NFSA NATIONAL FIRE SPRINKLER ASSOCIATION
The Voice of the Fire Sprinkler Industry

TechNotes

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March 12, 2019
Best of February 2019

Following are a dozen questions answered by the engineering staff as part of the NFSA's Expert of the Day (EOD) member assistance program during the month of February 2019. This information is being brought forward as the "Best of February 2019." If you have a question for the NFSA EOD (and you are an NFSA member), send your question to eod@nfsa.org and the EOD will get back to you.

It should be noted that the following are the opinions of the NFSA Engineering Department staff, generated as members of the relevant NFPA technical committees and through our general experience in writing and interpreting codes and standards. They have not been processed as formal interpretations in accordance with the NFPA Regulations Governing Committee Projects and should therefore not be considered, nor relied upon, as the official positions of the NFPA or its Committees. Unless otherwise noted the most recent published edition of the standard referenced was used

Question #1 - Limit to the Use of Mechanical Tees

You have identified an informal AHJ policy limiting the use of mechanical tees to three or less branch- line connections per main.

Are you aware of any research or information regarding the use of mechanical tees having an effect on pipe integrity or being more prone to leaks?

Answer: The answer to your question is "no, we are not aware of any research identifying increased leaks with mechanical tees when installed in accordance with manufacturer's instructions." Historically, there have been US government (USG) restrictions regarding the use of mechanical tees with j-hooks, or mechanical tees using only a single attachment bolt. Additionally, some USG specifications have required mechanical tees to have a two-bolt restraining housing that wraps around the pipe. In the public sector, restrictions can be either imposed through technical specifications or legislatively through jurisdictional rules or regulations. Technical specifications might provide restrictions based on the design professional's opinion or might be directed by the owner. These types of restrictions are enforceable as part of the

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Presented by Mark Hopkins, P.E., Vice President of Engineering

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The NFSA assigns a member of the Engineering Department staff every business day to answer your technical questions. We call this the Expert of the Day (EOD) program and it is available to our members by phone, or e-mail. Call us at (845) 878-4200 and press 2, or you can e-mail us at eod@nfsa.org. Last year we answered more than 1400 requests for assistance.

contract and acceptance might not be granted if these restrictions are established as part of the bid process and contract for the project. However, an AHJ would be stretching jurisdictional authority if there are no written rules, regulations or requirements in the adopted codes or standards limiting the use of mechanical tees. In these cases, there is no legitimate basis for the AHJ to impose a limit. This would be considered to be a possible restraint in trade.

Question #2 - Standpipe Pressure Limit

You have referenced NFPA 14-2019 section 7.2.1 which now limits the pressure at any point in the standpipe system to 400 psi. You note that NFPA 20 and NFPA 14 Stationary Fire Pumps and Standpipe Systems Handbook, 2019 edition still shows a maximum permitted pressure of 350 psi on page 689.

> ***7.2.1****The maximum pressure at any point in the system at any time shall not exceed 400 psi (28 bar).*

What is the correct maximum pressure limit?

Answer: The answer to your question is "400 psi as verified on the NFPA website at nfpa.org/14". We do not have a copy of the 2019 Stationary Fire Pumps and Standpipe Systems Handbook available to verify the context of the 350 psi figure but assume it is an editorial oversight. The maximum pressure was raised from 350 psi to 400 psi in the first revision of the 2019 draft standard. It was challenged unsuccessfully in second revision and was not changed for the final draft.

Question #3 - Installation of Pipe Above Fire Pump Controllers

Can pipe be run directly over a fire pump controller?

Answer: The answer to your question is "yes, but the pipe must follow the working clearance restrictions referenced in NFPA 20 and the additional restrictions of dedicated electrical spaces per NFPA 70 section 110."

Per NFPA 20-2016 section 10.2.4 "Working clearances around controllers shall comply with NFPA 70, Article 110." Utilize Table 110.26(A)(1) to determine the working space clearances.

