

Editor - Roland Asp, CET

#471

09/14/2021

Best of August 2021

The following are a dozen questions answered by the NFSA's Codes, Standards, and Public Fire Protection staff as part of the Expert of the Day (EOD) member assistance program during the month of August 2021. This information is being brought forward as the "Best of August 2021." If you have a question for the NFSA EOD submit your question online through the "My EOD" portal.

It should be noted that the following are the opinions of the NFSA Engineering, Codes, and Standards staff, generated as members of the relevant NFPA and ICC 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 or ICC Council Policy #11 and should therefore not be considered, nor relied upon, as the official positions of the NFSA, NFPA, ICC, or its Committees. Unless otherwise noted the most recent published edition of the standard referenced was used.

Question #1 – Older sprinkler system C-values

An existing fire sprinkler system is being calculated and the AHJ is requiring that a C-value of 100 be utilized due to the age of the system. The use of this lower C-value will require that the existing pipe be increased or that a fire pump be added.

Is there any justification in NFPA 13 for this request?

No, in fact, the C-values mandated by NFPA 13 already assume that the piping is aged. For example, when calculating black steel pipe in a wet pipe system (using the Hazen-Williams formula), Table 27.2.4.8.1 of the 2019 edition of NFPA 13 mandates the use of a C-value of 120, however the actual C-value of new black steel pipe is 140. To account for the aging of the piping, the Hazen Williams formula already adds an upscale factor of 16% to the C-value.

It should be noted that the footnote to Table 27.2.4.8.1 does state that the "The authority having of jurisdiction is permitted to allow other C-values" but it does not state that the AHJ can mandate a different C value.

Also, as suggested in the Automatic Sprinkler Systems Handbook - 2019 edition, in the commentary to Section 27.2.4.8, if the water quality is known to be poor and the pipe deteriorates faster than would be expected in most water supplies further adjustments to the C-value may be warranted. However, adjusting the C-value down from the prescribed values noted in Table 27.2.4.8.1 without a specific reason would be simply mandating an additional safety factor to the calculations which is a concept not required by NFPA 13.

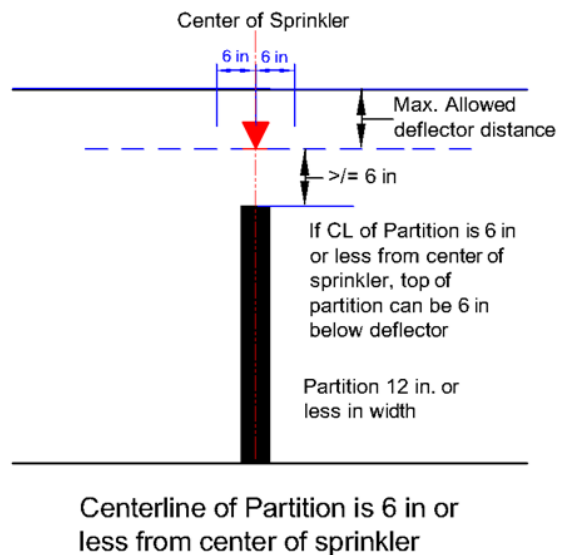
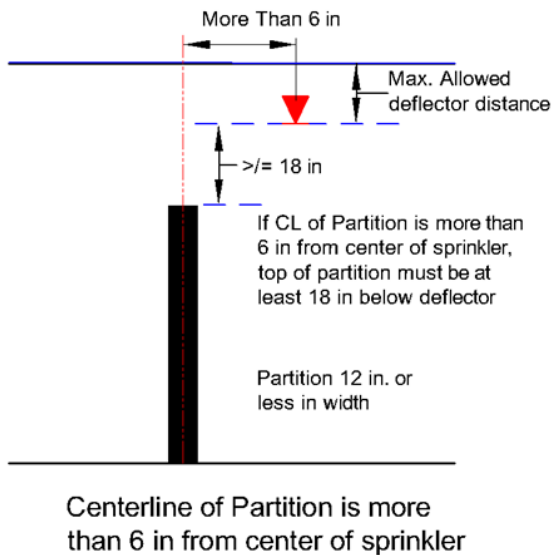
Question #2 – Floor mounted obstructions in ordinary hazard occupancies

Sprinklers are being installed in a self-storage occupancy. The walls for the self-storage units do not go to the ceiling deck and the distance from the sprinkler deflector to the top of the wall is less than 18-inches. Figure 8.6.5.2.2 in the 2016 edition of NFPA 13 is limited to light hazard occupancies for floor mounted obstruction.

