
MEMORANDUM

TO: ROCKY MARTIN, DIRECTOR OF BUILDINGS AND FACILITIES
AL BARBER, FIRE CHIEF

FROM: BRIAN J. BERTSCH, P.E.

SUBJECT: FIRE FLOW ANALYSIS FOR HANNAFORD'S SUPERMARKET

DATE: JANUARY 30, 2013

CC: DOUG BOYCE, DAVID WHITE

At your request we have analyzed the existing municipal water system for its ability to provide fire protection to the proposed Hannaford's building on Lot 15 in the Giroux Commercial Park.

Commerce Street is served by an existing 8" ductile iron water main with connections to both Mechanicsville Road and VT 116. Approximately 605' of new 8" water main has been proposed to serve the new building. The system is fed by the Town's 500,000 gallon storage tank.

The most recent fire flow data the Town had was from 2001 at the existing fire hydrant located on Mechanicsville Road just north of the Commerce Street/Mechanicsville road intersection. An updated fire flow test has been scheduled for spring 2013 and the buildings final sprinkler design will be based upon those test results. Based on the available information we have performed a hydraulic analysis to demonstrate the ability of the system to meet the fire flow needs of Hannaford's.

Per the attached memo from Hannaford's engineer Roger Buteau, P.E., dated 01-29-13, a minimum flow capacity of 840 gpm for 90 minutes is needed to satisfy both the sprinkler and hose stream allowance per NFPA 13. The system was evaluated using "WaterCAD" software (see attached results) and two evaluations were simulated for the following scenarios: (1) steady state, 0 gpm demand and (2) Fire Flow, 840 gpm demand. The following table summarizes the results of the two trials:

<u>Trial</u>	<u>Flow (gpm)</u>	<u>Pressure (psi)</u>
Steady State	0	99.9
Fire Flow Demand	840	71.2

O'Leary-Burke Civil Associates, PLC
1 Corporate Drive, Suite 1 Essex Jct., VT 05452
802-878-9990 Fax 802-878-9989

In addition to the impact to the distribution network we have also examined the projects impacts to the Towns 500,000 gallon reservoir tank. Per your 1-29-13 email to Paul O'Leary the reservoir tank is 13 ft. tall and has a capacity of 500,000 gallons. Booster pumps maintain the tank level between 11 and 13 ft. Your email also stated that in no case may the water level drop below an elevation of 6 ft. of head.

The maximum fire flow demand for Hannaford's is 840 gpm for 90 minutes or 75,600 gallons. Based on the tank dimensions, the reservoir tank has a storage capacity of 38,450 gallons per foot (500,000 gallons/13 ft.). Assuming that maximum fire flow demand occurs when the tank has only 11 ft. of head, a 75,600 gallon draw will drop the tank level by 2.0 ft., to a head level of 9.0 ft.

In conclusion our analysis shows that the existing water system has adequate pressure, flow capacity, and storage capacity to meet the project's anticipated fire protection need without encumbering existing users.

Scenario: Base
Steady State Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P-1	695.00	8.0	Ductile Iro	130.0	false	0.00	Open	0.00	583.80	583.80	0.00	0.00
P-2	610.00	8.0	Ductile Iro	130.0	false	0.00	Open	0.00	583.80	583.80	0.00	0.00
P-3	1.00	8.0	Ductile Iro	130.0	false	0.00	Open	0.00	583.80	583.80	0.00	0.00
P-4	1.00	8.0	Ductile Iro	130.0	false	0.00	Open	0.00	583.80	583.80	0.00	0.00
P-5	1.00	8.0	Ductile Iro	130.0	false	0.00	Open	0.00	353.00	353.00	0.00	0.00
P-6	1.00	8.0	Ductile Iro	130.0	false	0.00	Open	0.00	583.80	583.80	0.00	0.00

**Scenario: Base
Steady State Analysis
Junction Report**

Label	Elevation (ft)	Zone	Type	Base Flow (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	353.00	Zone-1	Demand	0.00	Fixed	0.00	583.80	99.86
J-2	342.00	Zone-1	Demand	0.00	Fixed	0.00	583.80	104.62
J-3	345.00	Zone-1	Demand	0.00	Fixed	0.00	583.80	103.32
J-4	342.00	Zone-1	Demand	0.00	Fixed	0.00	583.80	104.62
J-5	353.00	Zone-1	Demand	0.00	Fixed	0.00	583.80	99.86

