Alternative Means and Methods Proposal for Fire Protection

PDX FS#1 - Fire Sprinkler
2010-0624
prepared for:
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Executive Summary

A total of five skylights were recently installed on the 3rd floor of the Portland Fire Station #1 during a seismic upgrade and modernization project. The original roof structure was poured in place, pan and joist concrete. The concrete was required to be cut to allow the installation of the skylights. Hollow structural steel (HSS) members located around the circumference of the skylight were installed to reinforce the concrete structure around the skylight.

Per the building official’s permit review, the structural steel members are considered part of the roof construction and therefore a 1-hour fire-resistance rating of the steel support assemblies is required.

It is considered problematic, post occupancy, to provide an intumescent coating or gypsum protective layer for the steel assemblies to achieve the required rating so alternative solutions have been considered and two options have been developed and proposed to offer an equivalent measure of safety for use in a building code appeal.

Depending on the costs associated with the alternative methods and the requisite approval of the authority having jurisdiction, the least expensive option will be selected. The methods for obtaining equivalency are listed below.

Option 1: Install non code required smoke detection in the spaces Open Workstations 345, Payroll Station 344, Planning Workstations 303, and Reception 302. Due to the earlier detection of a fire by smoke detectors relative to the sprinkler system, it will allow a more timely evacuation of non essential personnel and quicker response by resident fire fighters. With anticipated quick response due to the early detection, the fire is not expected to achieve as substantial of a heat release rate before manual suppression is initiated.

Option 2: Install eight fire sprinkler system spray nozzles above, the suspended ceiling, for protection of the steel perimeter of each skylight. The nozzles will be directed to wet the exposed edges of the steel providing cooling of the steel and gases in the vicinity of the steel.
General Description

The Portland Fire Station, located at 55 SW Ash Street, Portland, Oregon, is a three story building with a basement and was originally constructed in 1952. The building was classified as a Type 1-B, nonconforming structure in 1980.

The building occupancy consists of A-3, B, R-2 and S-2 occupancy types as defined in the Oregon Structural Specialty Code (OSSC).

As part of the current upgrade project, skylights were installed on the third floor of the building to allow day lighting for the open workstation space below. The surrounding spaces on the third floor consist primarily of private offices and associated support spaces, e.g., conference rooms, file rooms, break rooms, etc. (Group B, occupancy).

The concrete roof pan and joists were cut to allow the skylight penetration through and terminating above the roof line. 4”x4”x1/2” hollow structural steel (HSS) members are located below the concrete joists and form an “H” pattern around the skylight to provide structural support. The steel is attached via metal ½” bent steel plates welded to the steel and bolted with a through bolt to the concrete webs of the pan joist concrete ceiling. Per the building official’s review of the structural steel supports for the skylights and roof assembly, the supports are considered part of the roof construction and therefore a 1-hour fire-resistance rating of the steel support assemblies is required for Type 1-B construction per Table 601 of the Oregon Structural Specialty Code (OSSC). Currently, the steel members are installed without any fire-resistance rating.

A suspended, lay-in ceiling 11’-6” above the finished floor (AFF) is installed in the office space around the skylights space. Gypsum soffits extend to 10’-6” below AFF in a square grid pattern around each skylight. The ceiling tile is of a wet-formed mineral fiber with a flame spread rating of 25 or less and a smoke developed index of 50 or less. The space above the ceiling is non-combustible construction.

A fire sprinkler system is required per the OSSC section 903.2.7 for group R occupancies. A fire sprinkler system was installed during the current upgrade in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, with sprinklers located throughout the building. Extended coverage, quick-response sprinklers (11.2K factor) are currently installed in the suspended ceiling adjacent to the skylights to provide protection within this area. Per NFPA 13, sprinklers are not required above the ceiling in the non-combustible interstitial space between the roof deck and the suspended ceiling.

The sprinklers have a coverage area of 256 sq. ft per sprinkler with a density of 0.10 GPM over 934 square feet which is compliant with NFPA 13 requirements. The skylights meet the exception in NFPA 13 not requiring sprinkler protection within the skylight cavity.