In an ordinary hazard occupancy, do these walls (that do not extend to the ceiling deck) need to be treated as full height walls?

Yes, Figure 8.6.5.2.2 applies only to light hazard occupancies. As the distance from the top of the wall to the sprinkler deflector is less than 18-inches, the partition wall would be an obstruction to sprinkler discharge pattern development. As there is no specific obstruction rule for this situation in an ordinary hazard occupancy, the sprinklers should be spaced to the wall as if it were full height, however a minimum distance between sprinklers of 6 ft must be maintained or baffles must be provided.

It should be noted however while Section 8.6.5.2.2 only applies to Light Hazard Occupancies in the 2016 edition, the 2022 edition will include updates which will provide obstruction criteria for floor mounted obstructions in ordinary hazard occupancies. The 2022 edition of NFPA 13 will allow the top of a partition to be a minimum of 6 inches below the sprinkler deflector if the sprinkler is located within 6 inches of the center line of the obstruction. This criterion will only apply to partitions 12 inches or less in width. The following diagram will illustrate the upcoming criteria:



Suspended or Floor-mounted obstructions in Ordinary Hazard Occupancies



Question #3 – Temporary protection in buildings under construction

The following questions were asked about temporary sprinkler protection during construction and are answered separately.

Question #3-1: Does NFPA 241 require temporary sprinkler protection during construction?

Question #3-2: Does NFPA 241 require a fire watch?

Question #3-3: Is it the owner’s responsibility to provide the fire watch, unless delegated to an agent or qualified contractor?

Answer 3-1: NFPA 241, 2019 edition, does not require temporary sprinkler protection. Section 7.9 indicates that during construction, alteration, or demolition, the use of temporary fire sprinkler protection approved by the AHJ shall be permitted (but is not required) as supplemental protection. Section 8.7.3 for sprinkler protection indicates if automatic sprinkler protection is to be provided, the installation shall be placed in service as soon as practicable. There is no

requirement in the standard for temporary sprinkler protection during construction or alteration operations.

Answer 3-2: NFPA 241, 2019 edition, does not require a fire watch for unprotected, unoccupied areas under construction, which are separated from other occupied and protected areas by fire walls, where all the precautions indicated in NFPA 241 are followed. Section 5.1 requires a fire watch that is specific to hot work only in accordance with NFPA 51B. Section 7.2.5 for site security indicates that guard service shall be provided where required by the authority having jurisdiction. Where guard service is provided, the guard(s) shall be trained to notify the fire department and management personnel, function and operation of fire protection equipment, familiarization with fire hazards, use of construction elevators, where provided. There is no requirement in the standard for a fire watch except as noted for hot work operations.

Answer 3-3: NFPA 241, 2019 edition, Section 7.2 for the owner's responsibility indicates the owner shall designate a person (fire protection program manager) who shall be responsible for the fire prevention program and who shall ensure that it is carried out to completion. Where guard service is provided, the fire prevention program manager as designated by the owner, shall be responsible for the guard service.

The owner is required to provide guard service if required by NFPA 241 or the International Fire Code (IFC). The IFC, 2021 edition, Section 3303.1 for the owner's responsibility for fire protection, indicates the owner or the owner's authorized agent shall be responsible for the development, implementation, and maintenance of an approved, written site safety plan establishing a fire prevention program at the project site. Section 3303.2 goes on to indicate the owner shall designate a person to be the site safety director and where guard service is provided, the site safety director shall be responsible for the guard service.

Question #4 – Underground velocities for NFPA 13D

NFPA 13D does not seem to set a velocity limit on a combined fire sprinkler and domestic underground service however the data sheets for many backflow prevention devices do include a velocity limitation.

Why does NFPA 13D not include a maximum flow velocity for combined underground service lines?

None of the sprinkler installation standards (NFPA 13, NFPA 13R and NFPA 13D) include a maximum velocity threshold. There are two reasons that some people insist that the velocity of water flowing through fire sprinkler pipes need to be limited, however neither of these concerns are valid. The two commonly cited concerns are:

