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USACE / NAVFAC / AFCEC / NASA **UFGS-21 13 18 (August 2020)**

Preparing Activity: USACE **Superseding**
UFGS-21 13 18.00 10 (May 2009)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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DIVISION 21 - FIRE SUPPRESSION

SECTION 21 13 18

PREACTION SPRINKLER SYSTEMS, FIRE PROTECTION

08/20

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SECTION 21 13 18

PREACTION SPRINKLER SYSTEMS, FIRE PROTECTION
08/20

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NOTE: This guide specification covers the requirements for preaction fire protection sprinkler systems.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information. The designer is permitted to edit any and all of this section for the project. If the designer is modifying/deleting non-bracketed items and text, the Designated Fire Protection Engineer (DFPE) should be consulted prior to incorporating final changes.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
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NOTE: For OCONUS projects, this specification section should be edited for specific Host Nation requirements. Coordinate compliance with Host Nation requirements with the DFPE.
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NOTE: This specification section includes requirements from UFC 3-600-01 (change 4, 7 February 2020)
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PART 1 GENERAL

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NOTE: Because preaction systems are more costly, less reliable, and require more maintenance than wet pipe systems, they should be used only where justified by occupancy conditions.

The Designer must edit this specification section for either a performance-designed system or a fully designed system as applicable.

This section is primarily intended for performance designed systems, e.g. systems where the size, layout, and support of branch lines and cross mains, and the layout of sprinklers will be designed by the Contractor.

This section is not intended to be used for NFPA 13D systems.

The Designer must provide the following information in the contract documents for performance designed systems. This information must be in accordance with UFC 3-600-01.

(1) Show the layout and size of all piping and equipment from the point of connection to the water supply, to the sprinkler riser. The contract drawings must include a detailed sprinkler riser diagram.

(2) Show location and size of service laterals, sprinkler risers, control valves, drain lines, sectional valves, and inspector's test valves and switches on the drawings.

(3) Specify waterflow data including hydrant flow test results, including the location where the hydrant flow test was conducted, the location and size of existing mains and new water supply lines that will serve the sprinkler system.

(4) Highlight or clearly indicate the area(s) to be protected by sprinklers on the drawings.

(5) Specify waterflow requirements including the design density, design area, the hose stream demand (including location of the hose stream demand), the duration of supply, and sprinkler spacing and area of coverage in this section.

(6) Show the location of the backflow preventer (including provisions for a drain and access for maintenance) on the drawings.

(7) Show all provisions necessary for forward flow testing of the backflow preventer at system demand as required by NFPA 13 on the drawings.

(8) Highlight all concealed spaces on the drawings that require sprinkler protection, such as spaces above suspended ceilings that are built of combustible material or that can contain combustible materials, such as storage, and communication cabling that is not fire-rated.

(9) Provide details on the drawings of pipe restraints for underground piping. This includes details of pipe clamps, tie rods, mechanical retainer glands, and thrust blocks.

(10) Nitrogen generators, including controls and complete installation details, including piping, control valves, mounting base.

(11) Show location of the control unit, batteries and charger (if remotely mounted), supervising station transmitter, annunciator, primary power supply, remote annunciator, detectors, notification appliances (unless performance requirements are specified), and each alarm initiating device including fire extinguishing system switches.

(12) Show single-line releasing systems riser diagram. Each device on the riser should be identified by type. Indicate connection of equipment.

(13) Show a releasing system operating matrix . Show actions of input devices such as detectors, manual stations, waterflow switches, initiating devices, etc. on one axis and output functions such as door releases, smoke control fans, elevator relays, indicating/notification appliances etc. on the other. Entries which require descriptions, explanation of processes, sequences, interfaces, etc. can be flagged by symbols keyed to supplementary notes. Alternately provide a zone-by-zone sequence of operation or a schedule identifying all initiators, outputs, and interfaces.

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1.1 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update

the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(2020) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.3	(2016) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2016) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.18	(2018) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2016) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2018) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(2018) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1013	(2011) Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers - (ANSI approved 2010)
ASSE 1015	(2011) Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies - (ANSI approved 2010)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2016) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2017) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C203	(2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA M14	(2015) Manual: Recommended Practice for Backflow Prevention and Cross-Connection Control

ASTM INTERNATIONAL (ASTM)

ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A135/A135M	(2009; R2014) Standard Specification for Electric-Resistance-Welded Steel Pipe
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A183	(2014; R 2020) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
ASTM B62	(2017) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B75/B75M	(2020) Standard Specification for Seamless Copper Tube
ASTM B88	(2020) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2020) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM F402	(2005; R 2012) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits

IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

INTELLIGENCE COMMUNITY STANDARD (ICS)

ICS 705-1	(2010) Physical and Technical Security Standard for Sensitive Compartmented Information Facilities

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71	(2018) Gray Iron Swing Check Valves, Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 4	(2018) Standard for Integrated Fire Protection and Life Safety System Testing
NFPA 13	(2019; Errata 19-1; Errata 19-2; TIA 19-1; TIA 19-2; TIA 19-3; TIA 19-4; Errata 19-3; Errata 20-4; TIA 19-5; TIA 19-6) Standard for the Installation of Sprinkler Systems
NFPA 24	(2019; TIA 19-1) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 72	(2019; TIA 19-1; ERTA 1 2019) National Fire Alarm and Signaling Code
NFPA 101	(2021) Life Safety Code
NFPA 291	(2016) Recommended Practice for Fire Flow Testing and Marking of Hydrants
NFPA 1963	(2019) Standard for Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	(2012) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL 199	(2020) UL Standard for Safety Automatic Sprinklers for Fire-Protection Service
UL 262	(2004; Reprint Oct 2011) Gate Valves for

	Fire-Protection Service
UL 268	(2016; Reprint Oct 2019) UL Standard for Safety Smoke Detectors for Fire Alarm Systems
UL 312	(2010; Reprint Mar 2018) UL Standard for Safety Check Valves for Fire-Protection Service
UL 405	(2013; Bul. 2020) UL Standard for Safety Fire Department Connection Devices
UL 464	(2016; Reprint Sep 2017) UL Standard for Safety Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories
UL 497A	(2001; Bul. 2019) UL Standard for Safety Secondary Protectors for Communications Circuits
UL 497B	(2004; Reprint Dec 2012) Protectors for Data Communication Circuits
UL 521	(1999; Reprint Dec 2017) UL Standard for Safety Heat Detectors for Fire Protective Signaling Systems
UL 668	(2004; Reprint Jul 2016) UL Standard for Safety Hose Valves for Fire-Protection Service
UL 789	(2004; Reprint May 2017) UL Standard for Safety Indicator Posts for Fire-Protection Service
UL 864	(2014; Reprint May 2020) UL Standard for Safety Control Units and Accessories for Fire Alarm Systems
UL 1283	(2017) UL Standard for Safety Electromagnetic Interference Filters
UL 1449	(2014; Reprint Jul 2017) UL Standard for Safety Surge Protective Devices
UL 1638	(2016; Reprint Sep 2017) UL Standard for Safety Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories
UL 1971	(2002; Reprint Oct 2008) Signaling Devices for the Hearing Impaired
UL Fire Prot Dir	(2012) Fire Protection Equipment Directory

1.2 SYSTEM DESCRIPTION

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NOTE: Seismic protection/bracing is to be provided for seismic design categories C or greater only, unless specifically requested by the DFPE. Consideration should also be giving to utilizing seismic protection/bracing to limit pipe movement.

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Provide [single-interlock][electric-pneumatic double-interlock]preaction[_____] [sprinkler] system(s) in [areas indicated on the drawings] [_____]. Except as modified herein, the system must meet the requirements of NFPA 13[and] and NFPA 72. Preaction systems must utilize nitrogen in lieu of air. Pipe sizes which are not indicated on the Contract drawings must be determined by hydraulic calculations.

1.2.1 Hydraulic Design

****

NOTE: Applications requiring multiple densities/design areas must be referred to and shown on the drawings.

Discharge density for non-storage occupancies must be in accordance with UFC 3-600-01. Specific densities must be listed on the drawings or noted in the specification when drawings are not provided. Stating "comply with UFC 3-600-01 is not acceptable.

Hazard classification of miscellaneous storage must be per NFPA 13. Discharge density for the hazard classification must be per UFC 3-600-01.

The paragraph below must be listed on the drawings. If this information is not listed on the drawings, provide the information in paragraph 1.1.1.3 (with brackets completed).

Hydraulically design the system to discharge a minimum density [of [_____] L/min per square meter gpm/square foot over the hydraulically most demanding [280] [_____] square meters[_____] square feet of floor area][as indicated on the drawings]. The minimum pipe size for branch lines in gridded systems must be 32 mm1 1/4-inch. Hydraulic calculations must be in accordance with the Area/Density Method of NFPA 13.

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NOTE: The addition, modification or relocation of no more than twenty sprinklers to an existing system or modifications to existing sprinkler systems fed from domestic supplies are permitted to be designed using the pipe schedule method in NFPA 13 based on the layout of the existing system.

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1.2.1.1 Basis for Calculations

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NOTE: The design must include an adequate water supply to meet the sprinkler water demand. The designer must provide waterflow test results and hydraulic calculations to ensure that the system demand will be met.

Design Calculations: The designer must provide detailed hydraulic calculations that clearly demonstrate that the water supply will meet the demand of the sprinkler system and hose streams. Calculations must be submitted with the concept design submission.

****

A waterflow test was performed on (DATE) at (LOCATION) and resulted in a static pressure of [_____ kPapsi] with a residual pressure of [_____ kPapsi] while flowing [_____ L/mingpm]. Perform a fire hydrant flow test prior to shop drawing submittal in accordance with NFPA 291. Results must include hydrant elevations relative to the building and hydrant number/identifiers for the tested hydrants, including which were flowed, which had a gauge. This information must be presented in a tabular form if multiple hydrants were flowed. The results must be included with the hydraulic calculations. Hydraulic calculations must be based on flow test noted in this paragraph, unless [verified by the NAVFAC[_____] Fire Protection Engineer and] approved by Contracting Officer. Hydraulic calculations must be based upon the Hazen-Williams formula with a "C" value noted in NFPA 13 for piping, [and [_____] for existing underground piping]. A "C" value of 120 is permitted to be used in hydraulic calculations when nitrogen is utilized.[Hydraulic calculations must be based on operation of the fire pump(s) provided in Section 21 30 00 FIRE PUMPS.] [The minimum residual pressure in a service lateral (lead-in) at the [design flow rate][150% of the fire pump rated flow] must be 138 kPa20 psi at [the inlet to the backflow preventer][the suction side of the fire pump]].

1.2.1.2 Hydraulic Calculations

a. Water supply curves and system requirements must be plotted on semi-logarithmic graph (N^1.85) paper so as to present a summary of the complete hydraulic calculation.

b. Provide a summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, minimum discharge pressures and minimum flows. Elevations of hydraulic reference points (nodes) must be indicated.

c. Documentation must identify each pipe individually and the nodes connected thereto. Indicate the diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient for each pipe.

d. Where the sprinkler system is supplied by interconnected risers, the sprinkler system must be hydraulically calculated using the hydraulically most demanding single riser. The calculations must not

assume the simultaneous use of more than one riser.

e. All calculations must include the backflow preventer manufacturer's stated friction loss at the design flow or [83 kPa12 psi for reduced pressure][55 kPa8 psi for double check] backflow preventer, whichever is greater.

f. All calculations must be performed back to the actual location of the flow test, taking into account the direction of flow in the service main at the test location.

g. For gridded systems, calculations must show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. A flow diagram indicating the quantity and direction of flows must be included.

1.2.1.3 Design Criteria

Hydraulically design the system to discharge a minimum density [of [_____] L/min per square metergpm/square foot over the hydraulically most demanding [_____] square metersquare feet of floor area][as indicated on the drawings]. Hydraulic calculations must be in accordance with the Area/Density Method of NFPA 13. Add an allowance for exterior hose streams of [_____] L/min gpm to the sprinkler system demand [at the fire hydrant shown on the drawings closest to the point where the water service enters the building] [at the point of connection to the existing water system].[An allowance for interior hose stations of [_____] L/min gpm must be added to the sprinkler system demand.]

1.2.2 Sprinkler Coverage

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NOTE: The exception in NFPA 13 to eliminate sprinklers in electrical rooms is not applicable per UFC 3-600-01.
****

Sprinklers must be uniformly spaced on branch lines. Provide coverage throughout 100 percent of the [building][area noted on the Contract drawings]. This includes, but is not limited to, telephone rooms, electrical equipment rooms (regardless of the fire resistance rating of the enclosure), boiler rooms, switchgear rooms, transformer rooms, attached electrical vaults and other electrical and mechanical spaces. Coverage per sprinkler must be in accordance with NFPA 13. Provide sprinklers below all obstructions in accordance with NFPA 13. Exceptions are as follows:

a. Sprinklers may be omitted from small rooms which are exempted for specific occupancies in accordance with NFPA 101.