Scenario: FIRE FLOW DEMAND
Steady State Analysis
Junction Report

Label	Elevation (ft)	Zone	Type	Base Flow (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	353.00	Zone-1	Demand	0.00	Fixed	0.00	526.78	75.19
J-2	342.00	Zone-1	Demand	0.00	Fixed	0.00	517.59	75.97
J-3	345.00	Zone-1	Demand	840.00	Fixed	840.00	509.52	71.18
J-4	342.00	Zone-1	Demand	0.00	Fixed	0.00	517.59	75.97
J-5	353.00	Zone-1	Demand	0.00	Fixed	0.00	526.78	75.19



Hannaford Bros. Co.
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White+Burke Real Estate Investment Advisors, Inc
P.O. Box 1007
168 Battery St.
Burlington, VT 05402-1007

29 January 2013

RE: Hinesburg Fire Flow

Mr. White

At the request of Mr. Douglas Boyce, I am forwarding our prototype sprinkler flow requirements. Actual flow requirements may vary, but not significantly, pending final layout of the store.

Attached is a hydraulic graph of the systems requirements. Based on an occupancy of Ordinary Hazard Group 2 as defined by NFPA 13 for Mercantile facility.

Our insurance advisor, IRI, recommends a flow density of 0.18 gpm per square foot over 3000 square feet as the involved fire area, for the Sales Floor, with ordinary temperature heads. Total volume needed for 60 minutes duration with hose stream allowance is 54000 gallons, (39000 gal for sprinkler + 15000 gallons for hose stream allowance).

NFPA 13 governs our Storage/Receiving Area requirements for single rack storage over 12 feet but less than 20 feet. The storage area density is 0.23 gpm per square foot over 2800 square feet as the involved fire area, with ordinary temperature heads.

NFPA 13 requires 90 minutes duration for sprinklers with a 500 gpm hose stream allowance for rack storage. This is the most demanding system estimated at 75600 gallons total, (30600 gallons for sprinkler+45000 gallons for hose stream allowance).

We are now under construction with store of the same size and same construction type in Bradford, Vermont

Lastly, the Fire Chief is unsure what the construction type of our facility is. The building is a non-load bearing wall, steel frame construction with a building code construction classification of Type 2B, unprotected non-combustible.

If there are questions concerning the above information, please do not hesitate to contact me.

Sincerely

Roger P. Buteau, P.E.
Mechanical Engineer
Delhaize America Shared Services
(Hannaford Supermarket)

CC: Charlie Merrifield
Douglas Boyce
Paul O'Leary, P.E.

enclosures

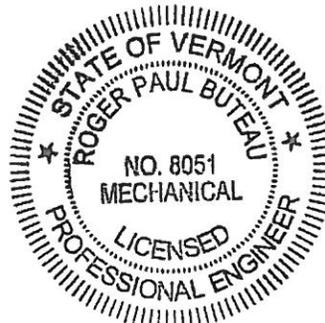


Table 11.2.2.1 Water Supply Requirements for Pipe Schedule Sprinkler Systems

Occupancy Classification	Minimum Residual Pressure Required		Acceptable Flow at Base of Riser (Including Hose Stream Allowance)		Duration (minutes)
	psi	bar	gpm	L/min	
Light hazard	15	1	500-750	1893-2839	30-60
Ordinary hazard	20	1.4	850-1500	3218-5678	60-90

11.2.2.5 The pipe schedule method shall be permitted for use in systems exceeding 5000 ft² (465 m²) where the flows required in Table 11.2.2.1 are available at a minimum residual pressure of 50 psi (3.4 bar) at the highest elevation of sprinkler.

11.2.2.6 The pipe schedule method shall be permitted for additions or modifications to existing extra hazard pipe schedule systems.

