Department of Building & Fire Prevention

4701 W. Russell Road • Las Vegas, NV 89118
(702) 455-3000 • Fax (702) 221-0630

Jerome A. Stueve, P.E., Director
Samuel D. Palmer, P.E., Assistant Director • Jim Gerren, P.E. Assistant Director • Girard W. Page, Fire Marshal

CLARK COUNTY BOARD OF FIRE CODE APPEALS

MINUTES of January 10, 2020

1:00 p.m. - Presentation Room

MEMBERS PRESENT:	Corey Wallace, Fire Sprinkler Contractor Allyn Vaughn, Fire Protection Engineer Tim M. Mulrooney, Civil Engineer Roy Mares, Fire Safety Specialist Diane Cravotta, Specialist In Hazardous Materials Bill Laub, Layman Gregory Cassell, Fire Chief, Clark County Fire Department
STAFF PRESENT:	Jerry Stueve, Director/Building & Fire Code Official Girard W. Page, Fire Marshal Danny Horvat, Assistant Fire Chief Theresa Atimalala, Executive Assistant
MEMBERS ABSENT:	Patrick Burke, Fire Alarm Contractor Katherine Springstead, Exhibit & Trade Industry Representative
APPELLANTS PRESENT:	Lee Marx, American Fire Systems Steve Marx, Ace Fire Systems, Inc.

A. Call to Order
The meeting was called to order at approximately 1:00pm by Chairman Corey Wallace.

1. Introductions were made around the table.

2. It was determined by Chairman Corey Wallace that a quorum was present.

B. Public Comment
There were no public comments.

C. Meeting Minutes – November 12, 2019
A motion was made by Bill Laub, seconded by Gregory Cassell, approving the minutes of November 12, 2019, as written.

D. Appeal of determination of by ACE Fire Systems of the code interpretation of NFPA Sections 25.2.1.5 and 25.2.1.6, 2013 edition.

Steve Marx, Ace Fire Systems, presented his appeal citing 2013 NFPA 13, Sections: 25.2.1.4, 25.2.1.4.1 and 25.2.4.2. 25.2.1.4, indicating modifications to an existing system shall require testing at system working pressure, therefore the existing system should never be tested again, more than 200 PSI at 2 hours. He stated nowhere in the code does it say anything about 15 lineal feet, or about fittings, or about branch lines.

Jerry Stueve, Fire Code Official explained that the current determination states that if modifications are made to an existing system affecting more than 20 heads and one of those modifications have an arm over of at least 15 feet, they have to completely add new drops or 25% of the new branch, then the new work will require hydrostatic testing at 200 psi since the work performed exceeds what is classified as "minor" work.

After discussion, the Board requested the appellant to restate the appeal. The appellant stated their appeal is that the current interpretation of the code should be striken in its entirety because the code already defines the differences of a minor and major modification.

The appellant further stated that the 25% on a single branch line threshold included in the interpretation, is overly stringent and has no basis in the code.

After further discussion Board agreed with the appellant that the modification of 25% or more of heads on a branch line threshold, and requested that that threshold criteria be deleted, and the Fire Code Official agreed to do so.

The Board determination was the interpretation be modified as follows:

Section 25.2.1.6 is not applicable if one or more of the following conditions exist:

1) *A single arm-over piping has a lateral length greater than 15 feet.*
2) *A single drop, sprig or arm-over includes more than five (5) fittings.*

Allyn Vaughn makes a motion to accept the interpretation as written with the exception of item 3 and delete item 3 in its entirety. Bill Laub seconds the motion; all were in favor.

Jerry adds that the reference in the 2013 and 2016 code will be modified and reissued to reflect the change.

The Appellant asks, if there are two drops on one attachment would that not apply; because it's a single drop? Jerry explains that was not considered in this interpretation and cannot be commented on at this time.

E. Comments from Staff
Jerry commented today was Chief Gregory Cassell's last meeting as he is retiring on February 6, 2020, the new chief will be Chief John Steinbeck. Wished Chief Cassell the best of luck and thanked him for all his support.

F. Public Comment
There were no comments.

G. Adjournment
A motion to adjourn was made by Bill Laub and seconded by Allyn Vaughn.

Meeting adjourned at 2:13 p.m.

Respectfully submitted,

Jerome A. Stueve
Director/Building & Fire Official

JAS: taa

Attachment(s):
Clark County Board of Fire Code Appeals Code Interpretation: FP-CI-49, 2013 NFPA 13, Section 25.2.1.6 and 2016 NFPA 13, Section 25.2.1.4.2 01/13/20
Letter from appellant Steve Marx, ACE Fire Systems, LLC to Jerry Stueve, 4/15/19
Letter from Jerome A. Stueve to Steve Marx, ACE Fire Systems, Inc., 4/3/19
Letter from appellant Steve Marx, ACE Fire Systems, LLC to Jerry Stueve, 12/10/18: Appeal of interpretation of section 25.2.1.5 and 25.2.1.6.
Letter from Steve Marx, ACE Fire Systems, LLC to Jerry Stueve, 12/10/18: Interpretation of NFPA 13, Section 25.2.1.5 & 25.1.1.6.
Letter from Jerome A. Stueve to Steve Marx, ACE Fire Systems, Inc., 12/5/18
Interpretation of NFPA 13, 25.2.1.5 and 25.2.1.6, 2013 Edition, 11/1/18
Installation of Sprinkler Systems, NFPA 13, sections 13-17-20, 240-241, 244 & 248.

Clark County Department of Building & Fire Prevention

4701 West Russell Road • Las Vegas NV 89118
(702) 455-3000 • Fax (702) 455-5810

Division:	Fire Prevention	**Code Interpretation:**	FP-CI-49
Subject:	APPLICABILITY OF 2013 NFPA 13, SECTION 25.2.1.6	**Effective Date:**	01/13/20
Code:	2013 NFPA 13, SECTION 25.2.1.6 AND 2016 NFPA 13, SECTION 25.2.1.4.2	**Revised Date:**	NEW

A. SUBJECT:

On January 10, 2020, the Clark County Board of Fire Code Appeals (CCBFCA) has ruled on a fire code interpretation dated April 3, 2019 issued by Jerry Stueve, Fire Code Official related to the applicability of 2013 NFPA 25.2.1.6.

B. CODE REQUIREMENT:

2013 NFPA 13, 25.2.1.6. Modifications that cannot be isolated, such as relocated drops, shall not require testing in excess of system working pressure.

2016 NFPA 13, 25.2.1.4.2. Modifications that cannot be isolated, such as relocated drops, shall not require testing in excess of system working pressure.

C. INTERPRETATION:

The CCBFCA ruled that 2013 NFPA, *Section 25.2.1.6 is not applicable if one or more of the following conditions exist:*

1) *A single arm-over piping has a lateral length greater than 15 feet.*
2) *A single drop, sprig or arm-over includes more than five (5) fittings.*

The CCBFC further ruled that this interpretation also apples to 2016 NFPA 25.2.1.4.2.

D. RATIONALE:

This code interpretation is intended to ensure consistent application hydrostatic testing requirements.

POLICY #	TITLE	Effective Date	Revised	Reviewed

Revision History:

Approved by:
Jerome A. Stueve
Jerome A. Stueve, P.E., Director, Building\Fire Code Official

ACE FIRE SYSTEMS, LLC

2620 WESTERN AVE.
LAS VEGAS NV 89109
P. 702-384-2932 FX. 702-384-7282

April 15, 2019

Jerry Stueve, Fire Code Official
Clark County of Building & Fire Prevention
4701 W Russell Rd
Las Vegas, NV 89118

RE: Appeal of interpretation of section 25.2.1.5 and 25-2.1.6

Jerry:

We are appealing your interpretation in its entirety in your letter dated April 3, 2019, of section 25.2.1.5 and 25.2.1.6

Sincerely

Steve Marx

Department of Building & Fire Prevention
4701 W. Russell Road • Las Vegas, NV 89118
(702) 455-3000 • Fax (702) 221-0630

Jerome A. Stueve, P.E., Director
Samuel D. Palmer, P.E., Assistant Director • Girard W. Page, Fire Marshal

April 3, 2019

ACE Fire Systems, Inc.
ATTENTION: Steve Marx
2620 Western Avenue
Las Vegas, Nevada 89109

SUBJECT: Code Interpretation NFPA 13, 25.2.1.5 and 25.2.1.6

Dear Mr. Marx,

At the Board of Fire Code Appeals meeting held on March 20, 2019, the Board heard your appeal of the code interpretation issued by the Clark County Fire Code Official (CCFCO) in a letter dated December 5, 2018, as it relates to 2013 NFPA 13, Sections 25.2.1.5 and 25.2.1.6, particularly the testing of existing elements or systems.

After hearing arguments by both the complainant and the CCFCO, and after discussing the matter amongst the members, the Board did not support the interpretation as written and requested the CCFCO to revise the interpretation to more directly define what constitutes a "minor change or modification," as it relates to existing sprinklers. The provisions of the NFPA 13 being interpreted are as follows:

> "**25.2.1.5** Where addition or modification to an existing system affecting more than 20 sprinklers, the new portion shall be isolated and tested at not less than 200 psi (13.8 bars)."
>
> "**25.2.1.6** Modifications that cannot be isolated, such as relocated drops, shall not require testing in excess of system working pressure."