[1.2.3 System Volume Limitations

Where the volume of an individual system piping exceeds 1890 liters500 gallons, provide the dry pipe valve with a quick-opening device. The maximum system capacity controlled by one dry pipe valve must not exceed 2800 liters750 gallons, unless it complies with the dry pipe system water delivery calculations noted in NFPA 13.

]1.2.4 Control System

****
NOTE: All areas to be protected with preaction sprinklers must be equipped with the detectors necessary to activate the sprinkler system.
****

The control system must meet the requirements of NFPA 72. The control unit must be listed for "Releasing Device Service". The control unit and the solenoid valve that activates the water control valves must be compatible with each other. Compatibility must be in accordance with the specific listing of the control equipment.

1.2.4.1 Circuit Requirements

Connect alarm initiating devices to initiating device circuits (IDC), Class [B][_____] or to signal line circuits (SLC), Class [B][_____], in accordance with NFPA 72.[Alarm notification or indicating appliances must be connected to notification appliance circuit (NAC), Class [B][_____] in accordance with NFPA 72.] Provide a separate circuit for actuation of each individual automatic water control valve. Fully supervise the circuits that actuate the water control valves so that the occurrence of a single open or a single ground fault condition in the interconnecting conductors will be indicated at the control unit.

1.2.5 System Operational Features

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NOTE: Delete manual actuation stations when not required.
****

Include in the system a detection system, manual actuation stations, supervisory and alarm switches,[alarm notification appliances,] control unit and associated equipment. Provide preaction sprinkler system piping with supervisory nitrogen pressure not to exceed 210 kPa30 psig.

1.2.5.1 System Actuation

Activation of [a single][two][smoke][heat] detector[s] [or a single manual actuation station] must actuate alarm zone circuits of the control unit that, in turn, actuate the corresponding automatic water control valve. Actuation of the automatic water control valve must cause water to [fill the discharge piping after loss of nitrogen pressure][fill the discharge piping].

1.2.5.2 Alarm Functions

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NOTE: Drawings must indicate and detail the connection of the system control unit to the building alarm system and/or to the base-wide fire reporting system.
****

Activation of a [heat detector][smoke detector], sprinkler pressure (waterflow) alarm switch or manual actuation station must cause the illumination of the respective device at the releasing control unit, and

[activation of the building fire alarm system][transmission of the alarm to the base-wide fire reporting system].

1.2.5.3 Supervisory Functions

The reduction of supervisory nitrogen pressure within the sprinkler system piping to less than [70][_____] kPa[10][_____] psi or the increase in nitrogen pressure more than [70][_____] kPa[10][_____] psi above normal set pressure must be transmitted to the building fire alarm system via the releasing control unit as a supervisory condition. Valve tamper switches must be monitored by the releasing control unit and transmitted to the building fire alarm system as a supervisory condition.

1.2.6 Qualified Fire Protection Engineer (QFPE)

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NOTE: UFC 3-600-01 requires that shop drawings must bear the Review Stamp and professional engineering stamp of the QFPE prior to submission to the Government for approval.

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NOTE: The term Qualified Fire Protection Engineer (QFPE) should be considered interchangeable with the terms "Fire Protection Designer of Record (FPDOR)" and/or "Fire Protection QC Specialist" where referred to in other applicable contract documents. The intent of defining the QFPE roles and responsibilities here is NOT to require personnel in addition to the QFPE, FPDOR, and/or FPQC specialist referenced elsewhere in the applicable contract documents.

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An individual who is a licensed professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveying (NCEES) and has relevant fire protection engineering experience. Services of the QFPE must include:

a. Reviewing SD-02, SD-03, and SD-05 submittal packages for completeness and compliance with the provisions of this specification. Working (shop) drawings and calculations must be prepared by, or prepared under the immediate supervision of, the QFPE. The QFPE must affix their professional engineering stamp with signature to the shop drawings, calculations, and material data sheets, indicating approval prior to submitting the shop drawings to the DFPE.

b. Provide a letter documenting that the SD-02, SD-03, and SD-05 submittal package has been reviewed and noting all outstanding comments.

c. Performing in-progress construction surveillance prior to installation of ceilings (rough-in inspection).

d. Witnessing pre-Government [and final Government]functional performance testing and performing a final installation review.

e. Signing applicable certificates under SD-07.

1.3 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G". Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

NOTE: When 20 or less sprinklers are added, modified or relocated, shop drawings, hydraulic calculations and product data are not required to be submitted. Edit this section accordingly.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Partial submittals and submittals not fully complying with NFPA 13 and this specification section must be returned disapproved without review. SD-02, SD-03 and SD-05 must be submitted simultaneously.

Shop drawings (SD-02), product data (SD-03) and calculations (SD-05) must be prepared by the designer and combined and submitted as one complete package. The QFPE must review the SD-02/SD-03/SD-05 submittal package for completeness and compliance with the Contract provisions prior to

submission to the Government. The QFPE must provide a Letter of Confirmation that they have reviewed the submittal package for compliance with the contract provisions. This letter must include their professional engineer stamp and signature. Partial submittals and submittals not reviewed by the QFPE must be returned disapproved without review.

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualified Fire Protection Engineer (QFPE); G[, [_____]]

Sprinkler System Designer; G[, [_____]]

Sprinkler System Installer; G[, [_____]]

Releasing System Designer; G[, [_____]]

Releasing System Technician; G[, [_____]]

Releasing System Installer; G[, [_____]]

Nitrogen Generation System Commissioning Technician ; G[, [_____]]

Releasing System Site-Specific Software Acknowledgement; G[, [_____]]

SD-02 Shop Drawings

Shop Drawing; G[, [_____]]

[Notification Appliances; G[, [_____]]

] Initiating Devices; G[, [_____]]

Battery Power; G[, [_____]]

Voltage Drop Calculations; G[, [_____]]

SD-03 Product Data

Pipe; G[, [_____]]

Fittings; G[, [_____]]

Valves, including gate, check, butterfly, and globe; G[, [_____]]

Relief Valves; G[, [_____]]

Sprinklers ; G[, [_____]]

Pipe Hangers and Supports ; G[, [_____]]

Sprinkler Alarm Switch; G[, [_____]]

Valve Supervisory (Tamper) Switch; G[, [_____]]

Fire Department Connection; G[, [_____]]

Backflow Prevention Assembly; G[, [_____]]

Hose Valve; G[, [_____]]

[Seismic Bracing; G[, [_____]]

][High/Low-Nitrogen Pressure Supervisory Switch; G[, [_____]]

] Deluge Valve; G[, [_____]]

[Nitrogen Generation System; G[, [_____]]

] Releasing Control Unit (RCU); G[, [_____]]

Terminal Cabinets; G[, [_____]]

Supplemental Notification Appliance Circuit Panels; G[, [_____]]

Auxiliary Power Supply Panels; G[, [_____]]

Nameplates; G[, [_____]]

Batteries; G[, [_____]]

Battery Charger; G[, [_____]]

Smoke Detectors; G[, [_____]]

Air Sampling Smoke Detectors; G[, [_____]]

Heat Detectors; G[, [_____]]

[Notification Appliances; G[, [_____]]

] Addressable Interface Devices; G[, [_____]]

Addressable Control Modules; G[, [_____]]

Isolation Modules; G[, [_____]]

Remote Annunciator Panel; G[, [_____]]

Graphic Annunciator Panel; G[, [_____]]

Document Storage Cabinet; G[, [_____]]

Wire; G[, [_____]]

Surge Protective Devices; G[, [_____]]

[Back Boxes and Conduit; G[, [_____]]

][Ceiling Bridges for Ceiling-Mounted Appliances; G[, [_____]]

] SD-05 Design Data

[Air Sampling Smoke Detection System Calculations; G[, [_____]]

][Seismic Bracing; G[, [_____]]

Load calculations for sizing of seismic bracing

] Hydraulic Calculations; G[, [_____]]

Voltage Drop Calculations; G[, [_____]]

SD-06 Test Reports

Test Procedures; G[, [_____]]

SD-07 Certificates

Verification of Compliant Installation; G[, [_____]]

Request for Government Final Test; G[, [_____]]

SD-10 Operation and Maintenance Data

Operating and Maintenance (O&M) Instructions; G[, [_____]]

Spare Parts Data; G[, [_____]]

SD-11 Closeout Submittals

As-built drawings

1.4 TECHNICAL DATA AND SITE-SPECIFIC SOFTWARE

Technical data and site-specific software (meaning technical data that relates to computer software) that are specifically identified in this project, and may be required in other specifications, must be delivered, strictly in accordance with the CONTRACT CLAUSES. The releasing system manufacturer must submit written confirmation of this contract provision as "Releasing System Site-Specific Software Acknowledgement". Identify data delivered by reference to the specification paragraph against which it is furnished. Data to be submitted must include complete system, equipment, and software descriptions. Descriptions must show how the equipment will operate as a system to meet the performance requirements of this contract. The site-specific software data package must include the following:

a. Items identified in NFPA 72, titled "Site-Specific Software".

b. Identification of programmable portions of the system equipment and capabilities.

c. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.

d. Provision of operational software data on all modes of programmable portions for foam releasing system.

e. Description of releasing system equipment operation.

f. Description of auxiliary and remote equipment operations.

g. Library of application software.

h. Operation and maintenance manuals.

1.5 QUALITY ASSURANCE

1.5.1 Preconstruction Submittals

Within 36 days of contract award but no less than [14 days][_____] prior to commencing work on site, the prime Contractor must submit the following for review and approval. SD-02, SD-03 and SD-05 submittals received prior to the review and approval of the qualifications will be returned Disapproved Without Review.

1.5.1.1 Shop Drawing

[_____] copies of the shop drawings, no later than 28 days prior to the start of system installation. Working drawings conforming to the requirements prescribed in NFPA 13 and must be no smaller than [ISO A1][ANSI D][the Contract Drawings]. Each set of drawings must include the following:

1. A descriptive index with drawings listed in sequence by number. A legend sheet identifying device symbols, nomenclature, and conventions used in the package.

2. Floor plans drawn to a scale not less than 1:100 1/8-inch equals 1-foot clearly showing locations of devices, equipment, risers, electrical power connections and other details required to clearly describe the proposed arrangement.

3. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross mains and branch lines to finished floor and roof or ceiling. A detail must show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

4. Longitudinal and transverse building sections showing typical branch line and cross main pipe routing, elevation of each typical sprinkler above finished floor and elevation of "cloud" or false ceilings in relation to the building ceilings.

5. Plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance.

6. Riser layout drawings drawn to a scale of not less than 1:25 1/2-inch equals 1-foot to show details of each system component, clearances between each other and from other equipment and construction in the room.

7. Details of each type of riser assembly, pipe hanger, [sway bracing for earthquake protection,]and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring. The dimension from the edge of vertical piping to the nearest adjacent wall(s) must be indicated on the drawings when vertical piping is located in stairs or other portions of the means of egress.

8. Details of each type of pipe hanger[, seismic bracing/restraint] and related components.

[9. Include fire pump curve with shop drawings and hydraulic calculations.]

10. The calculated volume of each system.

11. Point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems that are supervised or controlled by the system. Diagrams must show connections from field devices to the RCU and remote fire alarm control units, initiating circuits, switches, relays and terminals.

12. Complete riser diagrams indicating the wiring sequence of devices and their connections to the control equipment. Include a color code schedule for the wiring. Include floor plans showing the locations of devices and equipment.

1.5.1.2 Notification Appliances

Calculations and supporting data on each circuit to indicate that there is at least [25][_____] percent spare capacity for notification appliances. Annotate data for each circuit on the drawings.

1.5.1.3 Initiating Devices

Calculations and supporting data on each circuit to indicate that there is at least [25][_____] percent spare capacity for initiating devices. Annotate data for each circuit on the drawings.

1.5.1.4 Battery Power

Provide battery calculations as required in paragraph Battery Power Calculations for alarm, alert, and supervisory power requirements. Calculations including ampere-hour requirements for each system component and each control unit component, and the battery recharging period, must be included on the drawings.

1.5.1.5 Voltage Drop Calculations

Voltage drop calculations for each notification circuit indicating that sufficient voltage is available for proper operation of the system and all components, at a minimum rated voltage of the system operating on batteries. Include the calculations on the system layout drawings.

1.5.1.6 Product Data

[_____] copies of annotated catalog data to show the specific model, type, and size of each item. Catalog cuts must indicate the NRTL listing. The data must be highlighted to show model, size, options, and other pertinent information, that are intended for consideration. Data must be adequate to demonstrate compliance with all contract requirements. Product data for all equipment must be combined into a single submittal.

Provide an equipment list identifying the type, quantity, make, and model number of each piece of equipment to be provided under this submittal. The equipment list must include the type, quantity, make and model of spare equipment. Types and quantities of equipment submitted must coincide with the types and quantities of equipment used in the battery

calculations and those shown on the shop drawings.

1.5.1.7 Air Sampling Smoke Detection System Calculations

Submit air sampling detection system design analysis calculations consisting of battery capacity, loading calculations, and fan speed and air flow/transport calculations. Include schematic diagrams showing pipe segments, pipe diameters, lengths of pipe, node numbers, and sample port diameters to verify the requirements are met.

