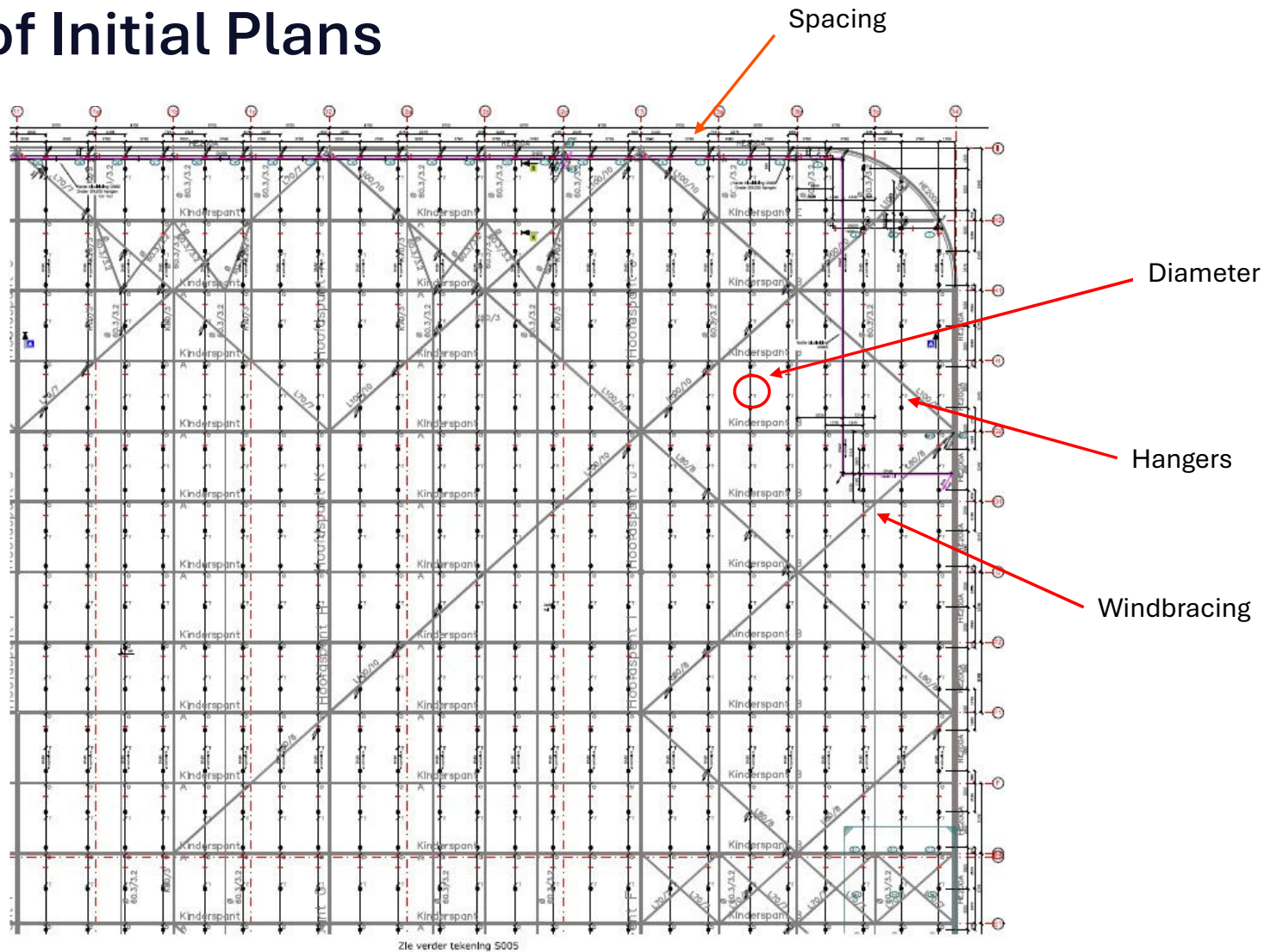
Sprinkler installation



[INTERNAL]

Submission of Initial Plans

Sprinkler installation Plan

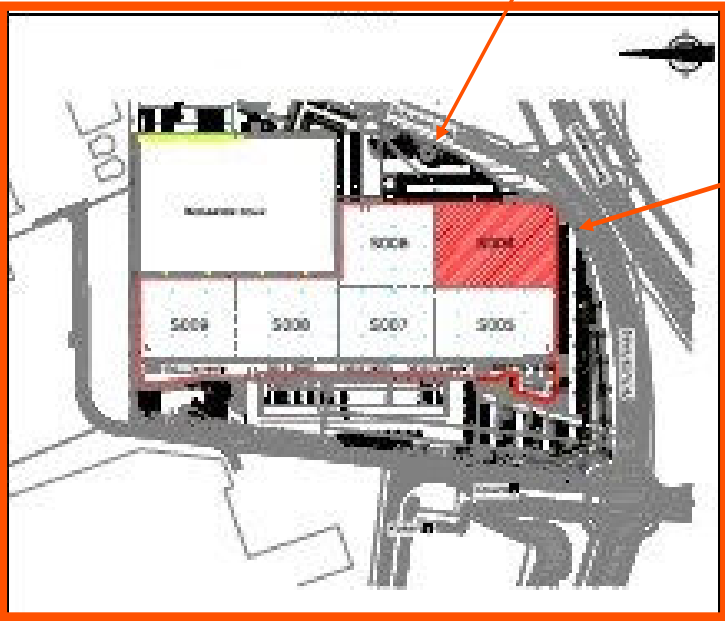


Submission of Initial Plans

Sprinkler installation
Key plan and title block

Water supply location

Name of the protected area



UNDERLEGGERS									
Symbol	Designation	Room	Design	Designation	Room	Design	Designation	Room	Design
1	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY
2	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY
3	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY
4	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY
5	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY
6	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY
7	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY
8	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY
9	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY
10	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY	5004	WATER SUPPLY

Client

AG-BUILT

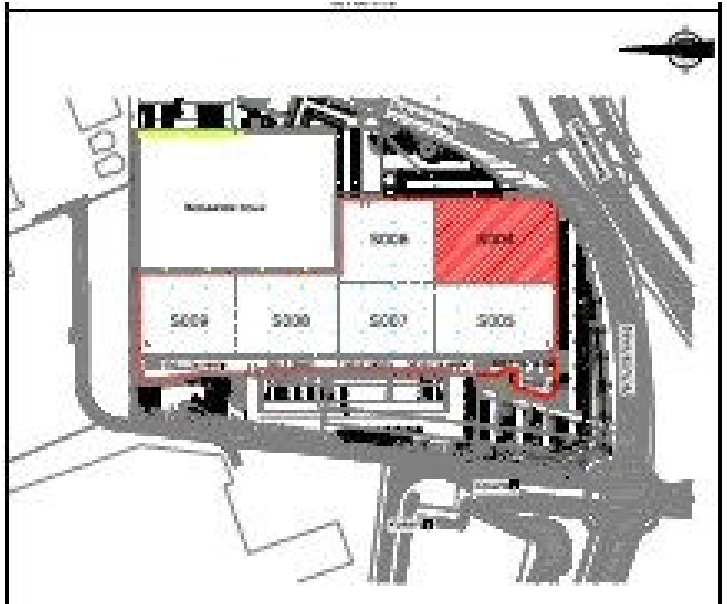
Sprinkler comp.

5004

00787

Submission of Initial Plans

- Sprinkler installation
- Key plan
- Title block



SPRINKLER COMP.					
Room	Description	Area	Volume	Height	Notes
S004	Living room	12.5	3.5	2.5	
S005	Bedroom	10.0	3.0	2.5	
S006	Bedroom	10.0	3.0	2.5	
S007	Bedroom	10.0	3.0	2.5	
S008	Bedroom	10.0	3.0	2.5	

Client		Project	
Name	Address	Name	Address
Client	Address	Project	Address

Drawing		Revision	
Number	Description	Number	Description
0001	Initial	0001	Initial

Sprinkler comp.	
Room	Description
S004	Living room

Design & product info

Name
Location and adress

Drawing number and revision

Submission of Initial Plans

Sprinkler installation

Key plan

Title block

Hydraulic design

Type of protection

Pipe material criteria

Design references

Symbol, type, K-factor...

SIN-number

ONTWERPGEGEVENS										
Installatie volgens de ☐ NEN-EN 12845 ☒ FM ☐ NFPA ☐ LPC ☐ VdS ☐ -voorschriften										
Uitgangspuntendocument nr.: bijlage 3A_01.15 UPD SPR_10-10-2023 Nota van aanvullingen nr.:										
Inspectieplan nr.:										
Ontwerp ☐ volgens tabellen: ☒ hydraulisch berekend:										
Gebouw/sectie	Gevarenklasse	Minimum sproeidichtheid	Maximum sproeivlak		Minimum sproeitijd	Type installatie				
		mm/min	m²	m²	min					
		mm/min	m²	m²	min					
		mm/min	m²	m²	min					
Gebouw/sectie	Gevarenklasse	Minimum voordruk op de sprinklers	Maximum sproeivlak		Minimum sproeitijd	Type installatie				
			Aantal sprinklers	Per sprinkler						
Warehouse	FM 8,9	4,1 bar	12	9 m²	60 min	Niet				
		bar		m²	min					
		bar		m²	min					
SPRINKLERS										
Symbol	Type	Temp.	Doortlaat	K-factor	Response	Uitvoering	Fabriekaat	Model	SIN	Aantal
☉	ESFR Pendent	74 °C	25	360	Quick	Brass	Viking	ESFR-K25	VK510	456
		°C								
		°C								
		°C								
		°C								
		°C								
		°C								
		°C								
LEIDINGEN										
Draadtype DIN 2440 - NEN-EN 10241 M (C-Factor: 120)				OPPERVLAKTE BEHANDELING LEIDINGEN						
	Buitendiameter	Wanddikte	Gewicht ind. water per meter	☐ Gestraald gemenied (fabr. matig) ☐ Thermisch verzinkt (fabr. matig) ☒ Poedercoating RAL 3000 ☐ Conform specificatie nr.:						
DN25 (1")	33,7 mm	3,25 mm	3,2 kg							
Vlamtype DIN 2458 - NEN-EN 10220 (C-Factor: 120)				BEUGELING						
	Buitendiameter		Gewicht ind. water per meter	Max. onderlinge afstand van de ophangbeugel voor leidingen ≤ .. 4 m. ¹						
				Max. onderlinge afstand van de ophangbeugel voor leidingen > .. 6 m. ²						
DN32 (1¼")	42,4 mm	2,6 mm	3,6 kg	Oppervlakte behandeling beugeling:						
DN40 (1½")	48,3 mm	2,6 mm	4,4 kg	☒ Electrolytisch verzinkt ☐ Thermisch verzinkt ☐ Conform specificatie nr.:						
DN50 (2")	60,3 mm	2,6 mm	6,5 kg	LEIDINGVERBINDINGEN						
DN65 (2½")	76,1 mm	2,6 mm	8,7 kg	Diameter	Soort verbinding	Fabriekaat	Model	Opp. beh.		
DN80 (3")	88,9 mm	2,9 mm	11,6 kg	≤ DN50	Draadverbinding	GF	-	Verzinkt		
DN100 (4")	114,3 mm	3,2 mm	17,9 kg	> DN50	Groefverbinding	Victaulic	Style 009	Rood		
DN125 (5")	139,7 mm	3,6 mm	25,9 kg	Voor het bepalen van de puntbelasting per ophangpunt, dient de constructie geschikt te zijn voor het genoemde gewicht in bovenstaande tabel, vermenigvuldigd met de beugelafstand en vermeerderd met een incidentele belasting van 1,15 kN per ophangpunt (conform NEN-EN 12845-voorschrift).						
DN150 (6")	168,3 mm	4,0 mm	36,6 kg							
DN200 (8")	219,1 mm	4,5 mm	58,8 kg							
DN250 (10")	273,0 mm	5,0 mm	88,1 kg							
DN300 (12")	323,9 mm	5,6 mm	121,8 kg							