Therefore, in compliance with the determination of the Board, the code interpretation issued on December 5, 2019, is rescinded. Further, also in compliance of the Board, the following:

Section 25.2.1.6 is not applicable if one or more of the following conditions exist:

1) *A single arm-over piping has a lateral length greater than 15 feet.*
2) *A single drop, sprig or arm-over includes more than five (5) fittings.*
3) *The number of sprinklers modified that are equal to or exceed 25 percent of the sprinklers served by the branch pipeline.*

Department of Building & Fire Prevention
4701 W. Russell Road • Las Vegas, NV 89118
(702) 455-3000 • Fax (702) 221-0630

Jerome A. Stueve, P.E., Director
Samuel D. Palmer, P.E., Assistant Director • Girard W. Page, Fire Marshal

You may appeal this interpretation to the Board of Fire Code by submitting a request in writing within 15 calendar days of receipt of this letter. Please submit your request for appeal to:

Jerry Stueve, Fire Code Official
Clark County Building & Fire Prevention
4701 W. Russell Road
Las Vegas, Nevada 89118

Sincerely,

Jerome A. Stueve, P.E., CBO
Director - Building/Fire Code Official
Department of Building & Fire Prevention

JAS/ta

ACE FIRE SYSTEMS, LLC

2620 WESTERN AVE.
LAS VEGAS NV 89109
P. 702-384-2932 FX. 702-384-7282

December 10, 2018

Jerry Stueve, Fire Code Official
Clark County of Building & Fire Prevention
4701 W Russell Rd
Las Vegas, NV 89118

RE: Appeal of interpretation of section 25.2.1.5 and 25-2.1.6

Jerry:

We are appealing your interpretation of section 25.2.1.5 and 25.2.1.6, 15 lineal feet, hydrostatic testing interpretation.

Sincerely

Steve Marx

ACE FIRE SYSTEMS, LLC

2620 WESTERN AVE.
LAS VEGAS NV 89109
P. 702-384-2932 FX. 702-384-7282

December 10, 2018

Clark County Dept of Building & Fire Prevention
4701 W Russell Rd
Las Vegas, NV 89118

Att: Jerry Stueve – Fire Code Official

RE: Interpretation of NFPA 13, Section 25.2.1.5 and 25.2.1.6

Jerry:

Your interpretation of 15' lineal feet of 1" diameter threaded pipe, where is the code that limits the length of 1" pipe that you're referring to. Your reference to hydrostatic test pressure must be clearly stated on the drawings. City pressure fluctuates and city pressure is city pressure. In addition for calculations on 1" pipe that exceeds 15' could you please refer to what code you are referring to that requires calculations and that the head loss cannot exceed 1 PSI.

Warehouses that have drops, arm over, sprigs or return bends in excess of 15' do not require calculations that I am aware of or to prove a 1 PSI loss, if there is can you please refer me to the code section that requires this in NFPA 13 for remodels.

Sincerely

Steve Marx

Department of Building & Fire Prevention

4701 W Russell Road • Las Vegas NV 89118
(702) 455-3000 • Fax (702) 221-0630

Jerome A. Stueve, P.E., Director
Samuel D. Palmer, P.E., Assistant Director • Girard W. Page, Fire Marshal

December 5, 2018

ACE Fire Systems, Inc.
2620 Western Avenue
Las Vegas, Nevada 89109
Attention: Steve Marx

Dear Mr. Marx,

A request was submitted for an interpretation of the hydrostatic testing requirements stating in 2013 NFPA 13, Sections 25.2.1.5 and 25.2.1.6, particularly as it relates to testing existing elements or systems.

> **"25.2.1.5** Where addition or modification to an existing system affecting more than 20 sprinklers, the new portion shall be isolated and tested at not less than 200 psi (13.8 bars)."
>
> **"25.2.1.6** Modifications that cannot be isolated, such as relocated drops, shall not require testing in excess of system working pressure."

After researching this matter; it has been determined that the number of heads being added or modified is less critical when determining whether or not the modifications can be isolated and whether or not the addition or modification is considered as a minor change. The critical factors appear to be the amount and type of pipe that is added or modified.

Therefore, the Fire Code Official interpretation of NFPA 13 Section 25.2.1.6 is as follows:

"Modifications consisting solely of arm overs, springs, drops or return bends, consisting of a maximum of 15 linear feet of 1-inch nominal diameter threaded pipe and each serving a single sprinkler head, connecting to an existing branch line by either an existing outlet or a new listed mechanical tee welded half-coupling, shall be considered modifications that cannot be isolated, and do not require testing in excess of system working pressure regardless of number heads installed or modified under a permit.

In the event that hydrostatic testing is be conducted using system working pressure, the hydrostatic testing pressure must be clearly noted on the drawings. In addition, if more than 15 feet of piping is installed to serve any single sprinkler head is installed, testing at system working pressure will only be permissible with the submission and approval of hydraulic calculations that demonstrate that the head loss within each arm over, sprig, drop or return bend does not exceed 1 psi."

You may appeal this interpretation to the Board of Fire Code by submitting you request in writing within 15 calendar days of receipt of this letter. Please submit your request for appeal to:

> Jerry Stueve, Fire Code Official
> Clark County Building & Fire Prevention
> 4701 W. Russell Road
> Las Vegas, Nevada 89118

Sincerely,

Jerome A. Stueve, P.E., CBO
Director - Building/Fire Code Official
Department of Building & Fire Prevention

ACE FIRE SYSTEMS, INC.
2620 Western Ave.
Las Vegas, NV 89109
Phone: (702) 384-2932
Fax: (702) 384-7282

Interpretation of NFPA 13 25.2.1.5 an 25.2.1.6
2013 Edition
Steve Marx – Ace Fire Systems Inc.
Acefire1@gmail.com

November 1, 2018

25.2.1.5 Where addition or modification is made to an **existing** system affecting more than 20 sprinklers, the **new** portion shall be isolated and tested at not less than 200 psi (13.8 bas) for 2 hours.

25.2.1.6 Modifications that cannot be isolated, such as relocated drops, shall not require testing in excess of system working pressure.

Definitions:

Existing: materials that were in the system before permitted work was started.

New: materials that were added to an existing system when permitted work was initiated such as main lines, grid lines, branch lines, feed mains, cross mains, arm overs, sprigs, drops, return bends.

Interpretation:

When new materials are added to an existing system such as main lines, grid lines, branch lines, feed mains, cross mains; a hydrostatic test at 200 psi for 2 hours at is performed for the entire existing system.

When arm overs, sprigs, drops, or return bends are modified to an existing system the new work cannot be isolated form the existing branch line therefore the system is not hydrostatically tested at 200 psi for 2 hours but tested at system working pressure.

(1) A connection to an approved public or private waterworks system in accordance with 24.2.2
(2) A connection including a fire pump in accordance with 24.2.3
(3) A connection to a water storage tank at grade or below grade installed in accordance with NFPA 22 and filled from an approved source
(4) A connection to a pressure tank in accordance with 24.2.4 and filled from an approved source
(5) A connection to a gravity tank in accordance with 24.2.5 and filled from an approved source
(6) A penstock, flume, river, lake, pond, or reservoir in accordance with 24.2.6
(7) *A source of recycled or reclaimed water where the building owner (or their agent) has analyzed the source of the water and the treatment process (if any) that the water undergoes before being made available to the sprinkler system and determined that any materials, chemicals, or contaminants in the water will not be detrimental to the components of the sprinkler system it comes in contact with

24.2.2* Connections to Waterworks Systems.

24.2.2.1 A connection to a reliable waterworks system shall be an acceptable water supply source.

24.2.2.2* The volume and pressure of a public water supply shall be determined from waterflow test data or other approved method.

24.2.3* Pumps. A single automatically controlled fire pump installed in accordance with NFPA 20 shall be an acceptable water supply source.

24.2.4 Pressure Tanks.

24.2.4.1 Acceptability.

24.2.4.1.1 A pressure tank installed in accordance with NFPA 22 shall be an acceptable water supply source.

24.2.4.1.2 Pressure tanks shall be provided with an approved means for automatically maintaining the required air pressure.

24.2.4.1.3 Where a pressure tank is the sole water supply, an approved trouble alarm shall also be provided to indicate low air pressure and low water level with the alarm supplied from an electrical branch circuit independent of the air compressor.

24.2.4.1.4 Pressure tanks shall not be used to supply other than sprinklers and hand hose attached to sprinkler piping.

24.2.4.2 Capacity.

24.2.4.2.1 In addition to the requirements of 24.1.2, the water capacity of a pressure tank shall include the extra capacity needed to fill dry pipe or preaction systems where installed.

24.2.4.2.2 The total volume shall be based on the water capacity plus the air capacity required by 24.2.4.3.

24.2.4.3* Water Level and Air Pressure.