1.5.1.8 Hydraulic Calculations

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NOTE: Include the first bracketed item for Army Corps projects.
****

Calculations must be as outlined in NFPA 13 except that calculations must be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings.[Calculations must include isometric diagram indicating hydraulic nodes and pipe segments.][Include fire pump curve with submittal.]

1.5.1.9 Voltage Drop Calculations

Voltage drop calculations for each notification circuit indicating that sufficient voltage is available for proper operation of the system and all components, at a minimum rated voltage of the system operating on batteries. Include the calculations on the system layout drawings.

1.5.1.10 Operating and Maintenance (O&M) Instructions

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA as supplemented and modified by this specification section.

Provide [six][_____] manuals[and one pdf version on electronic media]. The manuals must include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment.[Each service organization submitted must be capable of providing [4][_____]-hour on-site response to a service call on an emergency basis.]

Submit spare parts data for each different item of material and equipment specified. The data must include a complete list of parts and supplies, and a list of parts recommended by the manufacturer to be replaced after 1-year and 3 years of service. Include a list of special tools and test equipment required for maintenance and testing of the products supplied.

1.5.2 Qualifications

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NOTE: NICET (National Institute for Certification in Engineering Technologies) establishes the qualifications of an individual as an Engineering Technologist with verification of experience by having a current NICET certification.
****

1.5.2.1 Sprinkler System Designer

The sprinkler system designer must be certified as a Level [III][IV] Technician by National Institute for Certification in Engineering Technologies (NICET) in the Water-Based Systems Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7.

1.5.2.2 Sprinkler System Installer

The sprinkler system installer must be regularly engaged in the installation of the type and complexity of system specified in the contract documents, and must have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.5.2.3 Releasing System Designer

The system designer must be certified as a Level [III][IV] (minimum) Technician by National Institute for Certification in Engineering Technologies (NICET) in the Fire Alarm Systems subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7, or meet the qualifications for a QFPE.

1.5.2.4 Releasing System Technician

Fire alarm technicians with a minimum of four years of experience must be utilized to install and terminate devices, cabinets and control units. The fire alarm technicians installing the equipment must be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings[, and must be thoroughly experienced in the design and installation of air sampling detection systems].

1.5.2.5 Releasing System Installer

[Fire alarm installer with a minimum of two years of experience utilized to assist in the installation of devices, cabinets and control units.][NICET Level II technician to assist in the installation of devices, cabinets and control units.]A licensed electrician must be allowed to install wire, cable, conduit and backboxes for the system. The fire alarm installer must be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.5.2.6 Nitrogen Generation System Commissioning Technician

Commissioning technician of nitrogen generation system(s) must have one of the following qualifications. Qualifications must be provided prior to preliminary inspection and tests.

a. Commissioning of nitrogen generation system must be carried out by technician employed by and certified by the nitrogen generation system manufacturer.

b. In lieu of manufacturer's commissioning technician, the fire sprinkler contractor must provide proof their commissioning technician has manufacturer's certified training for the equipment being installed and proof of at least five previous installations of manufacturer's

equipment where the contractor's commissioning technician has successfully conducted commissioning under the direct supervision of the manufacturer's commissioning representative. Contractor must provide proof the five supervised commissioning occurred AFTER contractor's commissioning agent has obtained the certified training. Commissioning carried out prior to factory training, or without supervision of manufacturer's technician or commissioning of other manufacturer's equipment does not qualify as applicable experience. Conduct preliminary inspections and testing does not qualify as applicable experience.

1.5.3 Regulatory Requirements

Equipment and material must be listed or approved. Listed or approved, as used in this Section, means listed, labeled or approved by a Nationally Recognized Testing Laboratory (NRTL) such as UL Fire Prot Dir or FM APP GUIDE. The omission of these terms under the description of an item of equipment described must not be construed as waiving this requirement. All listings or approvals by testing laboratories must be from an existing ANSI or UL published standard. The recommended practices stated in the manufacturer's literature or documentation are mandatory requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

Protect all equipment delivered and placed in storage from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. All pipes must be either capped or plugged until installed.

1.7 EXTRA MATERIALS

Spare sprinklers and wrench(es) must be provided as spare parts in accordance with NFPA 13.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Standard Products

Provide materials, equipment, and devices listed for fire protection service when so required by NFPA 13 or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for a classification of materials. Material and equipment must be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least [2][_____] years prior to bid.

2.1.2 Nameplates

Major components of equipment must have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new name plate permanently affixed to the item or equipment. Nameplates must be etched metal or plastic, permanently attached by screws to control units, panels or adjacent walls.

2.1.3 Identification and Marking

Pipe and fitting markings must include name or identifying symbol of

manufacturer and nominal size. Pipe must be marked with ASTM designation. Valves and equipment markings must have name or identifying symbol of manufacturer, specific model number, nominal size, name of device, arrow indicating direction of flow, and position of installation (horizontal or vertical), except if valve can be installed in either position. Markings must be included on the body casting or on an etched or stamped metal nameplate permanently on the valve or cover plate.

2.1.4 Keys

Keys and locks for equipment, control units, panels and devices must be identical.[Master all keys and locks to a single key as required by the [Installation Fire Department][_____].][Keys must be CAT [60][_____].]

2.1.5 Pressure Ratings

Valves, fittings, couplings, alarm switches, and similar devices must be rated for the maximum working pressures that can be experienced in the system, but in no case less than [1207][1724] kPa[175][250] psi.

2.1.6 Instructions

Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame.[Install the instructions on the interior of the RCU.][Install the frame in a conspicuous location observable from the RCU.] The card must show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory, and trouble. The instructions and their mounting location must be approved by the Contracting Officer before being posted.

2.2 UNDERGROUND PIPING COMPONENTS

****

NOTE: The design drawings must show the service connection details and the underground service lateral for the sprinkler system. The drawings must show details of the water service point-of-entry into the building and through the floor slab, and underground piping restraints, including number and size of restraining rods and thrust blocks. 4-inch piping is the minimum permitted for service laterals serving NFPA 13R systems. 6-inch piping is the minimum permitted for NFPA 13 systems.

****

2.2.1 Pipe

Pipe must comply with NFPA 24. Minimum pipe size is [100 mm4 inches][150 mm6 inches]. Piping more than 1.50 meters5 feet outside the building walls must comply with Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING. A continuous section of welded stainless steel fire water service piping from a point outside the building perimeter to a flanged fitting at least 304 mm1-foot above the finished floor within the building is acceptable.

2.2.2 Fittings and Gaskets

Fittings must be ductile-iron conforming to AWWA C110/A21.10 with cement

mortar lining conforming to AWWA C104/A21.4. Gaskets must be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile-iron pipe joints must conform to AWWA C111/A21.11.

2.2.3 Gate Valve[and Indicator Posts]

****

NOTE: This paragraph will be deleted if underground valves are either not required or are specified elsewhere.

****

Installation must comply with NFPA 24. Gate valves for use with indicator post must conform to UL 262.[Indicator posts must conform to UL 789. Provide each indicator post with one coat of primer and two coats of red enamel paint.]

[2.2.4 Valve Boxes

Except where indicator posts are provided, for each buried valve, provide a cast-iron, ductile-iron, or plastic valve box of a suitable size. Plastic boxes must be constructed of acrylonitrile-butadiene-styrene (ABS) or inorganic fiber-reinforced black polyolefin. Provide cast-iron, ductile-iron, or plastic cover for valve box with the word "WATER" cast on the cover. The minimum box shaft diameter must be 133 mm5.25 inches. Coat cast-iron and ductile-iron boxes with bituminous paint applied to a minimum dry-film thickness of 0.254 mm10 mils.

]2.2.5 Buried Utility Warning and Identification Tape

Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape must be detectable by an electronic detection instrument. Provide tape, 80 mm3 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold block letters continuously and repeatedly over the entire tape length. Warning and identification must read "CAUTION BURIED WATER PIPING BELOW" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.3 ABOVEGROUND PIPING COMPONENTS

****

NOTE: Specify steel piping exposed to the weather or corrosive atmospheres to properly protect against corrosive effects.

NOTE: GALVANIZED PIPING IS ONLY PERMITTED FOR DELUGE SYSTEMS, VALVE TRIM PIPING AND DRAIN PIPING WHEN EXPOSED TO THE EXTERIOR.

****

2.3.1 Steel Piping Components

2.3.1.1 Steel Pipe

****
NOTE: For DLA, use Schedule 40 steel pipe only.

NOTE: Grooved pipe must be cut grooved for WHS projects.
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Except as modified herein, steel pipe must be black as permitted by NFPA 13 and conform to the applicable provisions of ASTM A53/A53M, ASTM A135/A135M or ASTM A153/A153M.

[Steel pipe must be minimum Schedule 40 for sizes 50 mm2 inches and less; and minimum Schedule 10 for sizes larger than 50 mm2 inches.][Steel pipe must be Schedule 40 only.] Steel piping with wall thickness less than Schedule 40 must not be threaded. [Grooved pipe must be cut-grooved.]

2.3.1.2 Fittings

Fittings must be welded, threaded, or grooved-end type. Threaded fittings must be cast-iron conforming to ASME B16.4, malleable-iron conforming to ASME B16.3 or ductile-iron conforming to ASTM A536. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe, steel press fittings and field welded fittings are not permitted. Fittings, mechanical couplings, and rubber gaskets must be supplied by the same manufacturer. Threaded fittings must use Teflon tape or manufacturer's approved joint compound.[Saddle tees using rubber gasketed fittings are permitted only when connecting to existing piping for additions or modifications. Saddle tees must use a connection method that completely wraps around the pipe.] Reducing couplings are not permitted except as allowed by NFPA 13.

2.3.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings must be designed for not less than 1200 kPa175 psi service and must be the product of the same manufacturer. Field welded fittings must not be used. Fitting and coupling housing must be malleable-iron conforming to ASTM A47/A47M, Grade 32510; ductile-iron conforming to ASTM A536, Grade 65-45-12. Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 50 mm2 inches and larger. Gasket must be of silicon compound and listed for dry fire protection systems. Gasket must be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts must be heat-treated steel conforming to ASTM A183 and must be cadmium-plated or zinc-electroplated.

2.3.1.4 Flanges

Flanges must conform to NFPA 13 and ASME B16.1. Gaskets must be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm 1/16-inch thick, and full face or self-centering flat ring type.

[2.3.2 Copper Tube Components

2.3.2.1 Copper Tube

Copper tube must conform to ASTM B88MASTM B88, Types L and M.

2.3.2.2 Copper Fittings and Joints

Cast copper alloy solder-joint pressure fittings must conform to ASME B16.18 and wrought copper and bronze solder-joint pressure fittings must conform to ASME B16.22 and ASTM B75/B75M. Cast copper alloy fittings for flared copper tube must conform to ASME B16.26 and ASTM B62. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment.

]2.3.3 Pipe Hangers and Supports

****
NOTE: Seismic parameters must follow UFC 3-301-01 Structural Engineering. The writer of this section must coordinate with the Structural Engineer or Government to determine the proper seismic design category for the project, in accordance with the IBC or ASCE guidelines. See UFC 3-310-04 for more information.
****

Provide galvanized pipe hangers[, supports and seismic bracing][and supports] in accordance with NFPA 13.[Design and install seismic protection in accordance with the requirements of NFPA 13 section titled "Protection of Piping Against Damage Where Subject to Earthquakes for Seismic Design Category ["D"]["_____"]].

2.3.4 Valves

Provide valves of types approved for fire service. Valves must open by counterclockwise rotation.

2.3.4.1 Control Valve

Manually operated sprinkler control/gate valve must be [outside stem and yoke (OS&Y) type][or][butterfly type][as indicated on the drawings] and must be listed.

2.3.4.2 Check Valves

Check valves must comply with UL 312. Check valves 100 mm4 inches and larger must be of the swing type, have a clear waterway and meet the requirements of MSS SP-71, for Type 3 or 4. Inspection plate must be provided on valves larger than 150 mm6 inches.

2.3.4.3 Hose Valve

****
NOTE: Hose valves are required as part of the backflow prevention test header.
****

Valve must comply with UL 668.

2.4 AUTOMATIC WATER CONTROL VALVE (DELUGE VALVE)

****

NOTE: "Automatic water control valve" is a generic term synonymous with "deluge valve" and is used for both preaction and deluge systems. "Automatic water control valve" is consistent with what is used in the UL Fire Protection Equipment Directory. Delete reset capability when not required.

****

Automatic water control valve (deluge valve) must be [electrically][hydraulically][pneumatically]-actuated and rated for a working pressure of 1207 kPa175 psi. Valve must be capable of being reset without opening the valve. Electrical solenoid valve used to actuate the water control valve must be an integral component of the valve or must be approved for use by the water control valve manufacturer. Solenoid valve must be rated at 24 volts direct current, and must be normally closed type that operates when energized. Solenoid valves must be rated for a maximum pressure differential of 1207 kPa175 psi. Water control valve must be equipped with a means to prevent the valve from returning to the closed position until being manually reset. Assembly must be complete with the valve manufacturer's standard trim piping, drain and test valves, pressure gauges, and other required appurtenances. Include with each assembly an emergency release device for manually tripping the water control valve in the event of a power or other system failure. Device must be a standard accessory component of the valve manufacturer and labeled as to its function and method of operation. Valves located in hazardous locations must be approved for the hazard classification of the area where located.