- **Wear and tear on the pipes and components:** Plumbing and other systems that have a constant flow at high velocities may experience wear on the pipe and fittings. This is the reason that the plumbing codes typically include a velocity limitation. Fire sprinkler systems (including NFPA 13D systems) rarely experience flow at system demand or at all. The only time a NFPA 13D fire sprinkler system may experience a high velocity flow is during a fire event. These flows (if experienced) are uncommon, and the system would experience this flow for only a short period of time. Based upon this, the concern for wear and tear due to high velocity is unwarranted. This holds true for a NFPA 13D system where the pipes also serve the plumbing or domestic needs (such as multipurpose systems or system with a common water service pipe). While the pipes may experience a constant domestic flow, the high velocity due to a fire event is a rare event and as such a velocity limitation is not warranted. The concern over wear and tear of the pipe due to high velocities is not a legitimate concern for fire sprinkler systems including residential systems designed in accordance with NFPA 13D.
- **Hazen-Williams Calculations:** The other commonly cited reason for limiting the velocity is the unsubstantiated belief that the Hazen-Williams method of calculation is not accurate at high velocities (exceeding 32 ft/sec). The NFPA 13 committee looked at this issue and determined that a velocity limitation was not warranted. This concept is found in NFPA 13 (2016) in Section 23.4.1.4 which reads:

Unless required by other NFPA standards, the velocity of water flow shall not be limited when hydraulic calculations are performed using the Hazen–Williams or Darcy Weisbach formulas.

Although NFPA 13D does not include a similar statement, this concept would still apply to NFPA 13D.

As for a velocity limitation to backflow preventors, the same concepts would apply. The data sheets for backflow preventers typically include a typical maximum system flow rate (usually 7.5 ft/sec). This typical maximum system flow rate is based upon the plumbing code and the wear and tear concept discussed above. As previously stated, the “wear and tear” concern of the plumbing codes are not a concern for the rare or “surge” flows of an operating fire sprinkler system. Additionally, the “typical maximum flow rate” cited in the data sheets is not a maximum flow rate that the device can handle but instead is a “typical” maximum flow rate that is included to help guide designers in applying an appropriate pressure loss for the backflow device.

For more information on this subject, see the NFSA article titled “Does Velocity Matter” which can be found at: <https://www.nfsa.tv/cgi-bin/download2.cgi?dir=sqarticles&ID=820>



Question #5 – Open sprinkler deluge fittings

The 2017 edition of NFPA 15 in Section 5.3.6.1 states that steel piping used in manual and open systems must be galvanized both internally and externally and Section 5.4.3 states that when galvanized pipe is used, then the fitting also must be galvanized but does not specify that it must be internally galvanized.

In an open deluge system using galvanized pipe, can black steel fittings be used if that are painted?

No, in the case of an open deluge system, galvanized pipe and fittings are required to resist both external and internal corrosion. This is made clear by Section 5.3.6.1 which requires steel pipe used in manual and open systems to be galvanized on both the external and internal surfaces. The reason is that open systems are more prone to internal corrosion than are closed systems. As the internal portions of open systems are exposed to the atmosphere, internal corrosion is more likely than in a closed or wet system. Therefore Section 5.3.6.3 allows water filled steel pipe systems to be black steel and not galvanized.

Section 5.4.3 simply says that if the piping is galvanized then the fittings need to be as well. The intent is that as the open deluge system requires internally and externally galvanized pipe per Section 5.3.6.1 then the fittings also need to be galvanized both internally and externally. Simply painting black steel fittings will only help with external corrosion.