24.2.4.3.1 Pressure tanks shall be kept with a sufficient supply of water to meet the demand of the fire protection system as calculated in Chapter 23 for the duration required by Chapter 11, Chapter 12, or Chapter 22.

24.2.4.3.2 The pressure shall be sufficient to push all of the water out of the tank while maintaining the necessary residual pressure (required by Chapter 23) at the top of the system.

24.2.5 Gravity Tanks. An elevated tank installed in accordance with NFPA 22 shall be an acceptable water supply source.

24.2.6 Penstocks, Flumes, Rivers, or Lakes. Water supply connections from penstocks, flumes, rivers, lakes, or reservoirs shall be arranged to avoid mud and sediment and shall be provided with approved double removable screens or approved strainers installed in an approved manner.

Chapter 25 Systems Acceptance

25.1 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 25.2)*
(3) Complete and sign the appropriate contractor's material and test certificate(s) *(see Figure 25.1)*
(4) Remove all caps and straps prior to placing the sprinkler system in service

25.2 Acceptance Requirements.

25.2.1* Hydrostatic Tests.

25.2.1.1 Unless permitted by 25.2.1.2 through 25.2.1.8, all piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi (13.8 bar) and shall maintain that pressure without loss for 2 hours.

25.2.1.2 Portions of systems normally subjected to system working pressures in excess of 150 psi (10.4 bar) shall be tested as described in 25.2.1.1, at a pressure of 50 psi (3.5 bar) in excess of system working pressure.

25.2.1.3 Where cold weather will not permit testing with water, an interim air test shall be permitted to be conducted as described in 25.2.2. This provision shall not remove or replace the requirement for conducting the hydrostatic test as described in 25.2.1.1.

25.2.1.4 Modifications affecting 20 or fewer sprinklers shall not require testing in excess of system working pressure.

25.2.1.5 Where addition or modification is made to an existing system affecting more than 20 sprinklers, the new portion shall be isolated and tested at not less than 200 psi (13.8 bar) for 2 hours.

25.2.1.6 Modifications that cannot be isolated, such as relocated drops, shall not require testing in excess of system working pressure.

25.2.1.7 Loss shall be determined by a drop in gauge pressure or visual leakage.

25.2.1.8* The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested. The pressures in piping at higher elevations shall be permitted to be less than 200 psi (13.8 bar) when accounting for elevation losses. Systems or portions of systems that can be isolated shall be permitted to be tested separately.

25.2.1.9* Additives, corrosive chemicals such as sodium silicate, or derivatives of sodium silicate, brine, or similar acting chemicals shall not be used while hydrostatically testing systems or for stopping leaks.

25.2.1.10 Piping between the exterior fire department connection and the check valve in the fire department inlet pipe shall be hydrostatically tested in the same manner as the balance of the system. After repair or replacement work affecting the fire department connection, the piping between the exterior and the check valve in the fire department inlet pipe shall be isolated and hydrostatically tested at 150 psi (10.3 bar).

25.2.1.11 When systems are being hydrostatically tested, tests shall be permitted to be conducted with pendent or horizontal sidewall sprinklers or plugs installed in fittings. Any plugs shall be replaced with pendent or horizontal sidewall sprinklers after the test is completed.

25.2.1.12 When deluge systems are being hydrostatically tested, plugs shall be installed in fittings and replaced with open sprinklers after the test is completed, or the operating elements of automatic sprinklers shall be removed after the test is completed.

25.2.1.13 Provision shall be made for the proper disposal of water used for flushing or testing.

25.2.1.14* Test Blanks.

25.2.1.14.1 Test blanks shall have painted lugs protruding in such a way as to clearly indicate their presence.

25.2.1.14.2 The test blanks shall be numbered, and the installing contractor shall have a recordkeeping method ensuring their removal after work is completed.

25.2.1.15 When subject to hydrostatic test pressures, the clapper of a differential-type valve shall be held off its seat to prevent damaging the valve.

25.2.2 Dry Pipe and Double Interlock Preaction System(s) Air Test.

25.2.2.1 In addition to the standard hydrostatic test, an air pressure leakage test at 40 psi (2.8 bar) shall be conducted for 24 hours. Any leakage that results in a loss of pressure in excess of 1½ psi (0.1 bar) for the 24 hours shall be corrected.

25.2.2.2 Where systems are installed in spaces that are capable of being operated at temperatures below 32°F (0°C), air or nitrogen gas pressure leakage tests required in 25.2.2 shall be conducted at the lowest nominal temperature of the space.

25.2.3 System Operational Tests.

25.2.3.1 Waterflow Devices. Waterflow detecting devices including the associated alarm circuits shall be flow tested through the inspector's test connection and shall result in an audible alarm on the premises within 5 minutes after such flow begins and until such flow stops.

25.2.3.2* Dry Pipe Systems.

25.2.3.2.1 A working test of the dry pipe valve alone and with a quick-opening device, if installed, shall be made by opening the inspector's test connection.

25.2.3.2.2* The test shall measure the time to trip the valve and the time for water to be discharged from the inspector's test connection. All times shall be measured from the time the inspector's test connection is completely opened.

25.2.3.2.2.1* Dry systems calculated for water delivery in accordance with 7.2.3.6 shall be exempt from any specific delivery time requirement.

25.2.3.2.3 The results shall be recorded using the contractor's material and test certificate for aboveground piping *(see Figure 25.1)*.

25.2.3.3 Deluge and Preaction Systems.

25.2.3.3.1 The automatic operation of a deluge or preaction valve shall be tested in accordance with the manufacturer's instructions.

25.2.3.3.2 The manual and remote control operation, where present, shall also be tested.

25.2.3.4 Main Drain Valves.

25.2.3.4.1 The main drain valve shall be opened and remain open until the system pressure stabilizes.

25.2.3.4.2* The static and residual pressures shall be recorded on the contractor's material and test certificate *(see Figure 25.1)*.

25.2.3.5 Operating Test for Control Valves. All control valves shall be fully closed and opened under system water pressure to ensure proper operation.

25.2.4 Pressure-Reducing Valves.

25.2.4.1 Each pressure-reducing valve shall be tested upon completion of installation to ensure proper operation under flow and no-flow conditions.

25.2.4.2 Testing shall verify that the device properly regulates outlet pressure at both maximum and normal inlet pressure conditions.

25.2.4.3 The results of the flow test of each pressure-reducing valve shall be recorded on the contractor's material and test certificate *(see Figure 25.1)*.

25.2.4.4 The results shall include the static and residual inlet pressures, static and residual outlet pressures, and the flow rate.

25.2.5 Backflow Prevention Assemblies.

25.2.5.1 The backflow prevention assembly shall be forward flow tested to ensure proper operation.

25.2.5.2 The minimum flow rate shall be the system demand, including hose stream allowance where applicable.

25.2.6 Exposure Systems. Operating tests shall be made of exposure protection systems upon completion of the installation, where such tests do not risk water damage to the building on which they are installed or to adjacent buildings.

25.3 Circulating Closed Loop Systems.

25.3.1 For sprinkler systems with non–fire protection connections, additional information shall be appended to the contractor's material and test certificate for aboveground piping shown in Figure 25.1 as follows:

(1) Certification that all auxiliary devices, such as heat pumps, circulating pumps, heat exchangers, radiators, and luminaires, if a part of the system, have a pressure rating of at least 175 psi or 300 psi (12.1 bar or 20.7 bar) if exposed to pressures greater than 175 psi (12.1 bar).
(2) All components of sprinkler system and auxiliary system have been pressure tested as a composite system in accordance with 25.2.2.

mains or risers shall be of the size required for the total number of sprinklers.

23.5.1.6 Stair Towers. Stair towers, or other construction with incomplete floors, if piped on independent risers, shall be treated as one area with reference to pipe sizes.

23.5.2 Schedule for Light Hazard Occupancies.

23.5.2.1 Branch Lines.

23.5.2.1.1 Unless permitted by 23.5.2.1.2 or 23.5.2.1.3, branch lines shall not exceed eight sprinklers on either side of a cross main.

23.5.2.1.2 Where more than eight sprinklers on a branch line are necessary, lines shall be permitted to be increased to nine sprinklers by making the two end lengths 1 in. (25.4 mm) and 1¼ in. (33 mm), respectively, and the sizes thereafter standard.

23.5.2.1.3 Ten sprinklers shall be permitted to be placed on a branch line, making the two end lengths 1 in. (25.4 mm) and 1¼ in. (33 mm), respectively, and feeding the tenth sprinkler by a 2½ in. (64 mm) pipe.