A fire alarm system is installed throughout the building to provide notification to building occupants as required by the OSSC. The system operates on water flow and limited area smoke detection in areas required by code as well as additional, non-required detection in electrical rooms, storage rooms, and in the residential level hallways. Smoke detection is provided in the sleeping units as required by code.
Analysis and Proposed Alternatives

Since application of a standard fire proofing material to the steel is problematic, post occupancy, two separate options utilizing active fire protection or fire detection to achieve equivalency were examined.

- Provide additional smoke detection to detect and warn of a fire at early stages of development.
- Application of water to cool the steel and fire gases in the vicinity of the steel.

The space above the suspended ceiling is non-combustible and not the likely origin for a fire. A threatening fire would be expected to develop in the office spaces below the suspended ceiling in the vicinity of the skylights or adjacent offices. For both alternative equivalency options, the overall size of the fire would be expected to be controlled due to the sprinkler system operation in the building. For a fire occurring in the personal offices adjacent to the skylights, the fire size would be initially restricted by the bounding walls. Development of a heat layer within the office would result in sprinkler operation within the office and subsequent control of the fire. Therefore the fire condition of concern is a fire occurring in the Open Workstation 345 or adjacent spaces open to the room, e.g., payroll workstations 344 where the fire growth is not immediately bounded by walls. The corridor adjacent to the space has minimal loading and was not considered as a large contributor to a fire threatening the steel.

Option 1 – Enhanced Smoke Detection:

Since fire growth is exponential, response time has a critical impact on the ability to control the fire and reduce its impact. Smoke detection is often used to enhance emergency and evacuation response. This is on account of the ability of smoke detection to activate an alarm condition prior to substantial development of the fire. Not only does this initiate occupant evacuation from the building more timely, it also initiates rapid fire department response for manual suppression of the fire. It should be noted, since fire department responders are located within the building, response should occur more quickly relative to a standard commercial building.

Due to the building being a municipal fire station, the fire alarm system is expected to be maintained and operative in compliance with adopted codes. This would provide the reasonable expectation the system is operable during a fire event, or adequate measures have been taken when the system is temporarily inoperative.

The proposed alternative is to provide non code required smoke detection in the vicinity of the skylights in the spaces Open Workstations 345, Payroll Station 344, Planning Workstations 303, and Reception 302 (See diagram 1).

Option 2 - Enhanced Fire Protection:

Water is very effective at removing heat due to its high latent heat of vaporization, and as a wetting agent, has been proven to provide excellent exposure protection.

Use of fire sprinklers in lieu of fireproofing is not unprecedented. Sprinklers can be used to reduce or eliminate the required fire resistive ratings in incidental use areas per the OSSC table 508.2. Additionally, NFPA 13 addresses the use of sprinklers for protection of unprotected steel columns in high-piled storage applications, e.g., NFPA 13, section 16.1.4. The allowance is for water spray to act in lieu of fire proofing in areas of high-pile storage of plastic and Class IV commodities. These commodities and storage configuration would be expected to pose a far greater fire hazard than the light-hazard threat associated with an office environment. Finally, NFPA 15, Standard for Water Spray Fixed
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*Systems for Fire Protection*³, section 7.4 also identifies the use of active fire protection for the protection of structural steel.

Due to the building being a municipal fire station, the sprinkler system is expected to be maintained and operative in compliance with adopted codes. This would provide the reasonable expectation the system is operable during a fire event, or adequate measures have been taken when the system is temporarily inoperative. In the unlikely case the system has been shut off for maintenance purposes during a fire event, the system could be rearmed by the disabling person to allow the system to operate and control the fire.

Because NFPA 15, section 7.4.3, details the application of water on horizontal structural steel, it is used as the basis of design for active fire sprinkler protection of the steel within the ceiling cavity. NFPA 15 indicates an application rate of 0.1 gpm/sq ft is adequate for protection for the duration of the fire.

