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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.

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

Recommended changes to a NASAKSC Master Specification Section should be submitted as a Criteria Change Request (CCR) to the appropriate Technical Proponent (TP) through the SpecsIntact Help Desk.

PART 1 GENERAL

This is a performance based specification with the Contractor responsible for providing engineering design, installation and testing associated with the work to be performed. Perform design work by a "delegated engineer", as defined under Florida Statutes, Chapter 471, who is a Professional Engineer, competent in fire protection engineering, licensed to practice in Florida.

NOTE: If Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS and Section 21 09 00.00 98 PREACTION CONTROL SYSTEMS is not included in the project specification, insert applicable requirements therefrom and delete the following paragraph.

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS and Section 21 09 00.00 98 PREACTION CONTROL SYSTEMS applies to work specified in this section. Provide design and installation in accordance with NFPA Standards. The interpretation of NFPA Standards rests with the [Kennedy Space Center] [Cape Canaveral Air Force Station] Fire Protection Engineer who is the Authority Having Jurisdiction (AHJ), and whose opinion is final.

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 are automatically deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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 INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 317 (1992; Reprint 1999) ASD Manual of Steel Construction, Vol II: Connections

ASME INTERNATIONAL (ASME)

ASME A112.18.1/CSA B125.1 (2012) Plumbing Supply Fittings

ASME B16.34 (2013) Valves - Flanged, Threaded and Welding End

ASME B16.39 (2014) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300

ASME B16.4 (2011) Standard for Gray Iron Threaded Fittings; Classes 125 and 250

ASME B16.5 (2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B16.9 (2012) Standard for Factory-Made Wrought Steel Butt welding Fittings

ASME B31.1 (2014; INT 1-47) Power Piping

ASTM INTERNATIONAL (ASTM)

ASTM A126 (2004; R 2014) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM A135/A135M (2009; R2014) Standard Specification for Electric-Resistance-Welded Steel Pipe

ASTM A183 (2014) Standard Specification for Carbon Steel Track Bolts and Nuts

ASTM A234/A234M (2013; E 2014) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

ASTM A307	(2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A563	(2007a; R2014) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A563M	(2007; R 2013) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM A795/A795M	(2013) Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM C592	(2013) Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
ASTM D2000	(2012) Standard Classification System for Rubber Products in Automotive Applications
ASTM F568M	(2007) Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners
FM GLOBAL (FM)	
FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-58	(1993; Reaffirmed 2010) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 13	(2013; TIA 10-1; TIA 11-2; ERTA 2014; TIA 14-3) Standard for the Installation of Sprinkler Systems
NFPA 13E	(2015) Recommended Practice for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems
NFPA 14	(2013) Standard for the Installation of Standpipes and Hose Systems
NFPA 1963	(2014) Standard for Fire Hose Connections

NFPA 24 (2013) Standard for the Installation of Private Fire Service Mains and Their Appurtenances

NFPA 251 (2006) Standard Methods of Tests of Fire Resistance of Building Construction and Materials

NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code

NFPA 72 (2013) National Fire Alarm and Signaling Code

NFPA 75 (2013; Errata 2013) Standard for the Protection of Information Technology Equipment

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7 (2010) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101 (2014; Rev C) Color Code for Pipelines and for Compressed Gas Cylinders

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595 (Rev C; Notice 1) Colors Used in Government Procurement

CID A-A-1922 (Rev A; Notice 2) Shield, Expansion (Caulking Anchors, Single Lead)

CID A-A-1923 (Rev A; Notice 2) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)

CID A-A-1924 (Rev A; Notice 2) Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors)

CID A-A-1925 (Rev A; Notice 2) Shield Expansion (Nail Anchors)

CID A-A-55614 (Basic; Notice 2) Shield, Expansion (Non-Drilling Expansion Anchors)

CID A-A-55615 (Basic; Notice 2) Shield, Expansion (Wood Screw and Lag Bolt Self-Threading Anchors)

UNDERWRITERS LABORATORIES (UL)

UL 6 (2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel

UL Fire Prot Dir (2012) Fire Protection Equipment Directory

1.2 SUBMITTALS

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Keep submittals to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

An "S" following a submittal item indicates that the submittal is required for the Sustainability Notebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Records of Existing Conditions [; G]

Contractor's State Certification [; G]

SD-02 Shop Drawings

Connection Diagrams [; G]

Schematics and Fabrication Drawings [; G]

Fire Service Floor Plans [; G]

Records of Existing Conditions [; G]

Design Analysis and Calculations [; G]

Preaction Sprinkler Systems [; G]

As-Built drawings [; G]

SD-03 Product Data

Piping Materials [; G]

Supporting Elements [; G]

Riser Alarm Equipment [; G]

Compressed Air Supply Equipment [; G]

Fire Department Connections [; G]

Preaction Control Systems [; G]

Standpipe Equipment [; G]

Sprinkler Heads [; G]

Valves [; G]

Miscellaneous Materials [; G]

Identification Tags [; G]

Sound Stopping [; G]