Submission of Initial Plans

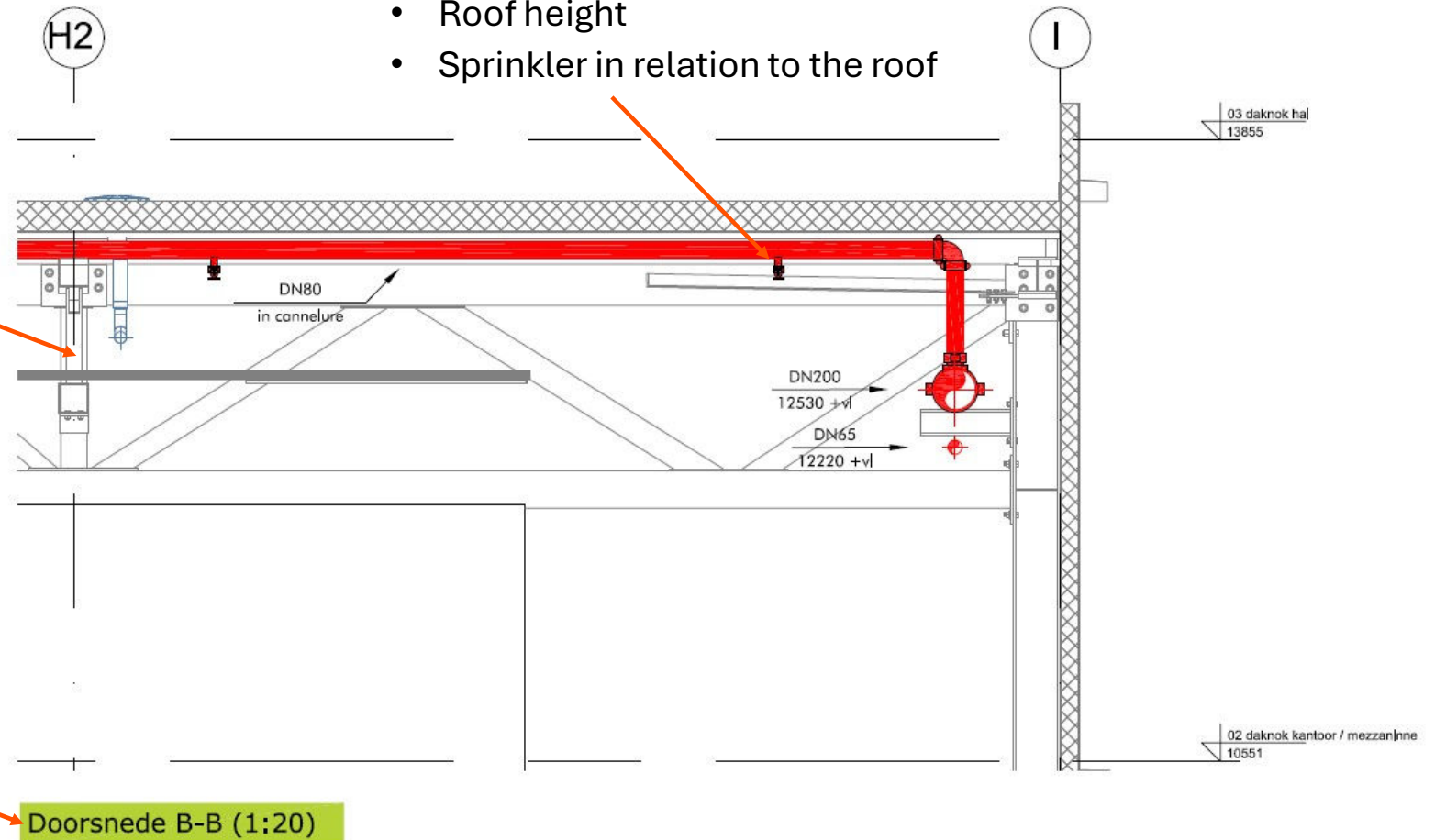
Sprinkler installation

Sections

Sprinkler relevant info:

- Roof height
- Sprinkler in relation to the roof

Obstructions

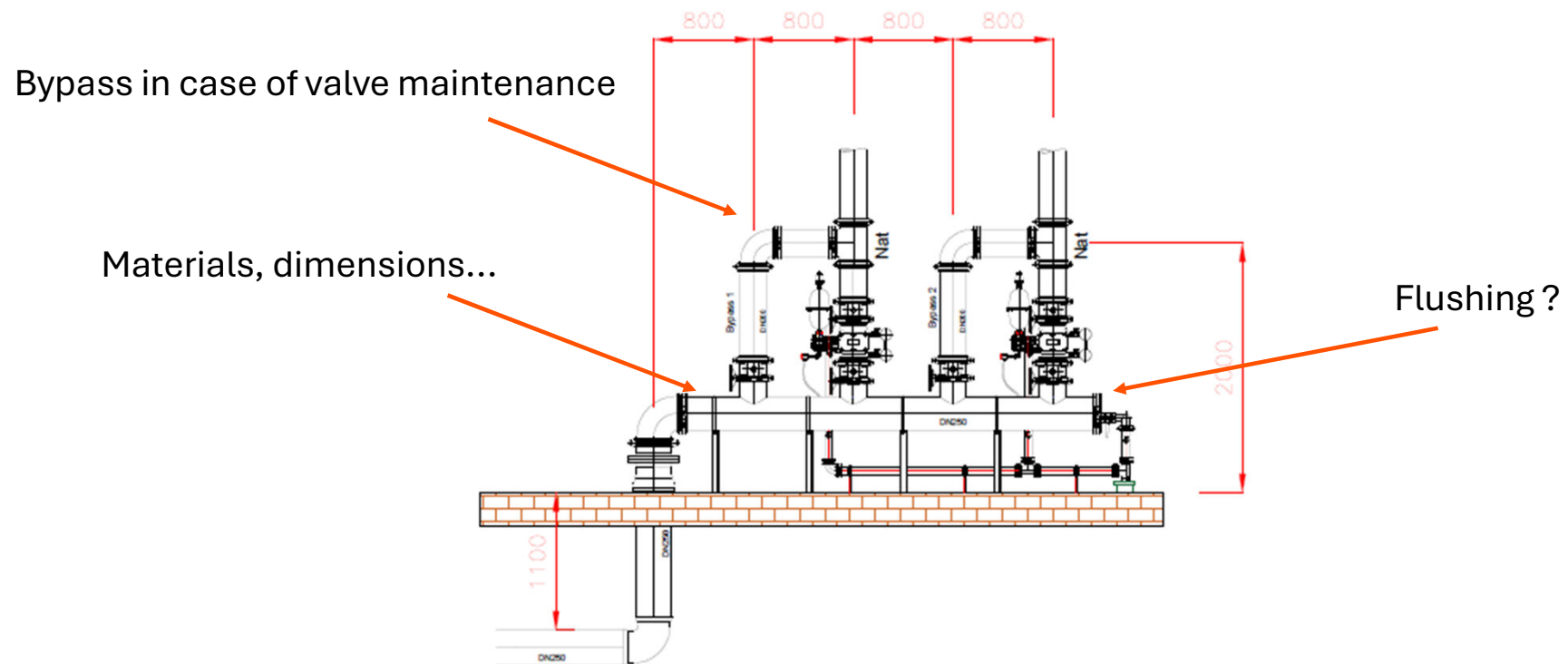


[INTERNAL]

Submission of Initial Plans

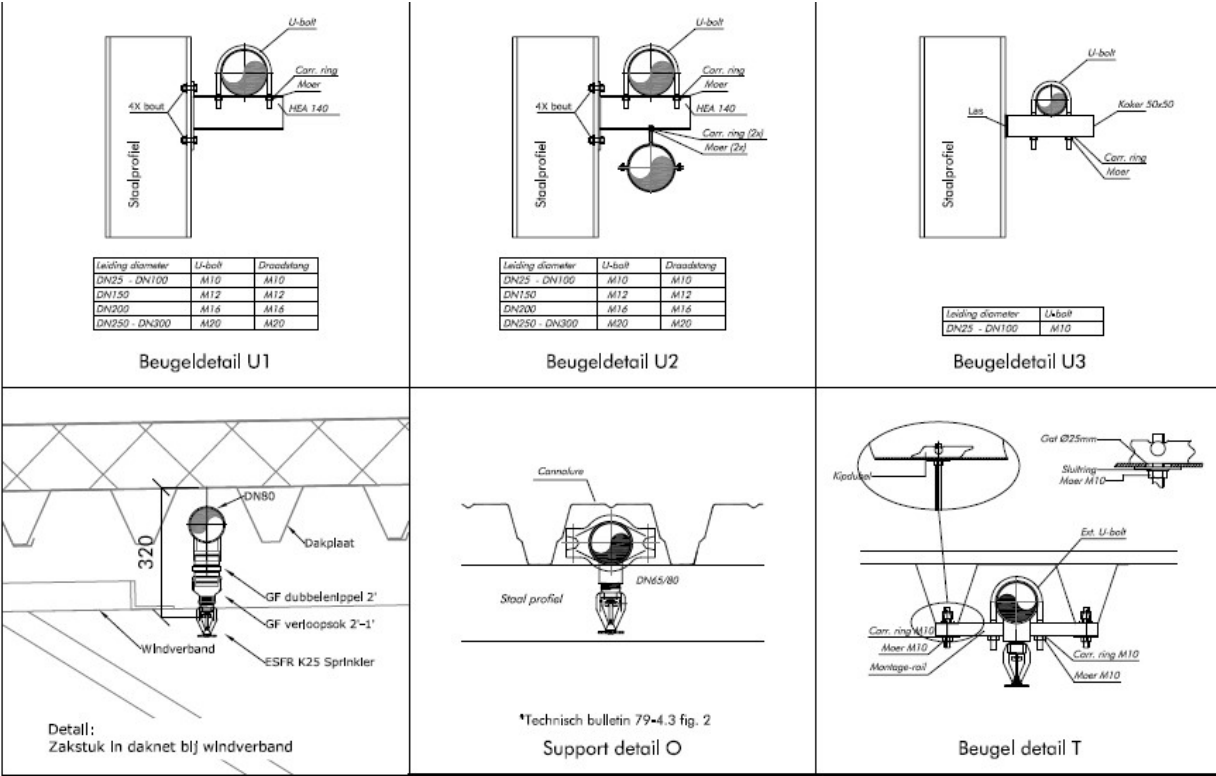
Sprinkler installation

Details (manifold)