For pipe run over the controller, a new annex note was added to the 2019 edition of NFPA 13 during this last cycle to help clarify this issue:

> ***A.9.2.6*** *Sprinklers and sprinkler piping is permitted in and is permitted to pass through an electrical room as long as the piping is not within the "dedicated electrical space" as defined by NFPA 70.*
>
> *In 110.26(E)(1)(a) of NFPA 70, a dedicated electrical space is defined as the space equal to the width and the*

depth of the equipment extending from the floor to a height of 6 ft (1.8 m)
above the equipment or the structural ceiling, whichever is lower. This section further states that no foreign systems are allowed in this zone. So, as long as the sprinkler piping does not run through this dedicated electrical space, it can go in and out of the electric room without issue. Paragraph 110.26(E)(1)(b) of NFPA 70 allows foreign systems in the area above the dedicated electrical space as long as the electrical equipment is properly protected against leaks or breaks in the foreign system. So the sprinkler piping can run above the dedicated electrical space [6 ft (1.8 m) above equipment] as long as the equipment below is protected from leaks. Additionally, sprinklers and sprinkler piping are not permitted to be located directly within the working space for the equipment as defined by NFPA 70. See Figure A.9.2.6.

In addition to the clearance rules referenced in NFPA 20, sprinkler piping is allowed to run through electrical rooms, so long as the piping does not pass through the dedicated electrical space which includes the equipment itself plus a height of 6 ft. If there is a structural ceiling installed then the height is limited to 6 ft or the ceiling, whichever is lower.

Question #4 - Car Stacking Facilities

What is the commodity/hazard classification for cars stacked two levels high?

Answer: Questions regarding hazard or commodity classification are difficult except in those circumstances where some NFPA occupancy committee has specifically addressed the issue. This is especially true because hazard classification is considered in many states and jurisdictions to be the most important aspect of fire protection system design, and an obligation of the responsible design professional. One reason many states require involvement of a responsible design professional is to ensure that the site-specific attributes of the project are recognized and properly addressed, which cannot be accomplished in a generic manner.

In this case, the responsible party should refer to NFPA 13-2016 Annex section A.5.4.2 which states that car stackers with 2 cars stacked vertically could be considered as an Extra Hazard Group 2 (EH2) occupancy: This section reads as follows

> ***A.5.4.2*** *Extra hazard (Group 2) occupancies include occupancies having uses and conditions similar to the following:*
> *...*
> ***(9) Car stackers and car lift systems with 2 cars stacked vertically***

It must be noted that the annex of NFPA 13 only provides examples and would not be considered as part of the "rules" of the standard. It is the responsibility of the design

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professional to determine the hazard classification for the specific project. The reasoning for the EH2 classification is that the cars would obstruct or shield sprinkler spray. EH2 is appropriate where "shielding of combustibles is extensive" (see section 5.4.2)

It must be also noted that some jurisdictions around the country has adopted specific protection criteria for these occupancies.

Question #5 - Storage with Open-Top Containers

NFPA 13 specifically prohibits open-top containers when CMSA or EFSR sprinklers are used for the protection of storage. Since there are no identified exclusions for control mode/standard spray sprinklers, is it permitted to use the CMDA approach with standard spray sprinklers for the protection of open-top containers when all other criteria are met?

Answer: The answer to your question is "no." NFPA 13-2019 section 20.3.3 identifies that protection of open-top containers is outside the scope of NFPA 13 chapters 21 through 25. These are the new chapters regarding the use of CMDA (Chapter 21), CMSA (Chapter 22), ESFR (Chapter 23), alternative design applications (Chapter 24), and protection using in-rack sprinklers (Chapter 25). As a result, open-top containers cannot be protected based solely on the requirements of NFPA 13.

> ***20.3.3 Open-Top Container***. *A container of any shape that is entirely or partially open on the top and arranged so as to allow for the collection of discharging sprinkler water cascading through the storage array shall be considered outside the protection criteria of rack storage protection outlined in Chapters 21 through 25.*

FM Global has developed criteria for the protection of open-top containers. The responsible design professional would need to consider application of the FM Global criteria, conduct large scale testing, or utilize data from some other source to identify an appropriate scheme for the protection of open-top containers which is considered to be acceptable to the authority having jurisdiction.

Question #6 - Pendent Sprinklers Used on Dry Pipe Systems

You describe a dry pipe sprinkler system that includes protection for an air conditioned and heated office space.

You ask if it is permissible to use pendent sprinklers on return bends to protect the office space provided that the sprinklers and the entire return bend are within the conditioned space. (You note that a third-party reviewer states that specially listed sprinklers are required for this arrangement.)