Fire Stopping [; G]

Inspector's Test Valve [; G]

Fire-Protection System [; G]

SD-05 Design Data

Hydraulic Calculations [; G]

SD-06 Test Reports

Pressure Tests [; G]

Air Tests [; G]

Valve-Operating Tests [; G]

Drainage Tests [; G]

Inspector'S Valve Station Tests [; G]

Pneumatic Tests [; G]

System Operating Tests [; G]

SD-07 Certificates

Quality Control Plan[; G]

SD-10 Operation and Maintenance Data

Operations and Maintenance Manuals[; G]

1.3 QUALITY CONTROL

1.3.1 Quality Control Plan

Provide equipment under this specification to be manufactured sprinkler system equipment which meets the requirements in accordance with the paragraph SYSTEM REQUIREMENTS. Provide the latest standard design, and list by Underwriters' Laboratories or approved by Factory Mutual and make suitable for the intended use. Provide one copy of the test procedures and recording forms for the preliminary tests. Provide 10 copies of the test procedures and recording forms for the final acceptance tests.

Installed components under this contract cannot be more than one year older than the date of installation.

Prepare a test procedure and test record forms for conducting and recording complete tests on [preaction sprinkler systems](#) installed in accordance with the hydraulic calculations, the installation drawings and these specifications. Submit for approval, the test procedure to the Contracting Officer at least 30 days prior to the preliminary system test described in the paragraph SYSTEM TESTING. Provide test procedure to identify each sprinkler component to be tested. Describe the initial condition, each step or function in the test, required test results, and equipment to be employed. Provide test forms with suitable spaces for recording test results on all equipment, devices, and wiring to be tested. Provide identified spaces on test record forms for verification signatures of official witnesses and dates of the test.

Submit proof that all components are Underwriter Laboratory [UL Fire Prot Dir](#) listed or Factory Mutual [FM APP GUIDE](#) approved for their intended use and function. Provide materials and equipment furnished that are compatible with the existing system.

1.3.2 Services of a Certified Automatic Sprinkler Specialist

Provide services of a Certified Specialist thoroughly experienced in automatic sprinkler system installations on site to perform or directly supervise the installation. Provide all necessary adjustments and perform all tests on the wet pipe sprinkler system at the site.

Ensure Sprinkler System Specialist is considered certified when the specialist holds a valid Sprinkler System Layout, Level III Certification from the National Institute for Certification in Engineering Technologies [NICET 1014-7](#) or is licensed by the State of Florida as a Contractor Class I in accordance with Florida State Statute, Chapter 633, Section 633.521 and holds a current Certificate of Competency.

Certification of other recognized agencies with equivalent requirements are considered. Provide evidence of the [Contractor's State Certification](#) and the basis of certification to the Contracting Officer for approval prior to any work being performed at Kennedy Space Center.

1.4 PROJECT SITE CONDITIONS

1.4.1 Existing Conditions

Indicate on the [fire service floor plans](#) the location of the preaction automatic sprinkler system risers, sprinkler piping (size and length), pipe hangers, preaction compressor and disconnect switch, sprinkler head type and locations, valves, riser trim and associated components, etc. to comply with [NFPA 13 WORKING PLANS](#). Coordinate the requirements of the Fire Alarm System Fire Service Floor Plan such that all fire alarm and suppression system devices are combined on a single Fire Service Floor Plan. Provide a symbol legend, which clearly identifies each device shown on the Fire Service Floor Plan. Install a copy of the Fire Service Floor plan minimum size [0.457 by 0.61 m 18-inches by 24-inches](#) in a painted metal frame with flexiglass Plexiglas cover. Prior to installation submit the floor plan and its location for approval to the Contracting Officer.

Submit [records of existing conditions](#) showing the results of Contractor's survey of work area conditions and features of existing structures and facilities within and adjacent to the job site. Commencement of work constitutes acceptance of existing conditions.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Submit [connection diagrams](#) indicating the relations and connections of the preaction sprinkler system.

Submit [schematics and fabrication drawings](#) for the system indicating functional and physical interfaces with facilities and other systems. Indicate on drawings the general physical layout of all controls, and internal tubing and wiring details.

Also include fabrication and assembly drawings of work performed in the shop prior to installation and at the actual job site. Fabrication drawings to meet all requirements in [NFPA 13](#), stipulated for working plans to include a building cross section. Sign and seal working plans by a Professional Engineer, licensed to practice in the state of Florida.

Indicate on working plans all sprinkler piping (size and length), pipe hangers, sprinkler head type and locations, valves, riser trim and associated components, etc. to comply with [NFPA 13, WORKING PLANS](#). Locate sprinkler heads in a consistent pattern with ceiling grid, lights, and supply and return air diffusers. Locate heads in center of tile for spaces with lay-in type ceilings, unless otherwise approved by the Contracting Officer. Provide design that gives full consideration to blind spaces, other system piping, electrical equipment, HVAC ductwork, and all other types of obstructions which could prevent the proper installation and operation of the preaction sprinkler systems.

