

SECTION TABLE OF CONTENTS

DIVISION 21 - FIRE SUPPRESSION

SECTION 21 13 13.00 10

***4 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION**

10/07

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Hydraulic Design
 - 1.2.1.1 Hose Demand
 - 1.2.1.2 Basis for Calculations
 - 1.2.2 Sprinkler Coverage
- 1.3 COORDINATION OF TRADES
- 1.4 DELIVERY AND STORAGE
- 1.5 FIELD MEASUREMENTS
- 1.6 SUBMITTALS
- 1.7 HYDRAULIC CALCULATIONS
- 1.8 FIRE PROTECTION SPECIALIST
- 1.9 SPRINKLER SYSTEM INSTALLER
- 1.10 REGULATORY REQUIREMENTS
- 1.11 SPARE PARTS
- 1.12 SHOP DRAWINGS

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCTS
- 2.2 NAMEPLATES
- 2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE
- 2.4 ABOVEGROUND PIPING COMPONENTS
 - 2.4.1 Steel Piping Components
 - 2.4.1.1 Steel Pipe
 - 2.4.1.2 Fittings for Non-Grooved Steel Pipe
 - 2.4.1.3 Grooved Mechanical Joints and Fittings
 - 2.4.1.4 Flanges
 - 2.4.1.5 Bolts, Nut, and Washers
 - 2.4.2 Pipe Hangers
 - 2.4.3 Valves
- 2.5 SPRINKLERS
 - 2.5.1 Recessed Sprinkler
 - 2.5.2 Pendent Sprinkler
 - 2.5.3 Upright Sprinkler
 - 2.5.4 Sidewall Sprinkler
 - 2.5.5 Dry Sprinkler Assembly
- 2.6 DISINFECTING MATERIALS
 - 2.6.1 Liquid Chlorine
 - 2.6.2 Hypochlorites
- 2.7 ACCESSORIES
 - 2.7.1 Sprinkler Cabinet
 - 2.7.2 Pendent Sprinkler Escutcheon
 - 2.7.3 Pipe Escutcheon

- 2.7.4 Sprinkler Guard
- 2.7.5 Identification Sign

PART 3 EXECUTION

- 3.1 FIRE PROTECTION RELATED SUBMITTALS
- 3.2 INSTALLATION REQUIREMENTS
- 3.3 INSPECTION BY FIRE PROTECTION SPECIALIST
- 3.4 ABOVEGROUND PIPING INSTALLATION
 - 3.4.1 Protection of Piping Against Earthquake Damage
 - 3.4.2 Piping in Exposed Areas
 - 3.4.3 Piping in Finished Areas
 - 3.4.4 Pendent Sprinklers
 - 3.4.4.1 Pendent Sprinkler Locations
 - 3.4.5 Upright Sprinklers
 - 3.4.6 Pipe Joints
 - 3.4.7 Reducers
 - 3.4.8 Pipe Penetrations
 - 3.4.9 Escutcheons
 - 3.4.10 Inspector's Test Connection
 - 3.4.11 Drains
 - 3.4.12 Installation of Fire Department Connection
 - 3.4.13 Identification Signs
- 3.5 ELECTRICAL WORK
- 3.6 DISINFECTION
- 3.7 PIPE COLOR CODE MARKING
- 3.8 PRELIMINARY TESTS
 - 3.8.1 Aboveground Piping
 - 3.8.1.1 Hydrostatic Testing
 - 3.8.1.2 Backflow Prevention Assembly Forward Flow Test
 - 3.8.2 Testing of Alarm Devices
 - 3.8.3 Main Drain Flow Test
- 3.9 FINAL ACCEPTANCE TEST
- 3.10 ON-SITE TRAINING

-- End of Section Table of Contents --

SECTION 21 13 13.00 10

***4 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION
10/07**

PART 1 GENERAL

1.1 REFERENCES

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 WATER WORKS ASSOCIATION (AWWA)

AWWA 10084	(2005) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(2004) Hypochlorites
AWWA B301	(2004) Liquid Chlorine
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains
AWWA C652	(2002) Disinfection of Water-Storage Facilities

ASME INTERNATIONAL (ASME)