23.5.2.2 Pipe Sizes.

23.5.2.2.1 Pipe sizes shall be in accordance with Table 23.5.2.2.1.

Table 23.5.2.2.1 Light Hazard Pipe Schedules

Steel		Copper	
1 in.	2 sprinklers	1 in.	2 sprinklers
1¼ in.	3 sprinklers	1¼ in.	3 sprinklers
1½ in.	5 sprinklers	1½ in.	5 sprinklers
2 in.	10 sprinklers	2 in.	12 sprinklers
2½ in.	30 sprinklers	2½ in.	40 sprinklers
3 in.	60 sprinklers	3 in.	65 sprinklers
3½ in.	100 sprinklers	3½ in.	115 sprinklers
4 in.	See Section 8.2	4 in.	See Section 8.2

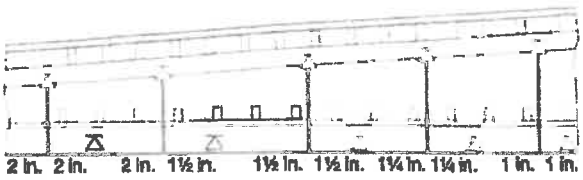
For SI units, 1 in. = 25.4 mm.

23.5.2.2.2 Each area requiring more sprinklers than the number specified for 3½ in. (89 mm) pipe in Table 23.5.2.2.1 and without subdividing partitions (not necessarily fire walls) shall be supplied by mains or risers sized for ordinary hazard occupancies.

23.5.2.3 Where sprinklers are installed above and below ceilings in accordance with Figure 23.5.2.3(a) through Figure 23.5.2.3(c), and such sprinklers are supplied from a common set of branch lines or separate branch lines from a common cross main, such branch lines shall not exceed eight sprinklers above and eight sprinklers below any ceiling on either side of the cross main.

23.5.2.4 Unless the requirements of 23.5.2.5 are met, pipe sizing up to and including 2½ in. (64 mm) shall be as shown in Table 23.5.2.4 utilizing the greatest number of sprinklers to be found on any two adjacent levels.

23.5.2.5 Branch lines and cross mains supplying sprinklers installed entirely above or entirely below ceilings shall be sized in accordance with Table 23.5.2.2.1.



For SI units, 1 in. = 25.4 mm.

FIGURE 23.5.2.3(a) Arrangement of Branch Lines Supplying Sprinklers Above and Below Ceiling.

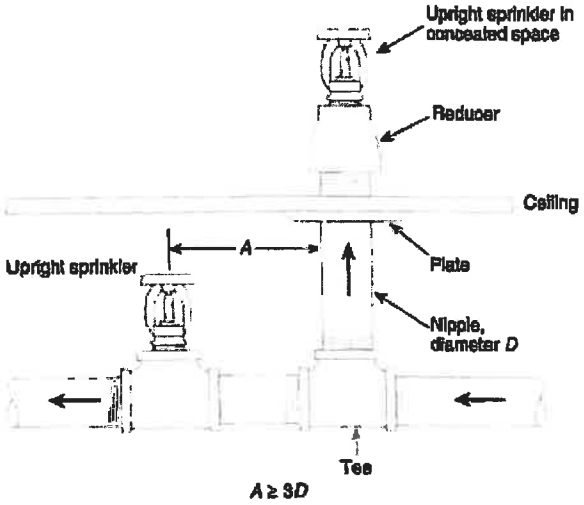


FIGURE 23.5.2.3(b) Sprinkler on Riser Nipple from Branch Line in Lower Fire Area.

23.5.2.6* Where the total number of sprinklers above and below a ceiling exceeds the number specified in Table 23.5.2.2.1 for 2½ in. (64 mm) pipe, the pipe supplying such sprinklers shall be increased to 3 in. (76 mm) and sized thereafter according to the schedule shown in Table 23.5.2.2.1 for the number of sprinklers above or below a ceiling, whichever is larger.

23.5.3 Schedule for Ordinary Hazard Occupancies.

23.5.3.1 Unless permitted by 23.5.3.2 or 23.5.3.3, branch lines shall not exceed eight sprinklers on either side of a cross main.

23.5.3.2 Where more than eight sprinklers on a branch line are necessary, lines shall be permitted to be increased to nine sprinklers by making the two end lengths 1 in. (25.4 mm) and 1¼ in. (33 mm), respectively, and the sizes thereafter standard.

23.5.3.3 Ten sprinklers shall be permitted to be placed on a branch line, making the two end lengths 1 in. (25.4 mm) and 1¼ in. (33 mm), respectively, and feeding the tenth sprinkler by a 2½ in. (64 mm) pipe.

23.5.3.4 Pipe sizes shall be in accordance with Table 23.5.3.4.

23.5.3.5 Where the distance between sprinklers on the branch line exceeds 12 ft (3.7 m) or the distance between the branch lines exceeds 12 ft (3.7 m), the number of sprinklers for a given pipe size shall be in accordance with Table 23.5.3.5.

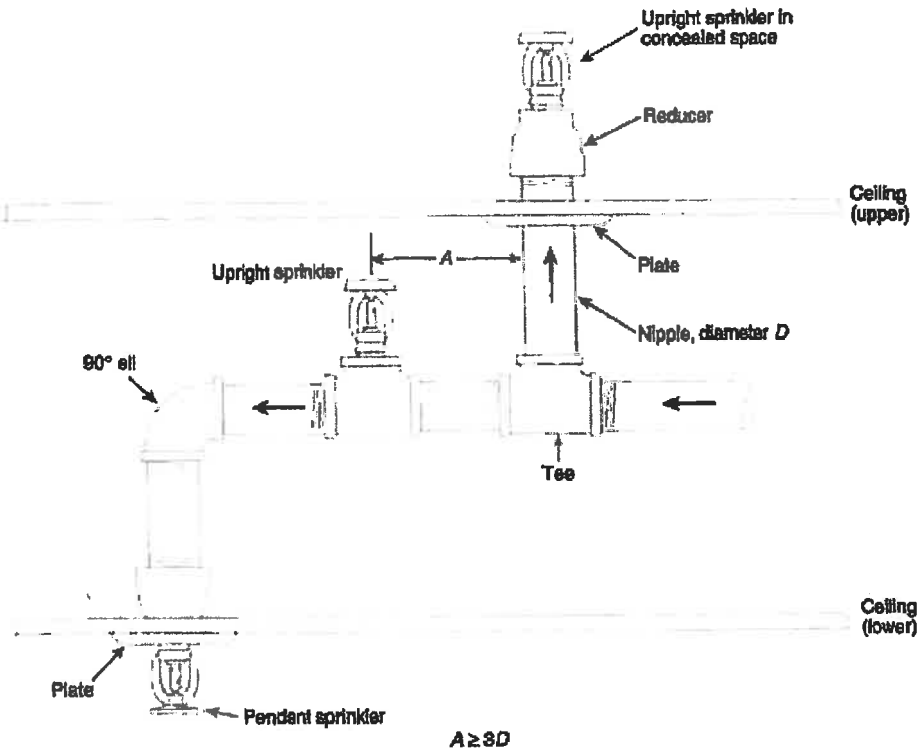


FIGURE 23.5.2.3(c) Arrangement of Branch Lines Supplying Sprinklers Above, Between, and Below Ceilings.

Table 23.5.2.4 Number of Sprinklers Above and Below Ceiling

Steel		Copper	
1 in.	2 sprinklers	1 in.	2 sprinklers
1¼ in.	4 sprinklers	1¼ in.	4 sprinklers
1½ in.	7 sprinklers	1½ in.	7 sprinklers
2 in.	15 sprinklers	2 in.	18 sprinklers
2½ in.	50 sprinklers	2½ in.	65 sprinklers

For SI units, 1 in. = 25.4 mm.

23.5.3.6 Where sprinklers are installed above and below ceilings and such sprinklers are supplied from a common set of branch lines or separate branch lines supplied by a common cross main, such branch lines shall not exceed eight sprinklers above and eight sprinklers below any ceiling on either side of the cross main.

23.5.3.7 Pipe sizing up to and including 3 in. (76 mm) shall be as shown in Table 23.5.3.7 in accordance with Figure 23.5.2.3(a), Figure 23.5.2.3(b), and Figure 23.5.2.3(c) utilizing the greatest number of sprinklers to be found on any two adjacent levels.

23.5.3.8 Branch lines and cross mains supplying sprinklers installed entirely above or entirely below ceilings shall be sized in accordance with Table 23.5.3.4 or Table 23.5.3.5.

Table 23.5.3.4 Ordinary Hazard Pipe Schedule

Steel		Copper	
1 in.	2 sprinklers	1 in.	2 sprinklers
1¼ in.	3 sprinklers	1¼ in.	3 sprinklers
1½ in.	5 sprinklers	1½ in.	5 sprinklers
2 in.	10 sprinklers	2 in.	12 sprinklers
2½ in.	20 sprinklers	2½ in.	25 sprinklers
3 in.	40 sprinklers	3 in.	45 sprinklers
3½ in.	65 sprinklers	3½ in.	75 sprinklers
4 in.	100 sprinklers	4 in.	115 sprinklers
5 in.	160 sprinklers	5 in.	180 sprinklers
6 in.	275 sprinklers	6 in.	300 sprinklers
8 in.	See Section 8.2	8 in.	See Section 8.2

For SI units, 1 in. = 25.4 mm.

Table 23.5.3.5 Number of Sprinklers — Greater Than 12 ft (3.7 m) Separations

Steel		Copper	
2½ in.	15 sprinklers	2½ in	20 sprinklers
3 in.	30 sprinklers	3 in.	35 sprinklers
3½ in.	60 sprinklers	3½ in.	65 sprinklers

For SI units, 1 in. = 25.4 mm.
Note: For other pipe and tube sizes, see Table 22.5.3.4.

mains or risers shall be of the size required for the total number of sprinklers.