2.1.1 Design Requirements

Submit [design analysis and calculations](#) for automatic sprinkler systems and standpipe systems to provide uniform distribution of water over the design area. Include design density, hydraulically most remote area, occupancy classification, sprinkler head orifice size and pipe velocities. Specify the design density in gpm per sq ft or L/m per sq m of floor area. Provide discharge from individual heads in the hydraulically most remote area to be

between 100 percent and 120 percent of the specified density.

Design systems such that pipe velocities do not exceed 6.1 m/second 20-feet per second.

2.1.2 System requirements

Provide a new automatic preaction sprinkler system consisting of but not limited to a [double interlocked pneumatic/electric] [single interlocked electric] releasing preaction valve with all associated trim, air compressor with air maintenance device, OS&Y isolation valves, floor drains, pressure switches, and dry pendant sprinkler heads. Provide design, equipment, materials, installation, workmanship, examination, inspection, and testing in strict accordance with the required and advisory provisions of NFPA 13, NFPA 24, NFPA 72 and NFPA 75 except as modified herein. Provide an operationally compliant system to include all materials, accessories, and equipment inside and outside the building. Provide system design to give full consideration to blind spaces, piping, electrical equipment, ductwork, and other construction and equipment in accordance with detailed drawings to be submitted for approval prior to installation. Locate sprinkler heads in a consistent pattern with ceiling grids, lights, speakers, supply diffusers, return diffusers, and other ceiling mounted items.

Provide all additional equipment, junction boxes, conduit, and labor to meet the requirements and intent of this specification.

2.2 COMPONENTS

2.2.1 Piping Materials

2.2.1.1 Type BCS - Black Carbon Steel

Provide piping DN 6 through DN 50 1/8-inch through 2-inches: Schedule 40 furnace butt weld black-carbon steel conforming to ASTM A53/A53M, ASTM A135/A135M, or ASTM A795/A795M, Type F furnace butt welded.

Provide piping DN 65 through DN 206 2-1/2-inches through 8-inches: Schedule 40 seamless or electric-resistance welded black carbon steel, conforming to ASTM A53/A53M, ASTM A135/A135M, or ASTM A795/A795M Type E (electric-resistance welded), Grade B, or Type S (seamless), Grade B.

Provide unions DN 50 2-inches and under: 2068 kilopascal's 300-psi pounds per square inch gage (psig) working steam pressure (wsp) female, screwed, black malleable iron, with ground joint and brass-to-iron seat conforming to ASME B16.39

Provide extra-heavy screwed black steel standard pipe couplings.

Provide fittings DN 50 2-inches and under: 1207 kilopascal's 175 psi working pressure, cast iron, screwed conforming to ASTM A126, Class A, and ASME B16.4.

Provide fittings DN 65 2-1/2-inches and larger: 1207 kilopascal's 175 psi working pressure, wrought steel, butt-weld fittings, wall thickness to match piping system, complying with ASME B16.9 and 68 kilogram 150 pound steel flanges complying with ASME B16.5.

Provide elbows that are of the long radius type.

Provide grooved pipe couplings (all sizes): 207 kilopascal's 175 psig minimum working pressure with a housing fabricated in two or more parts of black malleable-iron castings. Mold coupling gasket of synthetic rubber, conforming to requirements of ASTM D2000. Provide coupling bolts that are oval-neck, track-head type with heavy hexagonal nuts, conforming to ASTM A183

Fabricate grooved fittings (all sizes): 1207 kilopascal's 175 psig working pressure fittings used with grooved couplings of black malleable-iron castings, and of the same manufacture as the pipe coupling. Fabricate fittings from Grade B seamless-steel pipe and long-radius seamless welding fittings, with wall thickness to match pipe, conforming to ASTM A234/A234M and ASME B16.9 if a manufacturer's standard-size malleable-iron fitting pattern is not available.

Use only pre-manufactured concentric or eccentric reducing fittings or reducing tees/elbows to reduce pipe size. Do not use bushings.

Pre-manufactured shaped welded outlets (weld-o-lets) are allowed in lieu of "tee" fittings, where the branch pipe outlet is at least one pipe diameter smaller than the main.

Do not use non-grooved products which rely in any way upon gasketing, clamps, straps, or set screws for maintaining system integrity.

Do not use adjustable "drop nipples" which utilize an O-ring type seal arrangement.

2.2.2 Supporting Elements

Provide piping system components and miscellaneous supporting elements, including, but not limited to, building-structure attachments; standpipe equipment and fire hose cabinet stations; supplementary steel; hanger rods, stanchions, and fixtures; vertical-pipe attachments; horizontal-pipe attachments; restraining anchors; and guides. Provide supporting elements for natural, and other external forces, that are suitable for stresses imposed by systems pressures and temperatures. Include an additional 113 kilogram 250 pound load at each anchor per NFPA 13.

NOTE: Refer to Section 23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT if design can induce vibration considerations. requires vibration isolation.