The proposed alternative is to provide exposure protection utilizing frame spray nozzles, similar to those shown in the attachment, directed at the exterior perimeter of the steel in the above ceiling cavity. The conical pattern of the nozzle discharge will spray water on the exposed steel facing the nozzles. See diagram 1. Not only would the spray system cool the steel directly by impingement, a secondary benefit would be the resultant entrainment of the water spray and the associated cooling of the fire gases in the above ceiling space, similar to a water curtain.

The spray nozzles have fusible elements that operate only when the associated nozzle is exposed to hot gases, similar to a standard sprinkler. Only the nozzles exposed to the hot ceiling jet above the ceiling would operate (i.e., above the fusible set point temperature of the nozzle). This will avoid taxing the water supply and operate only nozzles near steel being exposed to excessive heat. A 286 degree fusible element is proposed for the nozzles.

The proposed design area is similar to the sprinkler system design area (approximately 900 sq. ft.). This results in simultaneous protection of three skylights during an event. The above ceiling exposure protection system and the existing sprinkler system would be designed to run concurrently.

The floor space below the skylight would be protected with the existing fire protection system which would maintain fire control and temperatures in the space as well as the steel on the underside of the skylight. In addition to the current gypsum covering, this will prevent exposing the underside of the skylight to hot gases.

The system duration of operation would only be limited by the city water supply availability and would exceed the 1-hour requirement of the steel.

**Alternative Means Technical Requirements**

**Option 1 - Enhanced Smoke Detection:**

Provide smoke detector coverage in Open Workstations 345, Payroll Station 344, Planning Workstations 303, and Reception 302 in accordance with NFPA 72 spacing criteria. Detectors would provide warning of a fire event for initiating evacuation and response time to initiate a manual attack on the fire at an earlier stage in the fire development. See Diagram 1.
Option 2 - Enhanced Fire Protection:

1. Provide 286 Degree, 1.4K factor Viking frame spray nozzles at each skylight, above the suspended ceiling, aimed at the exposed surface of the structural steel to allow wetting of the exposed portions of the structural steel as well as cooling of hot gases within the above ceiling space. See diagram 2 and catalog cut sheet.

2. Provide piping and connection to the existing sprinkler system as required to achieve simultaneous operation of the sprinkler system over the design area and operation of the exposure protection system for three skylights.

3. Provide signs at the main riser indicating a special exposure protection system is served by the sprinkler riser.

References


1. DESCRIPTION

Viking Frame Style Spray Nozzles are small, directional spray nozzles for use on water spray systems. They are thermosensitive glass bulb style nozzles, however they may be ordered OPEN (glass bulb and pip cap assembly removed) for use on deluge systems. These Frame Style Spray Nozzles are available in various finishes, temperature ratings, orifice sizes, and spray pattern discharge angles to meet design requirements. When spraying, the nozzles discharge a cone-shaped spray pattern. The deflector determines the included angle of spray pattern discharge. A special ring provides uniform distribution throughout the spray pattern.

Other features include the small frame, which allows proper nozzle positioning even in congested areas, and the nominal 5 mm glass bulb contained entirely inside the frame for protection from most mechanical damage. The glass bulb operating elements are resistant to more corrosive atmospheres than metal elements. The special Teflon® coating has been investigated for installation in corrosive atmospheres and is cULus listed as corrosion resistant as indicated in the Approval Chart.

2. LISTINGS AND APPROVALS

- **cULus Listed:** Category VGYZ
- **NYC Approved:** MEA 89-92-E, Volume 29

**NOTE:** International approval certificates are available upon request. Refer to the Approval Chart on page 31d and Design Criteria on page 31e for cULus listing requirements that must be followed.

3. TECHNICAL DATA

**Specifications:**
- Minimum Operating Pressure: 7 psi (0.5 bar)
- Rated to 175 psi (12 bar) water working pressure.
- Factory tested hydrostatically to 500 psi (34.5 bar)
- Refer to page 31e-i for spray patterns.