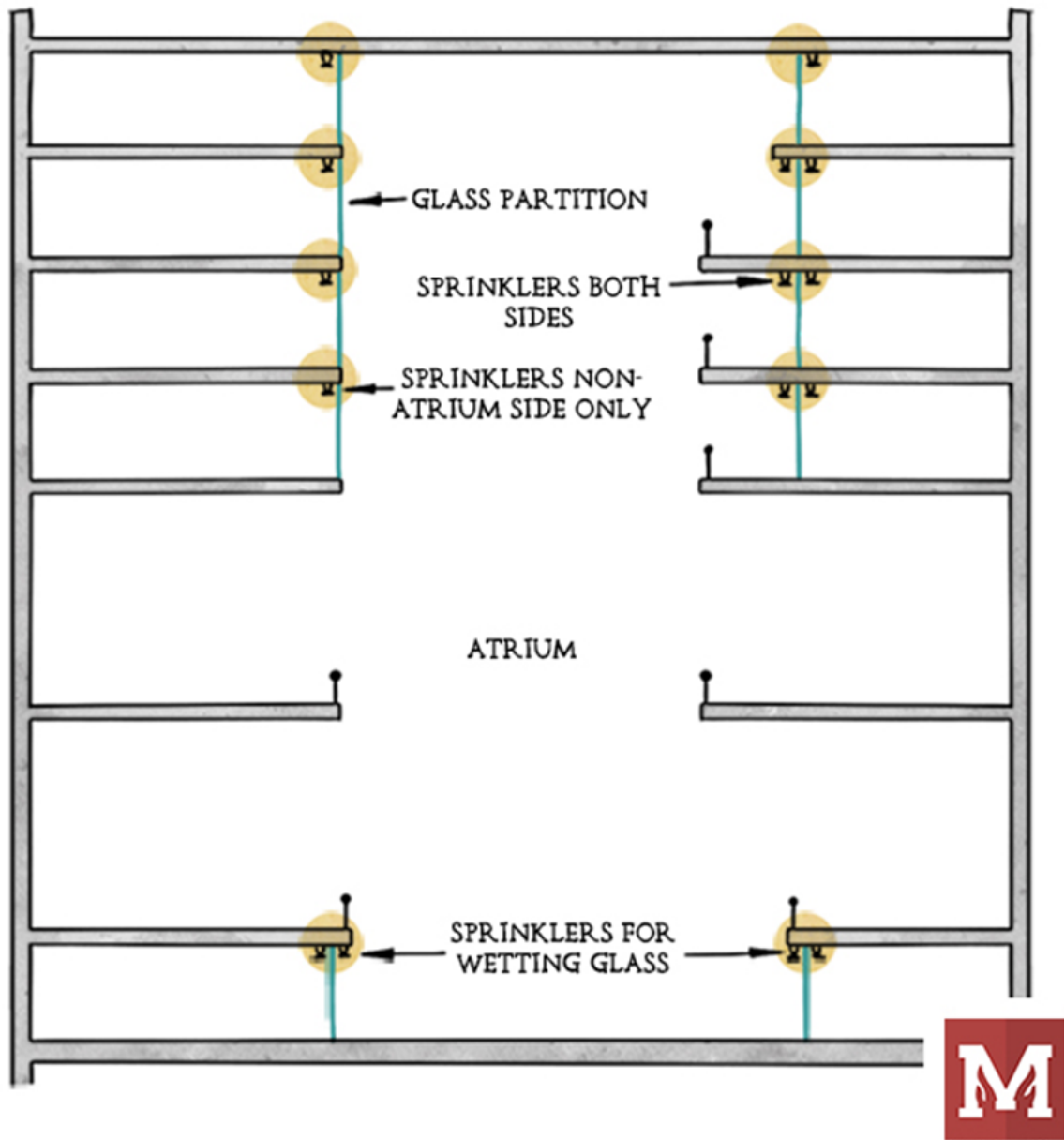
Question #6 - Sprinkler protection at atrium enclosures

The International Building Code in Section 404.6 includes an exception that allows a sprinkler water curtain in lieu of a 1-hr fire barrier.

Do the sprinklers in this water curtain need to be listed for window protection or can standard quick response sprinklers be used?

The IBC permits standard or quick response sprinklers. Specifically, IBC Section 404.6 requires “automatic sprinklers” to protect atrium glazing in walls and doors. This would allow any sprinkler with a link or a bulb.

There is not a requirement to protect atrium glazing with specifically listed window sprinklers in the IBC or NFPA 13. Specifically, atrium glazing is not required to meet a fire rating when sprinklered in the IBC per Section 404.6. When fire ratings are required for walls, and glazing is provided, then special application sprinklers are required, and Section 703.4 provides an equivalency. NFPA 13 also allows standard spray sprinklers, certainly, if the atrium space is light hazard, then quick response sprinklers would be required. The 2019 edition of NFPA 13, Section 9.3.15 also allows for standard spray sprinklers where the building code permits their installation.



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Question #7 – Water duration for a storage occupancy

A storage occupancy is to be protected with Control Mode Density Area (CMDA) sprinklers in combination with in-rack sprinklers in accordance with Chapter 25 of the 2019 edition of NFPA 13. For the required water supply requirements, Section 25.2.1.6 refers to Table 20.2.2.6 which would require a water supply duration of 120 minutes.

As this system is to be electrically supervised and monitored, can the duration be reduced to 90 minutes as discussed in Section 19.3.3.1.3?

No, the water supply durations as described in Chapter 20 are specific for storage occupancies and storage design criteria. NFPA 13, 2019 edition, Section 20.12, and Table 20.12.2.6 provide the requirements for water supply duration for storage applications. There is no allowance for a storage occupancy and storage design criteria to reduce the water supply duration similar to that of Section 19.3.3.1.3 for light, ordinary, and extra hazard occupancies.