Provide supporting elements that are FM approved or UL listed and conform to ASME B31.1, MSS SP-58, and ASME B16.34.

2.2.2.1 Building-Structure Attachments

a. Anchor Devices, Concrete and Masonry

Ensure anchor devices conform to CID A-A-1922, CID A-A-1923, CID A-A-1924A, CID A-A-1925, CID A-A-55614 and CID A-A-55615:

Group I:	Shield, expansion (lead, bolt, and stud anchors)
Group II:	Shield, expansion (bolt anchors), Type 2, Class 2, Style 1 or 2
Group III:	Shield, expansion (self drilling tubular expansion shell bolt anchors)

Provide adjustable positions for cast-in floor mounted equipment devices.

Do not use powder-actuated anchoring devices to support mechanical-systems components.

b. Beam Clamps

Provide beam clamps that are center-loading Types 21, 28, 29, and 30, UL listed, cataloged, and load-rated commercially manufactured products.

Type 20 beam clamps are allowed for pipe DN 50 2-inches and under.

Where Type 25 beam clamps are used, use two per point of pipe support.

c. C-Clamps

NOTE: Avoid C-clamps, as a means of attaching hangers to structural steel. Z-Purlin Beam Clamps can be used if approved by the contracting officer and KSC AHJ. Where used, consider vibration forces and single or accumulated load and resultant moment on structural steel.

Do not use c-clamps.

d. Inserts, Concrete

Construct concrete inserts in accordance with the requirements of MSS SP-58 for Type 18 or 19 and ASME B16.34. Insert a 304.8 mm 1-foot length of 12.7 mm 1/2-inch reinforcing rod and wire through wing slots when applied to 2-inch iron pipe size (ips) and larger, and where otherwise required by imposed loads.

2.2.2.2 Horizontal-Pipe Attachments

2.2.2.3 Single Pipes

Support piping in sizes up to and including DN 50 2-inch (IPS) by Type 1, 5, 6, 7, 9, 10, 11, or 12 solid, split-ring, or band type attachments.

Support piping in sizes DN 65 2-1/2 inches and larger by Type 1, 2, 3, or 4 attachments or with Type 41 or Type 49 pipe rolls.

2.2.2.4 Parallel Fire-Protection Pipes

Provide trapeze hangers fabricated from approved structural steel shapes, with U-bolts, when so specified. Conform structural steel shapes to

supplementary steel requirements or provide the support of commercially available, approved proprietary-design rolled steel.

2.2.2.5 Vertical-Pipe Attachments

Provide Type 8 single vertical pipe attachments.

2.2.2.6 Hanger Rods and Fixtures

Use only circular solid cross section rod hangers to connect building structure attachments to pipe-support devices. Provide pipe, straps, or bars of equivalent strength for hangers.

Provide turnbuckles, swing eyes, and clevises as required by support system to accommodate temperature changes, pipe accessibility, and adjustment for load and pitch.

2.2.2.7 Supplementary Steel

Design and fabricate supplementary steel in accordance with [AISC 317](#) where necessary to frame structural members between existing members or where structural members are used in lieu of commercially rated supports.

Provide supplementary steel that is hot dipped galvanized or otherwise protected from corrosion as approved by the Contracting Officer.

2.2.3 Fire Department Connections

Provide hose connections that have National Fire hose standard-thread form and rocker lugs in accordance with [NFPA 1963](#). Ensure hose connection sizes and threads are compatible with the equipment used by the fire department serving the facility.

2.2.3.1 Wall Siamese

Provide unit that is [cast brass] [bronze] flush-mounted escutcheon-plate type, with two [DN 65 2-1/2-inch](#), fire-department, swivel, female inlets; double-clapper valves; rocker-lug caps and chains; and cast-in function-identifying lettering. Provide with a chrome-plate or polish surface finishing accordance with [ASME A112.18.1/CSA B125.1](#).

2.2.3.2 Sidewalk Siamese

Provide unit that is [cast brass] [bronze], with two [DN 65 2-1/2-inch](#), fire-department, swivel, female inlets; double-clapper valves; rocker-lug caps and chains; and cast-in function-identifying lettering. Provide chrome-plated or polished surface finish. Fabricate chrome plate in accordance with [ASME A112.18.1/CSA B125.1](#). Mount unit on a Schedule 40 [ASTM A53/A53M](#) galvanized carbon-steel pipe with red-enameled finish on prime-coated surface. Protect all surfaces embedded in concrete or below grade with a 20-mil thick bituminous coating.

2.2.3.3 Wall Hydrant

Provide unit that is [cast brass] [bronze] flush-mounted escutcheon-plate type with two [DN 65 2-1/2-inch](#), fire-department, male outlets; rocker-lug caps and chains; and cast-in function-identifying lettering. Provide a chrome-plate or polish surface finish in accordance with [ASME A112.18.1/CSA B125.1](#).

2.2.4 Sprinkler Heads

2.2.4.1 Head Types

Provide standard 12.7 mm 1/2-inch orifice [dry pendant] sprinkler heads.