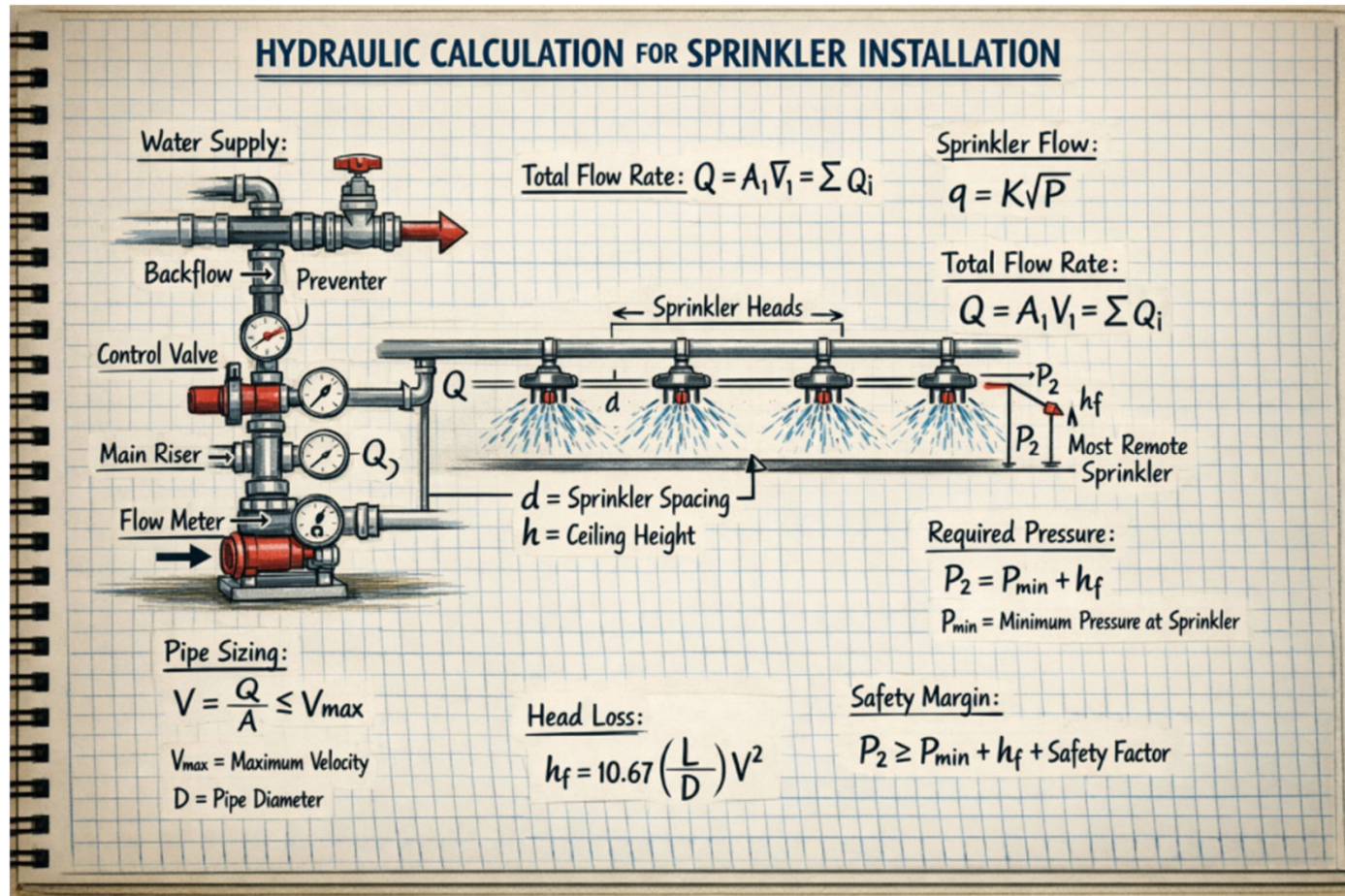
Submission of Initial Plans

Sprinkler installation Details (hangers)



Submission of Initial Plans

Hydraulic calculation



Submission of Initial Plans

Hydraulic calculation

Overview



Hydraulic Overview

Job									
Job Number					Designer				
Job Name					Phone			FAX	
Address 1					State Certification/License Number				
Address 2					AHJ				
Address 3					Job Site/Building				
System									
Density 4.00L/min/m ²					Area of Application 140.00m ² (Actual 140.75m ²)				
Most Demanding Sprinkler Data 80.6 K-Factor 56.02 at 0.483					Hose Streams 950.00				
Coverage Per Sprinkler 12.80m ²					Number Of Sprinklers Calculated 24			Number Of Nozzles Calculated 0	
System Pressure Demand 8.561					System Flow Demand 2694.52				
Total Demand 2694.52 @ 8.561					Pressure Result +2.344 (21.5%)				
Supplies						Check Point Gauges			
Node	Name	Flow(L/min)	Hose Flow(L/min)	Static(bar)	Residual(bar)	Identifier	Pressure(bar)	K-Factor(K bar)	Flow(L/min)
33	Pump	5683.00		11.000	9.000				
34	Pump	5800.00		11.400	9.000				
35	Pump	5800.00		11.800	9.400				

Submission of Initial Plans

Hydraulic calculation

Nodes

NODE ANALYSIS DATA					
NODE TAG	ELEVATION (M)	NODE TYPE	PRESSURE (BAR)	DISCHARGE (L/MIN)	
D10	13.00	- - - -	4.741	- - -	
D11	13.00	- - - -	4.855	- - -	
D12	13.00	- - - -	4.973	- - -	
D13	13.00	- - - -	5.083	- - -	
D14	13.00	- - - -	5.201	- - -	
D15	13.00	- - - -	5.314	- - -	
D16	13.00	- - - -	5.431	- - -	
D17	13.00	- - - -	5.539	- - -	
D18	13.00	- - - -	5.651	- - -	
D19	13.00	- - - -	5.752	- - -	
D20	13.00	- - - -	5.847	- - -	
D21	13.00	- - - -	5.923	- - -	
D22	13.00	- - - -	5.989	- - -	
D23	13.00	- - - -	6.034	- - -	
D24	13.00	- - - -	6.067	- - -	
S1	13.00	K=320.00	3.280	579.5	
S2	12.90	K=320.00	2.876	542.7	
S3	12.90	K=320.00	2.875	542.6	
S4	13.00	K=320.00	3.276	579.2	
S5	13.00	K=320.00	3.216	573.8	
S6	12.90	K=320.00	2.819	537.3	
S7	12.90	K=320.00	2.817	537.1	
S8	13.00	K=320.00	3.210	573.4	
S9	12.90	K=320.00	2.811	536.5	
S10	13.00	K=320.00	3.166	569.4	
S11	13.00	K=320.00	3.165	569.3	
S12	12.90	K=320.00	2.800	535.5	
T2	13.00	- - - -	3.278	- - -	
T3	13.00	- - - -	3.277	- - -	
T6	13.00	- - - -	3.214	- - -	
T7	13.00	- - - -	3.212	- - -	
T9	13.00	- - - -	3.205	- - -	
T12	13.00	- - - -	3.192	- - -	
POMP	0.60	SOURCE	8.728	7626.5	