Question #8 – CPVC hangers

Section 9.2.3.4 in the 2016 edition of NFPA 13 has detailed requirements for unsupported lengths for steel and copper but does not mention CPVC piping. The CPVC manufacturer requirements for hangers includes pipe hanger requirements that differ from the requirements found in NFPA 13.

Is there a mention in NFPA 13 that references the need to follow manufacturer requirements?

Yes, if a listed product is not installed per the manufacturer's directions than the installation does not follow the listing of that equipment and therefore is not compliant with NFPA 13. This holds true even when the installation instructions go beyond the prescriptive NFPA 13 requirements. For CPVC piping this concept is found in Section 6.3.9.1.2 which states that listed nonmetallic pipe must be installed in accordance with its listing requirements which includes the installation instructions.



Question #9 – Mixing of K-Factors

On a project there is a branch line with primarily K-14 sprinklers. At the end of this branch line, the piping drops down below an obstruction to feed a K-5.6 sprinkler.

Can sprinklers with different K-factors be on the same branchline?

Yes, you can have sprinklers of different K factors on the same branchline. NFPA 13, 2016 edition, Section 23.4.4.9.2 indicates unless the requirements of 23.4.4.9.3 or 23.4.4.9.4 are met, mixing of sprinklers of different K-factors by reducing the K-factor of adjacent sprinklers on the same branch line leading back to the main for the purpose of minimizing sprinkler over discharge shall not be permitted.

The standard does not allow mixing of sprinklers of different K-factors specifically by reducing the K-factor of adjacent sprinklers on the same branch line leading back to the main for the purpose of minimizing sprinkler over discharge. The standard permits sprinklers of different K-factor on the same branch line unless it is being done in a manner by reducing K-factor to minimize sprinkler over discharge for sprinklers closer to the water supply.

Question #10 – Exterior projection and combustible siding

A project consists of a 3-story office building with combustible siding and noncombustible external projections (aluminum decks) and is to be protected in accordance with the 2016 edition of NFPA 13. Section 8.15.7.2 states that sprinklers are not required when the exterior projection is noncombustible but does not mention the construction material of the building itself.

Are sprinklers required below a noncombustible external projection where the building has combustible siding?

No, these exterior decks are not required to be protected in accordance with the prescriptive requirements of NFPA 13. Based on the information provided, the decks are constructed of non-combustible materials and would not be required to be protected unless combustibles are to be stored under this projection (see Section 8.15.7.5). The protection required by Section 8.15.7 is solely based on the construction of the exterior projection and not on the finish material of the building it is connected to.



Question #11 – Wall hydrants

What are wall hydrants and when are they used in fire protection systems?

