



THE FIRE PROTECTION INTERNATIONAL CONSORTIUM, INC.

FIRE PROTECTION - LIFE SAFETY - CODE CONSULTING
SECURITY - PERFORMANCE BASED DESIGN

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June 18, 2015

Mr. Bassione Van Soest
Smith Fire Systems, Inc.
1106 54th Ave East
Tacoma, WA 98424

Reference: Commodity/Sprinkler Design
State Archives
8009 River Drive SE
Olympia, WA 98502

Dear Mr. Van Soest:

In response to your request we have reviewed the proposed storage arrangement, fire sprinkler design criteria and commodities to be stored in the above facility. This review is based on the requirements of NFPA 13, 2010 edition as referenced in the 2013 Washington State Fire Code.

Three options for sprinkler protection utilizing a variety of ceiling sprinkler design criteria and flue space requirements are provided.

The preferred option, option 3, will require preapproval by the local AHJ, the Thurston County Fire Marshal's office, before it can be used.

The State of Washington will occupy the space for high piled storage of paper records in cardboard cartons, a Class III commodity. The boxes are neither banded nor encapsulated.

Maximum storage height in the rack area is 24ft with a maximum ceiling/roof height of approximately 36ft at the peak and 32ft at the eaves.

Storage is on single row racks either 64" or 32" wide.

The building is protected by an existing wet sprinkler system designed to provide 0.64GPM/2,000sf using 286F, 3/4" K17 sprinklers. A minimum of 18" clearance is required between the top of storage and the sprinkler deflectors.

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Based on 24ft high storage of Class III, non-encapsulated commodities with 64" aisles, design criteria requirements are selected from 2010 NFPA 13 Table 16.2.1.3.2 and Figure 16.2.1.3.2(c), Curve G. The minimum required design without in-rack sprinklers is $1.6 \times 0.43 \text{GPM}/2,000\text{sf}$ or $0.688 \text{GPM}/\text{sf}$ with 286F sprinklers. $1.6 \times 0.43 = 0.688$ for 286F sprinklers since Figure 16.2.1.3.4.1 must be applied if no in-rack sprinklers are installed. This exceeds the existing design; therefore, in-rack sprinklers are required.

With in-rack sprinklers the required ceiling density decreases. Per Table 16.2.1.3.2 and Figure 16.2.1.3.2(c), Curve C, $0.285 \text{GPM}/2,000\text{sf}$ using 286F sprinklers is required. This ceiling demand is well below the existing design at the ceiling.

The use of solid shelves and/or the obstruction of required flues must also be considered in accordance with NFPA 13 Section 16.1.6.

Option 1: No in-rack sprinklers are required; however, additional transverse flues are required, and the existing ceiling design would need to be upgraded to a higher density of $0.688 \text{GPM}/2,000\text{sf}$ using 286F sprinklers. Using either solid shelf decking or open decking such as wire mesh deck or punch deck create nominal 6" transverse flues such that neither shelves nor the boxes loaded on the shelves block the flues. In this option flues are required every 3'-9" in the 64 inch wide rack or 7'-6" in the 32 inch wide rack to avoid obstructing required flues. This is based on maximum 20sf solid shelf under NFPA 13 Section 16.1.6.1. Based on the storage capacity lost in order to create all of the additional flues, coupled with the need to upgrade the sprinkler system at the ceiling, this may not be the preferred option.

Option 2: Three levels of in-rack sprinklers are required (at 6ft, 12ft and 18ft vertically). In rack sprinklers are required at 10ft intervals horizontally in the transverse flues at the rack uprights. Nominal 6" flues are required at the rack uprights. Installation of solid decking is allowed. With flues at the uprights the 'solid shelf' area will be greater than 20sf but less than 64sf and in-rack sprinklers are only required at 6ft vertical intervals per NFPA 13, Section 16.1.6.1. Although in compliance with NFPA 13 this is not the preferred option as it allows the installation of a solid shelving material and calls for 3 levels of in-rack sprinklers.

Option 3: *Preapproval by the Fire Marshal is necessary for this option.* Only one level of in-rack sprinklers would be required if approved. Replace the solid shelving typically used by the State currently with open shelving such as wire deck or punch deck. Provide minimum 6" transverse flues at 10ft intervals horizontally at rack uprights. Consider the racks to be equivalent to catwalk storage of cartoned paper records based on the use of the open decking without regard for placement of the boxes so long as the transverse flues are maintained at rack uprights. Provide one level of quick response in-rack sprinklers at 12ft vertically and at each transverse flue horizontally based on equivalency with catwalk storage rules found in NFPA 13, Section 20.5. Install the in-rack sprinklers in each row of racking rather than skipping a row as would be allowed in a multilevel catwalk system.

In my professional opinion the use of option 3 will provide proper sprinkler protection for this type of rack storage of non-encapsulated paper records in cardboard cartons by requiring the use of open shelving material rather than solid decking in conjunction with one level of in-rack sprinklers located in each transverse flue as an equivalency to the NFPA 13 Section 20.5 rules for catwalk storage of the same commodity.

Where in-rack sprinklers are installed, a minimum of 6" clearance is required between the sprinkler deflector and the top of the boxes at that level in accordance with NFPA 13 Section 16.2.4.2.5. Use of upright sprinklers is recommended to allow for the clearance most effectively, and to help protect the sprinklers from impact during the handling of boxes. Install water shields and head guards on all in-rack sprinklers.

Sprinkler protection for steel columns is not required in accordance with 2010 NFPA 13, 16.1.4.1 if in-rack sprinklers are installed.

The solid vertical barriers currently used in the existing racking are not required.

If more information is needed please do not hesitate to contact me.

Sincerely,



Carl Anderson, PE
Registered in CA, WA, OR, UT, TX and FL
The Fire Protection International Consortium, Inc.