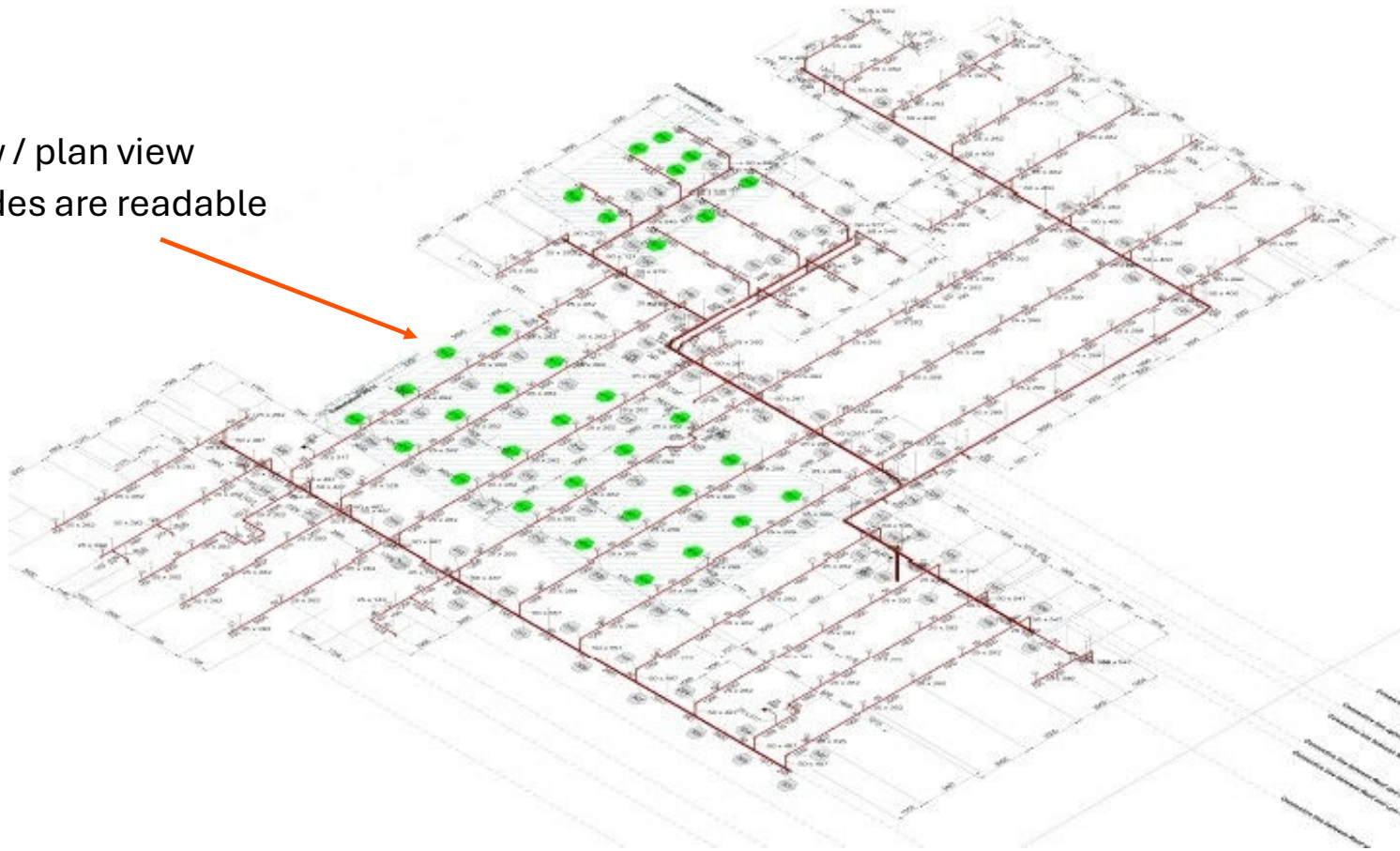
Submission of Initial Plans

Hydraulic calculation

Nodes

Isometric view / plan view

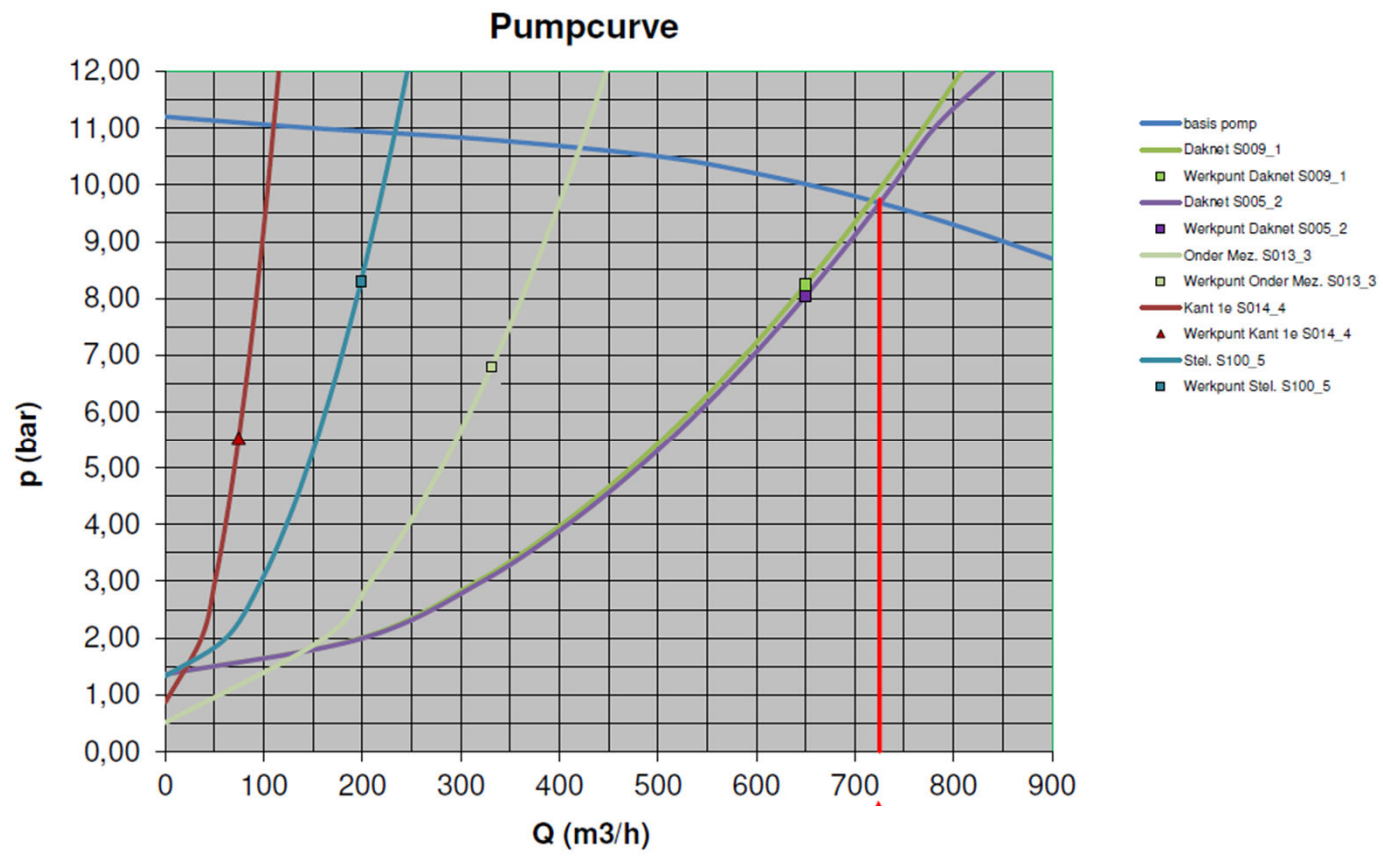
Make sure nodes are readable





Submission of Initial Plans

Hydraulic calculation



Submission of Initial Plans

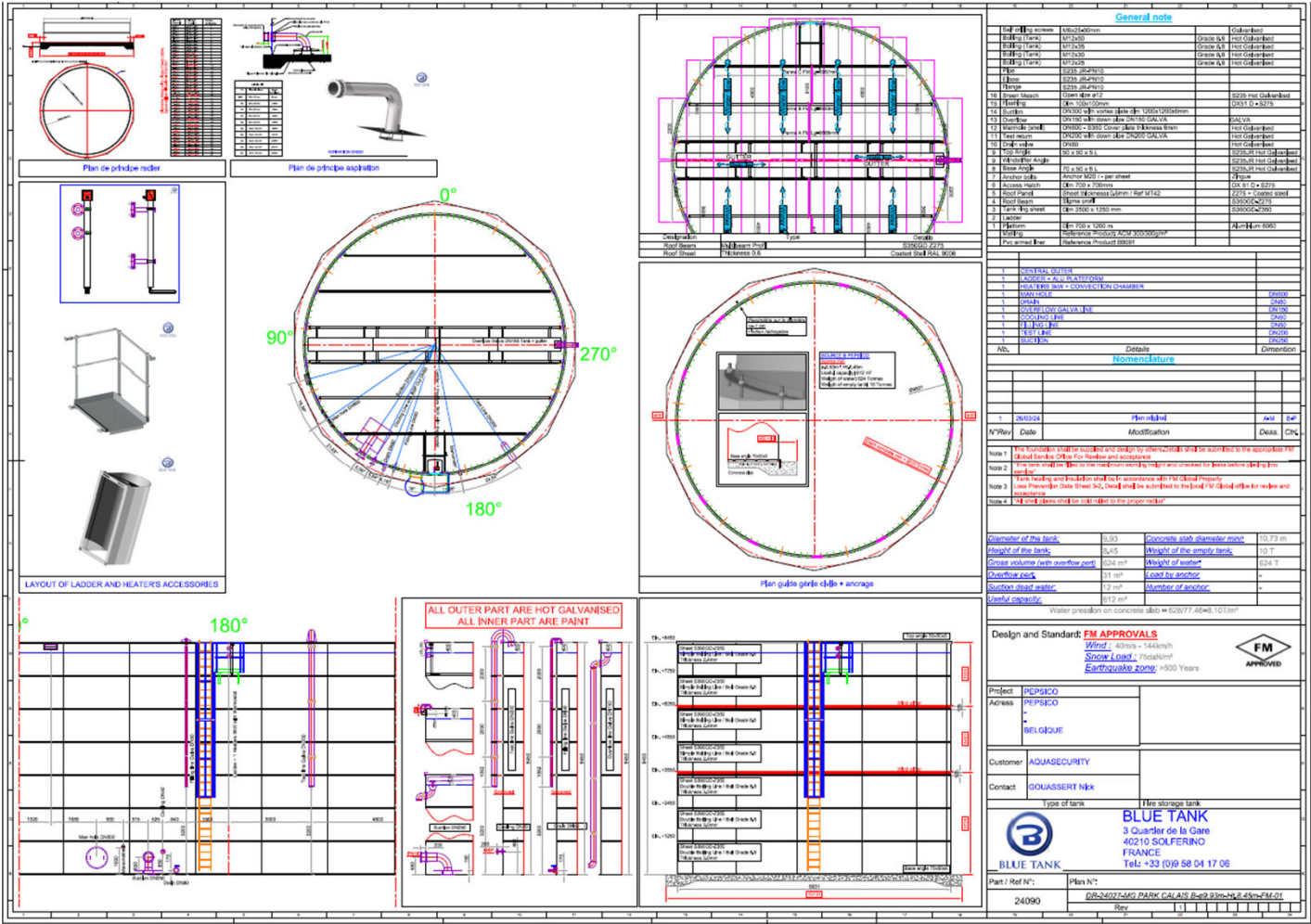
Water supply

Plans (good example)



Submission of Initial Plans

Water supply (good example)
Plans (good example)



[INTERNAL]

Submission of Initial Plans

Underground main

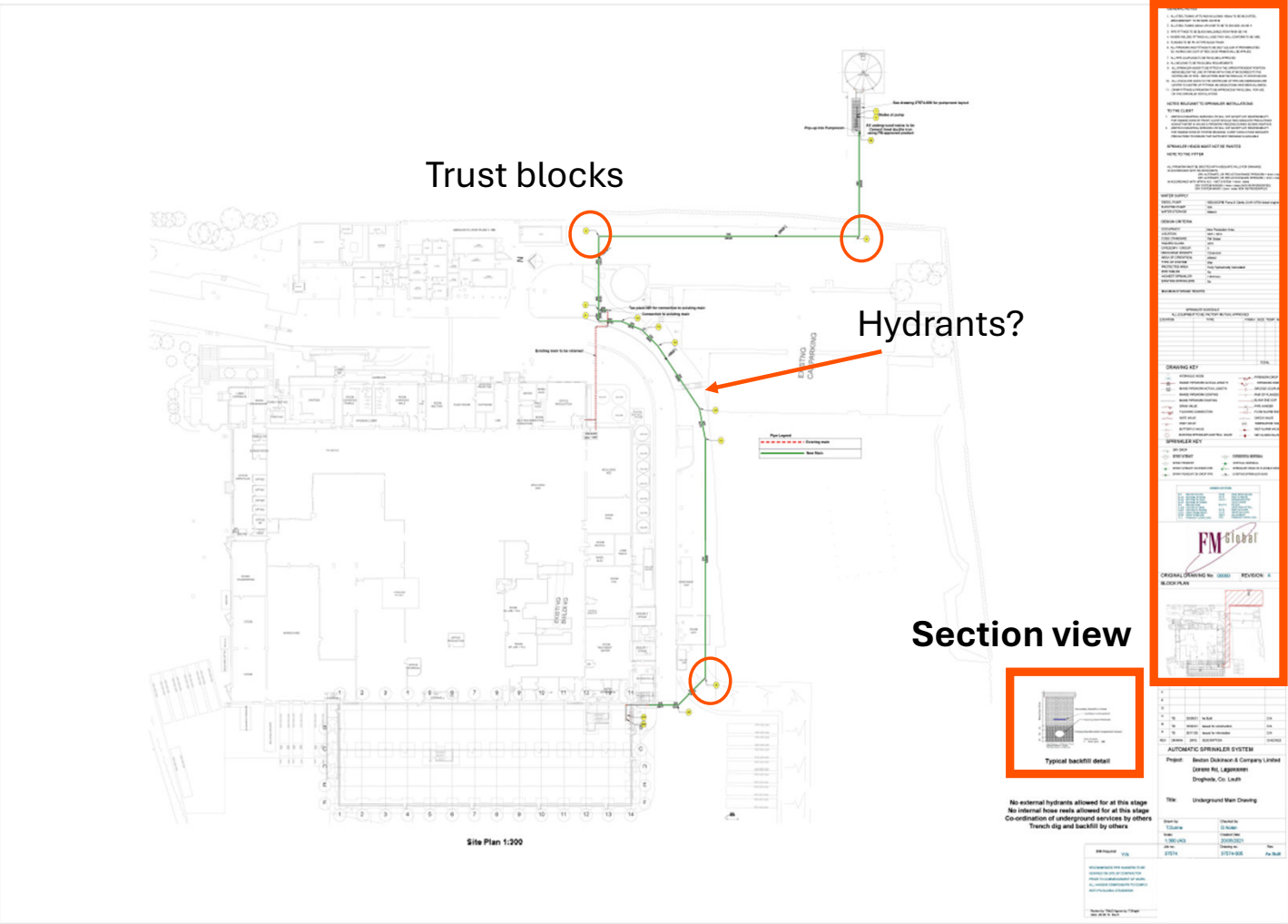


[INTERNAL]