11.2.2.7 The lower duration value of Table 11.2.2.1 shall be acceptable only where the sprinkler system waterflow alarm device(s) and supervisory device(s) are electrically supervised and such supervision is monitored at an approved, constantly attended location.

11.2.2.8* Residual Pressure.

11.2.2.8.1 The residual pressure requirement of Table 11.2.2.1 shall be met at the elevation of the highest sprinkler.

11.2.2.8.2 When backflow prevention valves are installed on pipe schedule systems, the friction losses of the device shall be accounted for when determining acceptable residual pressure at the top level of sprinklers. The friction loss of this device [in psi (bar)] shall be added to the elevation loss and the residual pressure at the top row of sprinklers to determine the total pressure needed at the water supply.

11.2.2.9 The lower flow figure of Table 11.2.2.1 shall be permitted only where the building is of noncombustible construction or the potential areas of fire are limited by building size or compartmentation such that no open areas exceed 3000 ft² (279 m²) for light hazard or 4000 ft² (372 m²) for ordinary hazard.

11.2.3 Water Demand Requirements — Hydraulic Calculation Methods.

11.2.3.1 General.

11.2.3.1.1 The water supply for sprinklers shall be determined only from one of the following:

- (1) Density/area curves of Figure 11.2.3.1.1 in accordance with the method of 11.2.3.2
- (2) On the basis of the room design method in accordance with 11.2.3.3
- (3) Special design areas in accordance with 11.2.3.4, at the discretion of the designer

11.2.3.1.2 The minimum water supply shall be available for the minimum duration specified in Table 11.2.3.1.2.

Table 11.2.3.1.2 Hose Stream Allowance and Water Supply Duration Requirements for Hydraulically Calculated Systems

Occupancy	Inside Hose		Total Combined Inside and Outside Hose		Duration (minutes)
	gpm	L/m	gpm	L/m	
Light hazard	0, 50, or 100	0, 189, 379	100	379	30
Ordinary hazard	0, 50, or 100	0, 189, 379	250	946	60-90
Extra hazard	0, 50, or 100	0, 189, 379	500	1893	90-120

11.2.3.1.3 The lower duration values in Table 11.2.3.1.2 shall be permitted where the sprinkler system waterflow alarm device(s) and supervisory device(s) are electrically supervised and such supervision is monitored at an approved, constantly attended location.

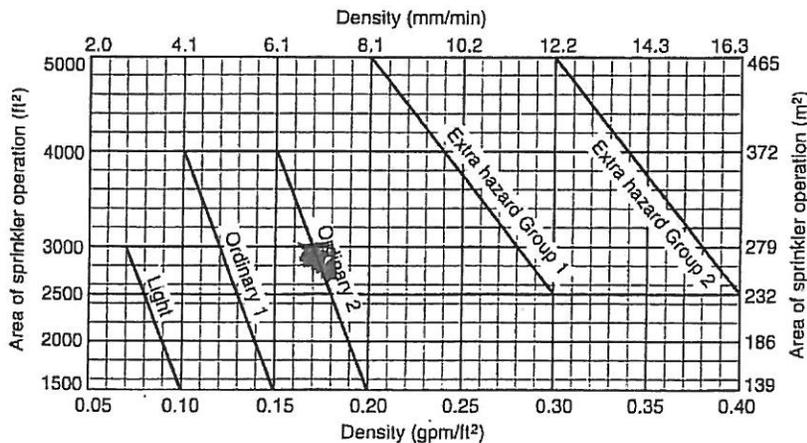


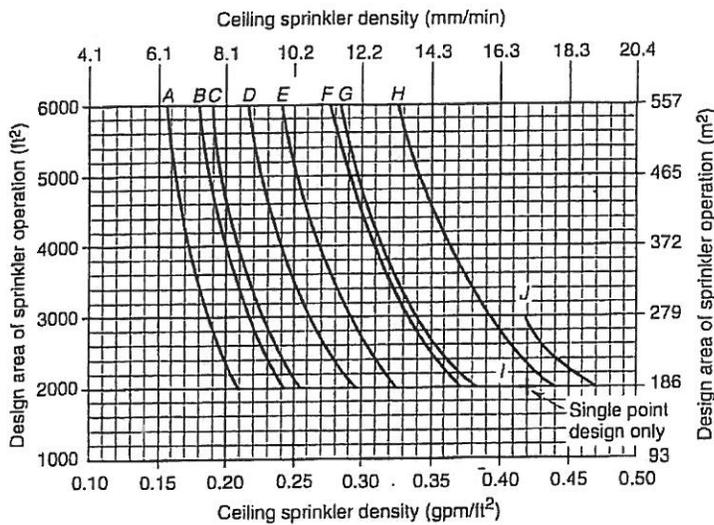
FIGURE 11.2.3.1.1 Density/Area Curves.