ASME B16.1	(2005) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.11	(2005) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2005) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.3	(2006) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2006) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.9	(2003) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.2	(1987; R 2005) Standard for Square and Hex Nuts (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A 183	(2003) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A 449	(2007b) Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated,

120/105/90 ksi Minimum Tensile Strength,
General Use

ASTM A 47/A 47M (1999; R 2004) Standard Specification for
Steel Sheet, Aluminum-Coated, by the
Hot-Dip Process

ASTM A 536 (1984; R 2004) Standard Specification for
Ductile Iron Castings

ASTM F 436 (2007a) Hardened Steel Washers

FM GLOBAL (FM)

FM P7825a (2005) Approval Guide Fire Protection

FM P7825b (2005) Approval Guide Electrical Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (2006; Errata 2007) Installation of
Sprinkler Systems

NFPA 24 (2006) Standard for the Installation of
Private Fire Service Mains and Their
Appurtenances

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES
(NICET)

NICET 1014-7 (2003) 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 Fire Prot Dir (2007) Fire Protection Equipment Directory

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-600-01 (2006) Fire Protection Engineering for
Facilities

1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided as indicated on the drawings. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13 and UFC 3-600-01. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation. The Contractor shall design any portions of the sprinkler system that are not indicated on the drawings including locating sprinklers, piping and equipment, and size piping and equipment when this information is not indicated on the drawings or is not specified herein. The design of the sprinkler system shall be based on hydraulic calculations, and the other provisions specified herein.

1.2.1 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density over the hydraulically most demanding floor area indicated on drawings. Hydraulic calculations shall be in accordance with the Area/Density Method of [NFPA 13](#). Water velocity in the piping shall not exceed [32 ft/s](#).

1.2.1.1 Hose Demand

An allowance for exterior hose streams indicated on drawings shall be added to the sprinkler system demand at the fire hydrant closest to the point where the water service enters the building.

1.2.1.2 Basis for Calculations

The design of the system shall be based upon the water supply. Water supply shall be presumed available at the base of the riser. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, and 100 for existing underground piping.

1.2.2 Sprinkler Coverage

Sprinklers shall be uniformly spaced on branch lines. Sprinklers shall provide coverage throughout 100 percent of the building. Coverage per sprinkler shall be in accordance with [NFPA 13](#), but shall not exceed [100 square feet](#) for extra hazard occupancies, [130 square feet](#) for ordinary hazard occupancies, and [225 square feet](#) for light hazard occupancies.

1.3 COORDINATION OF TRADES

Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinkler shall be installed over and under piping when such equipment can negatively effect or disrupt the sprinkler discharge pattern and coverage.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section [01 33 00 SUBMITTAL PROCEDURES](#):

[SD-02 Shop Drawings](#)

Shop Drawings; G, A/E

Three copies of the Sprinkler System Shop Drawings, no later than 21 days prior to the start of sprinkler system installation.

As-Built Drawings; G

As-built shop drawings, at least 14 days after completion of the Final Tests. The Sprinkler System Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

SD-03 Product Data

Fire Protection Related Submittals

A list of the Fire Protection Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist.

Sway Bracing; G, A/E

For systems that are required to be protected against damage from earthquakes, load calculations shall be provided for sizing of sway bracing.

Materials and Equipment; G, A/E

Manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; G, A/E

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Spare Parts

Spare parts data shall be included for each different item of material and equipment specified.

Preliminary Tests; G, A/E

Proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests. Proposed date and time to begin the preliminary tests.

Final Acceptance Test; G, A/E

Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests. Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test.

Notification shall include a copy of the Contractor's Material & Test Certificates.

On-site Training; G

Proposed On-site Training schedule, at least 14 days prior to the start of related training.

Fire Protection Specialist; G, A/E

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system drawings and hydraulic calculations.

Sprinkler System Installer; G, A/E

The name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

SD-06 Test Reports

Preliminary Test Report; G, A/E

Three copies of the completed Preliminary Test Report, no later than 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

Final Acceptance Test Report; G, A/E

Three copies of the completed Final Acceptance Tests Reports, no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist.

SD-07 Certificates

Inspection by Fire Protection Specialist; G, A/E

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions; G, RO

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall 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 including the name of a local supplier, 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 shall be capable of providing 4 hour on-site response to a service call on an emergency basis.