Submission of Initial Plans

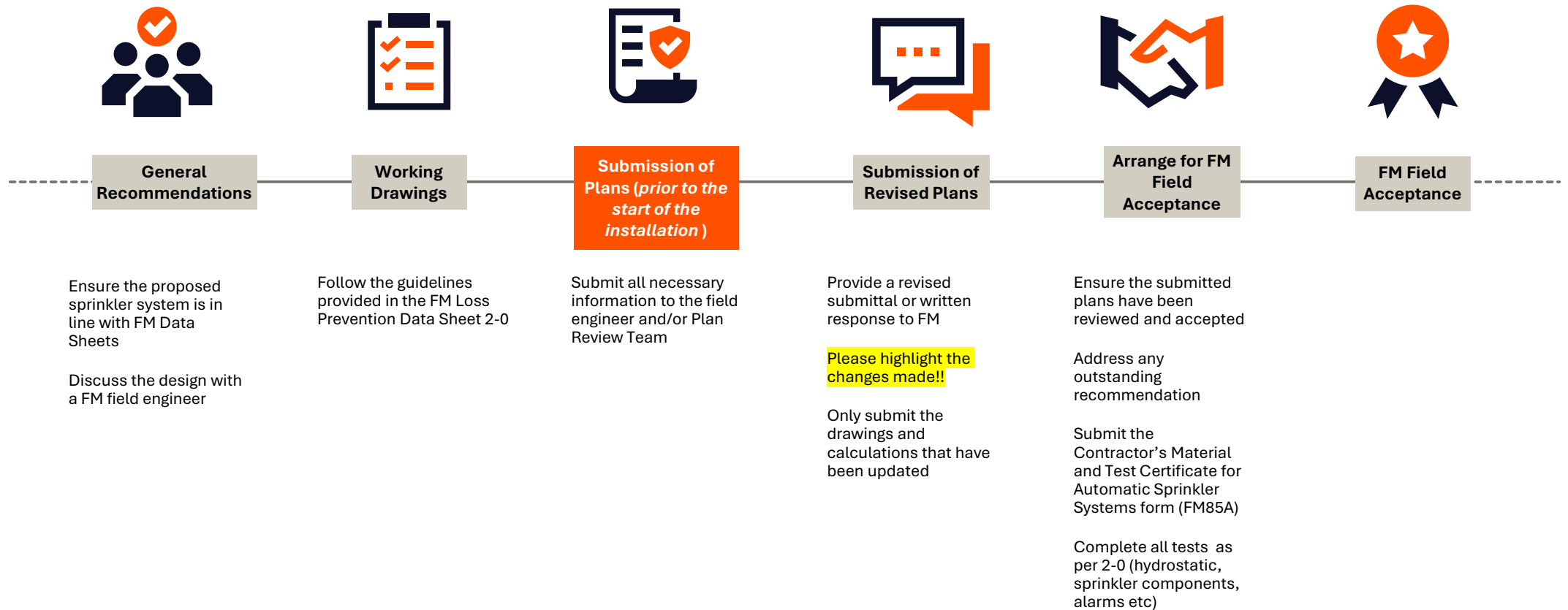
Underground main
Plans

Keyplan, etc.



[INTERNAL]

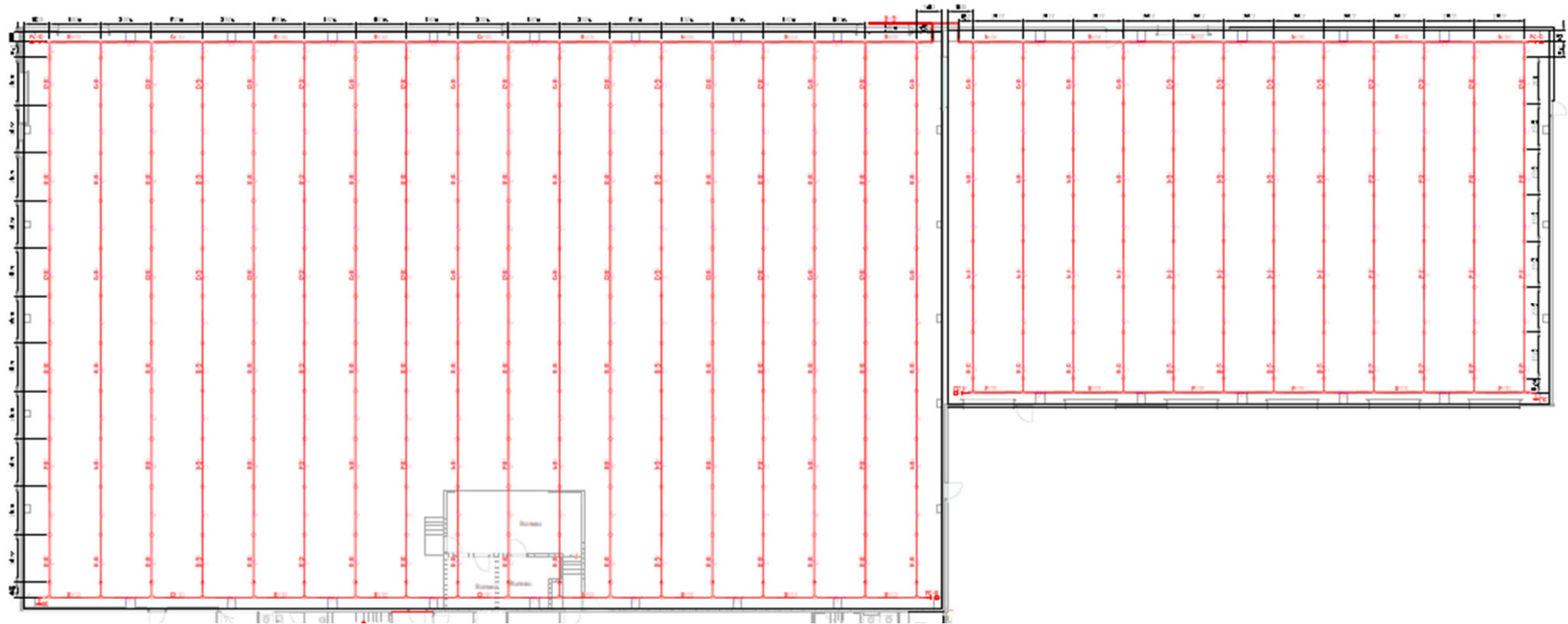
The Plan Review Process



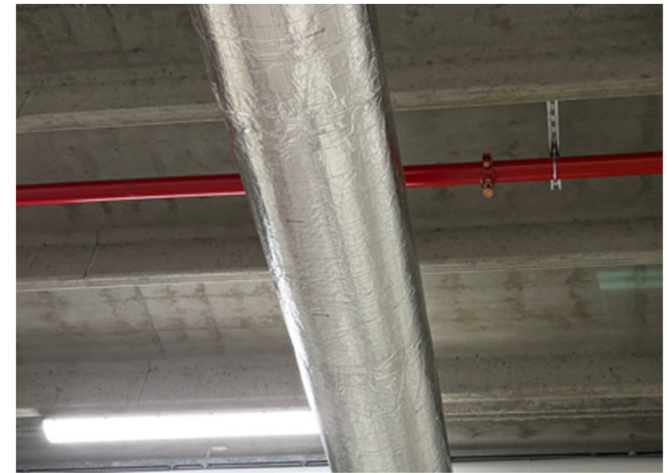
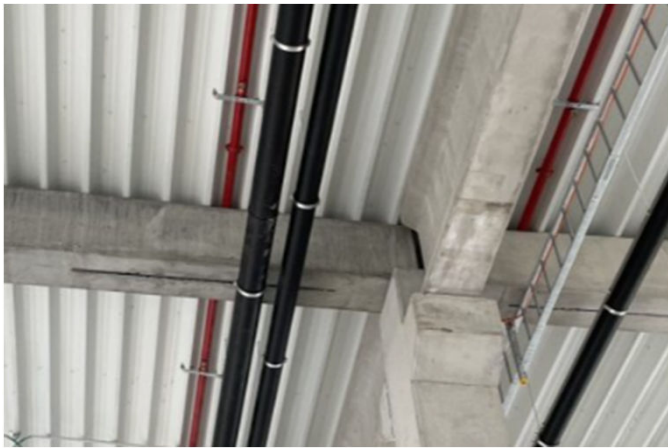
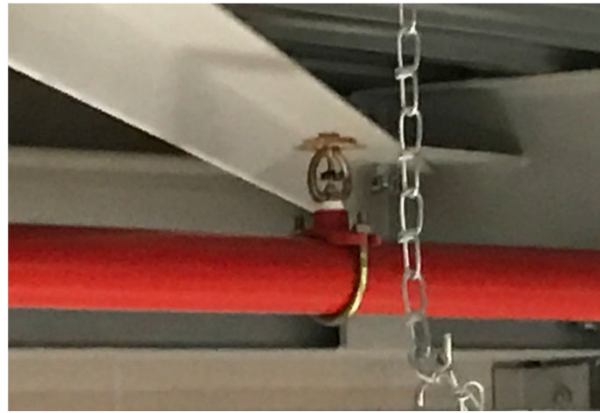
Our goal is to ensure accuracy and quality in every project, getting it right the first time!