SALES FLOOR DESIGN
 POINT 0.18 GPM/ft² - 3000 SF

Table 16.2.1.3.2 Single- or Double-Row Racks — Storage Height Over 12 ft (3.7 m) Up to and Including 25 ft (7.6 m) Without Solid Shelves

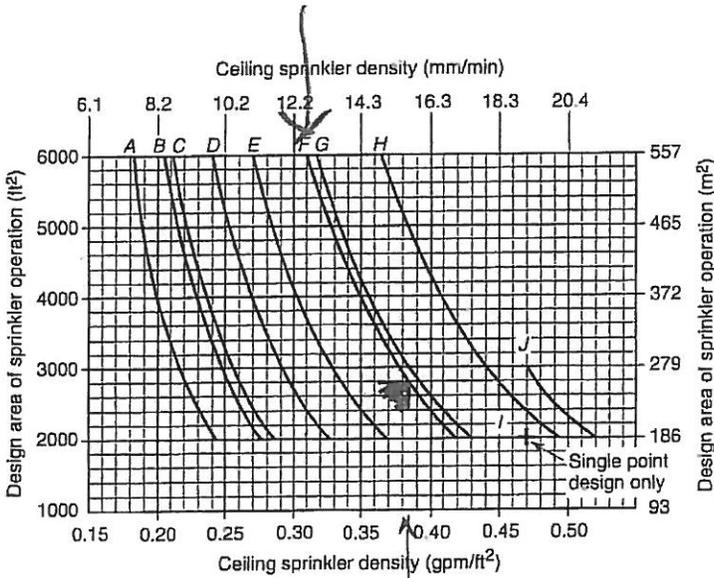
Height	Commodity Class	Encapsulated	Aisles*		Sprinklers Mandatory In-Rack	Ceiling Sprinkler Water Demand					
			ft	m		With In-Rack Sprinklers			Without In-Rack Sprinklers		
						Figure	Curves	Apply Figure 16.2.1.3.4.1	Figure	Curves	Apply Figure 16.2.1.3.4.1
Over 12 ft (3.7 m), up to and including 20 ft (6.1 m)	I	No	4	1.2	No	16.2.1.3.2(a)	C and D	Yes	16.2.1.3.2(a)	F and H	Yes
			8	2.4			A and B			E and G	
		Yes	4	1.2	No	16.2.1.3.2(c)	C and D	Yes	16.2.1.3.2(c)	G and H	Yes
			8	2.4			A and B			F and F	
	II	No	4	1.2	No	16.2.1.3.2(b)	C and D	Yes	16.2.1.3.2(b)	G and H	Yes
			8	2.4			A and B			E and F	
		Yes	4	1.2	No	16.2.1.3.2(e)	C and D	Yes	16.2.1.3.2(e)	G and H	Yes
			8	2.4			A and B			E and F	
	III	No	4	1.2	No	16.2.1.3.2(c)	C and D	Yes	16.2.1.3.2(c)	G and H	Yes
			8	2.4			A and B			E and F	
		Yes	4	1.2	1 level	16.2.1.3.2(f)	C and D	—	—	—	—
			8	2.4			A and B				
	IV	No	4	1.2	No	16.2.1.3.2(d)	C and D	Yes	16.2.1.3.2(d)	G and H	Yes
			8	2.4			A and B			E and F	
		Yes	4	1.2	1 level	16.2.1.3.2(g)	C and D	—	—	—	—
			8	2.4			A and B				
Over 20 ft (6.1 m), up to and including 22 ft (6.7 m)	I	No	4	1.2	No	16.2.1.3.2(a)	C and D	Yes	16.2.1.3.2(a)	F and H	Yes
			8	2.4			A and B			E and G	
		Yes	4	1.2	1 level	16.2.1.3.2(e)	C and D	—	—	—	—
			8	2.4			A and B				
	II	No	4	1.2	No	16.2.1.3.2(b)	C and D	Yes	16.2.1.3.2(b)	G and H	Yes
			8	2.4			A and B			E and F	
		Yes	4	1.2	1 level	16.2.1.3.2(e)	C and D	—	—	—	—
			8	2.4			A and B				
	III	No	4	1.2	No	16.2.1.3.2(c)	C and D	Yes	16.2.1.3.2(c)	G and H	Yes
			8	2.4			A and B			E and F	
		Yes	4	1.2	1 level	16.2.1.3.2(f)	C and D	—	—	—	—
			8	2.4			A and B				
	IV	No	4	1.2	No	16.2.1.3.2(d)	C and D	Yes	16.2.1.3.2(d)	G and H	Yes
			8	2.4			A and B			E and F	
		Yes	4	1.2	1 level	16.2.1.3.2(g)	C and D	—	—	—	—
			8	2.4			A and B				