Provide semi-recessed chrome-plated brass heads in finished areas below suspended ceilings . Provide escutcheon plate that is brass with a baked enamel or chrome plate finish to match ceiling.

[Provide return bends or FM approve FlexHead commercial ceiling sprinkler assembly with a maximum overall length of 2.1 m 7 feet for heads required to be located in the center of the suspended ceiling tiles.

] Provide concealed pendant type heads with a low-profile small-diameter cover plate with a factory applied finish for heads required to be concealed where the appearance of a smooth ceiling is required to match suspended ceiling tiles.

[Provide return bends for heads required to be located in the center of the suspended ceiling tiles.

]2.2.4.2 Temperature Rating

Provide fusible links that are ordinary temperature classification, except where otherwise indicated, or locations as defined in NFPA 13 requiring intermediate or high temperature heads.

2.2.4.3 Spares

Provide spares for each type of sprinkler head, complete with appropriate storage cabinet and wrench. Provide number of heads in accordance with NFPA 13. Mount cabinet next to riser or other location as directed by the Contracting Officer.

2.2.4.4 Head Protection

Protect heads with paper or plastic bags during painting operations. Remove protection immediately upon finishing painting operations.

Provide head guards constructed of steel wire where mechanical damage could occur. Provide red enamel guard finish.

2.2.5 Valves

2.2.5.1 Aboveground

Provide gate, globe, and check valves (all sizes) that are FM approved or UL listed.

Provide ball valves, DN 50 2-inches and under, that are FM approved, and rated 2070 kilopascal's 300 psi, with provisions to wire or lock handle in place where critical alarm function is isolated.

Provide gate valves that are of the outside screw and yoke configuration, cast iron body and wedge, bronze yoke bushing, seat ring and face ring. Provide solid wedge and construct of cast iron or bronze. Provide valves that are flanged or grooved and rated for 1206 kilopascal's 175 psi

non-shock cold water.

Provide angle valves (for main drain) that have bodies constructed of bronze with bronze disk, screwed or union bonnet type. Provide rubber disk seat. Provide valves that have screwed ends and are rated for 1206 kilopascal's 175 psi non-shock cold water.

Supervise all control and isolation valves using a tamper switch.

2.2.6 Miscellaneous Materials

2.2.6.1 Bolting

Provide flange and general-purpose bolting that is hex-head and conforms to ASTM A307, Grade B, ASTM F568M, Class 4.8 or higher. Ensure heavy hex-nuts conform to ASTM A563 and ASTM A563M. Square-head bolts and nuts are not acceptable.

2.2.6.2 Escutcheons

Provide escutcheons that are manufactured from nonferrous metals and are chrome-plated, except when AISI 300 series corrosion-resistant steel is provided. Ensure metals and finish conform to ASME A112.18.1/CSA B125.1.

Provide escutcheons that are one-piece type where mounted on chrome-plated pipe or tubing and one-piece or split-pattern type elsewhere. Provide escutcheons that have provisions consisting of internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.2.6.3 Flange Gaskets

Provide gaskets that are suitable for the intended use and contain no asbestos.

2.2.6.4 Pipe-Thread Compounds

Use tetrafluoroethylene tape or other suitable compounds.

2.2.7 Fire-Protection System Identification

Provide a coordinated system of piping and equipment identification which includes the following:

- a. Framed and plastic-protected diagrammatic layout of all piping systems, identifying and locating piping, equipment, and valves. Where existing systems are being modified, bring existing layouts up to date.
- b. Metal-tag-identified major valves, piping-system components, and equipment
- c. Metal identification plate at controlling alarm valve identifying system and area protected
- d. Service-labeled piping

2.2.7.1 Diagrams

List equipment on chart by designation number and show pertinent data. Provide drawings that are neat, mechanical drawings mounted in extruded

aluminum frames, with 3 mm 1/8-inch thick acrylic plastic protection. Locate as directed by the Contracting Officer. Provide a minimum of one mounted chart and diagram, plus one extra copy of each, for each fire-protection system.

2.2.7.2 Metal Tags

Install identification tags made of brass or aluminum and indicating function of valve or similar component devices. Provide tags no less than DN 50 2 inches in diameter and stamp marking.

Provide equipment with metal identification tags bearing an equipment designation number matching the drawing or diagram designations.

Secure tags to valve or equipment items with 2.7 mm 12-gauge galvanized wire.

Provide risers with a stamped metal tag containing the hydraulic design data. Identify main drain and inspectors test stations using metal nameplates with minimum 50 mm 2-inch high lettering chained to the valve.