2.5 SUPERVISORY NITROGEN SYSTEM

Provide a nitrogen supply system in accordance with NFPA 13. The connection pipe from the nitrogen generator must not be less than 13 mm 1/2-inch in diameter and must enter the system above the priming water level of the dry pipe valve. Install a check valve in the system supply nitrogen piping from the generator. A shutoff valve of the renewable disc type must be installed upstream of this check valve. The nitrogen supply system must be sized to pressurize the sprinkler system to [275][_____] kPa [40][_____] psi within 20 minutes.

2.5.1 Nitrogen Generation System

The nitrogen generation system (NGS) must be installed with a compressor sized appropriately for the application and capable of achieving system pressure within 30 minutes in accordance with the requirements of NFPA 13. The nitrogen generation system must be designed to achieve a nitrogen concentration of 98% or greater and maintain that concentration within the fire sprinkler system continuously. The output nitrogen quality must be confirmed by using a gas stream analyzer. Where multiple preaction sprinkler risers are present, provide a manifold adjacent to the preaction sprinkler risers. Manifold system must include automatic vent and air maintenance devices for each sprinkler system riser. Nitrogen generation system requires a dedicated, hardwired 120V AC power supply.

2.5.1.1 Design of Nitrogen Generation System

Design the system so all equipment is installed within the confines of the

riser room with the exception of a connection for a manual or automatic gas analyzer. Provide a system that is capable of delivering a minimum of 98 percent nitrogen composition throughout all of the system piping within 14 days from the commencement of the inerting process. Provide membrane type nitrogen generators that provide "instant on-instant off" nitrogen gas production without the need for nitrogen storage tanks. The complete nitrogen generator system must be self-contained and skid mounted with "drop-in" operability with a simple one step direct connection of the nitrogen gas supply line to each zone/riser. Provide an automatic "fill and purge" breathing process. This must be done while the sprinkler system is fully functional and must not alter the design performance of the sprinkler system. A process that involves continuous venting of the piping network is not permitted. Air maintenance devices used in conjunction with the nitrogen generation system must be listed for use on sprinkler systems. At the riser and at the end of each zone, provide a connection for a [manual][automatic] gas analyzer.

2.5.1.2 Nitrogen Air Compressor

Air compressors to be used in conjunction with the nitrogen generator must be capable of the following:

a. Capable of producing a continuous stream of compressed air at 100+ psig.

b. Capable of automatic cut in and cut out.

c. Equipped with an on-board after-cooler.

d. Equipped with an on-board automatic water blow down system.

e. Equipped with vibration dampening system.

f. Equipped with an air storage tank to provide continuous delivery of compressed air to the nitrogen generator.

g. Rated for continuous duty service.

h. Compressors less than 3.0 hp must be an oil-less design.

i. Oil-less compressors must be such that the manufacturer has designed the oil-less compressor to provide 5000 hours of continuous duty service before requiring a gasket and seal rebuild.

2.5.1.3 Nitrogen Venting Device

The functional component of the nitrogen venting device for use in the "fill and purge" breathing process must:

a. Be NRTL listed for use on sprinkler systems.

b. Not require plumbing to drain.

c. Close automatically at the completion of the nitrogen inerting process without manual intervention.

d. Be installed on each zone in the riser room.

2.5.1.4 Supervision of Nitrogen Generator

Nitrogen generator must be able to provide the following monitoring options:

a. Power supply "on" for nitrogen generators.

b. Power supply "on" for compressor.

c. Amp draw for compressor.

d. Line pressure (psig).

e. Nitrogen purity at discharge (sample port for use with [manual][automatic] gas analyzer).

2.5.2 Nitrogen Pressure Maintenance Device

Device must be a pressure regulator that automatically reduces supply air pressure to the minimum pressure required to be maintained in the piping system. The device must have a cast bronze body and valve housing complete with diaphragm assembly, spring, filter, ball check to prevent backflow, 1.6-mm1/16-inch restriction to prevent rapid pressurization of the system, and adjustment screw. The device must be capable of reducing maximum inlet pressure of 680 kPa100 psi to a fixed outlet pressure adjustable to [70][_____] kPa[10][_____] psi.

2.6 ALARM INITIATING AND SUPERVISORY DEVICES

2.6.1 Sprinkler Alarm Switch

pressure-type flow switch(es). [Connection of switch must be by the fire alarm installer].

2.6.2 High/Low-Nitrogen Pressure Supervisory Switch

Each automatic water control valve must be provided with a nitrogen pressure switch connected to the control unit. The pressure switch must supervise the nitrogen pressure in the system and must be set to activate at 70 kPa10 psi above the automatic water control valve trip point pressure (low) and 70 kPa10 psi above normal nitrogen pressure (high). The switch must have an adjustable range between 35 and 500 kPa5 and 80 psi. The switch must have screw terminal connection and must be capable of being wired for normally open or normally closed circuit.

2.6.3 Valve Supervisory (Tamper) Switch

Switch must be integral to the control valve or suitable for mounting to the type of control valve to be supervised open. The switch must be tamper resistant and contain SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

[2.7 BACKFLOW PREVENTION ASSEMBLY

****

NOTE: Indicate piping, type of connection and equipment, such as a test header with hose valves, required for flow testing of the backflow preventer

at full system demand as required by NFPA 13. Arrangement of test assembly should be coordinated with the installation.
****

[Reduced-pressure principle][Double-check] valve assembly backflow preventer complying with ASSE 1013, ASSE 1015 and AWWA M14. Each check valve must have a drain. Backflow prevention assemblies must have current "Certificate of Approval from the Foundation for Cross-Connection Control and Hydraulic Research, FCCCHR List" and be listed for fire protection use. Listing of the specific make, model, design, and size in the FCCCHR List is acceptable as the required documentation.

2.7.1 Backflow Preventer Test Connection

Test connection must consist of a series of listed hose valves with 65-mm2 1/2-inch National Standard male hose threads with cap and chain.

]2.8 FIRE DEPARTMENT CONNECTION

****
NOTE: The designer will coordinate the desired location and thread type for the fire department connection with the responding fire department.
****

Fire department connection must be [freestanding][projecting][flush] type with cast-brass body, matching [wall] escutcheon lettered "Auto Spkr" with a [polished-brass][chromium-plated] finish. [The connection must have individual self-closing clappers, caps with drip drains and chains.] Female inlets must have [65-mm2 1/2-inch][100 mm4-inch][125 mm5-inch][_____] diameter [American National Fire Hose Connection Screw Threads (NH) per NFPA 1963] [Storz][_____]. Comply with UL 405.

2.9 SPRINKLERS

****
NOTE: The designer will indicate on the contract drawings the type of sprinklers for each area if more than one type of sprinkler is to be provided. Delete sprinkler types from this paragraph that are not intended for use in the system(s) used in the Contract.

Areas that are classified as light hazard will be equipped with quick-response sprinklers.
****

Sprinklers must comply with UL 199 and NFPA 13. Sprinklers with internal O-rings are not acceptable. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters must have temperature classification in accordance with NFPA 13. Extended coverage sprinklers are permitted for loading docks, residential occupancies and high-piled storage applications only. Sprinklers for preaction systems must be automatic, fusible solder or glass bulb type.

2.9.1 Pendent Sprinkler

Pendent sprinkler must be of the dry pendent type, unless otherwise

indicated. Pendent sprinkler must be[recessed][quick-response][dry pendent] type with nominal K-factor of [80][115][160][_____] [5.6][8.0][11.2][_____]. Pendent sprinklers must have a [polished chrome][stainless steel][white polyester][_____] finish. Assembly must include an integral escutcheon.

2.9.2 Upright Sprinkler

Upright sprinkler must be [brass][chrome-plated][stainless steel][white polyester] [quick-response type][_____] with a nominal K-factor of [80][115][160][_____][5.6][8.0][11.2][_____].

2.9.3 Sidewall Sprinkler

Sidewall sprinkler must be the [quick-response][standard-response] [recessed][dry sidewall] type. Sidewall sprinkler must have a nominal K-factor of [80][115][160][_____][5.6][8.0][11.2][_____]. Sidewall sprinkler must have a [brass][polished-chrome][stainless steel][white polyester][_____] finish.

[2.9.4 Corrosion-Resistant Sprinkler

****
NOTE: The use of corrosion-resistant sprinklers is generally limited to industrial type occupancies such as electroplating, steam rooms, salt storage, and piers and wharves.
****

Corrosion-resistant sprinkler must be the [upright][pendent] type installed in locations as indicated. Corrosion-resistant coatings must be factory-applied by the sprinkler manufacturer.

]2.10 ACCESSORIES

2.10.1 Sprinkler Cabinet

Spare sprinklers must be provided in accordance with NFPA 13 and must be placed in a suitable metal or plastic cabinet of sufficient size to accommodate all the spare sprinklers and wrenches in designated locations. Spare sprinklers must be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed as required by NFPA 13. At least one wrench of each type required must be provided.

2.10.2 Pendent Sprinkler Escutcheon

Escutcheon must be one-piece metallic type with a depth of less than 19 mm 3/4-inch and suitable for installation on pendent sprinklers. The escutcheon must have a factory finish that matches the pendent sprinkler.

2.10.3 Pipe Escutcheon

Provide split hinge metal plates for piping entering walls, floors, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

2.10.4 Sprinkler Guard

Listed guard must be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards must be provided on sprinklers located [_____][within 2.1 meters7 feet of the floor][as indicated].

2.10.5 Relief Valve

Relief valves must be listed and installed at there riser in accordance with NFPA 13.

2.10.6 Identification Sign

Valve identification sign must be minimum 150 mm wide by 50 mm high6 inches wide by 2 inches high with enamel baked finish on minimum 1.214-mm 18 gage steel or 0.6-mm0.024-inch aluminum with red letters on a white background or white letters on red background. Wording of sign must include, but not be limited to "main drain", "auxiliary drain", "inspector's test", "alarm test", "alarm line", and similar wording as required to identify operational components. Where there is more than one sprinkler system, signage must include specific details as to the respective system.

2.11 RELEASING CONTROL UNIT (RCU)

The RCU must be listed, analog-addressable and compatible with the system, devices and functions specified.[Route all supervision of the RCU through the main FACU.] The RCU must perform all functions necessary to operate the system detection, actuation, and auxiliary functions independent of the FACU. The control system must be microprocessor-based utilizing distributed processing concept. A single microprocessor failure must not impact operation of additional modules on the system. The control system must be capable of supporting an air aspirating smoke detection system. The control system's initiating circuits must be capable of Class A or Class B operation. The solenoid must be listed for use with the releasing unit and extinguishing equipment. Each circuit must be capable of monitoring contact devices configured for manual release, trouble input or auxiliary (non-fire) input. The RCU must contain release circuits for activation of an extinguishing system[s]. Each release circuit must be capable of Class B operation. The RCU must contain at least two notification appliance circuits for annunciation. Each notification circuit must be capable of Class A or Class B operation. Provide alarm/trouble reset switches to reset a cleared device in alarm or trouble. Alarm or trouble signals are not to be self-restoring without activating the switch.

Annunciator must be integral with the RCU. Annunciation must be by an indicator lamp, alphanumeric display, or other equivalent means in which each indication provides status information about a circuit, condition, or location and visible through the cabinet door. Supervision is not required provided that a fault in the annunciator circuits results only in loss of annunciation and does not affect the normal functional operation of the remainder of the system. Ensure each visible indicator provides specific identification of the [zone][area][device]. Do not use generic nondescript wording such as "Zone 1", or "Zone 2", for the label identification.

An operator at the RCU, having the proper access level must have the

capability to manually access the following information for each initiating device:

a. Primary status.

b. Device type.

c. Present average value.

d. Present sensitivity selected.

e. Sensor range (normal, dirty, etc).

2.12 ANNUNCIATOR

[2.12.1 Remote Annunciator Panel

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NOTE: Provide a remote annunciator only for very large spaces with 10 or more smoke detectors.
****

Provide a [semi-recessed][flush] mounted annunciator that includes an LCD display. The display must indicate the device in trouble/alarm or the supervisory device. Display the device name, address[, and actual building location]. The remote annunciator must duplicate functions of the RCU for message display, fire alarm, supervisory alarm, and trouble conditions, visual and audible notification, and system reset functions. Remote annunciator must require the use of a key for accessing the reset, control and other functions.

][2.12.2 Graphic Annunciator Panel

****
NOTE: Graphic annunciator panels should be provided only when a large number of concealed devices are installed. Normally, exposed devices will be annunciated by zone only on the fire alarm control unit zone annunciator and remote zone annunciator. Edit accordingly. Locate panel(s) at or near building entrance to allow fire department quick access to panel.
****

Panel must be of the [interior][weatherproof] type, [flush][surface][pedestal]-mounted. Panel must be provided with the [building][room] floor plan, drawn to scale, with alarm lamps mounted to represent the location of [each concealed detector][each initiating device]. Panel graphic must also show the locations of the annunciator panel and control unit, and must have a "you are here" arrow showing its location. Orient building floor plan on graphic to location of person viewing the graphic, i.e. the direction the viewer is facing must be toward the top of the graphic display. Provide a North arrow.[Principal rooms and areas shown must be labeled with room numbers or titles.] Detectors mounted above ceilings[, on ceilings,] and beneath raised floors and different types of initiating devices must have different symbols or lamps of different colors for identification. Lamps must illuminate upon activation of corresponding device and must remain illuminated until the system is reset. Panel must have a lamp test switch.