(continues)



Curve	Legend	Curve	Legend
A	Single- or double-row racks with 8 ft (2.44 m) aisles with high temperature ceiling sprinklers and ordinary temperature in-rack sprinklers	E	Single- or double-row racks with 8 ft (2.44 m) aisles and high temperature ceiling sprinklers
B	Single- or double-row racks with 8 ft (2.44 m) aisles with ordinary temperature ceiling sprinklers and ordinary temperature in-rack sprinklers	F	Single- or double-row racks with 8 ft (2.44 m) aisles and ordinary temperature ceiling sprinklers
C	Single- or double-row racks with 4 ft (1.22 m) aisles or multiple-row racks with high temperature ceiling sprinklers and ordinary temperature in-rack sprinklers	G	Single- or double-row racks with 4 ft (1.22 m) aisles and high temperature ceiling sprinklers
D	Single- or double-row racks with 4 ft (1.22 m) aisles or multiple-row racks with ordinary temperature ceiling sprinklers and ordinary temperature in-rack sprinklers	H	Single- or double-row racks with 4 ft (1.22 m) aisles and ordinary temperature ceiling sprinklers
		I	Multiple-row racks with 8 ft (2.44 m) or wider aisles and high temperature ceiling sprinklers
		J	Multiple-row racks with 8 ft (2.44 m) or wider aisles and ordinary temperature ceiling sprinklers

FIGURE 16.2.1.3.2(b) Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Class II Nonencapsulated Commodities — Conventional Pallets.



Curve	Legend	Curve	Legend
A	Single- or double-row racks with 8 ft (2.44 m) aisles with high temperature ceiling sprinklers and ordinary temperature in-rack sprinklers	E	Single- or double-row racks with 8 ft (2.44 m) aisles and high temperature ceiling sprinklers
B	Single- or double-row racks with 8 ft (2.44 m) aisles with ordinary temperature ceiling sprinklers and ordinary temperature in-rack sprinklers	F	Single- or double-row racks with 8 ft (2.44 m) aisles and ordinary temperature ceiling sprinklers
C	Single- or double-row racks with 4 ft (1.22 m) aisles or multiple-row racks with high temperature ceiling sprinklers and ordinary temperature in-rack sprinklers	G	Single- or double-row racks with 4 ft (1.22 m) aisles and high temperature ceiling sprinklers
D	Single- or double-row racks with 4 ft (1.22 m) aisles or multiple-row racks with ordinary temperature ceiling sprinklers and ordinary temperature in-rack sprinklers	H	Single- or double-row racks with 4 ft (1.22 m) aisles and ordinary temperature ceiling sprinklers
		I	Multiple-row racks with 8 ft (2.44 m) or wider aisles and high temperature ceiling sprinklers
		J	Multiple-row racks with 8 ft (2.44 m) or wider aisles and ordinary temperature ceiling sprinklers

FIGURE 16.2.1.3.2(c) Sprinkler System Design Curves — 20 ft (6.1 m) High Rack Storage — Class III Nonencapsulated Commodities — Conventional Pallets.