23.5.1.6 Stair Towers. Stair towers, or other construction with incomplete floors, if piped on independent risers, shall be treated as one area with reference to pipe sizes.

23.5.2 Schedule for Light Hazard Occupancies.

23.5.2.1 Branch Lines.

23.5.2.1.1 Unless permitted by 23.5.2.1.2 or 23.5.2.1.3, branch lines shall not exceed eight sprinklers on either side of a cross main.

23.5.2.1.2 Where more than eight sprinklers on a branch line are necessary, lines shall be permitted to be increased to nine sprinklers by making the two end lengths 1 in. (25.4 mm) and 1¼ in. (33 mm), respectively, and the sizes thereafter standard.

23.5.2.1.3 Ten sprinklers shall be permitted to be placed on a branch line, making the two end lengths 1 in. (25.4 mm) and 1¼ in. (33 mm), respectively, and feeding the tenth sprinkler by a 2½ in. (64 mm) pipe.

23.5.2.2 Pipe Sizes.

23.5.2.2.1 Pipe sizes shall be in accordance with Table 23.5.2.2.1.

Table 23.5.2.2.1 Light Hazard Pipe Schedules

Steel		Copper	
1 in.	2 sprinklers	1 in.	2 sprinklers
1¼ in.	3 sprinklers	1¼ in.	3 sprinklers
1½ in.	5 sprinklers	1½ in.	5 sprinklers
2 in.	10 sprinklers	2 in.	12 sprinklers
2½ in.	30 sprinklers	2½ in.	40 sprinklers
3 in.	60 sprinklers	3 in.	65 sprinklers
3½ in.	100 sprinklers	3½ in.	115 sprinklers
4 in.	See Section 8.2	4 in.	See Section 8.2

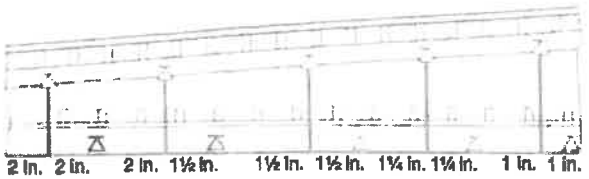
For SI units, 1 in. = 25.4 mm.

23.5.2.2.2 Each area requiring more sprinklers than the number specified for 3½ in. (89 mm) pipe in Table 23.5.2.2.1 and without subdividing partitions (not necessarily fire walls) shall be supplied by mains or risers sized for ordinary hazard occupancies.

23.5.2.3 Where sprinklers are installed above and below ceilings in accordance with Figure 23.5.2.3(a) through Figure 23.5.2.3(c), and such sprinklers are supplied from a common set of branch lines or separate branch lines from a common cross main, such branch lines shall not exceed eight sprinklers above and eight sprinklers below any ceiling on either side of the cross main.

23.5.2.4 Unless the requirements of 23.5.2.5 are met, pipe sizing up to and including 2½ in. (64 mm) shall be as shown in Table 23.5.2.4 utilizing the greatest number of sprinklers to be found on any two adjacent levels.

23.5.2.5 Branch lines and cross mains supplying sprinklers installed entirely above or entirely below ceilings shall be sized in accordance with Table 23.5.2.2.1.



For SI units, 1 in. = 25.4 mm.

FIGURE 23.5.2.3(a) Arrangement of Branch Lines Supplying Sprinklers Above and Below Ceiling.

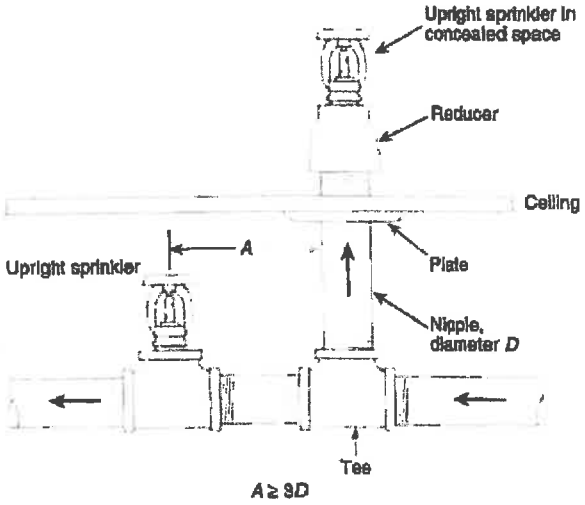


FIGURE 23.5.2.3(b) Sprinkler on Riser Nipple from Branch Line in Lower Fire Area.

23.5.2.6* Where the total number of sprinklers above and below a ceiling exceeds the number specified in Table 23.5.2.2.1 for 2½ in. (64 mm) pipe, the pipe supplying such sprinklers shall be increased to 3 in. (76 mm) and sized thereafter according to the schedule shown in Table 23.5.2.2.1 for the number of sprinklers above or below a ceiling, whichever is larger.

23.5.3 Schedule for Ordinary Hazard Occupancies.

23.5.3.1 Unless permitted by 23.5.3.2 or 23.5.3.3, branch lines shall not exceed eight sprinklers on either side of a cross main.

23.5.3.2 Where more than eight sprinklers on a branch line are necessary, lines shall be permitted to be increased to nine sprinklers by making the two end lengths 1 in. (25.4 mm) and 1¼ in. (33 mm), respectively, and the sizes thereafter standard.

23.5.3.3 Ten sprinklers shall be permitted to be placed on a branch line, making the two end lengths 1 in. (25.4 mm) and 1¼ in. (33 mm), respectively, and feeding the tenth sprinkler by a 2½ in. (64 mm) pipe.

23.5.3.4 Pipe sizes shall be in accordance with Table 23.5.3.4.

23.5.3.5 Where the distance between sprinklers on the branch line exceeds 12 ft (3.7 m) or the distance between the branch lines exceeds 12 ft (3.7 m), the number of sprinklers for a given pipe size shall be in accordance with Table 23.5.3.5.

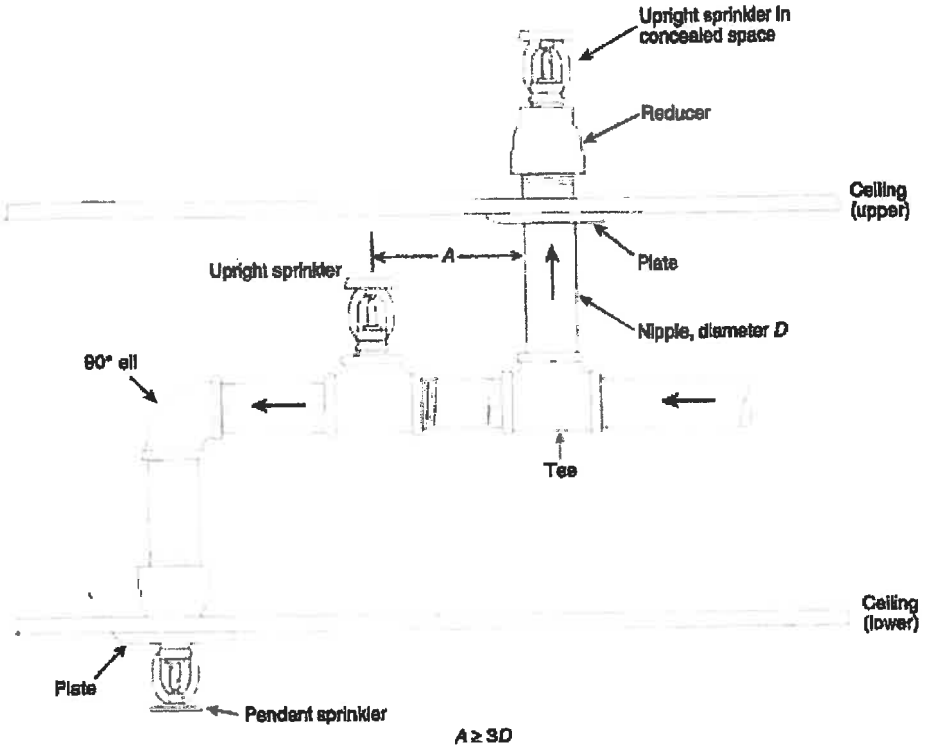


FIGURE 23.5.2.3(c) Arrangement of Branch Lines Supplying Sprinklers Above, Between, and Below Ceilings.

Table 23.5.2.4 Number of Sprinklers Above and Below Ceiling

Steel		Copper	
1 in.	2 sprinklers	1 in.	2 sprinklers
1¼ in.	4 sprinklers	1¼ in.	4 sprinklers
1½ in.	7 sprinklers	1½ in.	7 sprinklers
2 in.	15 sprinklers	2 in.	18 sprinklers
2½ in.	50 sprinklers	2½ in.	65 sprinklers

For SI units, 1 in. = 25.4 mm.