Some attention points



Obstructions



Storage Sprinkler Obstructions

Table 2.5.4.5.4.1. Acceptable Location of Obstructing Objects from Ceiling Sprinklers

Width of Object in its Least Dimension Measured Horizontally, in. (mm)	Horizontal Distance from Sprinkler to Nearest Edge of Obstructing Object, in. (mm)	Acceptable Criteria
≤ 0.75 (20)*	< 6 (150)	The obstructing object is an acceptable horizontal distance away from the sprinkler when it is a minimum of 4 in. (100 mm) vertically below the sprinkler
	≥ 6 (150)	The obstructing object is an acceptable distance away from the sprinkler
≤ 1.5 (38)*	< 6 (150)	The obstructing object is an acceptable horizontal distance away from the sprinkler when it is a minimum of 12 in. (300 mm) vertically below the sprinkler
	≥ 6 (150)	The obstructing object is an acceptable distance away from the sprinkler
≤ 2 (50)*	< 6 (150)	The obstructing object is an acceptable horizontal distance away from the sprinkler when it is a minimum of 24 in. (600 mm) vertically below the sprinkler
	≥ 6 (150)	The obstructing object is an acceptable distance away from the sprinkler
≤ 6 (150)*	< 6 (150)	The obstructing object is too close to the sprinkler and must be relocated a minimum of 6 in. (150 mm) horizontally from the sprinkler
	≥ 6 (150)	The obstructing object is an acceptable distance away from the sprinkler
≤ 12 (300)	< 12 (300)	The obstructing object is too close to the sprinkler and must be relocated to follow the guidelines indicated for the object being a minimum of 12 in. (300 mm) horizontally from the sprinkler
	≥ 12 (300)	The obstructing object is an acceptable horizontal distance away from the sprinkler, but it also must be located at least 18 in. (450 mm) above the top of storage
≤ 24 (600)	< 12 (300)	The obstructing object is too close to the sprinkler and must be relocated to follow the guidelines indicated for the object being a minimum of 12 in. (300 mm) horizontally from the sprinkler
	≥ 12 (300)	The obstructing object is an acceptable horizontal distance away from the sprinkler, but it also must be located at least 36 in. (900 mm) above the top of storage
> 24 (600)	See Section 2.5.4.5.5	See Section 2.5.4.5.5

Obstructions



Storage occupancy

Objects ≤ 20 mm

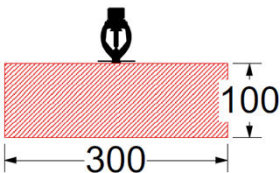


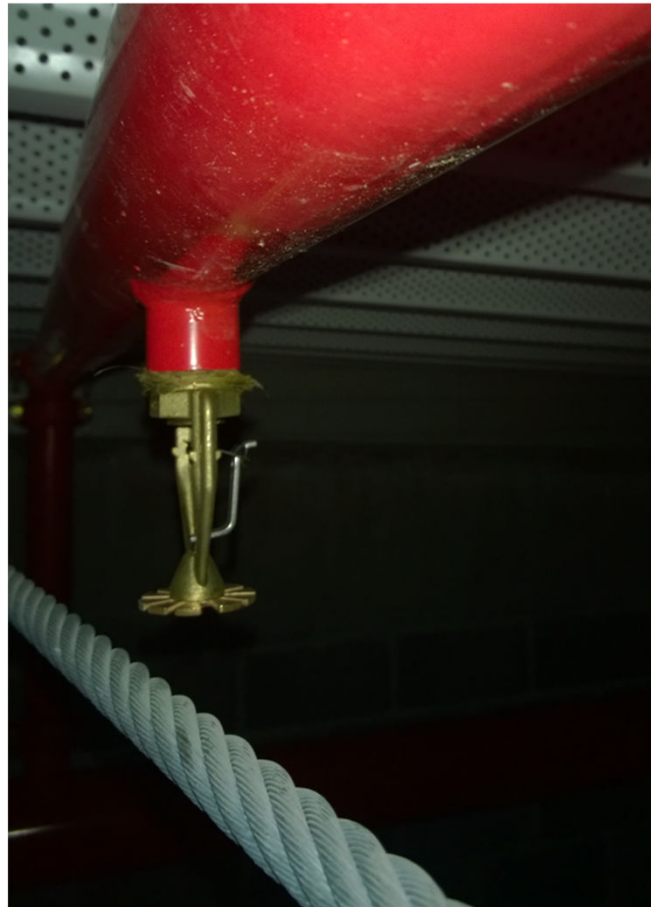
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≤ 0.75 (20)*	< 6 (150)	The obstructing object is an acceptable horizontal distance away from the sprinkler when it is a minimum of 4 in. (100 mm) vertically below the sprinkler
	≥ 6 (150)	The obstructing object is an acceptable distance away from the sprinkler

Obstructions

Storage occupancy

Objects ≤ 20 mm



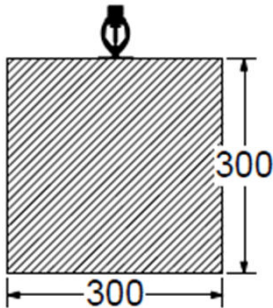
Obstructions



Storage occupancy

Objects ≤ 38 mm

Objects in storage		
≤ 1.5 (38)*	< 6 (150)	The obstructing object is an acceptable horizontal distance away from the sprinkler when it is a minimum of 12 in. (300 mm) vertically below the sprinkler
	≥ 6 (150)	The obstructing object is an acceptable distance away from the sprinkler



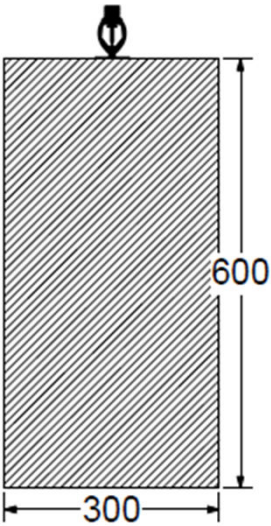
Obstructions



Storage occupancy

Objects ≤ 50 mm

≤ 2 (50)*	< 6 (150)	The obstructing object is an acceptable horizontal distance away from the sprinkler when it is a minimum of 24 in (600 mm) vertically below the sprinkler
	≥ 6 (150)	The obstructing object is an acceptable distance away from the sprinkler



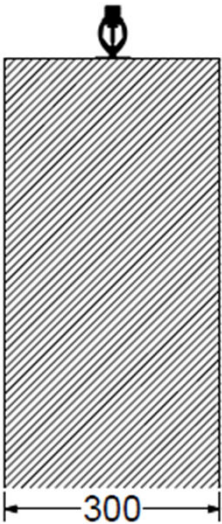
Obstructions



Storage occupancy

Objects $\leq$ 150 mm

≤ 6 (150)*	< 6 (150)	The obstructing object is too close to the sprinkler and must be relocated a minimum of 6 in (150 mm) horizontally from the sprinkler.
	≥ 6 (150)	The obstructing object is an acceptable distance away from the sprinkler.



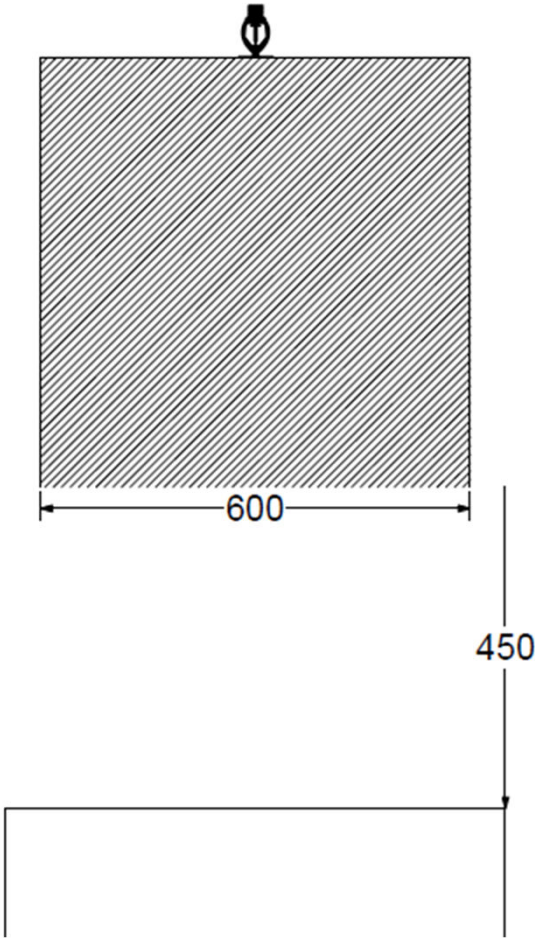
Obstructions



Storage occupancy

Objects ≤ 300 mm

≤ 12 (300)	< 12 (300)	The obstructing object is too close to the sprinkler and must be relocated to follow the guidelines indicated for the object being a minimum of 12 in. (300 mm) horizontally from the sprinkler
	≥ 12 (300)	The obstructing object is an acceptable horizontal distance away from the sprinkler, but it also must be located at least 18 in. (450 mm) above the top of storage



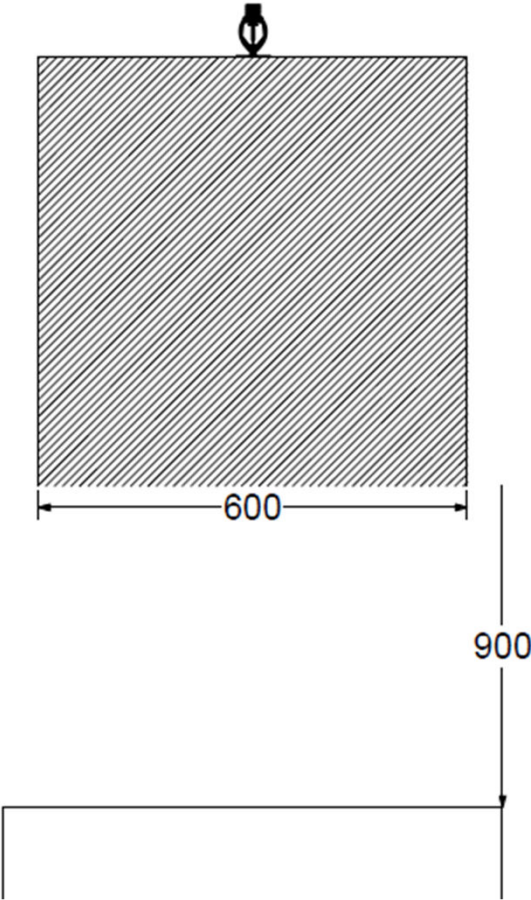
Obstructions



Storage occupancy

Objects ≤ 600 mm

≤ 24 (600)	< 12 (300)	The obstructing object is too close to the sprinkler and must be relocated to follow the guidelines indicated for the object being a minimum of 12 in. (300 mm) horizontally from the sprinkler
	≥ 12 (300)	The obstructing object is an acceptable horizontal distance away from the sprinkler, but it also must be located at least 36 in. (900 mm) above the top of storage