Frame Style Spray Nozzles are available in various orifice sizes. The smallest nozzle passage is 1/4" (6 mm) for VK720-VK723; 5/16 (8 mm) for VK715-VK718; 3/8" (10 mm) for VK7710-VK713; 7/16" (11 mm) for VK705-VK708, 1/2" (13 mm) for VK700-VK703.

The spray nozzle deflector is identified with the SIN, K-Factor, spray angle, and temperature rating.
- Thread size: 1/2" (15 mm) NPT
- Nominal K-Factors: Refer to the Approval Chart
- Glass-bulb fluid temperature rated to -65 °F (-55 °C)
- Overall Length: Refer to the Approval Chart

**Spray Nozzle Material Standards:**
- Frame Casting: Brass UNS-C84400
- Deflector: Copper UNS-C19500
- Ring: Copper UNS-C19500
- Bulb: Glass, nominal 5 mm diameter
- Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with Teflon Tape
- Screw: Brass UNS-C36000
- Bushing (Small Orifice Nozzles): Brass UNS-C36000
- Pip Cap: Brass UNS-C314000 or UNS-C31600

Viking Technical Data may be found on The Viking Corporation’s Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Form No. F_011594

Replaces page 31a-e, dated April 13, 2007.

(Changed the metric K-factor for K4.2 sprinklers to 57.)
**For Teflon® Coated Nozzles:** Belleville Spring-Exposed, Screw-Nickel Plated (painted black for appearance only), Pip Cap-Teflon® Coated

**Ordering Information:** (Also refer to the current Viking price list.)
Order Frame Style Spray Nozzles by selecting the appropriate part number from the Approval Chart. Add the appropriate suffix for the nozzle finish and then the appropriate suffix for the temperature rating to the spray nozzle base part number.

**Finish Suffix:** Brass = A, Black Teflon® = N


For example, Spray Nozzle VK700 with a Brass finish and a 155°F/68°C temperature rating = Part No. 08501AB

**Available Finishes And Temperature Ratings:**
Refer to Table 1

**Accessories:** (Also refer to the “Sprinkler Accessories” section of the Viking data book.)

**Spray Nozzles Wrenches:**
A. Standard Wrench: Part No. 10896W/B (available since 2000).
B. Wrench for coated spray nozzles: Part No. 13577W/B** (available since 2006)
   
   **A ½” ratchet is required (not available from Viking).**

**Sprinkler Cabinets:**
A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

### 4. INSTALLATION

**WARNING:** Viking Frame Style Spray Nozzles are manufactured and tested to meet the rigid requirements of the approving agency. The nozzles are designed to be installed in accordance with recognized installation standards. Deviation from the standards or any alteration to the nozzle after it leaves the factory including, but not limited to: painting, plating, coating, or modification, may render the unit inoperative and will automatically nullify the approval and any guarantee made by The Viking Corporation.

The Approval Chart on page 31c shows listings and approvals of Frame Style Spray Nozzles for use on water spray systems and water based deluge systems. The chart shows listings and approvals available at the time of printing. Other approvals are in process. Check with the manufacturer for any additional approvals.

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**TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES**

<table>
<thead>
<tr>
<th>Sprinkler Temperature Classification</th>
<th>Sprinkler Nominal Temperature Rating¹</th>
<th>Maximum Ambient Ceiling Temperature²</th>
<th>Bulb Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary</td>
<td>135 °F (57 °C)</td>
<td>100 °F (38 °C)</td>
<td>Orange</td>
</tr>
<tr>
<td>Ordinary</td>
<td>155 °F (68 °C)</td>
<td>100 °F (38 °C)</td>
<td>Red</td>
</tr>
<tr>
<td>Intermediate</td>
<td>175 °F (79 °C)</td>
<td>150 °F (65 °C)</td>
<td>Yellow</td>
</tr>
<tr>
<td>Intermediate</td>
<td>200 °F (93 °C)</td>
<td>150 °F (65 °C)</td>
<td>Green</td>
</tr>
<tr>
<td>High</td>
<td>286 °F (141 °C)</td>
<td>225 °F (107 °C)</td>
<td>Blue</td>
</tr>
</tbody>
</table>

**Sprinkler Finishes:** Brass and Black Teflon®

**Corrosion-Resistant Coatings:** Black Teflon®

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**Footnotes**

¹ The sprinkler temperature rating is stamped on the deflector.

² Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

³ The corrosion-resistant coating has passed the standard corrosion test required by the approving agencies indicated in the Approval Chart. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coating is compatible with or suitable for the proposed environment. For automatic spray nozzles, the coating is applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Teflon® coatings. For Teflon® coated open spray nozzles only, the waterway is coated.
# Approval Chart

## Frame Style Spray Nozzles²

<table>
<thead>
<tr>
<th>Base Part Number¹</th>
<th>SIN</th>
<th>Pattern</th>
<th>Thread Size</th>
<th>Nominal Orifice</th>
<th>Nominal K-Factor</th>
<th>Overall Length</th>
<th>Listings and Approvals⁴ (Refer also to Design Criteria on page 31d.)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>NPT</td>
<td>BSP</td>
<td>Inches</td>
<td>mm</td>
<td>U.S. metric³</td>
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<tr>
<td>1/2&quot; (15 mm) Orifice</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08501</td>
<td>VK700</td>
<td>60°</td>
<td>1/2&quot;</td>
<td>15 mm</td>
<td>1/2&quot;</td>
<td>15 mm</td>
<td>5.6</td>
</tr>
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<td>VK701</td>
<td>90°</td>
<td>1/2&quot;</td>
<td>15 mm</td>
<td>1/2&quot;</td>
<td>15 mm</td>
<td>5.6</td>
</tr>
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<td>08503</td>
<td>VK702</td>
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<td>1/2&quot;</td>
<td>15 mm</td>
<td>1/2&quot;</td>
<td>15 mm</td>
<td>5.6</td>
</tr>
<tr>
<td>08504</td>
<td>VK703</td>
<td>150°</td>
<td>1/2&quot;</td>
<td>15 mm</td>
<td>1/2&quot;</td>
<td>15 mm</td>
<td>5.6</td>
</tr>
<tr>
<td>7/16&quot; Orifice⁷</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08595</td>
<td>VK705</td>
<td>60°</td>
<td>1/2&quot;</td>
<td>15 mm</td>
<td>7/16&quot;</td>
<td>--</td>
<td>4.2</td>
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<tr>
<td>08599</td>
<td>VK706</td>
<td>90°</td>
<td>1/2&quot;</td>
<td>15 mm</td>
<td>7/16&quot;</td>
<td>--</td>
<td>4.2</td>
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<tr>
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<td>VK707</td>
<td>120°</td>
<td>1/2&quot;</td>
<td>15 mm</td>
<td>7/16&quot;</td>
<td>--</td>
<td>4.2</td>
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<tr>
<td>08607</td>
<td>VK708</td>
<td>150°</td>
<td>1/2&quot;</td>
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<td>7/16&quot;</td>
<td>--</td>
<td>4.2</td>
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<td>3/8&quot; (10 mm) Orifice³</td>
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<td>VK710</td>
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<td>3/8&quot;</td>
<td>10 mm</td>
<td>2.8</td>
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<td>VK711</td>
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<td>3/8&quot;</td>
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<td>VK712</td>
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<td>3/8&quot;</td>
<td>10 mm</td>
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<td>3/8&quot;</td>
<td>10 mm</td>
<td>2.8</td>
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<tr>
<td>5/16&quot; Orifice⁷</td>
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<td>08597</td>
<td>VK715</td>
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<td>5/16&quot;</td>
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<td>1.9</td>
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<td>5/16&quot;</td>
<td>--</td>
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<td>5/16&quot;</td>
<td>--</td>
<td>1.9</td>
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<td>150°</td>
<td>1/2&quot;</td>
<td>15 mm</td>
<td>5/16&quot;</td>
<td>--</td>
<td>1.9</td>
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<td>1/4&quot; Orifice</td>
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<td>VK720</td>
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<td>15 mm</td>
<td>1/4&quot;</td>
<td>--</td>
<td>1.4</td>
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</table>

### Approved Temperature Ratings
- A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)
- B - Open (glass bulb and pip cap removed)

### Approved Finishes
- 1 - Brass and Black Teflon® for use on water-based deluge and water spray systems.

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¹ Base part number is shown. When ordering, specify either open or automatic. For complete part number, see current Viking price schedule.