23.5.3.6 Where sprinklers are installed above and below ceilings and such sprinklers are supplied from a common set of branch lines or separate branch lines supplied by a common cross main, such branch lines shall not exceed eight sprinklers above and eight sprinklers below any ceiling on either side of the cross main.

23.5.3.7 Pipe sizing up to and including 3 in. (76 mm) shall be as shown in Table 23.5.3.7 in accordance with Figure 23.5.2.3(a), Figure 23.5.2.3(b), and Figure 23.5.2.3(c) utilizing the greatest number of sprinklers to be found on any two adjacent levels.

23.5.3.8 Branch lines and cross mains supplying sprinklers installed entirely above or entirely below ceilings shall be sized in accordance with Table 23.5.3.4 or Table 23.5.3.5.

Table 23.5.3.4 Ordinary Hazard Pipe Schedule

Steel		Copper	
1 in.	2 sprinklers	1 in.	2 sprinklers
1¼ in.	3 sprinklers	1¼ in.	3 sprinklers
1½ in.	5 sprinklers	1½ in.	5 sprinklers
2 in.	10 sprinklers	2 in.	12 sprinklers
2½ in.	20 sprinklers	2½ in.	25 sprinklers
3 in.	40 sprinklers	3 in.	45 sprinklers
3½ in.	65 sprinklers	3½ in.	75 sprinklers
4 in.	100 sprinklers	4 in.	115 sprinklers
5 in.	160 sprinklers	5 in.	180 sprinklers
6 in.	275 sprinklers	6 in.	300 sprinklers
8 in.	See Section 8.2	8 in.	See Section 8.2

For SI units, 1 in. = 25.4 mm.

Table 23.5.3.5 Number of Sprinklers — Greater Than 12 ft (3.7 m) Separations

Steel		Copper	
2½ in.	15 sprinklers	2½ in	20 sprinklers
3 in.	30 sprinklers	3 in.	35 sprinklers
3½ in.	60 sprinklers	3½ in.	65 sprinklers

For SI units, 1 in. = 25.4 mm.
Note: For other pipe and tube sizes, see Table 22.5.3.4.

NFPA 120, *Standard for Fire Prevention and Control in Coal Mines*, 2010 edition.

NFPA 122, *Standard for Fire Prevention and Control in Metal/Nonmetal Mining and Metal Mineral Processing Facilities*, 2010 edition.

NFPA 130, *Standard for Fixed Guideway Transit and Passenger Rail Systems*, 2010 edition.

NFPA 140, *Standard on Motion Picture and Television Production Studio Soundstages, Approved Production Facilities, and Production Locations*, 2008 edition.

NFPA 150, *Standard on Fire and Life Safety in Animal Housing Facilities*, 2013 edition.

NFPA 214, *Standard on Water-Cooling Towers*, 2011 edition.

NFPA 307, *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves*, 2011 edition.

NFPA 318, *Standard for the Protection of Semiconductor Fabrication Facilities*, 2012 edition.

NFPA 400, *Hazardous Materials Code*, 2013 edition.

NFPA 415, *Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways*, 2013 edition.

NFPA 423, *Standard for Construction and Protection of Aircraft Engine Test Facilities*, 2010 edition.

NFPA 804, *Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants*, 2010 edition.

NFPA 805, *Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants*, 2010 edition.

NFPA 851, *Recommended Practice for Fire Protection for Hydroelectric Generating Plants*, 2010 edition.

NFPA 909, *Code for the Protection of Cultural Resource Properties — Museums, Libraries, and Places of Worship*, 2010 edition.

Chapter 3 Definitions

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.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.4 Shall. Indicates a mandatory requirement.

3.2.5 Should. Indicates a recommendation or that which is advised but not required.

3.2.6 Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the *Manual of Style for NFPA Technical Committee Documents*.

3.3 General Definitions.

3.3.1 Automatic Sprinkler. A fire suppression or control device that operates automatically when its heat-activated element is heated to its thermal rating or above, allowing water to discharge over a specified area.

3.3.2* Bathroom. Within a dwelling unit, any room or compartment dedicated to personal hygiene, containing a toilet, sink, or bathing capability such as a shower or tub.

3.3.3 Ceiling Height. The distance between the floor and the underside of the ceiling above (or roof deck) within the area.

3.3.4* Ceiling Pocket. An architectural ceiling feature that consists of a bounded area of ceiling located at a higher elevation than the attached lower ceiling.

3.3.5 Ceiling Types.

3.3.5.1 ***Flat Ceiling.*** A continuous ceiling in a single plane.

3.3.5.2 ***Horizontal Ceiling.*** A ceiling with a slope not exceeding 2 in 12.

3.3.5.3 ***Sloped Ceiling.*** A ceiling with a slope exceeding 2 in 12.

3.3.5.4 ***Smooth Ceiling.*** A continuous ceiling free from significant irregularities, lumps, or indentations.

3.3.6 Compartment. A space completely enclosed by walls and a ceiling. Each wall in the compartment is permitted to have openings to an adjoining space if the openings have a minimum lintel depth of 8 in. (200 mm) from the ceiling and the total width of the openings in each wall does not exceed 8 ft (2.4 m). A single opening of 36 in. (900 mm) or less in width without a lintel is permitted when there are no other openings to adjoining spaces.

3.3.7* Control Valve. A valve controlling flow to water-based fire protection systems.

3.3.8* Draft Curtain. A continuous material protruding downward from the ceiling to create a reservoir for collecting smoke and heat.

3.3.9 Drop-Out Ceiling. A suspended ceiling system, which is installed below the sprinklers, with listed translucent or opaque panels that are heat sensitive and fall from their setting when exposed to heat.

3.3.10 Dwelling Unit (for sprinkler system installations). One or more rooms arranged for the use of one or more individuals living together, as in a single housekeeping unit normally having cooking, living, sanitary, and sleeping facilities that include, but are not limited to, hotel rooms, dormitory rooms, apartments, condominiums, sleeping rooms in nursing homes, and similar living units.

3.3.11 Fire Control. Limiting the size of a fire by distribution of water so as to decrease the heat release rate and pre-wet adjacent combustibles, while controlling ceiling gas temperatures to avoid structural damage.

3.3.12 Fire Suppression. Sharply reducing the heat release rate of a fire and preventing its regrowth by means of direct and sufficient application of water through the fire plume to the burning fuel surface.

3.3.13 Fuel-Fired Heating Unit. An appliance that produces heat by burning fuel.

3.3.14 High Volume Low Speed Fan. A ceiling fan that is approximately 6 ft to 24 ft in diameter with a rotational speed of approximately 30 to 70 revolutions per minute.

3.3.15 Hydraulically Designed System. A calculated sprinkler system in which pipe sizes are selected on a pressure loss basis to provide a prescribed water density, in gallons per minute per square foot (mm/min), or a prescribed minimum discharge pressure or flow per sprinkler, distributed with a reasonable degree of uniformity over a specified area.

3.3.16* Limited-Combustible (Material). Refers to a building construction material not complying with the definition of noncombustible material that, in the form in which it is used, has a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg), where tested in accordance with NFPA 259, and includes either of the following: (1) materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of ⅛ in. (3.2 mm) that has a flame spread index not greater than 50; or (2) materials, in the form and thickness used, having neither a flame spread index greater than 25 nor evidence of continued progressive combustion, and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evidence of continued progressive combustion, when tested in accordance with ASTM E 84, *Standard Test Method of Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard Test Method of Surface Burning Characteristics of Building Materials*.

3.3.17 Noncombustible Material. A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors, when subjected to fire or heat; materials that are reported as passing ASTM E 136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, shall be considered noncombustible materials.

3.3.18 Obstruction.

3.3.18.1 ***Continuous Obstruction.*** An obstruction located at or below the level of sprinkler deflectors that affect the discharge pattern of two or more adjacent sprinklers.

3.3.18.2 ***Noncontinuous Obstruction.*** An obstruction at or below the level of the sprinkler deflector that affects the discharge pattern of a single sprinkler.

3.3.19* Raw Water Source. A water supply that has not been treated and could contain foreign material that could enter the sprinkler system.

3.3.20 Shop-Welded. As used in this standard, *shop* in the term *shop-welded* means either (1) a sprinkler contractor's or fabricator's premise or (2) an area specifically designed or authorized for welding, such as a detached outside location, maintenance shop, or other area (either temporary or permanent) of noncombustible or fire-resistive construction free of combustible and flammable contents and suitably segregated from adjacent areas.

3.3.21 Small Room. A compartment of light hazard occupancy classification having unobstructed construction and a floor area not exceeding 800 ft^2 (74.3 m^2).

3.3.22* Sprinkler System. A system 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 and is commonly activated by heat from a fire, discharging water over the fire area. 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. The system is commonly activated by heat from a fire and discharges water over the fire area.

3.3.23 System Working Pressure. The maximum anticipated static (nonflowing) or flowing pressure applied to sprinkler system components exclusive of surge pressures and exclusive of pressure from the fire department connection.

3.3.24 Thermal Barrier. A material that limits the average temperature rise of the unexposed surface to not more than 250°F (139°C) above ambient for a specified fire exposure duration using the standard time–temperature curve of ASTM E 119, *Standard Test Methods for Fire Tests of Building Construction and Materials*.