Answer: The answer to your question is "yes, this is permitted

by NFPA 13-2016 section 7.2.2(3)". The only option requiring specially listed sprinklers is found in section 7.2.2(2) for dry sprinklers. This section does not impose any special requirements on pendent standard spray or extended coverage sprinklers.

> ***7.2.2 Sprinklers**. The following sprinkler orientations and arrangements shall be permitted for dry pipe systems:*
> *(1) Upright sprinklers*
> *(2)* Listed dry sprinklers*
> *(3) Pendent sprinklers and sidewall sprinklers installed on return bends, where the sprinklers, return bend, and branch line piping are in an area maintained at or above 40°F (4°C)*
> *(4) Horizontal sidewall sprinklers installed so that water is not trapped*
> *(5) Pendent sprinklers and sidewall sprinklers, where the sprinklers and branch line piping are in an area maintained at or above 40°F (4°C), the water supply is potable, and the piping for the dry pipe system is copper or CPVC specifically listed for dry pipe applications*
> ***3.6.2.3 Pendent Sprinkler**. A sprinkler designed to be installed in such a way that the water stream is directed downward against the deflector.*
> ***3.6.3.2* 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.*

Question #7 - Check Valves for Floor Control Valve Assemblies

You have identified a project having fire sprinkler systems in a large, two-story nursing home. You have indicated that a standpipe system will not be required since the floor level of the highest story is less than 30 ft above the lowest level of fire department access. You identified that a riser will be installed in each of the two stairwells, which will supply four separate floor control valve assemblies for the sprinkler systems in the building.

You have also identified that NFPA 13-2016 includes two figures in the annex that provide different requirements. You have cited that Figure A.8.17.5.2.2(a) shows a check valve as part of the floor control valve assembly. However, Figure A.8.17.4.1(b) does not show a check valve. You have indicated that your understanding is that the difference between the two figures is that the first is fed from a vertical riser, and the second is fed from a Standpipe. You have asked two questions which will be answered separately in this email. You have also asked for confirmation of your interpretation.

Question 7.1: Why does the purpose of the supply pipe feeding a Floor Control Valve Assembly matter when determining whether we need a check valve or not?

Answer: Your understanding of the differences between the figures is correct. The reason that Figure A.8.17.5.2.2(a) includes a check valve is because it is part of a combined sprinkler and standpipe system which uses the standpipes to

supply the sprinkler system floor control assemblies. Figure A.8.17.4.1(b) refers to a vertical riser as part of a sprinkler system only. Figure A.8.17.5.2.2(a) demonstrates a system where the fire service can attach hose to conduct firefighting operations on upper floors of a building. These operations can cause drastic changes in the pressure in the combinational system. The check valve is necessary to prevent the mains and branch lines from draining of water when the fire service is using the standpipe. Additionally, the check valve ensures that the mains and branch lines are pressurized, which reduces the severity of a sudden jump in pressure due to fire service efforts. Figure A.8.17.4.1(b) is an example of a riser that exclusively serves the sprinkler system, and does not experience the pressure losses, or rapid changes that a riser/standpipe system does due to firefighter flowing water from their hand lines. While inclusion of a check valve would be considered to be good practice, Figure A.8.17.4.1(b) demonstrates that it is not necessary to meet the minimum requirements of NFPA 13.

It is important to recognize that if this building was more than two stories in height a check valve would be required as part of the floor control valve assembly regardless of whether it is supplied by a standpipe. NFPA 13-2016 section 8.2.4 requires multistory buildings exceeding two stories in height to have check valves. As you have stated this building is two stories in height, this requirement is not applicable in this given situation. However, it is worth recognizing that this requirement does apply to some multistory buildings.

> ***8.2.4 Floor Control Valve Assemblies.***
>
> ***8.2.4.1**** *Multistory buildings exceeding two stories in height shall be provided with a floor control valve, check valve, main drain valve, and flow switch for isolation, control, and annunciation of water flow for each individual floor level.*
>
> ***8.2.4.2*** *The floor control valve, check valve, main drain valve, and flow switch required by 8.2.4.1 shall not be required where sprinklers on the top level of a multistory building are supplied by piping on the floor below.*
>
> ***8.2.4.3*** *The floor control valve, check valve, main drain valve, and flow switch required by 8.2.4.1 shall not be required where the total area of all floors combined does not exceed the system protection area limitations of 8.2.1.*

Question 7.2: Why are these requirements not found in the body of the Standard, only in the Annex figures?