Obstructions

Storage occupancy

Bigger than 600mm = obstruction sprinkler needed



Combined Obstructions

Storage occupancy

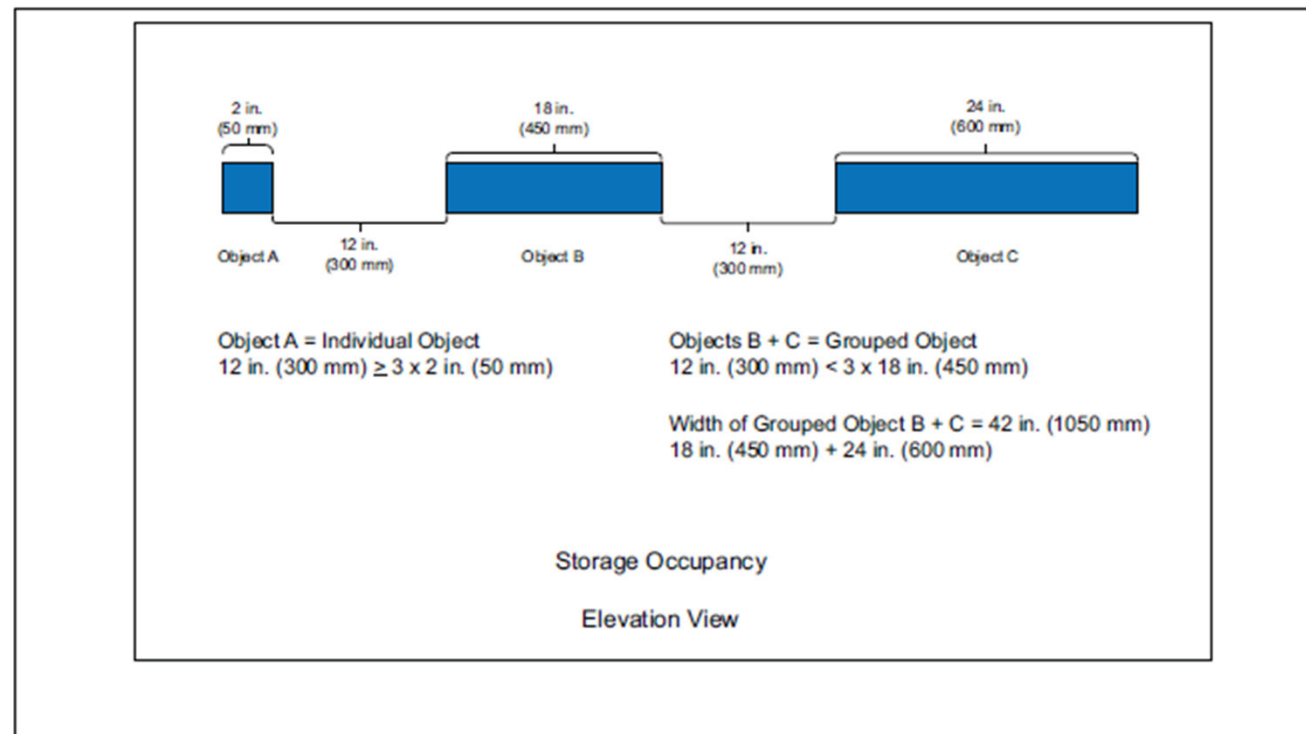
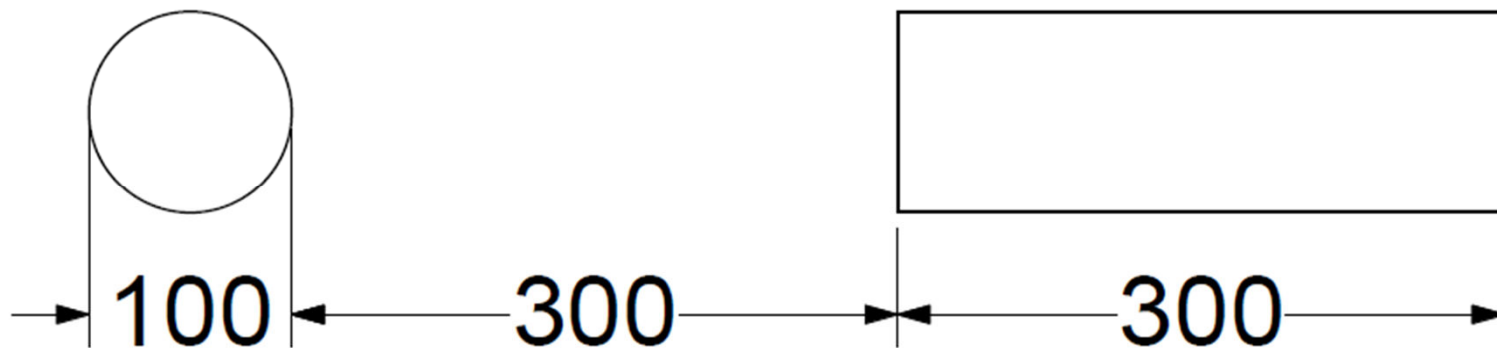


Fig. 2.5.4.5.3.1. Example of an "Individual Object" and a "Grouped Object" for analyzing obstructions

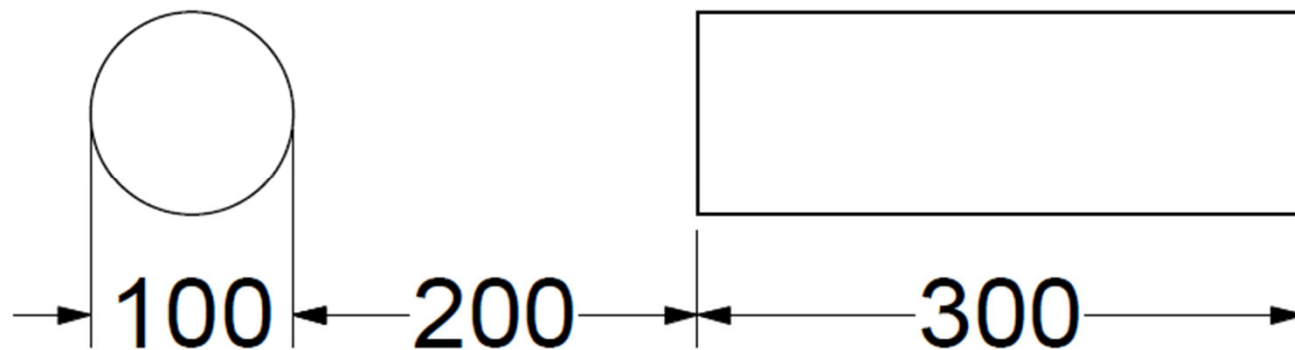
Combined Obstructions

Storage occupancy



Combined Obstructions

Storage occupancy

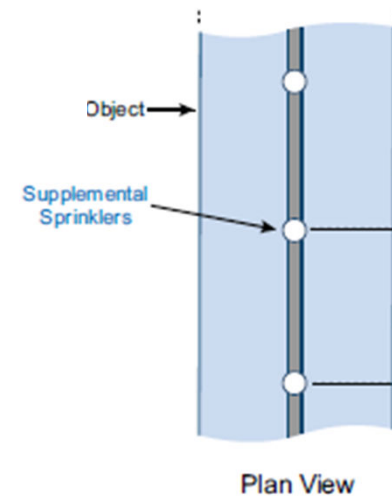
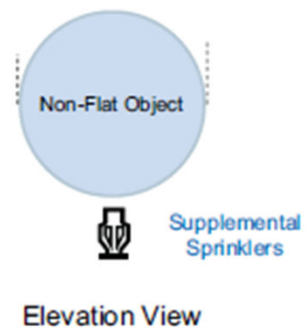


Obstructions

Storage occupancy

Position of obstruction sprinklers:

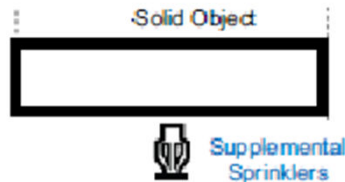
- Close to the underside of the obstruction
- Within the footprint of the obstruction



Obstructions

Storage occupancy

Flat and continuous obstruction
Solid objects



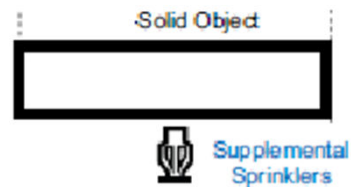
Width < 600 mm
max 2.4 m spacing

Width 600 mm to 3000mm
max 3.0 m spacing

Width > 3000 mm
area spacing as roof system

Obstructions

Storage occupancy

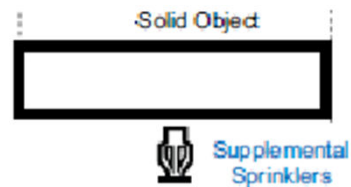


Solid objects 600 mm to 3000mm
max 3.0 m spacing

Obstructions

Storage occupancy

Solid objects > 3000 mm

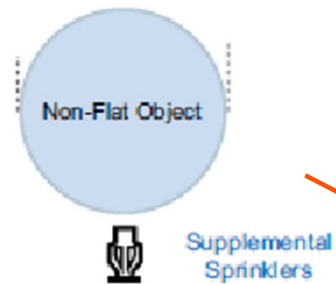


Linear and area spacing
as roof sprinkler system

Obstructions

Storage occupancy

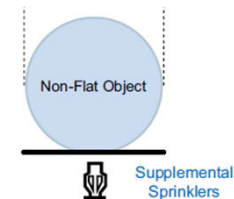
Non-Flat obstructions
Non-continuous obstructions



Width < 600 mm
max 1.2 m spacing

Width > 600 mm
max 1.2 m linear spacing
max 1.5 m² area spacing

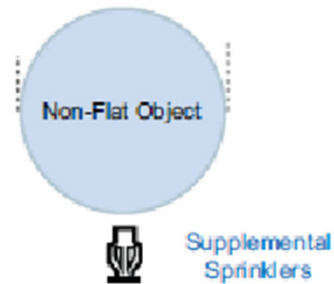
Horizontal barrier
Spacing as flat obstruction



Obstructions

Storage occupancy

Non-flat or non-solid objects < 600 mm

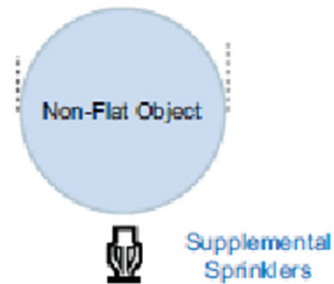


max 1.2 m spacing

Obstructions

Storage occupancy

Non-flat or non-solid objects > 600 mm

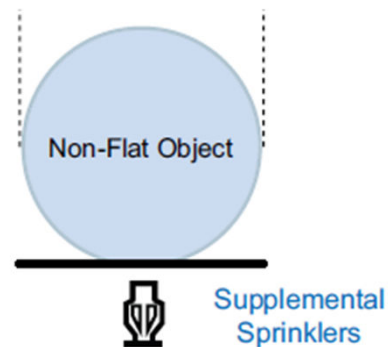


max 1.2 m linear spacing
max 1.5 m² area spacing

Obstructions

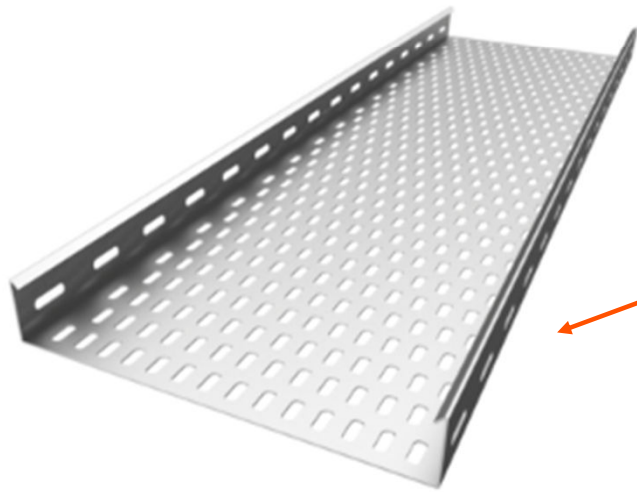
Storage occupancy

Non-flat or non-solid objects but with horizontal barrier

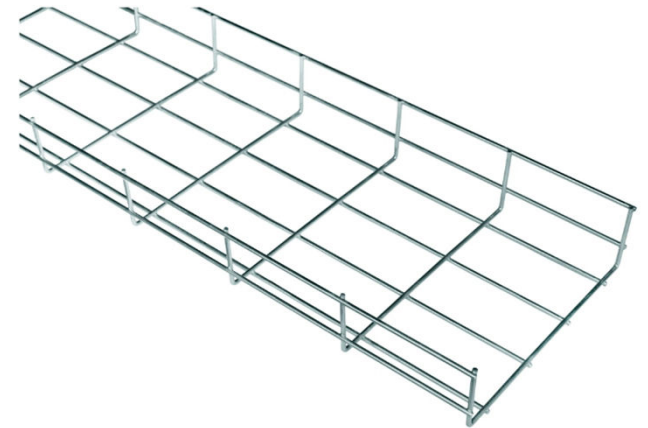


linear & area spacing
As for solid objects

Obstructions



Non-solid obstructions
(treat as filled)