3.4 Sprinkler System Type Definitions.

3.4.1 Antifreeze Sprinkler System. A wet pipe system using automatic sprinklers that contains a liquid solution to prevent freezing of the system, intended to discharge the solution upon sprinkler operation, followed immediately by water from a water supply.

3.4.1.1 ***Premixed Antifreeze Solution.*** A mixture of an antifreeze material with water that is prepared and factory-mixed by the manufacturer with a quality control procedure in place that ensures that the antifreeze solution remains homogeneous and that the concentration is as specified.

3.4.2 Circulating Closed-Loop Sprinkler System. A wet pipe sprinkler system having non–fire protection connections to automatic sprinkler systems in a closed-loop piping arrangement for the purpose of utilizing sprinkler piping to conduct water for heating or cooling, where water is not removed or used from the system but only circulated through the piping system.

3.4.3 Combined Dry Pipe–Reaction Sprinkler System. A sprinkler system employing automatic sprinklers attached to a piping system containing air under pressure with a supplemental detection system installed in the same areas as the sprinklers. Operation of the detection system actuates tripping devices that open dry pipe valves simultaneously and without loss of air pressure in the system. The detection system also serves as an automatic fire alarm system.

3.4.4 Deluge Sprinkler System. A sprinkler system employing open sprinklers or nozzles that are attached to a piping system that is connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the sprinklers or the nozzles. When this valve opens, water flows into the piping system and discharges from all sprinklers or nozzles attached thereto.

3.4.5 Dry Pipe Sprinkler System. A sprinkler system employing automatic sprinklers that are attached to a piping system containing air or nitrogen under pressure, the release of which (as from

the opening of a sprinkler) permits the water pressure to open a valve known as a dry pipe valve, and the water then flows into the piping system and out the opened sprinklers.

3.4.6* Gridded Sprinkler System. A sprinkler system in which parallel cross mains are connected by multiple branch lines, causing an operating sprinkler to receive water from both ends of its branch line while other branch lines help transfer water between cross mains.

3.4.7* Looped Sprinkler System. A sprinkler system in which multiple cross mains are tied together so as to provide more than one path for water to flow to an operating sprinkler and branch lines are not tied together.

3.4.8 Multicycle System. A type of sprinkler system capable of repeated on–off flow cycles in response to heat.

3.4.9 Pipe Schedule System. A sprinkler system in which the pipe sizing is selected from a schedule that is determined by the occupancy classification and in which a given number of sprinklers are allowed to be supplied from specific sizes of pipe.

3.4.10* Preaction Sprinkler System. A sprinkler system employing automatic sprinklers that are attached to a piping system that contains air that might or might not be under pressure, with a supplemental detection system installed in the same areas as the sprinklers.

3.4.11 Wet Pipe Sprinkler System. A sprinkler system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by heat from a fire.

3.5* System Component Definitions.

3.5.1 Air Receiver. A chamber, compatible with an air compressor, that can store air under pressure that is higher in pressure than that in the dry pipe or preaction system piping.

3.5.2 Air Reservoir. A chamber that can store air at the same pressure that is in the wet pipe system piping.

3.5.3 Arm-Over. A horizontal pipe that extends from the branch line to a single sprinkler or a sprinkler above and below a ceiling.

3.5.4 Branch Lines. The pipes supplying sprinklers, either directly or through sprigs, drops, return bends, or arm-overs.

3.5.5 Cross Mains. The pipes supplying the branch lines, either directly or through riser nipples.

3.5.6 Feed Mains. The pipes supplying cross mains, either directly or through risers.

3.5.7 Flexible Listed Pipe Coupling. A listed coupling or fitting that allows axial displacement, rotation, and at least 1 degree of angular movement of the pipe without inducing harm on the pipe. For pipe diameters of 8 in. (203.2 mm) and larger, the angular movement shall be permitted to be less than 1 degree but not less than 0.5 degree.

3.5.8 Riser Nipple. Vertical piece of pipe between the main and branch line.

3.5.9 Risers. The vertical supply pipes in a sprinkler system.

3.5.10 Sprig. A pipe that rises vertically and supplies a single sprinkler.

3.5.11 Supervisory Device. A device arranged to supervise the operative condition of automatic sprinkler systems.

3.5.12 System Riser. The aboveground horizontal or vertical pipe between the water supply and the mains (cross or feed) that contains a control valve (either directly or within its supply pipe), pressure gauge, drain, and a waterflow alarm device.

3.5.13 Waterflow Alarm Device. An attachment to the sprinkler system that detects a predetermined water flow and is connected to a fire alarm system to initiate an alarm condition or is used to mechanically or electrically initiate a fire pump or local audible or visual alarm.

3.6 Sprinkler Definitions.

3.6.1* General Sprinkler Characteristics. The following are characteristics of a sprinkler that define its ability to control or extinguish a fire. (1) Thermal sensitivity. A measure of the rapidity with which the thermal element operates as installed in a specific sprinkler or sprinkler assembly. One measure of thermal sensitivity is the response time index (RTI) as measured under standardized test conditions. (a) Sprinklers defined as fast response have a thermal element with an RTI of 50 (meters-seconds)$^{1/2}$ or less. (b) Sprinklers defined as standard response have a thermal element with an RTI of 80 (meters-seconds)$^{1/2}$ or more. (2) Temperature rating. (3) K-factor *(see Chapter 6)*. (4) Installation orientation *(see 3.6.2)*. (5) Water distribution characteristics (i.e., application rate, wall wetting). (6) Special service conditions *(see 3.6.3)*.

3.6.2 Installation Orientation. The following sprinklers are defined according to orientation.

3.6.2.1 ***Concealed Sprinkler.*** A recessed sprinkler with cover plate.

3.6.2.2 ***Flush Sprinkler.*** A sprinkler in which all or part of the body, including the shank thread, is mounted above the lower plane of the ceiling.

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.

3.6.2.4 ***Recessed Sprinkler.*** A sprinkler in which all or part of the body, other than the shank thread, is mounted within a recessed housing.

3.6.2.5 ***Sidewall Sprinkler.*** A sprinkler having special deflectors that are designed to discharge most of the water away from the nearby wall in a pattern resembling one-quarter of a sphere, with a small portion of the discharge directed at the wall behind the sprinkler.

3.6.2.6 ***Upright Sprinkler.*** A sprinkler designed to be installed in such a way that the water spray is directed upwards against the deflector.

3.6.3 Special Service Conditions. The following sprinklers are defined according to special application or environment.

3.6.3.1 ***Corrosion-Resistant Sprinkler.*** A sprinkler fabricated with corrosion-resistant material, or with special coatings or platings, to be used in an atmosphere that would normally corrode sprinklers.

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.

3.6.3.3 ***Institutional Sprinkler.*** A sprinkler specially designed for resistance to load-bearing purposes and with components not readily converted for use as weapons.

3.6.3.4 ***Intermediate Level Sprinkler/Rack Storage Sprinkler.*** A sprinkler equipped with integral shields to protect its operating elements from the discharge of sprinklers installed at higher elevations.

3.6.3.5 ***Ornamental/Decorative Sprinkler.*** A sprinkler that has been painted or plated by the manufacturer.

3.6.3.6 ***Pilot Line Detector.*** A standard spray sprinkler or thermostatic fixed-temperature release device used as a detector to pneumatically or hydraulically release the main valve, controlling the flow of water into a fire protection system.

3.6.4 Sprinkler Types. The following sprinklers are defined according to design and performance characteristics.

3.6.4.1* ***Control Mode Specific Application (CMSA) Sprinkler.*** A type of spray sprinkler that is capable of producing characteristic large water droplets and that is listed for its capability to provide fire control of specific high-challenge fire hazards.

3.6.4.2* ***Early Suppression Fast-Response (ESFR) Sprinkler.*** A type of fast-response sprinkler that has a thermal element with an RTI of 50 (meters-seconds)$^{1/2}$ or less and is listed for its capability to provide fire suppression of specific high-challenge fire hazards.

3.6.4.3 ***Extended Coverage Sprinkler.*** A type of spray sprinkler with maximum coverage areas as specified in Sections 8.8 and 8.9 of this standard.

3.6.4.4 ***Nozzles.*** A device for use in applications requiring special water discharge patterns, directional spray, or other unusual discharge characteristics.

3.6.4.5 ***Old-Style/Conventional Sprinkler.*** A sprinkler that directs from 40 percent to 60 percent of the total water initially in a downward direction and that is designed to be installed with the deflector either upright or pendent.

3.6.4.6 ***Open Sprinkler.*** A sprinkler that does not have actuators or heat-responsive elements.

3.6.4.7* ***Quick-Response (QR) Sprinkler.*** A type of spray sprinkler that has a thermal element with an RTI of 50 (meter-seconds)$^{1/2}$ or less and is listed as a quick-response sprinkler for its intended use.