Answer: The reason that this information is in the annex rather than the main body of the standard is that NFPA 14 provides most of the guidance on combinational sprinkler/standpipe systems. The figures in NFPA 13 are intended to provide additional explanatory information, recommendations or guidance, which is not considered to be part of the minimum requires found in the body of the standard. As a result, the annex requirements are not enforceable part of the standard.

Question #8 - Sprinkler Sample Area for Testing

Question 8.1: You have asked two questions which will be answered separately in this email.
In the case of a multi building apartment complex built concurrently in a single phase, is it appropriate to consider the entire complex as the sample area?

Answer: The answer is "no, four sprinklers from each system (building) would be the minimum required." Although it is not clearly defined in NFPA 25-2014 section 5.3, the entirety of Chapter 5 applies to 'sprinkler systems' so any sampling requirements must be applied individually to each system which would require a minimum sample size of four sprinklers from each building in accordance with section 5.3.1.2.

> ***5.1.1.1*** *This chapter shall provide the minimum requirements for the routine inspection, testing, and maintenance of sprinkler systems.*
>
> ***5.3.1.2**** *A representative sample of sprinklers for testing per 5.3.1.1.1 shall consist of a minimum of not less than four sprinklers or 1 percent of the number of sprinklers per individual sprinkler sample, whichever is greater.*

While an argument could certainly be made for a one percent test sample from the whole complex, that does not satisfy the intent of the standard.

The annex provides additional guidance regarding the selection of sprinkler samples. The annex suggests that sprinklers should be sampled from the same environment, which would also limit selection to an individual building.

> ***A.5.3.1.2*** *Within an environment, similar sidewall, upright, and pendent sprinklers produced by the same manufacturer could be considered part of the same sample, but additional sprinklers would be included within the sample if produced by a different manufacturer.*

Question 8.2: If the sample area is determined to be a single building, and not the entire complex, and any sample fails would this necessitate replacement of the sprinklers only in the building with the failed sample and not the entire complex?

Answer: The answer to your question is "yes, if any single sprinkler sample fails, all sprinklers in the area where the failed sprinkler was taken would require replacement per section 5.3.1.3, not the entire complex."

> ***5.3.1.3*** *Where one sprinkler within a representative sample fails to meet the test requirement, all sprinklers within the area represented by that sample shall be replaced*

Question #9 - Contractor's Material and Test Certificates for Buildings with Multiple Sprinkler Zones

You have asked if a single test certificate (Contractor's

Material and Test Certificate for Aboveground Piping) can be used for a building having multiple sprinkler system zones separated by zone control assemblies or if an individual test certificate must be submitted for each sprinkler system zone.

Answer: NFPA 13-2019 section 28.1 does not specifically state the requirement one way or the other. Section 28.1(3) states that "appropriate" contractor's material test certificate(s) shall be completed and signed. NFPA 25 also requires that these certificates be retained throughout the life of the system.

> ***28.1 Approval of Sprinkler Systems and Private Fire Service Mains***. *The installing contractor shall do the following:*
> *(1) Notify the authority having jurisdiction and the property owner or the property owner's authorized representative of the time and date testing will be performed*
> *(2) Perform all required acceptance tests (see Section 28.2)*
> *(3) Complete and sign the appropriate contractor's material and test certificate(s) (see Figure 28.1)*
> *(4) Remove all caps and straps prior to placing the sprinkler system in service*

Since NFPA 13 does not provide a definition for "appropriate," the definition provided in Merriam-Webster Collegiate Dictionary, 11th Edition must be used to determine the ordinarily accepted meaning.

> ***3.1 General***. *The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. Merriam-Webster's Collegiate Dictionary, 11th edition, shall be the source for the ordinarily accepted meaning.*

The following definition is provided for appropriate:

Definition of appropriate
especially suitable or compatible : fitting

Use of the terms especially suitable allows for interpretation regarding the application. The requirements provided in NFPA 13 do not align with the way things are actually done in practice. The determination of when the test certificates are required to be submitted is critical in defining the outcome. NFPA 13 defines each "zone" as a separate sprinkler system, so technically it would make sense to have a test certificate per zone. However, if construction is done in a manner in which all zones are completed and tested at the same time a single test certificate would also make sense.