² The spray nozzle deflector is identified with the SIN, K-Factor, spray angle, and temperature rating.

³ Metric K-factor shown is for use when pressure is measured in bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

⁴ This chart shows the listings and approvals available at the time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.

⁵ Listed by Underwriters Laboratories Inc. for use in the U.S. and Canada.

⁶ Accepted for use, City of New York Department of Buildings, MEA 89-92-E, Vol. 29.

⁷ The orifice is bushed.

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The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501  Technical Services: 877-384-5464  Fax: 269-818-1680  Email: techsvcs@vikingcorp.com
cULus Listing Requirements:
Frame Style Spray Nozzles are small, directional spray nozzles for use on water spray systems. Refer to the installation standards, such as NFPA 13, for minimum water supply requirements, nozzle pressure, and installation guidelines.

**IMPORTANT:** Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Viking frame style spray nozzles are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

A. Spray nozzles are to be installed in accordance with the latest edition of Viking technical data, the latest published standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards whenever applicable. The use of Frame Style Spray Nozzles may be limited due to occupany and hazard. Refer to the Authority Having Jurisdiction prior to installation.

B. Frame Style Spray Nozzles are installed on fixed fire protection systems, such as deluge systems, where total flooding is required.

C. Handle sprinklers and spray nozzles with care. They must be stored in a cool, dry place in their original shipping container. Never install a sprinkler or spray nozzle that has been dropped, damaged, or exposed to temperatures exceeding the maximum ambient temperature allowed (refer to Table 1 below).

D. Never install any glass-bulb sprinkler if the bulb is cracked or if there is a loss of liquid from the bulb. A small air bubble should be present in the glass bulb. Any sprinkler with a loss of liquid from the glass bulb or damage to the fusible element should be destroyed immediately.

E. Corrosion-resistant sprinklers and spray nozzles must be installed when subject to corrosive atmospheres. When installing corrosion resistant nozzles, take care not to damage the corrosion resistant coating.

F. Spray nozzles must be installed after the piping is in place to prevent mechanical damage.

G. Sprinklers and spray nozzles must be protected from mechanical damage. Where open sprinklers are used, care must be taken to prevent foreign materials from entering the orifice. Foreign materials may accumulate and restrict or plug the waterway and may prevent proper operation of the spray nozzle.

H. Before installing, be sure to have the appropriate sprinkler model and style, with the correct K-Factor, temperature rating, and response characteristics. When installing automatic (closed) Frame Style Spray Nozzles, proceed to paragraphs I, J, and K below.

1. **When installing open Frame Style Spray Nozzles:** Hydrostatic testing must be completed prior to spray nozzle installation. Install plugs in place of spray nozzles for test purposes only. In areas where leakage during testing must be prevented, system piping may be air tested prior to testing with water. Refer to the appropriate installation standard and the Authority Having Jurisdiction. When hydrostatic testing is complete, verify that all test plugs have been removed. Proceed to paragraphs I and K below. Omit paragraph J.

I. **For Automatic (closed) and Open Frame Style Spray Nozzles:** Before installing, be sure to have the appropriate model and style, with the correct orifice size, temperature rating, and response characteristics. Frame Style Spray Nozzle deflectors are identified with the U.S. K-Factor, spray angle, and temperature rating.

1. Apply a small amount of pipe-joint compound or tape to the external threads of the spray nozzle only, taking care not to allow a build-up of compound inside the inlet.

2. Install the nozzle on the fixed piping, using the special sprinkler/spray nozzle wrench only. Take care not to over-tighten or damage the spray nozzle operating parts. DO NOT use the deflector to start or thread the unit into a fitting.