2.12.2.1 Materials

Construct the graphic annunciator face plate of [smoked Plexiglas][non-glare matte finish][anodized bronze][anodized aluminum]. The face plate must be backlit with LEDs. Control equipment and wiring must be housed in a [recessed][semi-recessed][surface mounted] back box. The exposed portions of the back box must be [chrome plated][anodized bronze][anodized aluminum] without knockouts.

2.12.2.2 Programming

Where programming for the operation of the graphic annunciator is accomplished by a separate software program other than the software for the RCU, the software program must not require reprogramming after loss of power. The software must be reprogrammable in the field.

]2.13 SMOKE DETECTORS

2.13.1 Photoelectric Smoke Detectors

Smoke detector must be photoelectric type and listed for use with the RCU.

a. Provide analog/addressable photoelectric smoke detectors utilizing the photoelectric light scattering principle for operation in accordance with UL 268. Smoke detectors must be listed for use with the RCU.

b. Provide self-restoring type detectors that do not require readjustment after actuation at the RCU to restore them to normal operation. Detectors must be listed as smoke-automatic fire detectors.

c. Components must be rust and corrosion resistant. Vibration must have no effect on the detector's operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen must not inhibit the movement of smoke particles into the chamber.

d. Provide twist lock bases for the detectors. The detectors must maintain contact with their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on the screw terminals. The detector must have a visual indicator to show actuation.

e. The detector address must identify the particular unit, its location within the system, and its sensitivity setting. Detectors must be of the low voltage type rated for use on a 24 VDC system.

f. An operator at the control unit, having a proper access level, must have the capability to manually access the following information for each initiating device.

(1) Primary status.

(2) Device type.

(3) Present average value.

(4) Present sensitivity selected.

(5) Sensor range (normal, dirty, and other similar information).

2.13.2 Laser Smoke Detectors

a. Addressable laser smoke detectors must utilize laser diode and patented smoke sensing chamber, designed to amplify signals from smoke but diminish stray internal reflections and must, on command from the RCU, send data to the panel representing the analog level of smoke density.

b. Smoke detector must be listed for use with the RCU. Detector must be able to achieve sensitivities from 0.02 percent-per-foot to 2 percent-per-foot obscuration.

c. Laser smoke detector must provide point identification of the fire location through addressability, must experience no delay in response time due to smoke dilution or smoke transportation time, and must offer complete supervision of wiring and detector.

[2.13.3 Air Sampling Smoke Detectors

****

NOTE: Detector selection and spacing should be based on the applicable cooling system in the hazard area. Detection should be listed for the anticipated temperature and airflow in the hazard area.

****

The [addressable]air sampling smoke system must consist of a detector assembly housing an integral aspiration fan, filter, laser-based detection chamber and control, output and supervision circuitry.[Each sampling point must be capable of being independently addressable.] The system must consist of a piping or tubing distribution network that runs from the detector assembly(s) to the protected area(s) and is supported by air sampling smoke detection system calculations from a computer-based design modeling tool. The system must include configurable alarm and trouble relay outputs for interface to other systems where required.

a. System must be complete in all ways. It must include all engineering, and electrical installation, all detection and control equipment, auxiliary devices and controls, alarm interface, functional checkout and testing, training and all other operations necessary for a functional system.

b. System base detectors and modules must each accommodate up to [40 addressable][_____] microbore sampling tubes where each tube has a sampling point at the end. Additional modules may be used to provide up to [20 addressable][_____] sampling holes per system.

c. Program alarm thresholds to the following values unless the results of the system acceptance tests indicate a clear need to change them. In the event that such a need is indicated, notify the Contracting Officer and provide complete documentation concerning the need to deviate from these values. Include within the deviation documentation request, information that complies with the paragraph entitled "Sensitivity Verification Test". Ensure initial threshold levels are approved prior to the final acceptance test.

(1) Alarm Level 1: set ALERT at [_____][0.0250] percent

obscuration/foot.

(2) Alarm Level 2: set PRE-ALARM at [_____][0.0500] percent obscuration/foot.

(3) Alarm Level 3: set FIRE 1 at [_____][0.1000] percent obscuration/foot.

(4) Alarm Level 4: set FIRE 2 at [_____][0.2000] percent obscuration/foot.

d. All air sampling smoke detection devices and associated components must be new, standard products or the manufacturer's latest design and suitable to perform the functions intended.

e. The laser detection chamber must be of the mass light scattering type and capable of detecting a wide range of smoke particle types of varying size. A particle counting method must be employed for the purposes of:

(1) Preventing large particles from affecting the true smoke reading.

(2) Monitoring contamination of the filter, e.g., dust and dirt, to automatically notify when maintenance is required. The particle counting method must not be used for the purpose of smoke density measurement.

f. Detector(s) must be self-monitoring for filter contamination and provide indication through system fault when replacement is necessary. Detectors which allow automatic reset of filter status upon removal and re-insertion are not permitted.

g. Detector(s) must contain relays for alarm and fault conditions. The relays must be software programmable to the required functions.

h. Detector(s) must permit configuration by programmers that are either integral to the system, portable or PC based.

i. Detector(s) must allow programming of:

(1) Smoke threshold alarm levels; ALERT, PRE-ALARM, FIRE 1 and FIRE 2.

(2) Time delays. Ensure the display control unit contains individual adjustable alarm time delay features for each of the alarm threshold levels. Provide an adjustment range between 0 and 60 seconds. Program the alarm threshold time delays to 30 seconds for alarm levels 1 and 2, and 15 seconds for alarm levels 3 and 4.

(3) Faults, including airflow, detector, power, filter and network, as well as an indication of the urgency of the fault.

(4) Configuration of relay outputs for remote indication of alarm and fault conditions.

(5) General purpose input functionality.

]2.14 HEAT DETECTORS

****

NOTE: The location and type of heat detectors and

alarm devices must be indicated on project drawings. Delete descriptive paragraphs of detectors types not used. Alarm indicator should be used only if necessary to meet project requirements.
****

2.14.1 Heat Detectors

Heat detectors must be analog/addressable and designed for detection of fire by [fixed temperature][combination fixed temperature and rate-of-rise principle] [rate-compensating principle] in accordance with UL 521. The alarm condition must be determined by comparing detector value with the stored values.. Detectors located in areas subject to moisture, exterior atmospheric conditions, or hazardous locations[as defined by NFPA 70][and][as indicated], must be types approved for such locations.

[2.14.1.1 Rate Compensating Detectors

Detector back box must be [surface][flush] mounted in the [vertical][horizontal] orientation and supported independently of wiring connections. Detectors must be self-restoring and hermetically sealed. The detector assembly must be [weatherproof][and][explosionproof].

][2.14.1.2 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors must be [surface][semi-flush] mounted in the [vertical][horizontal] orientation and supported independently of wiring connections. Detectors must be self-resetting Detector must operate at [57.2][90] degrees C[135][194] degrees F. Detector must feature rate compensation. [Detectors rated to operate at 57.2 degrees C135 degrees F will not respond to momentary temperature fluctuations less than 16.7 degrees C30 degrees F per minute between 16 and 38 degrees C60 and 100 degrees F.][Detectors rated to operate at 90 degrees C194 degrees F will not respond to momentary temperature fluctuations less than 27.8 degrees C 50 degrees F per minute between 16 and 66 degrees C60 and 150 degrees F].[The detector assembly must be [weatherproof][and][explosionproof].]

][2.14.1.3 Fixed Temperature Detectors

Detectors must be [surface][semi-flush] mounted in the [vertical][horizontal] orientation and supported independently of wiring connections. Detectors must be self-restoring. The detectors must have a specific temperature setting [of [57.2][_____] degrees C[135][_____] degrees F][as shown]. [The detector assembly must be [weatherproof][and][explosionproof].]

]2.15 ADDRESSABLE INTERFACE DEVICES

The initiating device being monitored must be configured as a [Class "A"][Class "B"] initiating device circuit. The module must be listed as compatible with the control unit. The monitor module must provide address setting means compatible with the control unit's SLC supervision and store an internal identifying code. Monitor module must contain an integral LED that flashes each time the monitor module is polled and is visible through the device cover plate. Pull stations with a monitor module in a common backbox are not required to have an LED.[Existing releasing system initiating device circuits must be connected to a single module to supervise the circuit.] Modules must be listed for the environmental conditions in which they will be installed.

2.16 ADDRESSABLE CONTROL MODULES

The control module must be capable of operating as a relay (dry contact form C) for interfacing the control unit with other systems, and to control door holders. The module must be listed as compatible with the control unit. The indicating device or the external load being controlled must be configured as a Class "B" notification appliance circuits. The system must be capable of supervising, audible, visual and dry contact circuits. The control module must have both an input and output address. The supervision must detect a short on the supervised circuit and prevent power from being applied to the circuit. The control model must provide address setting means compatible with the control unit's SLC supervision and store an internal identifying code. The control module must contain an integral LED that flashes each time the control module is polled and is visible through the device cover plate. Control Modules must be listed for the environmental conditions in which they will be installed.

2.17 ISOLATION MODULES

a. Provide isolation modules to subdivide each signaling line circuit [into groups of not more than [20 addressable devices][_____]][each floor][in accordance with NFPA 72] between adjacent isolation modules.

b. Isolation modules must provide short circuit isolation for signaling line circuit wiring.

c. Power and communications must be supplied by the SLC and report faults to the RCU.

d. After the wiring fault is repaired, the fault isolation modules must test the lines and automatically restore the connection.

[2.18 NOTIFICATION APPLIANCES

****

NOTE: The notification appliances are for providing local notification of a sprinkler system operation. These devices are not intended to provide general building fire alarm evacuation.

****

Notification appliances must be suitable for connection to supervised notification appliance circuits. Appliance must have a separate screw terminal for each conductor. The surface of the appliance must be red in color.

2.18.1 Horns

Horns must conform to the applicable requirements of UL 464. Horns must be [semi-flush mounted][surface mounted], with the matching mounting backbox surface mounted vibrating type suitable for use in an electrically supervised circuit. Horns must produce a sound rating of at least 85 dBA at 3 meters10 feet. Horns used in exterior locations must be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles.

2.18.2 Visual Notification Appliances

****

NOTE: 1. ABA requires that Visual Notification Appliances be provided in buildings and facilities in each of the following areas: restrooms, and any general usage area (e.g., meeting rooms), hallways, lobbies, and any other area for common use and other areas stated at www.access-board.gov. The Visual Notification Appliance must be mounted as required by ABA that directs compliance with NFPA 72 except that the maximum allowable sound level of audible notification appliances must have a sound level no more than 110 dB at the minimum hearing distance from the audible appliance. In addition, alarms in guest rooms required to provide communication features must comply with sections 18.5.4.6 of NFPA 72. Shop drawings must indicate location, dimensions, content, details, and other required information to indicate extent of complying with ABA requirements.

2. Currently NFPA 72 requires "clear color" strobes for Fire Alarm Notification. NFPA 72 requires the strobe must be marked "Fire" to clearly identify the function.

****

Visual notification appliances must conform to the applicable requirements of UL 1638, UL 1971 and conform to the Architectural Barriers Act (ABA). Visual Notification Appliances must have clear high intensity optic lens, xenon flash tubes, or light emitting diode (LED). The light pattern must be disbursed so that it is visible above and below the strobe and from a 90 degree angle on both sides of the strobe. Strobe flash rate must be 1 flash per second and a minimum of [15][30][75][_____] candela based on the UL 1971 test. Strobe must be [surface][semi-flush] mounted.

]2.19 ELECTRICAL

****

NOTE: Coordinate power and alarm requirements with the contract drawings and other specification sections.

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2.19.1 Wire

Provide wiring materials under this section as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM with the additions and modifications specified herein.

2.19.2 Alarm Wiring

IDC and SLC wiring must be [fiber optic][or][solid copper] cable in accordance with the manufacturers requirements. Copper signaling line circuits and initiating device circuit field wiring must be No. [14][16][18][_____] AWG size conductors at a minimum.[Visual notification appliance circuit conductors, that contain audible alarm appliances, must be copper No. 14 AWG size conductors at a minimum.] Wire

size must be sufficient to prevent voltage drop problems. Circuits operating at 24 VDC must not operate at less than the listed voltages for the detectors, appliances, or combination thereof. Power wiring, operating at 120 VAC minimum, must be a minimum No. 12 AWG solid copper having similar insulation. Acceptable power-limited cables are FPL, FPLR or FPLP as appropriate with red colored covering. Nonpower-limited cables must comply with NFPA 70.