> ***3.3.206* Sprinkler System***. *A system, commonly activated by heat from a fire and discharges water over the fire area, that consists of an integrated network of piping designed in accordance with fire protection engineering standards that includes a water supply source, a water control valve, a waterflow alarm, and a*

drain. The portion of the sprinkler system above ground is a network of specifically sized or hydraulically designed piping installed in a building, structure, or area, generally overhead, and to which sprinklers are attached in a systematic pattern.

In some instances, multiple test certificates might be required for a single sprinkler system installation. As an example, once the hydrostatic test is conducted a test certificate is required to document the procedure. In order to be submitted to the AHJ or design professional prior to completion of the project, a partially completed test certificate is needed. Separate test certificates might also be required after each subsequent test or material submission for documentation purposes. Currently, NFPA 13 does not provide specific requirements which coincide with the actual process that is being applied in the industry. Determination of appropriate is often left to the AHJ based on how jurisdictional requirements for submission of test certificates are required to be implemented. Additional requirements are often included as part of contracts or technical specifications.

In my opinion, a test certificate should be submitted for each sprinkler system zone. However, this would be considered my opinion regarding best practice and not a requirement of NFPA 13. Unfortunately, this is a case where additional clarification would be appropriate in the standard.

Question #10 - Hydraulic Calculations for ESFR Sprinklers Beneath Obstructions

You have asked that when dealing with an ESFR sprinkler system that includes sprinklers under obstructions (like a duct) is there a requirement to include sprinklers under the obstruction in the calculations?

Answer: The answer is "no", although there used to be.

The 2010 edition of NFPA 13, Section 22.4.4.6.4 states that when using ESFR sprinklers and when there are additional sprinklers below obstructions, it is not required to include all of the sprinklers (both above and below the obstruction) located in the design area in the hydraulic calculations. However, when there are additional sprinklers below obstructions, Section 22.4.4.6.4.1 requires that two additional sprinklers be added to the hydraulic calculations.

The justification for including these two additional sprinklers was that Factory Mutual, who originally proposed this rule, was concerned that the 12 sprinkler design area may not be adequate when additional sprinklers were installed under obstructions. Factory Mutual had since removed this requirement to add two additional sprinklers to the ESFR design area from their requirements. As a result, section 22.4.4.6.4.1 was removed from the 2013 addition of NFPA 13. To summarize, when calculating the same system (ESFR system with sprinklers under obstructions) using the 2013 or newer editions of NFPA 13, the design area would only need to include 12 sprinklers, not 14 as in the 2010 edition.

Question #11 - Pipe Passing Through Exit Enclosures

You describe a project where sprinkler piping will pass through an exit stair enclosure to serve an adjacent exit stair enclosure and other adjacent spaces.

You ask if NFPA standards prohibit sprinkler piping from passing through an exit stairway enclosure to supply an adjacent exit stairway enclosure and other adjacent spaces.

Answer: The answer to your question is "no, this is not prohibited by NFPA installation standards, however, penetrations between adjacent exit stair enclosures are typically prohibited by the building code". The International Building Code (IBC) limits penetrations into exit stair enclosures in 1023.5 (2018) but makesa general exception for fire protection systems. However, it specifically prohibits penetrations between adjacent exit stair enclosures.

> ***1023.5 Penetrations**. Penetrations into or through interior exit stairways and ramps are prohibited except for the following:*
> *1. Equipment and ductwork necessary for independent ventilation or pressurization.*
> *2. Fire protection systems.*
> *3. Security systems.*
> *4. Two-way communication systems.*
> *5. Electrical raceway for fire department communication systems.*
> *6. Electrical raceway serving the interior exit stairway and ramp and terminating at a steel box not exceeding 16 square inches (0.010 m2).*

Such penetrations shall be protected in accordance with Section 714. There shall not be penetrations or communication openings, whether protected or not, between adjacent interior exit stairways and ramps.