3.6.4.7.1* ***Quick-Response Early Suppression (QRES) Sprinkler.*** A type of quick-response sprinkler that has a thermal element with an RTI of 50 (meter-seconds)$^{1/2}$ or less and is listed for its capability to provide fire suppression of specific fire hazards.

3.6.4.7.2 ***Quick-Response Extended Coverage Sprinkler.*** A type of quick-response sprinkler that has a thermal element with an RTI of 50 (meter-seconds)$^{1/2}$ or less and complies with the extended protection areas defined in Chapter 8.

3.6.4.8 ***Residential Sprinkler.*** A type of fast-response sprinkler having a thermal element with an RTI of 50 (meters-seconds)$^{1/2}$ or less, that has been specifically investigated for its ability to enhance survivability in the room of fire origin, and that is listed for use in the protection of dwelling units.

3.6.4.9 ***Special Sprinkler.*** A sprinkler that has been tested and listed as prescribed in 8.4.8.

3.6.4.10 ***Spray Sprinkler.*** A type of sprinkler listed for its capability to provide fire control for a wide range of fire hazards.

3.6.4.10.1 ***Standard Spray Sprinkler.*** A spray sprinkler with maximum coverage areas as specified in Sections 8.6 and 8.7 of this standard.

3.7 Construction Definitions.

3.7.1* Obstructed Construction. Panel construction and other construction where beams, trusses, or other members impede heat flow or water distribution in a manner that materially affects the ability of sprinklers to control or suppress a fire.

3.7.2* Unobstructed Construction. Construction where beams, trusses, or other members do not impede heat flow or water distribution in a manner that materially affects the ability of sprinklers to control or suppress a fire. Unobstructed construction has horizontal structural members that are not solid, where the openings are at least 70 percent of the cross-section area and the depth of the member does not exceed the least dimension of the openings, or all construction types where the spacing of structural members exceeds 7½ ft (2.3 m) on center.

3.8 Private Water Supply Piping Definitions.

3.8.1 General Definitions from NFPA 24.

3.8.1.1 ***Appurtenance.*** An accessory or attachment that enables the private fire service main to perform its intended function. [24, 2013]

3.8.1.2 ***Corrosion-Resistant Piping.*** Piping that has the property of being able to withstand deterioration of its surface or its properties when exposed to its environment. [24, 2013]

3.8.1.3 ***Corrosion-Retardant Material.*** A lining or coating material that when applied to piping or appurtenances has the property of reducing or slowing the deterioration of the object's surface or properties when exposed to its environment. [24, 2013]

3.8.1.4 ***Fire Department Connection.*** A connection through which the fire department can pump supplemental water into the sprinkler system, standpipe, or other system, furnishing water for fire extinguishment to supplement existing water supplies. [24, 2013]

3.8.1.5 ***Fire Pump.*** A pump that is a provider of liquid flow and pressure dedicated to fire protection. [20, 2013]

3.8.1.6 ***Hose House.*** An enclosure located over or adjacent to a hydrant or other water supply designed to contain the necessary hose nozzles, hose wrenches, gaskets, and spanners to be used in fire fighting in conjunction with and to provide aid to the local fire department. [24, 2013]

3.8.1.7 ***Hydrant Butt.*** The hose connection outlet of a hydrant. [24, 2013]

3.8.1.8 ***Hydraulically Calculated Water Demand Flow Rate.*** The waterflow rate for a system or hose stream that has been calculated using accepted engineering practices. [24, 2013]

3.8.1.9 ***Pressure.***

3.8.1.9.1 ***Residual Pressure.*** The pressure that exists in the distribution system, measured at the residual hydrant at the time the flow readings are taken at the flow hydrants. [24, 2013]

3.8.1.9.2 ***Static Pressure.*** The pressure that exists at a given point under normal distribution system conditions measured at the residual hydrant with no hydrants flowing. [24, 2013]

3.8.1.10 ***Pressure Regulating Device.*** A device designed for the purpose of reducing, regulating, controlling, or restricting water pressure. [24, 2013]

3.8.1.11* ***Private Fire Service Main.*** Private fire service main, as used in this standard, is that pipe and its appurtenances on private property (1) between a source of water and the base of the system riser for water-based fire protection systems, (2) between a source of water and inlets to foam-making systems, (3) between a source of water and the base elbow of private hydrants or monitor nozzles, and (4) used as fire pump suction and discharge piping, (5) beginning at the inlet side of the check valve on a gravity or pressure tank. [24, 2013]

3.8.1.12 ***Pumper Outlet.*** The hydrant outlet intended for use by fire departments for taking supply from the hydrant for pumpers. [24, 2013]

3.8.1.13 ***Rated Capacity.*** . The flow available from a hydrant at the designated residual pressure (rated pressure) either measured or calculated. [24, 2013]

3.8.1.14 ***Test.***

3.8.1.14.1 ***Flow Test.*** A test performed by the flow and measurement of water from one hydrant and the static and residual pressures from an adjacent hydrant for the purpose of determining the available water supply at that location. [24, 2013]

3.8.1.14.2 ***Flushing Test.*** A test of a piping system using high velocity flows to remove debris from the piping system prior to it being placed in service. [24, 2013]

3.8.1.14.3 ***Hydrostatic Test.*** A test of a closed piping system and its attached appurtenances consisting of subjecting the piping to an increased internal pressure for a specified period of duration to verify system integrity and leak rates. [24, 2013]

3.8.1.15 ***Valve.***

3.8.1.15.1 ***Check Valve.*** A valve that allows flow in one direction only. [24, 2013]

3.8.1.15.2 ***Indicating Valve.*** A valve that has components that show if the valve is open or closed. Examples are outside screw and yoke (OS&Y) gate valves and underground gate valves with indicator posts. [24, 2013]

3.8.2 Hydrant Definitions from NFPA 24.

3.8.2.1 ***Hydrant.*** An exterior valved connection to a water supply system that provides hose connections. [24, 2013]

3.8.2.1.1 ***Dry Barrel Hydrant.*** This is the most common type of hydrant; it has a control valve below the frost line between the footpiece and the barrel. [24, 2013]

3.8.2.1.2 ***Flow Hydrant.*** The hydrant that is used for the flow and flow measurement of water during a flow test. [24, 2013]

3.8.2.1.3 ***Private Fire Hydrant.*** A valved connection on a water supply system having one or more outlets and that is used to supply hose and fire department pumpers with water on private property. [24, 2013]

3.8.2.1.4 ***Public Hydrant.*** A valved connection on a water supply system having one or more outlets and that is used to supply hose and fire department pumpers with water. [24, 2013]

3.8.2.1.5 ***Residual Hydrant.*** The hydrant that is used for measuring static and residual pressures during a flow test. [24, 2013]

3.8.2.1.6 ***Wet Barrel Hydrant.*** A type of hydrant that sometimes is used where there is no danger of freezing weather. Each outlet on a wet barrel hydrant is provided with a valved outlet threaded for fire hose. [24, 2013]

3.9 Storage Definitions.

3.9.1* General.

3.9.1.1* ***Available Height for Storage.*** The maximum height at which commodities can be stored above the floor and still maintain necessary clearance from structural members and the required clearance below sprinklers.

3.9.1.2 ***Cartoned.*** A method of storage consisting of corrugated cardboard or paperboard containers fully enclosing the commodity.

3.9.1.3* ***Carton Records Storage.*** A Class III commodity consisting predominantly of paper records in cardboard cartons.

3.9.1.4 ***Catwalk.*** For the purposes of carton records storage, a storage aid consisting of either open metal grating or solid horizontal barriers supported from a rack storage system that is utilized as a walkway for access to storage at elevated levels. Catwalks are accessed using stairs and are not separate floors of a building.

3.9.1.5 ***Clearance to Ceiling.*** The distance from the top of storage to the ceiling above.

3.9.1.6 ***Commodity.*** The combination of products, packing material, and container that determines commodity classification.

3.9.1.7 ***Compact Storage.*** Storage on solid shelves not exceeding 36 in. (0.9 m) in total depth, arranged as part of a compact storage module, with no more than 30 in. (0.76 m) between shelves vertically and with no internal vertical flue spaces other than those between individual shelving sections.

3.9.1.8 ***Compact Storage Module.*** A type of shelving unit consisting of compact storage whereby the units move to allow for storage to be pushed together creating a storage unit with no flues or minimal spaces between units. Aisles are created by moving the shelving unit. Compact storage modules can be manual or electric in operation.

3.9.1.9* ***Compartmented.*** The rigid separation of the products in a container by dividers that form a stable unit under fire conditions.

3.9.1.10* ***Container (Shipping, Master, or Outer Container).*** A receptacle strong enough, by reason of material, design, and construction, to be shipped safely without further packaging.

3.9.1.11* ***Conventional Pallets.*** A material-handling aid designed to support a unit load with openings to provide access for material-handling devices. *(See Figure A.3.9.1.11.)*

3.9.1.12* ***Encapsulation.*** A method of packaging that either consists of a plastic sheet completely enclosing the sides and top of a pallet load containing a combustible commodity, a combustible package, or a group of combustible commodities or combustible packages, or consists of combustible commodities individually wrapped in plastic sheeting and stored exposed in a pallet load.