2.2.7.3 Service Labeling

Label piping, including that concealed in accessible spaces, to designate service. On each label include an arrow or arrows to indicate flow direction. Provide labels or tag designations that are as follows:

<u>SERVICE</u>	<u>LABEL OR TAG DESIGNATION</u>
Main sprinkler supply	MAIN SPRINKLER SUPPLY
Sprinkler riser number	SPRINKLER RISER NO.
Sprinkler branch	SPRINKLER BRANCH
Standpipe equipment	STANDPIPE

Label and arrow piping in accordance with the following:

- a. Each point of entry and exit through walls.
- b. Each change in direction.
- c. Each point in congested or hidden areas required to clarify service or indicate hazard.
- d. Locate labels in long straight runs at a distance visible to each other. Ensure the distance between labels does not exceed 12.2 m 40 feet.
- e. Provide label lettering that is 50 mm 2 inches high. Where the size of pipes is 65 mm 2-1/2 inch outside diameter and smaller, attach labels to 1.6 mm 16-gauge aluminum sheet which is attached to the pipe with 2.7 mm 12-gauge galvanized wire. Provide labels that are legible from the primary service and operating area.
- f. Provide labels that are made of self-sticking plastic film designed for permanent installation. Provide labels that have red letters on white

background.

- g. Label all piping systems and do not construe label and valve tag schedule above as defining or limiting the work.

2.2.8 Painting

Furnish equipment of the manufacturer's standard product with the manufacturer's standard finish coat.

Furnish other mechanical equipment with a shop-applied prime paint.

2.2.9 Main Drains

Provide dedicated drain piping at riser [to discharge to the building exterior] [to discharge to sight cones attached to drains of adequate size to readily accept the full flow from each drain under maximum pressure]. Select discharge location that avoids creating a nuisance or hazardous condition and approved by the Contracting Officer. Increase drain size by one pipe size as required by NFPA for multi-story buildings using a common drain system.

Sleeve and caulk penetration of exterior walls at a height no greater than 610 mm 24-inches and no less than 152 mm 6-inches above grade. Drain lines to terminate in a 45 or 90 degree elbow turned down and discharging to 450 mm 18-inch concrete splash block.

2.3 EQUIPMENT

2.3.1 Sprinkler Riser Equipment

Provide riser alarm equipment that is UL listed or FM approved for fire-protection use.

2.3.2 Standard Check Valve

Provide check valve that is UL listed or FM approved standard swing-check type with elastomer-disc seat. Provide check valve that has a ductile iron body with flanged or grooved ends and is of the clear opening type with flanged inspection and access cover plate for sizes DN 100 4-inches and larger. Install check valve vertically or horizontally and rate for 2068 kilopascal's 300 psi working pressure. Provide clapper that is type 304 stainless steel or bronze with field replaceable EDPM or Nitrite seal, with nickel or bronze seat. Provide spring, hinge shaft, and retaining ring to be stainless steel and paint the valve body with a corrosion resistant non-lead coating.

2.3.3 Preaction Valve

Provide a preaction valve that is a Viking [double interlocked pneumatic/electric] [single interlocked electric] interlocking deluge type. Provide standard accessories and trim necessary to give a water flow alarm, supervisory alarm for low air pressure, and includes pressure gages, accelerator, priming provisions, testing provisions, deluge valve, supervisor air compressor, release system and all required compressed-air and water piping, fittings, and valves. Install accelerator(s) as needed to meet the 60 second discharge time required by the paragraph SYSTEM TESTING.

Provide deluge valve that is of the diaphragm type with field replaceable diaphragm and seat EDPM materials, without removal from the system. Construct valves of ductile iron, rated for a minimum 1207 kilopascal's 175 psi working pressure. Provide valve that is [double interlocked electric/pneumatic] [single interlock electric] releasing type and designed to allow for resetting without having to open the valve. Provide the manufacturers standard trim package consisting of all gauges, manual release station, unions, fittings, drains and valves as required for a completely functional installation. Provide galvanized trip piping and fittings.

Provide pressure switches to indicate alarm and supervisory trouble corresponding to an increase in water pressure or a loss of air pressure respectively.

Provide releasing means through a solenoid valve.

Provide solenoid valve that is an electrically operated control valve UL listed or FM approved for releasing of [deluge] [preaction] sprinkler valves. Provide solenoid that is the normally closed type and is electrically energized to open.

Provide a suppression system safing/disconnect switch for maintenance purposes and disconnect both conductors upon switching. Provide circuits that are Class B, with yellow positive/violet negative conductors. Provide item that is Best Lock Switch No. 1W702-S4D, and install in a separate enclosure, with an engraved phenolic sign stating, "Preaction System Safing Switch."

2.3.4 Compressed Air Supply Equipment

2.3.4.1 Riser Mounted Compressed Air Independent Source Supply

Maintain preaction system air pressure by an independent air compressor mounted on the riser. Provide compressor that is spring and elastomer vibration isolated from the riser, and is oil free construction, complete with adjustable low-differential set point pressure switch, check valve, and necessary unloader and intercomponent piping and wiring. Provide spare inlet-air filter media.

Supply power for the compressed air system as indicated on the drawings. Provide an independent, properly fused safety disconnect switch with provisions for locking the covers and operating handles in both the "Power ON" and "Power OFF" positions. Locate the disconnect switch within .91 m 3-feet of the compressor. Paint the disconnect switch with two coats of enamel, color No 11105 (red) and permanently affix a label, that reads "Preaction Compressor Disconnect Switch - Fed from Panel [_____] CKT No. [_____]".