1.7 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 and UFC 3-600-01 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.8 FIRE PROTECTION SPECIALIST

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall 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.

1.9 SPRINKLER SYSTEM INSTALLER

Work specified in this section shall be performed by the Sprinkler System Installer. The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the Contract documents, and shall 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.

1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA and UFC standards are mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this

specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.11 SPARE PARTS

The Contractor shall submit spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

1.12 SHOP DRAWINGS

The Sprinkler System Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

- a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.
- b. Floor plans drawn to a scale not less than $1/4" = 1'-0"$ which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.
- c. 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 shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.
- d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.
- e. Details of the 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.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in **UL Fire Prot Dir** or approved by Factory Mutual and listed in **FM P7825a** and **FM P7825b**. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in **UL Fire Prot Dir** or **FM P7825a** and **FM P7825b**

2.4 ABOVEGROUND PIPING COMPONENTS

Aboveground piping shall be steel.

2.4.1 Steel Piping Components

2.4.1.1 Steel Pipe

Except as modified herein, steel pipe shall be rigid black Schedule 40. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation. Roll grooved piping is not acceptable.

2.4.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to **ASME B16.4**, steel conforming to **ASME B16.9** or **ASME B16.11**, or malleable iron conforming to **ASME B16.3**. Steel press fittings shall be approved for fire protection systems. Galvanized fittings shall be used for piping systems or portions of piping systems utilizing galvanized piping. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.4.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than **175 psi** service and shall be the product of the same manufacturer; segmented welded fittings shall not be used. Fitting and coupling houses shall be malleable iron conforming to **ASTM A 47/A 47M**, Grade 32510; ductile iron conforming to **ASTM A 536**, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to **ASTM A 183** and shall be cadmium plated or zinc electroplated.

2.4.1.4 Flanges

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

2.4.1.5 Bolts, Nut, and Washers

Bolts shall be conform to **ASTM A 449**, Type 1 and shall extend no less than three full threads beyond the nut with bolts tightened to the required torque. Nuts shall be hexagon type conforming to **ASME B18.2.2**. Washers

shall meet the requirements of [ASTM F 436](#). Flat circular washers shall be provided under all bolt heads and nuts.

2.4.2 Pipe Hangers

Hangers shall be listed in [UL Fire Prot Dir](#) or [FM P7825a](#) and [FM P7825b](#) and of the type suitable for the application, construction, and pipe type and sized to be supported.

2.4.3 Valves

2.5 SPRINKLERS

Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed coverage limitations. Temperature classification shall be ordinary. Sprinklers in high heat areas or in close proximity to unit heaters shall have temperature classification in accordance with [NFPA 13](#). Extended coverage sprinklers shall not be used.

2.5.1 Recessed Sprinkler

Recessed sprinkler shall be chrome-plated quick-response type and shall have a nominal [1/2 inch](#) or [17/32 inch](#) orifice.

2.5.2 Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, quick-response type with nominal [1/2 inch](#) or [17/32 inch](#) orifice. Pendent sprinklers shall have a polished chrome finish.

2.5.3 Upright Sprinkler

Upright sprinkler shall be brass quick-response type and shall have a nominal [1/2 inch](#) or [17/32 inch](#) orifice.

2.5.4 Sidewall Sprinkler

Sidewall sprinkler shall have a nominal [1/2 inch](#) orifice. Sidewall sprinkler shall have a polished chrome finish. Sidewall sprinkler shall be the quick-response type.

2.5.5 Dry Sprinkler Assembly

Dry sprinkler assembly shall be of the pendent, upright, sidewall, or 45-degree type as indicated. Assembly shall include an integral escutcheon. Maximum length shall not exceed maximum indicated in [UL Fire Prot Dir](#). Sprinklers shall have a polished chrome finish.

2.6 DISINFECTING MATERIALS

2.6.1 Liquid Chlorine

Liquid chlorine shall conform to [AWWA B301](#).

2.6.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to [AWWA B300](#).

2.7 ACCESSORIES

2.7.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with **NFPA 13** and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.7.2 Pendent Sprinkler Escutcheon

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

2.7.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.7.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located below 8 feet in unfinished areas.

2.7.5 Identification Sign

Valve identification sign shall be minimum **6 inches wide x 2 inches high** with enamel baked finish on minimum **18 gauge** steel or **0.024 inch** aluminum with red letters on a white background or white letters on red background. Wording of sign shall 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.