Question #12 - Fire Department Connection Serving Multiple Buildings

You have asked if a single fire department connection is permitted to serve sprinkler and standpipe systems in multiple buildings. You have identified two separate campus projects that have a central fire pump house with a fire department connection on the discharge side of the fire pumps. You have indicated that one campus has 14 buildings and the other has six buildings. You also indicated that most buildings have sprinkler systems, and some have wet standpipe systems. You have indicated that all buildings have a post indicating valve on the fire service lead-in main.
You have asked if NFPA 13-2019, NFPA 14-2019, NFPA 20-2019, and NFPA 24-2019 would permit the use of a single fire department connection for multiple buildings?

Answer: The answer to your question is "yes, if approved by the authority having jurisdiction (AHJ)." In the cases described, it would be prudent to discuss the configuration with the fire plans examiner (fire protection engineer, or fire official) and the

fire chief. One would identify if the layout is code compliant, the other would consider how the fire department operations would be impacted. NFPA 13-2019, NFPA 14-2019, and NFPA 24-2019 would all allow for a single FDC to serve multiple buildings. NFPA 20-2019 only identifies that the fire department connection must be downstream (system side) of the fire pump. However, there are some additional considerations, such as the pressure rating of the underground piping, whether it is acceptable to pressurize all systems at one time, fire operational procedures, the ramifications of a single point failure, and whether there are any insurance regulations.

NFPA 13-2019 provides the following relevant requirements.

> ***16.12.5* Arrangement***. *The fire department connection shall be arranged in accordance with Figure 16.12.1.*
>
> ***16.12.5.1**** *The fire department connection shall be on the system side of the water supply check valve.*
>
> ***16.12.5.1.1*** *The fire department connection shall not be attached to branch line piping.*
>
> ***16.12.5.1.2*** *The fire department connection shall be located not less than 18 in. (450 mm) and not more than 4 ft (1.2 m) above the level of the adjacent grade or access level.*
>
> ***16.12.5.2*** *For single systems, the fire department connection shall be installed as follows:*
>
> *(1) Wet system - on the system side of system control, check, and alarm valves (see Figure A.16.9.3)*
> *(2) Dry system - between the system control valve and the dry pipe valve*
> *(3) Preaction system - between the preaction valve and the check valve on the system side of the preaction valve*
> *(4) Deluge system - on the system side of the deluge valve 16.12.5.3 The fire department connection shall be permitted to be connected to the main piping on the wet pipe or deluge system it serves.*
>
> ***16.12.5.4*** *For multiple systems, the fire department connection shall be connected between the supply control valves and the system control valves.*
>
> ***16.12.5.5**** *The requirements of 16.12.5.2 and 16.12.5.4 shall not apply where the fire department connection is connected to the underground piping.*
> *...*
>
> ***16.12.5.7**** *Fire department connections shall be located at the nearest point of fire department apparatus accessibility or at a location approved by the authority having jurisdiction.*

NFPA 14, and NFPA 24 also make references to allow for an FDC, or a remote FDC to service multiple buildings, so long as the appropriate signage is provided.

NFPA 14 - 2019 requirement.

> ***6.4.5.3*** *Where a fire department connection services multiple buildings, structures, or locations, a sign shall be provided indicating the buildings, structures, or locations served.*

NFPA 24 - 2019 requirement.

> ***5.9.5.7*** *Where a fire department connection services multiple buildings, structures, or locations, a sign shall be provided indicating the buildings, structures, or locations served.*

The pressure rating of the underground piping should be considered to ensure that the fire department can pressurize the underground systems without causing catastrophic failure. Some components might be rated for 150 psi, while the fire department might need to pump to a higher pressure to support the fire protection system(s).

Boosting all systems at the same time might be advantageous under some conditions, possibly at an industrial facility, but might be undesirable at a hospital, library, or college campus. Check valves will lock the pressure on the system side which would expose all buildings to high pressure. This might be an acceptable risk, or it might not. It would be advisable to discuss the configuration with the owner or facility manager. While cost would obviously be considered, risk aversion might be paramount.

In some instances, multiple FDCs are required, such as for high rise buildings. There might also be desire by the fire department to have multiple locations to supply water to the campus or an individual building. Having a single FDC location would subject both the primary water supply (fire pump with supply) and the FDC to the potential for a single point failure to comprise water supply for the fire protections in all buildings. The single FDC would also expose firefighters if wind conditions carried smoke from a fire to the location of the FDC.

In summary, a single FDC can be used to supply multiple buildings if approved by the authorities having jurisdiction and the associated risks are acceptable.