0.385 GPM/ft² x 0.60 = 0.23 GPM/ft²

ALLOWED % OF DESIGN CURVE PER FIG. 16.2.1.3.4.1

2800 S.F.

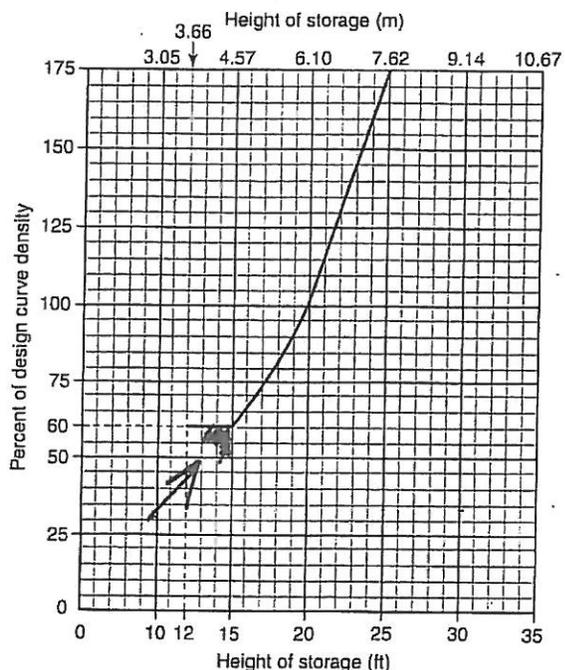


FIGURE 16.2.1.3.4.1 Ceiling Sprinkler Density vs. Storage Height.

16.2.1.3.4.4 For storage height over 20 ft (6.1 m) up to and including 25 ft (7.6 m) protected with ceiling sprinklers and with more than the minimum required level of in-rack sprinklers, but not in every tier, densities obtained from design curves shall be permitted to be reduced 20 percent as indicated in Table 16.2.1.3.4.3. Densities shall not be adjusted in accordance with Figure 16.2.1.3.4.1 for storage height.

16.2.1.3.4.5 For storage height over 12 ft (3.7 m) up to and including 20 ft (6.1 m) protected with ceiling sprinklers and in-rack sprinklers at each tier, densities obtained from design curves and adjusted in accordance with Figure 16.2.1.3.4.1 shall be permitted to be reduced an additional 40 percent, as indicated in Table 16.2.1.3.4.3.

16.2.1.3.4.6 For storage height over 20 ft (6.1 m) up to and including 25 ft (7.6 m) protected with ceiling sprinklers and in-rack sprinklers at each tier, densities obtained from design curves shall be permitted to be reduced 40 percent, as indicated in Table 16.2.1.3.4.3. Densities shall not be adjusted in accordance with Figure 16.2.1.3.4.1 for storage height.

16.2.1.3.4.7 Where solid, flat-bottom, combustible pallets (slave pallets) are used with storage height up to and including 25 ft (7.6 m), the densities that are indicated in the design curves shown in Figure 16.2.1.3.2(a) through Figure 16.2.1.3.2(g), based on conventional pallets, shall be increased 20 percent for the given area. The percentage shall be applied to the density determined in accordance with Figure 16.2.1.3.4.1. The increase in density shall not apply where in-rack sprinklers are installed in accordance with Table 16.2.1.3.4.3.

16.2.1.3.5* The minimum water supply requirements for a hydraulically designed occupancy hazard fire control sprinkler system shall be determined by adding the hose stream allowance from Table 16.2.1.3.5 to the water supply for sprinklers determined in 16.2.1.3. This supply shall be available for the minimum duration specified in Table 16.2.1.3.5. (See Section C.8.)

16.2.2 Large Drop Sprinklers and Specific Application Control Mode Sprinklers for Rack Storage of Class I Through Class IV Commodities Stored Up to and Including 25 ft (7.6 m) in Height.

16.2.2.1 Protection of single-, double-, and multiple-row rack storage without solid shelves for Class I through Class IV commodities shall be in accordance with Table 16.2.2.1(a) or Table 16.2.2.1(b).