2.3.4.2 Floor/Wall Mounted Compressed Air Supply

Provide [floor] [wall] mounted compressed air system complete with air compressor, pressure gages, pressure switches, air maintenance devices, desiccant air dryer and appurtenances. Maintain compressed air system to 275 kilopascal's 40 pounds per square inch pressure on the preaction system piping and transmit a supervisory trouble alarm to the fire alarm control panel when pressure drops below 207 kilopascal's 30 pounds per square inch. Provide pressure switch for controlling the compressor that is field adjustable for both the "on" and "off" pressure settings. Provide

air strainer, air pressure regulator, air restrictor, air check valve, and all other associated piping, valves and fittings for the by-pass line for fast filling the system. Provide compressor that is spring and elastomer vibration-isolated from the floor. Provide pressure gages that are air or oil type calibrated in pounds per square inch. Supply power for the compressed air system as indicated on the drawings. Provide an independent, properly fused safety disconnect switch with provisions for locking the covers and operating handles in both the "Power ON" and "Power OFF" positions. Locate the disconnect switch within .91 m 3-feet of the compressor. Paint the disconnect switch with two coats of enamel, color No 11105 (red) and permanently affix a label, that reads "Preaction Compressor Disconnect Switch - Fed from Panel [_____] CKT No. [_____]".

a. Compressed Air By-Pass Line

Provide air-supply line near each preaction valve with an orifice union having an 3 millimeter 1/8-inch orifice corrosion-resistant steel plate, externally identified, and a 13 mm 1/2-inch 19 mm 3/4-inch three-valve by-pass around the orifice union.

b. Low Air Pressure Supervisory Switch

Provide low air pressure supervisory switch for the preaction sprinkler system and connect to the building fire alarm control panel to activate the system supervisory alarm when air pressure in the sprinkler system drops below 207 kilopascal's 3 psig. Provide a bleeder valve in the airline ahead of the switch for testing operation of the low air pressure switch.

c. Water Flow Alarm Device

Provide water flow alarm devices that are UL listed for the particular type of system. Wire water flow switch to make or break a circuit on rise of water pressure.

Provide water flow alarm device that has a design working pressure of 2068 kilopascal 300 psi. Include two sets of single pole, double throw contacts rated for not less than 2.0 amps at 30 VDC. Provide die-cast housing that is suitable for both indoor and outdoor use and includes knockouts for conduit connections.

d. Pressure Gauge

Provide pressure gauge that is a minimum of 89 mm 3.5-inch in diameter, with a brass or stainless steel case and chrome finish. Ensure pressure gauge has a glass or polycarbonate window, brass dial with white background and black markings, with dual units (English and Metric). Ensure pressure gauge has phosphor bronze bourdon tube, brass precision geared movement, plus or minus 3 percent accuracy, 2068 kilopascal's 300 psi working pressure, and three-way globe style gauge isolation valve with plugged end.

e. Inspector's Test

Provide inspector's test valve that is a combination test and drain device (OFF-TEST-DRAIN), bronze body, bronze ball valve, one quarter turn handle, with an integral sight glass (on discharge side), and internal corrosion resistant orifice, sized to match the sprinkler head orifice size.

2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

Submit fully verified and dated copies of all test data and results with a copy of the approved test procedure and any factory test information

PART 3 EXECUTION

NOTE: Rewrite following paragraph if no NFPA 13, NFPA 13E, NFPA 14, or NFPA 24 work is included in project.

3.1 INSTALLATION

Install system materials and equipment in accordance with the recommendations and provisions of **NFPA 13, NFPA 13E, NFPA 14, and NFPA 24**, and related Codes and Standards contained herein. Perform work in the presence of the Contracting Officer. Notify the Contracting Officer 48 hours in advance of the start of work.

Perform all installation work by licensed fire protection sprinkler contractors, licensed for such work in the state where the work is to be performed.

The riser locations, as well as the number shown on the drawings are approximate in nature. Coordinate with the building construction, system design, Code requirements, water supply limitations and maintenance requirements. Keep the number of risers shown on the documents. Provide and approve exact location and number on the Contractor's shop drawing submittal.

Install wire head guards for heads which could be damaged. Provide water shields for heads located beneath other heads where the spray from the upper head could cool the lower head. Provide multiple levels of protection for locations where existing building elements could disrupt sprinkler or nozzle spray patterns.

Provide return bends for systems with non-potable water sources.

Install piping level flat or sloped back to the riser to allow for drainage. Provide auxiliary drains where trapped piping is unavoidable.

3.1.1 Aboveground Piping-Systems Installation

Run piping parallel with the lines of the building. Install and space piping and components so that a threaded pipe fitting is removable between adjacent pipes and that there is not less than **12.7 mm 1/2-inch** of clear space between the finished surface and the surface of parallel adjacent piping and other work. Arrange hangers on different adjacent service lines running parallel to the lines of the building and each other.