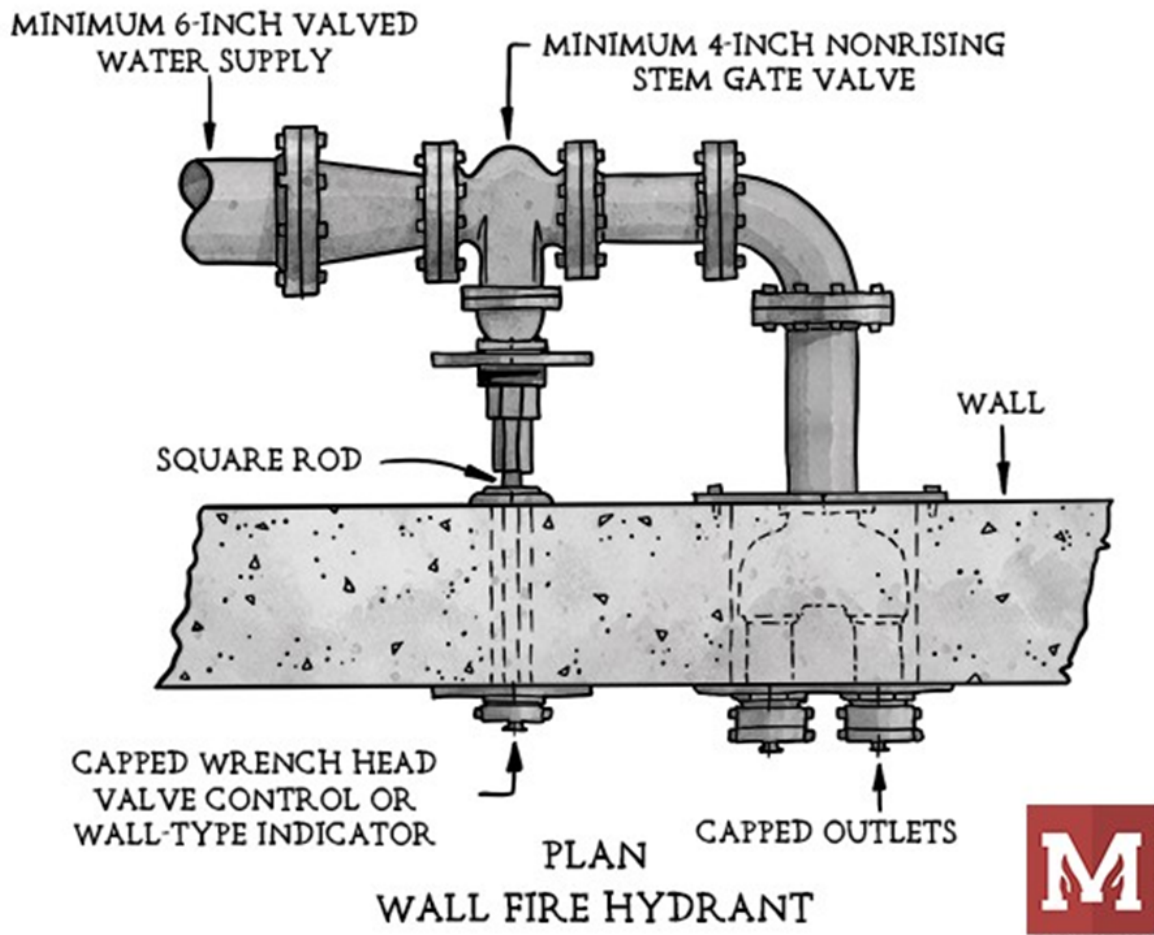
The term *wall hydrant* is often misunderstood, as a wall hydrant connection has multiple uses. They are used as auxiliary outlets connections to provide a water supply for the fire service, roof manifolds, and test headers to name a few.

These hydrants are typically found in private buildings, and they should be pre-planned or evaluated prior to emergency use to verify appropriate flows and design. Many buildings may not have been designed to support an adequate hydrant flow without adversely affecting the other fire protection within the building. Verification should also be done to properly identify a wall hydrant designed use.

When a wall hydrant is designed as part of the fire protection system it is required to be hydraulically calculated for an outside hose allowance. NFFPA 13 *Standard for the Installation of Sprinkler Systems Section 19.2.6.2** (2019) requires the outside hose allowance to be added to the sprinkler demand, at the connection to the main water supply or private fire hydrant. The annex note A.19.2.6.2 adds additional clarity that the sprinkler demand is not required to be added to the outside hose demand, where a separate water supply is used to feed each.

NFFPA 24 *Standard for the Installation of Private Fire Mains and Their Appurtenances*, does reference wall hydrants and requires consultation with the Authority Having Jurisdiction (AHJ) regarding necessary water supply, location, and arrangement.

Requirements for inspection, testing and maintenance for wall hydrants can be found in NFFPA 25 *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*.



Question #12 – NFPA 150 Animal Housing

When is NFPA 150, *Fire and Life Safety in Animal Housing Facilities Code* required to be enforced?

It will completely depend on the codes and standards adopted by the authority having jurisdiction (AHJ).

If the AHJ directly adopts NFPA 150, then in it would be required to be enforced.

If the 2018 or newer editions of NFPA 101 are adopted, Section 11.12.2 requires that only the egress requirements of NFPA 150 be applied to animal housing facilities. This would exempt the sprinkler requirements from applying.

If the 2018 or newer editions of NFPA 5000 are adopted, Section 6.4.2.10 does require that animal housing facilities be constructed in accordance with the requirements of NFPA 150. This would include the sprinkler requirements. Lastly, if the model I-Codes are adopted by the AHJ, then there are no requirements that NFPA 150 be applied. Only the sprinkler requirements found in Chapter 9

of the *International Building Code* would be applied, which exempts animal housing facilities.

It's important to note that the NFSA currently has a proposal for these lack of sprinkler requirements to be changed in the 2024 model I-Codes. The proposal defines animal housing facilities, along with the providing the sprinkler requirements for said facilities. The proposal was voted down at the committee action hearings in April, however, the industry is working with the committee to get NFPA 150 recognized in the I-Codes.



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New EOD Process

Starting on July 15, 2020, the NFSA has a new EOD process where members can submit questions, track the progress, and view their EOD cases. The step by step process is detailed in [TechNotes #442](#).

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