Table 16.2.1.3.4.3 Adjustment to Ceiling Sprinkler Density for Storage Height and In-Rack Sprinklers

Storage Height	In-Rack Sprinklers	Apply Figure 16.2.1.3.4.1 for Storage Height Adjustment	Permitted Ceiling Sprinklers Density Adjustments Where In-Rack Sprinklers Are Installed
Over 12 ft (3.7 m) through 25 ft (7.6 m)	None	Yes	None
Over 12 ft (3.7 m) through 20 ft (6.1 m)	Minimum required	Yes	None
	More than minimum, but not in every tier	Yes	Reduce density 20% from that of minimum in-rack sprinklers
	In every tier	Yes	Reduce density 40% from that of minimum in-rack sprinklers
Over 20 ft (6.1 m) through 24 ft (7.5 m)	Minimum required	No	None
	More than minimum, but not in every tier	No	Reduce density 20% from that of minimum in-rack sprinklers
	In every tier	No	Reduce density 40% from that of minimum in-rack sprinklers

Table 16.2.1.3.5 Hose Stream Allowance and Water Supply Duration Requirements for Rack Storage of Class I Through Class IV Commodities Stored Up to and Including 25 ft (7.6 m) in Height

Commodity Classification	Storage Height		Inside Hose		Total Combined Inside and Outside Hose		Duration (minutes)
	ft	m	gpm	L/min	gpm	L/min	
Class I, II and III Class IV	Over 12 Over 12	Over 3.7 Over 3.7	0, 50, or 100 0, 50, or 100	0, 190, 380 0, 190, 380	500 500	1900 1900	90 120

Table 16.2.2.1(a) Large Drop Sprinkler Design Criteria for Single-, Double-, and Multiple-Row Racks Without Solid Shelves of Class I Through Class IV Commodities Stored Up to and Including 25 ft (7.6 m) in Height

Commodity Class	Nominal K-Factor	Maximum Storage Height		Maximum Ceiling/Roof Height		Type of System	Number of Design Sprinklers/Minimum Pressure		Hose Stream Allowance		Water Supply Duration (hours)
		ft	m	ft	m		/psi	/bar	gpm	L/min	
I, II	11.2 (161)	25	7.6	30	9.1	Wet	20/25	20/1.7	500	1900	1½
						Dry	30/25	30/1.7	500	1900	1½
I, II, III	11.2 (161)	20	6.1	30	9.1	Wet	15/25	15/1.7	500	1900	1½
						Dry	25/25	25/1.7	N/A	N/A	1½
I, II, III	11.2 (161)	25	7.6	35	10.7	Wet	15/25 + 1 level of in-rack	15/1.7 + 1 level of in-rack	500	1900	1½
						Dry	25/25 + 1 level of in-rack	25/1.7 + 1 level of in-rack	500	1900	1½
IV	11.2 (161)	20	6.1	25	7.6	Wet	15/50	15/3.4	500	1900	2
						Dry	N/A	N/A	N/A	N/A	N/A
IV	11.2 (161)	20	6.1	30	9.1	Wet	20/50	20/3.4	500	1900	2
						Dry	N/A	N/A	N/A	N/A	N/A
IV	11.2 (161)	20	6.1	30	9.1	Wet	15/75	15/5.2	500	1900	2
						Dry	N/A	N/A	N/A	N/A	N/A
IV	11.2 (161)	25	7.6	30	9.1	Wet	15/50 + 1 level of in-rack	15/3.4 + 1 level of in-rack	500	1900	2
						Dry	N/A	N/A	N/A	N/A	N/A
IV	11.2 (161)	25	7.6	35	10.7	Wet	20/50 + 1 level of in-rack	20/3.4 + 1 level of in-rack	500	1900	2
						Dry	N/A	N/A	N/A	N/A	N/A
IV	11.2 (161)	25	7.6	35	10.7	Wet	15/75 + 1 level of in-rack	15/5.2 + 1 level of in-rack	500	1900	2
						Dry	N/A	N/A	N/A	N/A	N/A

NA: Not applicable.