PART 3 EXECUTION

3.1 FIRE PROTECTION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation of the sprinkler systems(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of **NFPA 13**, **NFPA 24** and publications referenced therein. Installation of in-rack sprinklers shall comply with applicable provisions of **NFPA 13**.

3.3 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the sprinkler system periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements. The Fire Protection Specialist shall witness the preliminary and final

tests, and shall sign the test results. The Fire Protection Specialist, after completion of the system inspections and a successful final test, shall certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.4 ABOVEGROUND PIPING INSTALLATION

3.4.1 Protection of Piping Against Earthquake Damage

The system piping shall be seismically protected against damage from earthquakes. This requirement is not subject to determination under NFPA 13. Install the seismic protection of the system piping in accordance with UFC 3-310-04, NFPA 13 and Annex A. Include the required features identified therein that are applicable to the specific piping system.

3.4.2 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall 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 shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.4.4 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 1 inch pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 12 inches for steel pipe. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 1 inch below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 4 inches. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area.

3.4.4.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be centered in ceiling grid.

3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 30 inches in length shall be individually supported.

3.4.6 Pipe Joints

Pipe joints shall conform to **NFPA 13**, except as modified herein. Not more than four threads shall 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 shall be provided where indicated or required by **NFPA 13**. Grooved pipe and fittings shall 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 shall be products of the same manufacturer. For copper tubing, pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall 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 shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.4.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not 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 $1/2$ inch.

3.4.8 Pipe Penetrations

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 shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per **NFPA 13**. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section **07 84 00 FIRESTOPPING**. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall 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.

3.4.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.4.10 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 1 inch pipe

connected at the riser; 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." The discharge shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

3.4.11 Drains

Main drain piping shall be provided to discharge at a safe point outside the building. Auxiliary drains shall be provided as required by [NFPA 13](#).

3.4.12 Installation of Fire Department Connection

Connection shall be mounted on the exterior wall approximately 3 feet above finished grade. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with [NFPA 13](#) and arranged to drain to the outside.

3.4.13 Identification Signs

Signs shall 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](#). Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in [NFPA 13](#).

3.5 ELECTRICAL WORK

Except as modified herein, electric equipment and wiring shall be in accordance with Section [26 20 00 INTERIOR DISTRIBUTION SYSTEM](#). Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section [28 31 64.00 10 FIRE DETECTION AND ALARM SYSTEM](#). Wiring color code shall remain uniform throughout the system.

3.6 DISINFECTION

After all system components are installed and hydrostatic test(s) are successfully completed, each portion of the system upstream of the backflow preventer shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with [AWWA C651](#) and [AWWA C652](#). The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from system which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with [AWWA 10084](#). The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection

shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained. After successful completion, verify installation of all sprinklers and plugs and pressure test the system.

3.7 PIPE COLOR CODE MARKING

Color code marking of piping shall match existing building color code.

3.8 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with [NFPA 13](#) and [NFPA 24](#). Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.8.1 Aboveground Piping

3.8.1.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with [NFPA 13](#) at not less than 200 psi or 50 psi in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.8.1.2 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly shall be tested at system flow demand, including all applicable hose streams, as specified in [NFPA 13](#). The Contractor shall provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5 inch diameter hoses, playpipe nozzles, calibrated pressure gauges, and pitot tube gauge. The Contractor shall 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) across the assembly shall be recorded. A metal placard shall 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. The pressure drop shall be compared to the manufacturer's data.

3.8.2 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

3.8.3 Main Drain Flow Test

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

SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.9 FINAL ACCEPTANCE TEST

Final Acceptance Test shall begin only when the [Preliminary Test Report](#) has been approved. The Fire Protection Specialist shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of [as-built drawings](#) and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received. The Contractor shall submit the [Final Acceptance Test Report](#) as specified in the Submittals paragraph.

3.10 ON-SITE TRAINING

The Fire Protection Specialist shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 4 hours of normal working time and shall start after the system is functionally complete and after the Final Acceptance Test. The On-Site Training shall cover all of the items contained in the approved [Operating and Maintenance Instructions](#).

-- End of Section --