2.20 SURGE PROTECTIVE DEVICES

Surge protective devices must be provided to suppress all voltage transients which might damage RCU components. Systems having circuits located outdoors, communications equipment must be protected against surges induced on the signaling line circuits. Cables and conductors, that serve as communications links, must have surge protection circuits installed at each end. The surge protective device must wire in series to the power supply of the protected equipment with screw terminations. Line voltage surge arrestor must be installed directly adjacent to the power panel where the releasing control unit breaker is located.

a. Surge protective devices for nominal 120 VAC must be UL 1449 listed with a maximum 500 volt suppression level and have a maximum response time of 5 nanoseconds. The surge protective device must meet IEEE C62.41.1 and IEEE C62.41.2 category B tests for surge capacity. The surge protective device must feature multi-stage construction and be provided with a long-life indicator lamp (either light emitting diode or neon) which extinguishes upon failure of protected components. A unit fusing must be externally accessible.

b. Surge protective devices for nominal 24 VAC, fire alarm telephone dialer, or ethernet connection must be UL 497B listed, meet IEEE C62.41.1 and have a maximum response time of 1-nanosecond. The surge protective device must feature multi-stage construction and be self-resetting. The surge protective device must be a base and plug style. The base assembly must have screw terminals for releasing system wiring. The base assembly must accept "plug-in" surge protective module.

c. All surge protective devices (SPD) must be the standard product of a single manufacturer and be equal or better than the following:

   (1) For 120 VAC nominal line voltage: UL 1449 and UL 1283 listed, series connected 120 VAC, 20A rated, surge protective device in a NEMA 4x enclosure. Minimum 50,000 amp surge current rating with EMI/RFI filtering and a dry contact circuit for remote monitoring of surge protection status.

   (2) For 24-volt nominal line voltage: UL 497B listed, series connected low voltage, 24-volt, 5A rated, loop circuit protector, base and replaceable module.

   (3) For alarm telephone dialers: UL 497A listed, series connected, 130-volt, 150 mA rated with self-resetting fuse, dialer circuit protector with modular plug and play.

   (4) For IP-DACTS: UL 497B listed, series connected, 6.4-volt, 1.5A rated with 20 kA/pair surge current, data network protector with modular plug and play.

2.21 ELECTRIC POWER

2.21.1 Primary Power

Power must be [120][_____] VAC [50][60] Hz service for the RCU from the AC service to the building in accordance with NFPA 72.

2.22 SECONDARY POWER SUPPLY

Provide for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power must be automatic and must not cause transmission of a false alarm.

2.22.1 Batteries

Provide sealed, maintenance-free,[valve regulated lead acid] batteries as the source for emergency power to the RCU. Batteries must contain suspended electrolyte. The battery system must be maintained in a fully charged condition by means of a solid state battery charger. Provide an automatic transfer switch to transfer the load to the batteries in the event of the failure of primary power.

2.22.1.1 Capacity

Battery size must apply to every control unit and panel associated with this system, including supplemental notification appliance circuit panels, auxiliary power supply panels, and fire alarm transmitters.

a. Sufficient capacity to operate the releasing system under supervisory and trouble conditions, including audible trouble signal devices for 48 hours and audible and visual signal devices under alarm conditions for an additional 15 minutes (or minimum required time for automatice water control valve release).

2.22.1.2 Battery Power Calculations

a. Verify that battery capacity exceeds supervisory and alarm power requirements for the criteria noted in the paragraph "Capacity" above.

   (1) Substantiate the battery calculations for alarm and supervisory power requirements. Include ampere-hour requirements for each system component and each control unit or panel component, and compliance with UL 864.

   (2) Provide complete battery calculations for both the alarm and supervisory power requirements. Submit ampere-hour requirements for each system component with the calculations.

   (3) Provide voltage drop calculations to indicate that sufficient voltage is available for proper operation of the system and all components, at the minimum rated voltage of the system operating on batteries. Calculations must be performed using the minimum rated voltage of each component.

b. For battery calculations assume a starting voltage of 24 VDC for starting the calculations to size the batteries. Calculate the required Amp-Hours for the specified standby time, and then calculate the required Amp-Hours for the specified alarm time. Using 20.4 VDC

as starting voltage, perform a voltage drop calculation for circuits containing devices, appliances, or combination of devices and appliances remote from the power sources.

2.22.2 Battery Chargers

Provide a solid state, fully automatic, variable charging rate battery charger. The charger must be capable of providing 120 percent of the connected system load and maintain the batteries at full charge. In the event the batteries are fully discharged (20.4 Volts dc), the charger must recharge the batteries back to 95 percent of full charge within 48 hours after a single discharge cycle as described in paragraph CAPACITY above. Provide pilot light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided.

PART 3 EXECUTION

3.1 VERIFYING ACTUAL FIELD CONDITIONS

Before commencing work, examine all adjoining work on which the contractor's work that is dependent for perfect workmanship according to the intent of this specification section, and report to the Contracting Officer's Representative all conditions that prevents performance of first class work. No "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed before submittal of a proposal.

3.2 INSTALLATION

The installation must be in accordance with the applicable provisions of NFPA 13, NFPA 24, NFPA 72 and publications referenced therein.[Installation of in-rack sprinklers must comply with applicable provisions of NFPA 13.] Locate sprinklers in a consistent pattern with ceiling grid, lights, and air supply diffusers. Install sprinkler system over and under ducts, piping and platforms when such equipment can negatively affect or disrupt the sprinkler discharge pattern and coverage.

a. Piping offsets, fittings, and other accessories required must be furnished to provide a complete installation and to eliminate interference with other construction.

b. Wherever the contractor's work interconnects with work of other trades the Contractor must coordinate with other Contractors to insure all Contractors have the information necessary so that they may properly install all necessary connections and equipment. Identify all work items needing access (dampers and similar equipment) concealed above hung ceilings by permanent color coded pins/tabs in the ceiling directly below the item.

c. Provide required supports and hangers for piping, conduit, and equipment so that loading will not exceed allowable loadings of structure. Submittal of a bid must be a deemed representation that the contractor submitting such bid has ascertained allowable loadings and has included in his estimates the costs associated in furnishing required supports.

3.2.1 Waste Removal

At the conclusion of each day's work, clean up and stockpile on site all waste, debris, and trash which may have accumulated during the day as a result of work by the contractor and of his presence on the job. Sidewalks and streets adjoining the property must be kept broom clean and free of waste, debris, trash and obstructions caused by work of the contractor, which will affect the condition and safety of streets, walks, utilities, and property.

3.3 UNDERGROUND PIPING INSTALLATION

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NOTE: Restraint of the underground piping must be detailed on the contract drawings.

****

The fire protection water main must be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover must be [900][_____] mm [3][_____] feet or the frost line, whichever is deeper. The supply line must terminate inside the building with a flanged piece, the bottom of which must be set not less than 304 mm1-foot above the finished floor. A blind flange must be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block must be provided at the elbow where the pipe turns up toward the floor. In addition, joints must be anchored in accordance with NFPA 24. Buried steel components must be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 1500 mm5 feet outside the building walls must meet the requirements of Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING.

3.4 ABOVEGROUND PIPING INSTALLATION

The methods of fabrication and installation of the aboveground piping must fully comply with the requirements and recommended practices of NFPA 13 and this specification section.

3.4.1 Protection of Piping Against Earthquake Damage

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NOTE: The writer of this section must coordinate with the Structural Engineer or Government to determine the proper seismic design category for the project, in accordance with the IBC or ASCE guidelines. See UFC 3-310-04 for more information.

****

Seismic restraint is [not]required.

3.4.2 Piping in Exposed Areas

Install exposed piping without diminishing exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, must be installed to provide maximum headroom.

3.4.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping must be concealed above ceilings. Piping

must be inspected, hydrostatically tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas must be concealed.

3.4.4 Pendent Sprinklers

****

NOTE: Where the maximum static or flowing pressure, whichever is greater at the sprinkler, applied other than through the fire department connection, exceeds 6.9 bar100 psi and a branch line above the ceiling supplies sprinklers in a pendent position below the ceiling, the cumulative horizontal length of an unsupported armover to a sprinkler or sprinkler drop must not exceed 300 mm12 inches for steel pipe and 1500 mm6 inches for copper tube.

****

a. Drop nipples to pendent sprinklers must consist of minimum 25-mm1-inch pipe with a reducing coupling into which the sprinkler must be threaded.

b. Where sprinklers are installed below suspended or dropped ceilings, drop nipples must be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling must not extend below the underside of the ceiling.

c. Recessed pendent sprinklers must be installed such that the distance from the sprinkler deflector to the underside of the ceiling must not exceed the manufacturer's listed range and must be of uniform depth throughout the finished area.

d. Pendent sprinklers in suspended ceilings must be located in the center of the tile (+/- 2 inches).[

e. Dry pendent sprinkler assemblies must be such that sprinkler ceiling plates or escutcheons are of the uniform depth throughout the finished space.][

f. Dry pendent sprinklers must be of the required length to permit the sprinkler to be threaded directly into a branch line tee.][

g. Where the maximum static or flowing pressure, whichever is greater at the sprinkler, applied other than through the fire department connection, exceeds 6.9 bar100 psi and a branch line above the ceiling supplies sprinklers in a pendent position below the ceiling, the cumulative horizontal length of an unsupported armover to a sprinkler or sprinkler drop must not exceed 300 mm12 inches for steel pipe and 1500 mm6 inches for copper tube.]

h. Sprinklers installed in the pendent position must be of the listed dry pendent type or on return bends, unless otherwise indicated.

3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers must contain no fittings between the branch line tee and the reducing coupling at the sprinkler.

3.4.6 Pipe Joints

Pipe joints must conform to NFPA 13, except as modified herein. Not more than four threads must show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints must be provided where indicated or required by NFPA 13. Grooved pipe and fittings must be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools must be products of the same manufacturer. For copper tubing, pipe and groove dimensions must comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field must be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe must be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances.

3.4.7 Reducers

Reductions in pipe sizes must be made with one-piece tapered reducing fittings. When standard fittings of the required size are not manufactured, single bushings of the face or hex type will be permitted. Where used, face bushings must be installed with the outer face flush with the face of the fitting opening being reduced. Bushings cannot be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 13 mm1/2-inch.

3.4.8 Pipe Penetrations

a. Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors must be core-drilled and provided with pipe sleeves. Each sleeve must be Schedule 40 galvanized steel, ductile-iron or cast-iron pipe and extend through its respective wall or floor and be cut flush with each wall surface. Sleeves must provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe must be firmly packed with mineral wool insulation.

b. Where pipes and sleeves penetrate fire walls, fire partitions, or floors, pipes/sleeves must be firestopped in accordance with Section 07 84 00 FIRESTOPPING.

c. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe must be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

d. All penetrations through the boundary of rooms/areas identified as secure space area must meet ICS 705-1.

3.4.9 Escutcheons

Escutcheons must be provided for pipe penetration in finished areas of ceilings, floors and walls. Escutcheons must be securely fastened to the pipe at surfaces through which piping passes.

3.4.10 Inspector's Test Connection

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NOTE: Designer will indicate location of the inspector's test connections and all associated valves on the contract drawings, and will provide details of drain piping.

****

Unless otherwise indicated, the test connection must consist of 25-mm1-inch pipe connected to the remote branch line; a test valve located approximately 2 meters7 feet above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test". All test connection piping must be inside of the building and penetrate the exterior wall at the location of the discharge orifice only. The discharge orifice must be located outside the building wall no more than 0.6 meters2 feet above finished grade, directed so as not to cause damage to adjacent construction or landscaping during full flow discharge, or to the sanitary sewer. Discharge to the exterior must not interfere with exiting from the facility. Water discharge or runoff must not cross the path of egress from the building. Do not discharge to the roof. Discharge to floor drains, janitor sinks or similar fixtures is not permitted.

Provide concrete splash blocks at all drain and inspector's test connection discharge locations if not discharging to a concrete surface. Splash blocks must be large enough to mitigate erosion and not become dislodged during a full flow of the drain. Ensure all discharged water drains away from the facility and does not cause property damage.

3.4.11 Backflow Preventer

Locate within the building or in a heated enclosure in locations subject to freezing. For heated enclosures, provide a low temperature supervisory alarm connected to the facility fire alarm system. Heat trace is not permitted to be used.

Install backflow preventers so that the bottom of the assembly is a minimum of 150 mm6 inches above the finished floor/grade. Install horizontal backflow preventers so that the bottom of the assembly is no greater than [_____]610 mm24 inches above the finished floor/grade. Install vertical backflow preventers so that the upper operating handwheel is no more than [_____]1.8 meters6 feet above the finished floor/grade. Clearance around control valve handles must be minimum 150 mm6inches above grade/finished floor and away from walls.

[3.4.11.1 Test Connection

Provide downstream of the backflow prevention assembly UL 668 hose valves with 65-mm2.5-inch National Standard male hose threads with cap and chain. Provide one valve for each 946 L/min250 gpm of system demand or fraction thereof. Provide a permanent sign in accordance with paragraph entitled "Identification Signs" which reads, "Test Valve". Indicate location of test header. If an exterior connection, provide a control valve inside a heated mechanical room to prevent freezing. The piping between the backflow preventer test header control valve and the exterior test header must be provided with an automatic drip arranged to drain to

the outside.