J. **For automatic (closed) spray nozzle installations:** After installation, the entire fixed pipe system must be tested. The test must be conducted to comply with the installation standards. Make sure the spray nozzle has been properly tightened. If a thread leak occurs, normally the unit must be removed, new pipe-joint compound or tape applied, and then reinstalled. This is due to the fact that when the joint seal is damaged, the sealing compound or tape is washed out of the joint. In areas where leakage during testing must be prevented, system piping may be air tested prior to testing with water. Refer to the appropriate installation standard and the Authority Having Jurisdiction.
K. For Automatic (closed) and Open Frame Style Spray Nozzles: Spray nozzles must be protected from mechanical damage. Where open spray nozzles are used, care must be taken to prevent foreign materials from entering the orifice. Foreign materials may accumulate and restrict or plug the waterway and may prevent proper operation of the spray nozzle. Wet pipe systems must be provided with adequate heat. When installing Frame Style Spray Nozzles on dry systems, refer to the Installation Guides and the Authority Having Jurisdiction.

5. OPERATION
During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the bulb to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the orifice strikes the special deflector to direct a specific spray pattern toward the surface covered.

6. INSPECTIONS, TESTS AND MAINTENANCE
   NOTICE: Refer to NFPA 25 for Inspection, Testing and Maintenance requirements. NOTICE: The owner is responsible for having the fire-protection system and devices inspected, tested, and maintained in proper operating condition in accordance with this guide, and applicable NFPA standards. In addition, the Authority Having Jurisdiction may have additional maintenance, testing, and inspection requirements that must be followed.
   A. Sprinklers and spray nozzles must be inspected on a regular basis for corrosion, mechanical damage, obstructions, paint, etc. Where open spray nozzles are installed, verify that foreign materials (such as dust, dirt, etc.) do not restrict or plug the waterway. Frequency of inspections may vary due to corrosive atmospheres, water supplies, and activity around the device.
   B. Sprinklers or spray nozzles that have been filed painted, caulked, or mechanically damaged must be replaced immediately. Sprinklers showing signs of corrosion shall be tested and/or replaced immediately as required. Installation standards require sprinklers to be tested and, if necessary, replaced after a specified term of service. Refer to NFPA 25 and the Authority Having Jurisdiction for the specified period of time after which testing and/or replacement is required. Never attempt to repair or reassemble a sprinkler. Sprinklers that have operated cannot be reassembled or re-used, but must be replaced. When replacement is necessary, use only new sprinklers with identical performance characteristics.
   C. The sprinkler discharge pattern is critical for proper fire protection. Therefore, nothing should be hung from, attached to, or otherwise obstruct the discharge pattern. All obstructions must be immediately removed or, if necessary, additional sprinklers installed.
   D. When replacing existing sprinklers, the system must be removed from service. Refer to the appropriate system description and/or valve instructions. Prior to removing the system from service, notify all Authorities Having Jurisdiction. Consideration should be given to employment of a fire patrol in the affected area.
      1. Remove the system from service, drain all water, and relieve all pressure on the piping.
      2. Use the special sprinkler wrench to remove the old sprinkler by turning it counterclockwise to unthread it from the piping.
      3. Install the new sprinkler unit by following the instructions in section 4. INSTALLATION. Care must be taken to ensure that the replacement sprinkler is the proper model and style, with the correct K-Factor, temperature rating, and response characteristics. A fully stocked spare sprinkler cabinet should be provided for this purpose.
   E. Place the system back in service and secure all valves. Check for and repair all leaks. Sprinkler systems that have been subjected to a fire must be returned to service as soon as possible. The entire system must be inspected for damage, and repaired or replaced as necessary. Sprinklers that have been exposed to corrosive products of combustion or high ambient temperatures, but have not operated, should be replaced. Refer to the Authority Having Jurisdiction for minimum replacement requirements.

7. AVAILABILITY
The Viking Frame Style Spray Nozzles are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE
For details of warranty, refer to Viking’s current list price schedule or contact Viking directly.
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