Obstructions

Non-solid obstructions



Open grating floor

Storage sprinkler
Quick Response (QR)
Upright / Pendent
70°C
Water shield

1.2 m linear spacing
1.5 m² area spacing

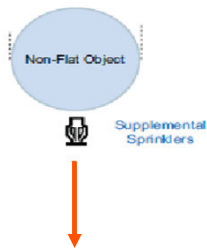


Open grid walkway

Storage sprinkler
Quick Response (QR)
Upright / Pendent
70°C
Water shield

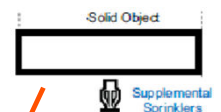
2.4 m linear spacing

Non-Flat obstructions
Non-continuous obstructions



Width > 600 mm
max 1.2 m linear spacing
max 1.5 m² area spacing

Flat and continuous obstruction
Solid objects



Width < 600 mm
max 2.4 m spacing

Vertical distance from ceiling

Non Storage occupancy

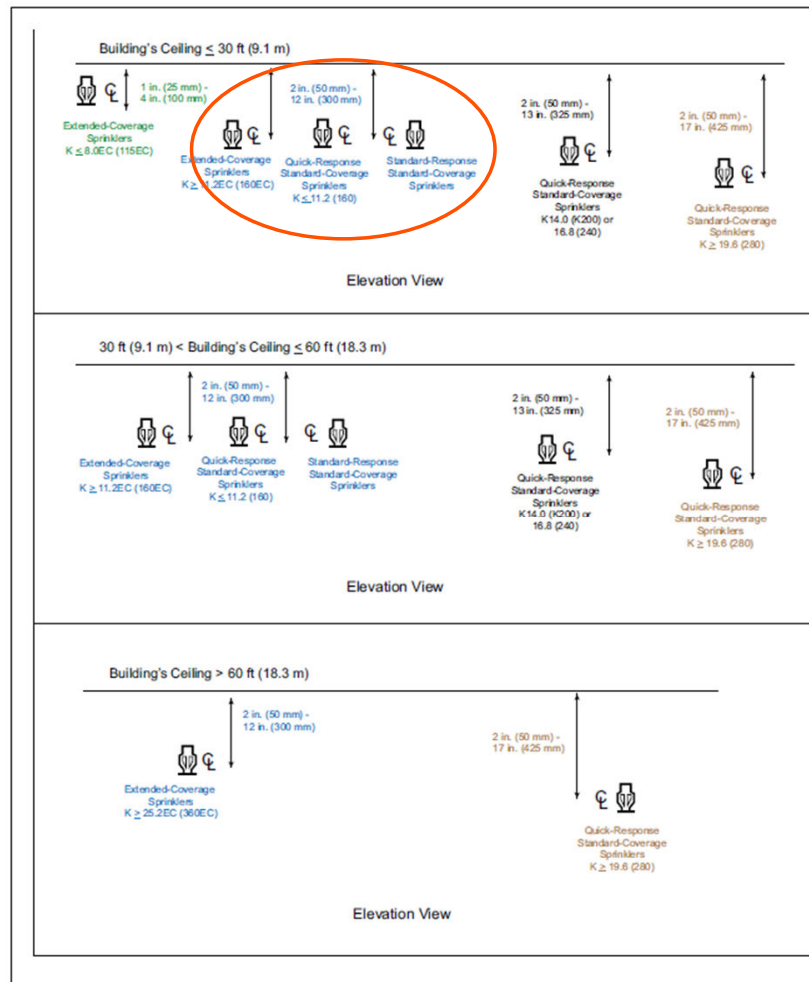


Fig. 2.5.2.3.3.4. Vertical location of Nonstorage pendent and upright sprinklers under unobstructed ceiling construction for various ceiling heights

Vertical distance from ceiling

Storage occupancy

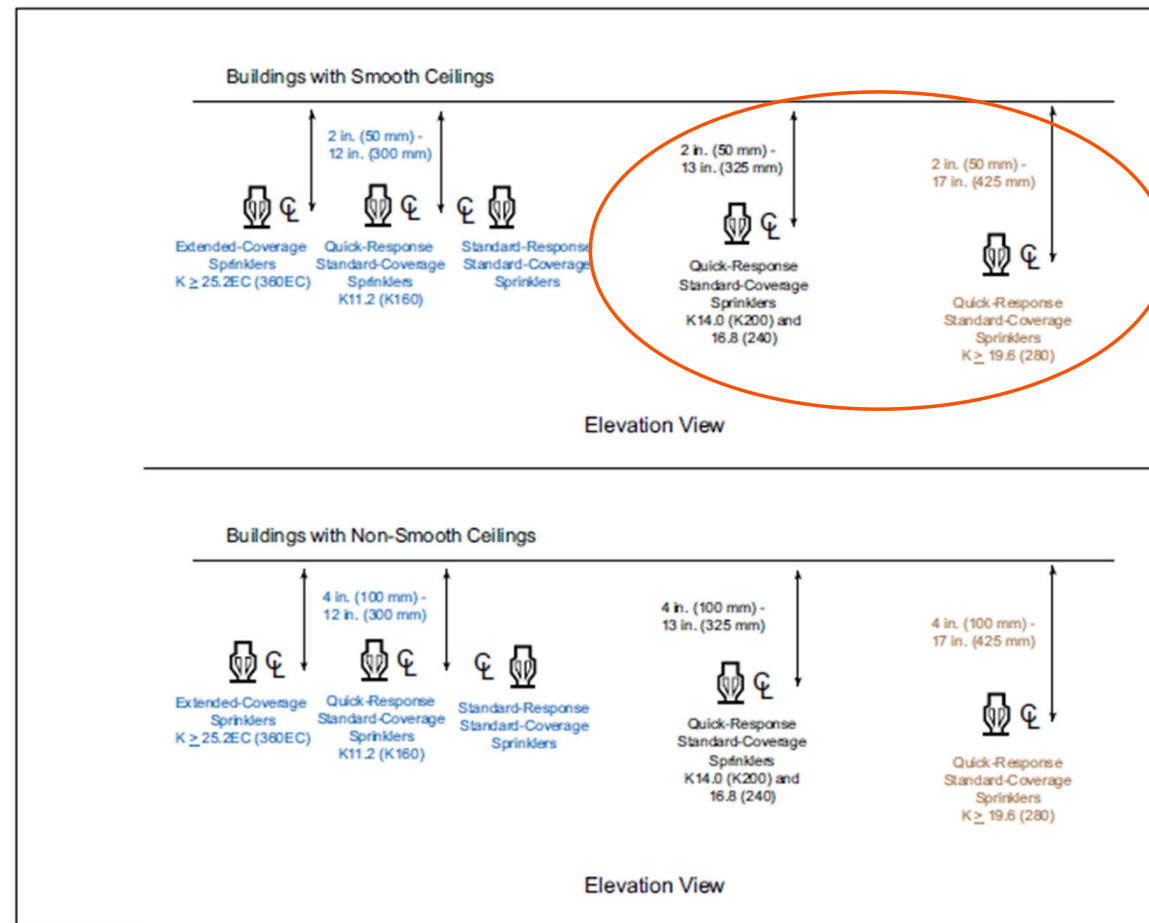


Fig. 2.5.4.3.3.4. Vertical location of Storage sprinklers under unobstructed ceiling construction for various ceiling heights

Vertical distance from ceiling

Storage occupancy OS 8-9 Table 17b – roofs over 12.2 m.

Table 17b. Quick-Response, Standard-Coverage Pendent Storage Sprinkler Ceiling-Only Designs for Ceiling Heights Over 40 ft (12.2 m)

Storage Arrangement	Commodity	Max. Storage Height, ft (m)	Max. Ceiling Height, ft (m)	Ceiling Sprinkler K-Factor	Max. Vertical Distance from Ceiling to Sprinkler's Thermal Element, in. (mm)*	If Racks Being Protected, Min. Aisle Width, ft (m)	Sprinkler System Design		
							Ceiling Sprinkler System, No. of AS @ psi (bar)	Hose Demand, gpm (L/min)	System Duration, min
Solid-Piled, Palletized, Bin-Box, Shelf, and Open-Frame Racks*	Class 1, 2, 3, 4 and Cartoned Unexpanded Plastics	45 (13.7)	50 (15.2)	22.4 (320)	13 (325)	6 (1.8)	10 @ 63 (4.3)	250 (950)	60
				25.2 (360)	13 (325)	6 (1.8)	10 @ 50 (3.5)		
					17 (425)	6 (1.8)	10 @ 75 (5.2)		
				28.0** (400**)	13 (325)	6 (1.8)	10 @ 40 (2.8)		
		50 (15.2)	55 (16.8)	33.6 (480)	17 (425)	6 (1.8)	9 @ 55 (3.8)		
				28.0 (400)	13 (325)	8 (2.4)	9 @ 80 (5.5)		
				33.6 (480)	17 (425)	6 (1.8)	9 @ 55 (3.8)		

* See the guidelines in Section 2.3.3.3.2 if the ceiling has obstructed type construction.

** See the guidelines in Section 2.2.3.2 to confirm that any multiple-row racks being protected in accordance with this table meet the requirements to be considered open-frame. If the multiple-row racks are not provided with adequate longitudinal flue spaces, the minimum aisle width for them is 8 ft (2.4 m) and is not overruled by the values indicated in the Min. Aisle Width column.

*** The design of 10 AS @ 40 psi (2.8 bar) can be reduced to 9 AS @ 40 psi (2.8 bar) when the water supply can also provide a minimum pressure of 80 psi (5.5 bar) from the most remote 4 sprinklers (2 sprinklers on 2 lines).

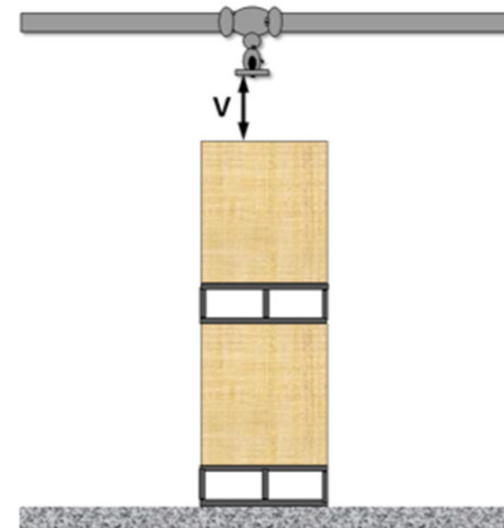
Vertical clearance of sprinklers

Installation requirements for sprinklers

Vertical distances

Minimum vertical clearance between sprinkler deflector and combustible materials:

- Standard coverage sprinklers:
 $V = 0,9 \text{ m}$
- Extended coverage sprinklers:
 $V = 1,5 \text{ m}$



Pipe storage



Pipe storage



Pipe storage



Sprinklers installed on pipes



Sprinklers installed on pipes



Sprinkler storage



Use of different materials