]3.4.12 Drains

a. Main drain piping must be provided to discharge [at a safe point outside the building, no more than 0.6 meters2 feet above finished grade][at the location indicated][to the sanitary sewer]. Provide a concrete splash block at drain outlet. Discharge to the exterior must not interfere with exiting from the facility. Water discharge or runoff must not cross the path of egress from the building.

b. Auxiliary drains must be provided as required by NFPA 13. Auxiliary drains are permitted to discharge to a floor drain if the drain is sized to accommodate full flow (min 151 L/min40 gpm). Discharge to service sinks or similar plumbing fixtures is not permitted.

3.4.13 Installation of Fire Department Connection

Connection must be mounted [on the exterior wall approximately 900 mm3 feet above finished grade][adjacent to and on the sprinkler system side of the backflow preventer]. The piping between the connection and the check valve must be provided with an automatic drip in accordance with NFPA 13 and piped to drain to the outside or a floor drain within the same room.

3.4.14 Identification Signs

Signs must be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Main drain test results must be etched into main drain identification sign. Hydraulic design data must be etched into the nameplates and permanently affixed to each sprinkler riser as specified in NFPA 13. Provide labeling on the surfaces of all feed and cross mains to show the pipe function (e.g., "Sprinkler System", "Fire Department Connection", "Standpipe") and normal valve position (e.g. "Normally Open", "Normally Closed"). For pipe sizes 100 mm4-inch and larger provide white painted stenciled letters and arrows, a minimum of 50 mm2 inches in height and visible from at least two sides when viewed from the floor. For pipe sizes less than 100 mm4-inch, provide white painted stenciled letters and arrows, a minimum of 18 mm0.75-inch in height and visible from the floor.[Provide properly lettered and approved metal sign to elevator flow switch stating the circuits' voltage, and identify the switch as an "Elevator Power Shunt Flow Switch".]

[3.4.15 Isolation Valve

Provide a control valve on the riser assembly, downstream of the backflow preventer test connection and waterflow indicator, to allow isolation of riser when testing (tripping) the automatic water control valve without allowing water to enter the system piping. The control valve must be electrically supervised in the open position.

]3.5 ELECTRICAL

****

NOTE: Coordinate power and alarm requirements with the contract drawings and other specification sections.

****

Except as modified herein, electric equipment and wiring must be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.[Alarm signal wiring connected to the building fire alarm control system must be by the fire alarm installer.]

3.5.1 Overcurrent and Surge Protection

All equipment connected to alternating current circuits must be protected from surges. Cables and conductors that serve as communications links, except fiber optics, must have surge protection circuits installed at each end. Fuses must not be used for surge protection.

3.5.2 Grounding

Grounding must be provided to building ground.

3.5.3 System Field Wiring

3.5.3.1 Wiring within Cabinets, Enclosures, and Boxes

Provide wiring installed in a neat and workmanlike manner and installed parallel with or at right angles to the sides and back of the box, enclosure, or cabinet. Conductors that are terminated, spliced, or otherwise interrupted in an enclosure, cabinet, mounting, or junction box must be connected to screw-type terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. The use of wire nuts or similar devices is prohibited. Wiring to conform with NFPA 70.

Indicate the following in the wiring diagrams:

a. Point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems that are supervised or controlled by the system. Diagrams must show connections from field devices to the RCU and remote RCU, initiating circuits, switches, relays and terminals.

b. Complete riser diagrams indicating the wiring sequence of devices and their connections to the control equipment. Include a color code schedule for the wiring. Include floor plans showing the locations of devices and equipment.

3.5.3.2 Terminal Cabinets

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NOTE: Provide terminal cabinets on each floor where the fire alarm system supply riser is located and where the fire alarm return riser is located.

****

Provide a terminal cabinet at the base of the circuit riser, on each floor at each riser, and where indicated on the drawings. Terminal size must be appropriate for the size of the wiring to be connected. Conductor terminations must be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection must be permanently mounted in the terminal cabinet. Minimum size is 200 mm by 200 mm8 inches by 8 inches. Only screw-type terminals are permitted. Provide an identification label, that displays "RELEASING SYSTEM TERMINAL CABINET" with 50-mm2-inch lettering, on the front of the terminal cabinet.

3.5.3.3 Alarm Wiring

****

NOTE: Do not penetrate SCIF perimeters with copper signal line circuits. SCIF penetrations should be either fiber optic cable or IDC. IDC circuits penetrating the SCIF must be filtered.

****

a. Voltages must not be mixed in junction boxes, housing or device, except those containing power supplies and control relays.

b. Utilize shielded wiring where recommended by the manufacturer. For shielded wiring, ground the shield at only one point, in or adjacent to the RCU.

c. [Pigtail or T-tap connections to signal line circuits, initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited.][T-tapping using screw terminal blocks is allowed for Class "B" initiating device circuitssignaling line circuits.]

d. Color coding is required for circuits and must be maintained throughout the circuit. Conductors used for the same functions must be similarly color coded. Conform wiring to NFPA 70.

e. Pull all conductors splice free. The use of wire nuts, crimped connectors, or twisting of conductors is prohibited. Where splices are unavoidable, the location of the junction box or pull box where they occur must be identified on the as-built drawings. The number and location of splices must be subject to approval by the [_____] Designated Fire Protection Engineer (DFPE).

3.5.3.4 Back Boxes and Conduit

In addition to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, provide all wiring in rigid metal conduit or intermediate metal conduit unless specifically indicated otherwise. Minimum conduit size must be 19 mm3/4-inch in diameter. Do not use electrical non-metallic tubing (ENT) or flexible non-metallic tubing and associated fittings.

a. Galvanized rigid steel (GRS) conduit must be utilized where exposed to weather, where subject to physical damage, and where exposed on exterior of buildings. Intermediate metal conduit (IMC) may be used in lieu of GRS as allowed by NFPA 70.

b. Electrical metallic tubing (EMT) is permitted above suspended ceilings or exposed where not subject to physical damage. Do not use EMT underground, encased in concrete, mortar, or grout, in hazardous locations, where exposed to physical damage, outdoors or in fire pump rooms. Use die-cast compression connectors.

c. For rigid metallic conduit (RMC), only threaded type fitting are permitted for wet or damp locations.

d. Flexible metal conduit is permitted for initiating device circuits 2 meters6 feet in length or less. Flexible metal conduit is prohibited for notification appliance circuits and signaling line circuits. Use

liquid tight flexible metal conduit in damp and wet locations.

e. Schedule 40 (minimum) polyvinyl chloride (PVC) is permitted where conduit is routed underground or underground below floor slabs. Convert non-metallic conduit, other than PVC Schedule 40 or 80, to plastic-coated rigid, or IMC, steel conduit before turning up through floor slab.

f. Exterior wall penetrations must be weathertight. Conduit must be sealed to prevent the infiltration of moisture.

[g. For Class "A" or "X" circuits with conductor lengths of 3 meters10 feet or less, the conductors must be permitted to be installed in the same raceway in accordance with NFPA 72.]

3.5.3.5 Conductor Terminations

Labeling of conductors at terminal blocks in terminal cabinets, and RCU must be provided at each conductor connection. Each conductor or cable must have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet and RCU must contain a laminated drawing that indicates each conductor, its label, circuit, and terminal. The laminated drawing must be neat, using 12-point lettering minimum size, and mounted within each cabinet, panel, or control unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

3.6 RELEASING CONTROL SYSTEM

3.6.1 Releasing Control Unit (RCU)

The RCU must be located in a year round environmentally conditioned space and not in the hazard area served but adjacent to it. Locate the RCU [where indicated on the drawings][_____]. [Recess][Semi-recess][Surface mount] the enclosure with the top of the cabinet 2 meters6 feet above the finished floor or center the cabinet at [1.5][_____] meters[5][_____] feet, whichever is lower. Conductor terminations must be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection must be permanently mounted in the RCU.

3.6.2 Smoke Detectors

Locate detectors [as required by NFPA 72 and their listing][as indicated on the drawings] on a 100-mm4-inch mounting box. Smoke detectors are permitted to be on the wall no lower than 300 mm12 inches from the ceiling with no minimum distance from the ceiling.[In raised floor spaces, install the smoke detectors to protect [21 square meters225 square feet per detector][_____].] Install smoke detectors no closer than 1-meter3 feet from air handling supply diffusers.[Detectors mounted in acoustical ceiling tiles must be centered in the tiles +/- 50 mm2 inches.]

3.6.3 Air Sampling Smoke Detector

Locate air sampling smoke detectors in accordance with the manufacturer's instructions. Air sampling smoke detectors must be installed as follows:

a. Air Sampling Smoke Detector Assembly:

(1) Detector assembly must be mounted to a wall at a height between

1200 to 1800 mm48 to 60 inches to top of detector measured above the finished floor.

(2) Mounting must be in a fully accessible and visible location.

(3) Mounting or attachment to site equipment, cable trays, movable walls, other equipment or equipment supports is not permitted.

(4) Piping network insertion into the detector inlet must not be glued.

(5) Air sampling smoke detector assembly must be installed in accordance with this specification section and the manufacturer's installation and instruction manuals.

(6) Flexible tubing for termination of the sampling pipe network into detector inlet is not permitted unless allowed by its listing.

(7) Provide red background with white lettering labels that are plastic or phenolic type with a minimum of 6.4 mm0.25-inch block lettering to indicate detector and zone. For example: "AIR SAMPLING SMOKE DETECTOR No. 1-1 No. 5".

(8) Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the ASD panel. The card must show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory, and trouble. The instructions must be approved by the Contracting Officer before being posted.

b. Pipe and Sampling Tube Mounting:

(1) The pipe and sampling tubing detection network must be mounted as per the design and manufacturer's specification. The hardware used for mounting will depend upon the design and site requirements.

(2) To minimize flexing, pipes must be secured every 1.5 meters5 feet.

(3) Pipes must be suspended between 25 and 100 mm1 and 4 inches below the ceiling. In areas with a suspended ceiling, the pipe network must be installed above the ceiling utilizing the manufacturer's capillary sample port supported by the ceiling.

(4) The sampling tubes must be of the same length or use the manufacturer's guidelines to run tubes of the required lengths.

(5) When installing a pipe network in areas subject to high temperature fluctuations allow for the contraction and expansion of pipes.

(6) Where expansion or contraction of pipes is likely either after installation or on a continuous basis, do not place pipe clips adjacent to couplings and socket unions as these may interfere with the movement of the pipe.

(7) No bends are permitted within the first 450 mm18 inches from the detector inlet.

(8) The routing of the piping and sample tube network must be coordinated with potential obstructions, including cable trays, grounding bars, and HVAC ductwork.

(9) All changes in direction must be made with standard elbows or tees.

(10) All joints must be air-tight and made by using solvent cement, except at the entry to the detector assembly. Refer to ASTM F402.

(11) All pipes must be supported by mechanical hangers attached to the structure of the building. Not more than 300 mm1-foot of pipe must extend beyond the last hanger of each sampling pipe. The final installation must result in no noticeable deflection in the piping network.

(12) Attachment of air sampling pipes to cable trays, "gray iron", and telecommunications equipment is prohibited.

(13) Clearly label pipe network to distinguish the pipe from other facility pipe work or protective cabling enclosures. For example: "SMOKE DETECTION SAMPLING TUBE - DO NOT DISTURB". In open rooms and exposed areas, provide labels at no greater than 6.1-meter 20-foot intervals. Provide labels every 3 meters10 feet where piping is installed above suspended ceilings and every 609 mm2 feet, centered in the floor panels, where piping is installed within the raised floor cavity.

(14) Placement of the sampling tube must take into consideration appropriate sampling point locations and spacing.

c. Air Sampling Points:

(1) Open area ceiling sampling points must be oriented downward and must be within 25 to 100 mm1 to 4 inches below the underside of the ceiling above where the ceiling is smooth.

(2) Label all air sampling points with a round red label, each with a center hole to match the diameter of the drilled sampling point. For example: "AIR SAMPLING POINT DIA 3.2 MM0.125 INCHES". Indicate fractional dimensions in decimal format with a minimum of three decimal places.

[3.6.4 Manual Stations

Locate manual stations as required by NFPA 72[and as indicated on the drawings]. Mount stations so they are located no farther than [1.5][_____] meters[5][_____] feet from the exit door they serve, measured horizontally. Manual stations must be mounted at [1067][1117][_____] mm [42][44][_____] inches measured to the operating handle.

][3.6.5 Notification Appliances

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NOTE: Locate strobes wall mounted in corridors no more than 4.5 meters15 feet from the end of a corridor with 30meters100 feet maximum distance between strobes. Where there is an obstruction to the viewing path in the corridors, such as a

cross-corridor door or ceiling elevation change, consider the obstruction as defining a new corridor. Provide ceiling mounted strobes in rooms accessible to the public, such as conference rooms, restrooms, courtrooms, cafeterias, and auditoriums in accordance with NFPA 72. In Child Development Centers only chimes must be used as the pre-alert tone prior to voice messages.

****

a. Locate notification appliance devices [as required by NFPA 72][where indicated]. Where more than two appliances are located in the same room or corridor or field of view, provide synchronized operation. Devices must use screw terminals for all field wiring.[Audible and visual notification appliances mounted in acoustical ceiling tiles must be centered in the tiles +/- 50 mm2 inches.]

b. Audible and visual notification appliances mounted on the exterior of the building, within unconditioned spaces, or in the vicinity of showers must be listed weatherproof appliances installed on weatherproof backboxes.

][3.6.6 Graphic Annunciator

Locate the graphic annunciator as shown on the drawings. Mount the panel, with the top of the panel 1830 mm6 feet above the finished floor or center the panel at [1525][_____] mm[5][_____] feet, whichever is lower. [Locate the graphic annunciator as shown on the drawings. Surface-mount the panel, with the top of the panel 1830 mm6 feet AFF or center the panel at [1525][_____] mm[5][_____] feet, whichever is lower.]

]3.6.7 Remote LCD Annunciator

Locate the remote LCD annunciator as shown on the drawings. Mount the panel, with the top of the panel 2 meters6 feet above the finished floor or center the panel at [1.5][_____] meters[5][_____] feet, whichever is lower.

3.6.8 Ceiling Bridges

Provide ceiling bridges for ceiling-mounted appliances. Ceiling bridges must be as recommended/required by the manufacturer of the ceiling-mounted notification appliance.

3.7 PAINTING

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NOTE: Designer will coordinate color code marking with Section 09 90 00 PAINTS AND COATINGS. Color code marking for piping which are not listed in Table I of Paragraph 3.5 Pipe Color Code Marking of UFGS Section 09 90 00 will be added to the table.

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Color code mark piping [red][as specified in Section 09 90 00 PAINTS AND COATINGS].

a. In unfinished areas (including areas above drop ceilings), paint all exposed electrical conduit (serving releasing system equipment),

releasing system conduit, surface metal raceway, junction boxes and covers red. In lieu of painting conduit, the contractor may utilize red conduit with a factory applied finish.

b. In finished areas, paint exposed electrical conduit (serving releasing system equipment), releasing system conduit, surface metal raceways, junction boxes, and electrical boxes to match adjacent finishes. The inside cover of the junction box must be identified as "Releasing System" and the conduit must have painted red bands 19 mm3/4-inch wide at 3-meter10-foot centers and at each side of a floor, wall, or ceiling penetration.

3.8 FIELD QUALITY CONTROL

3.8.1 Test Procedures

Submit detailed test procedures, prepared and signed by the NICET Level [III][or][IV] Fire Sprinkler Technician, and the representative of the installing company,[and reviewed by the QFPE] [60][_____] days prior to performing system tests. Detailed test procedures must list all components of the installed system such as initiating devices and circuits, [notification appliances and circuits,] signaling line devices and circuits, control devices/equipment, batteries, power sources/supply, annunciators, special hazard equipment, and interface equipment. Test procedures must include sequence of testing, time estimate for each test, and sample test data forms. The test data forms must be in a check-off format (pass/fail with space to add applicable test data; similar to the forms in NFPA 13 and NFPA 4.) The test procedures and accompanying test data forms must be used for the pre-Government testing and the Government final testing.

a. Identify the NFPA Class of all initiating device circuits (IDC),[notification appliance circuits (NAC),] and signaling line circuits (SLC).

b. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how these tests must be performed.

c. Identify each component and circuit as to type, location within the facility, and unique identity within the installed system. Provide necessary floor plan sheets showing each component location, test location, and alphanumeric identity.

d. Identify all test equipment and personnel required to perform each test (including equipment necessary for smoke detector testing. The use of magnets is not permitted.

e. Provide space to identify the date and time of each test. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

3.8.2 Pre-Government Testing

3.8.2.1 Verification of Compliant Installation

Conduct inspections and tests to ensure that equipment is functioning properly. Tests must meet the requirements of paragraph entitled "Minimum System Tests" and "System Acceptance" as noted in NFPA 13 and NFPA 72.

The Contractor [and QFPE] must be in attendance at the pre-Government testing to make necessary adjustments. After inspection and testing is complete, provide a signed Verification of Compliant Installation letter by the QFPE that the installation is complete, compliant with the specification and fully operable. The letter must include the names and titles of the witnesses to the pre-Government tests. Provide all completion documentation as required by NFPA 13 and the test reports noted below.

a. NFPA 13 Aboveground Material and Test Certificate

b. NFPA 13 Underground Material and Test Certificate

c. NFPA 72 Record of Completion

d. NFPA 72 Record of Inspection and Testing

3.8.2.2 Request for Government Final Test

When the verification of compliant installation has been completed, submit a formal request for Government final test to the [_____][Designated Fire Protection Engineer (DFPE)][Contracting Officers Designated Representative (COR)]. Government final testing will not be scheduled until the DFPE has received copies of the request for Government final testing and Verification of Compliant Installation letter with all required reports. Government final testing will not be performed until after the connections to the [building fire alarm system][installation fire alarm reporting system] have been completed and tested to confirm communications are fully functional. Submit request for test at least [15][_____] calendar days prior to the requested test date.

3.8.3 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, perform corrective actions and repeat the tests. Tests must be conducted and repeated if necessary until the system has been demonstrated to comply with all contract requirements.

3.8.4 Government Final Tests

The tests must be performed in accordance with the approved test procedures in the presence of the DFPE. Furnish instruments and personnel required for the tests. The following must be provided at the job site for Government Final Testing:

a. The manufacturer's technical representative.

[b. The contractor's Qualified Fire Protection Engineer (QFPE).]

c. Marked-up red line drawings of the system as actually installed.

d. Loop resistance test results.

e. Complete program printout including input/output addresses.

f. Copy of pre-Government Test Certificate, test procedures and completed test data forms.

Government Final Tests will be witnessed by the [_____], [Designated Fire

Protection Engineer][Contracting Officer][, Qualified Fire Protection Engineer (QFPE)]. At this time, all required tests noted in the paragraph "Minimum System Tests" must be repeated at their discretion.

3.9 MINIMUM SYSTEM TESTS

The system, including the underground water mains, and the aboveground piping and system components, must be tested to ensure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure must be tested in accordance with NFPA 13 and NFPA 24.

3.9.1 Underground Piping

3.9.1.1 Flushing

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NOTE: Designer should check the site water section for inconsistencies and to verify flushing of all underground pipe will be performed prior to connection to the sprinkler system.
****

Underground piping must be flushed in accordance with NFPA 24.

3.9.1.2 Hydrostatic Test

New underground piping must be hydrostatically tested in accordance with NFPA 24.

3.9.2 Aboveground Piping

3.9.2.1 Hydrostatic Test

Aboveground piping must be hydrostatically tested in accordance with NFPA 13. There must be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure must be read from a gauge located at the low elevation point of the system or portion being tested.

[#### 3.9.2.2 Air Pressure Test

As specified in NFPA 13, an air pressure leakage test at 350 kPa50 psi must be conducted for 24 hours. There must be no drop in gauge pressure in excess of 10 kPa1.5 psi for the 24 hours. This air pressure test is in addition to the required hydrostatic test.

]#### 3.9.2.3 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly must be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. The Contractor must provide all equipment and instruments necessary to conduct a complete forward flow test, including 65-mm2.5-inch diameter hoses, playpipe nozzles or flow diffusers, calibrated pressure gauges, and pitot tube gauge. The Contractor must provide all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction loss) across the assembly must be recorded. A metal placard must be provided on the backflow prevention assembly that lists the pressure readings both upstream and

downstream of the assembly, total pressure drop, and the system test flow rate determined during the preliminary testing. The pressure drop must be compared to the manufacturer's data and the readings observed during the final inspections and tests.

3.9.3 System Tests

Test the system in accordance with the procedures outlined in NFPA 72. The required tests are as follows:

a. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests must be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.

b. Verify the absence of unwanted voltages between circuit conductors and ground. The tests must be accomplished at the preliminary test with results available at the final system test.

c. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.

d. Test each initiating device[and notification appliance] and circuit for proper operation and response at the control unit. Smoke detectors must be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors must comply with the requirements of NFPA 72 except disconnect at least 20 percent of devices. If there is a failure at these devices, then supervision must be tested at each device.

e. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M manual.

f. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.

g. Determine that the system is operable under trouble conditions as specified.

h. Visually inspect wiring.

i. Test the battery charger and batteries.

j. Verify that software control and data files have been entered or programmed into the releasing control unit. Hard copy records of the software must be provided to the Contracting Officer.

k. Verify that red-line drawings are accurate.

l. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.

m. Measure voltage readings for circuits to ensure that voltage drop is not excessive.

n. Disconnect the verification feature for smoke detectors during tests to minimize the amount of smoke needed to activate the sensor.

Testing of smoke detectors must be conducted using real smoke or the use of canned smoke which is permitted.

[

o. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.]

p. Verify the documentation cabinet is installed and contains all as-built shop drawings, product data sheets, design calculations, site-specific software data package, and all documentation required by paragraph titled "Test Reports".

3.9.4 Alarm Device Test

Each alarm switch/device must be tested by flowing water through the inspector's test connection.

[3.9.5 Audibility Tests

Sound pressure levels from audible notification appliances must not exceed 110 dBA in occupiable areas. The provisions for audible notification (audibility) must be met with doors, fire shutters, movable partitions, and similar devices closed.

]3.9.6 Main Drain Flow Test

Following flushing of the underground piping, a main drain test must be made to verify the adequacy of the water supply. Static and residual pressures must be recorded on the certificate specified in paragraph SUBMITTALS.

3.9.7 Automatic Water Control Valves Trip Test

Each water control valve must be independently trip-tested in accordance with the manufacturer's published instructions. Each valve must be electrically trip-tested by actuating a respective heat detector, a manual actuation station connected to the system control unit and the manual release which is part of the valve trim. Each valve must be returned to normal condition after each test. Prior to trip testing sprinkler deluge system, precautionary steps must be taken to prevent water damage to the building and equipment from sprinkler discharge. Water delivery times must be measured starting at the normal nitrogen pressure on the system. Control valves on preaction systems must remain open until piping is filled with water.

3.9.8 Supervisory Nitrogen System Test

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NOTE: Delete this paragraph for deluge system applications and preaction systems not requiring supervisory nitrogen.

****

System supervisory nitrogen pressure must be reduced from the normal system pressure to the point at which a low-pressure alarm is sounded. Nitrogen pressure must be restored to verify trouble signal restoration. Automatic start/stop features of nitrogen generator must be tested.

3.10 SYSTEM ACCEPTANCE

Following acceptance of the system, as-built drawings and O&M manuals must be delivered to the Contracting Officer for review and acceptance. Submit six sets of detailed as-built drawings. The drawings must show the system as installed, including deviations from both the project drawings and the approved shop drawings. These drawings must be submitted within two weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings must be provided at the time of, or prior to the final acceptance test.

[a. Provide one set of full size paper as-built drawings and schematics. The drawings must be prepared electronically and sized no less than the contract drawings.] [Furnish one set of CDs or DVDs containing software back-up and CAD based drawings in latest version of [MicroStation][AutoCAD,]DXF and portable document formats of as-built drawings and schematics.]

b. Include complete wiring diagrams showing connections between devices and equipment, both factory and field wired.

c. Include a riser diagram and drawings showing the as-built location of devices and equipment.

d. Provide operating and maintenance (O&M) instructions.

3.11 ONSITE TRAINING

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NOTE: The number of hours of instruction should be determined based of the number and complexity of the systems specified.

****

Conduct a training course for the responding fire department and operating and maintenance personnel as designated by the Contracting Officer. Training must be performed on two separate days (to accommodate different shifts of Fire Department personnel) for a period of [_____][4] hours of normal working time and must start after the system is functionally complete and after the final acceptance test. The on-site training must cover all of the items contained in the approved Operating and Maintenance Instructions.

3.12 EXTRA MATERIALS

3.12.1 Repair Service/Replacement Parts

Repair services and replacement parts for the system must be available for a period of 10 years after the date of final acceptance of this work by the Contracting Officer. During the warranty period, the service technician must be on-site within 24 hours after notification. All repairs must be completed within 24 hours of arrival on-site.

During the warranty period, the installing fire alarm contractor is responsible for conducting all required testing and maintenance in accordance with the requirements and recommended practices of NFPA 72 and the system manufacturer[s]. Installing fire alarm contractor is NOT responsible for damage resulting from abuse, misuse, or neglect of equipment by the end user.

3.12.2 Spare Parts

Spare parts furnished must be directly interchangeable with the corresponding components of the installed system[s]. Spare parts must be suitably packaged and identified by nameplate, tagging, or stamping. Spare parts must be delivered to the Contracting Officer at the time of the final acceptance testing and must be accompanied by an inventory list.

3.12.3 Document Storage Cabinet

Upon completion of the project, but prior to project close-out, place in the document storage cabinet copies of the following record documentation:

a. As-built shop drawings

b. Product data sheets

c. Design calculations

d. Site-specific software data package

e. All documentation required by SD-06

-- End of Section --