Base load rating for pipe-hanger supports on all lines filled with water. Ensure deflection per span does not exceed slope gradient of pipe. Provide schedule 40 and heavier ferrous pipe supports in accordance with the following minimum rod size and maximum allowable hanger spacing. Reduce allowable span proportionately for concentrated loads such as valves.

<u>HANGAR SPACING FOR PIPE</u>		
<u>PIPE SIZE (DN)</u>	<u>ROD SIZE (Millimeters)</u>	<u>STEEL PIPE (Millimeters)</u>
Up to 25	10	2400
32	10	3600
40	10	4500
65 to 90	10	4500
125	15	4500
150	15	4500
200	15	4500
<u>HANGAR SPACING FOR PIPE</u>		
<u>PIPE SIZE (INCHES)</u>	<u>ROD SIZE (INCHES)</u>	<u>STEEL PIPE (FEET)</u>
Up to 1	3/8	8
1-1/4	3/8	12
1-1/2	3/8	15
2-1/2 to 3-1/2	3/8	15
5	1/2	15
6	1/2	15
8	1/2	15

Support vertical risers at the base where possible and at intervals specified. Install clamps under fittings wherever possible. Support carbon-steel pipe at each floor at not more than 4.5 m 15-feet intervals for pipe DN 50 2-inches and smaller, and at not more than 6.1 m 20-feet intervals for pipe DN 65 2-1/2-inches and larger.

Securely support piping with allowance for thrust forces and thermal expansion and contraction and do not subject to mechanical, chemical, vibration, or other damage, in conformance with ASME B31.1.

Locate and extend riser main drain piping full size to discharge outdoors in as approved by the Contracting Officer.

Locate inspectors test valve approximately 1.5 m 5-feet above finished floor. Provide inspectors test for each sprinkler system or portion thereof, equipped with an alarm device for testing purposes. Locate inspectors test at the hydraulically most remote portion of the sprinkler system. Provide inspectors test to [discharge to the building exterior] [discharge to a drain location sized to accommodate the full flow] without resulting in property damage. Do not permit discharge to janitors sinks

and similar locations.

Provide penetrations of exterior walls to be no greater than 610 mm 24-inches and no less than 152 mm 6-inches above grade, and sleeve and caulk. Install and terminate inspector discharge in a 45 or 90 degree elbow turned down, discharging to an 450 mm 18-inch concrete splash block. Size inspectors test lines to be capable of development of the design flow from one sprinkler without creating excessive back pressure.

Install piping level flat or sloped back towards the riser or the auxiliary drains to allow for drainage. Provide auxiliary drains where trapped piping is unavoidable.

3.1.2 Sound Stopping

Provide effective sound stopping and adequate operating clearance to prevent structure contact where piping penetrates walls, floors, or ceilings. Provide effective sound stopping and adequate operating clearance to prevent structure contact into occupied spaces adjacent to equipment rooms and where similar penetrations occur between occupied spaces and where penetrations occur from pipe chases into occupied spaces. Occupied spaces include space above ceiling where no special acoustic treatment of ceiling is provided. Ensure finish penetrations are compatible with surface being penetrated.

Install sound stopping and vapor-barrier sealing of pipe shafts, and large floor and wall openings by packing with properly supported mineral fiber insulation or by foaming-in-place with self-extinguishing, 0.9 kilogram 2-pound density polyurethane foam to a depth not less than 152 mm 6-inches. Sand and finish foam with a rasp. Provide vapor barrier that is not less than 3 mm 1/8-inch thick of vinyl mastic applied to visible and accessible surfaces.

3.1.3 Fire Stopping

Seal through-penetrations in fire walls, partitions, or any floors to allow passage of cables, ducts, pipes and conduits with a "fire stopping assembly" that is UL listed or FM approved with a fire-resistance rating equal to the fire resistance rating of the walls, partitions, or floors in accordance with NFPA 251. Consider all floors to have a fire resistance rating of 2 hours. Seal openings no longer required with a material of equal or greater fire resistance to that of the walls, partitions, or floors.

3.1.4 Sleeves

Provide sleeves where piping passes through roofs, masonry or concrete walls, or floors.

Continuously weld or braze sleeves passing through steel decks to the deck.

Provide sleeves extending through floors, roofs, or load-bearing walls, and sleeves through fire barriers that are continuous and are fabricated from Schedule 40 steel pipe with welded anchor lugs. Fabricate other sleeves using molded linear polyethylene liners or similar materials that are removable. Provide diameter of sleeves that are large enough to accommodate pipe, insulation, and jacketing without touching the sleeve, and additionally provide a minimum 10 mm 3/8-inch clearance. Provide sleeve that accommodates mechanical and thermal motion of pipe to preclude

transmission of vibration to walls and generation of noise.

Pack space between the pipe and the inside of the pipe sleeve or a construction surface penetration solid with mineral fiber conforming to [ASTM C592](#) wherever the piping passes through firewalls, equipment-room walls, floors, and ceilings connected to occupied spaces, and other locations where sleeves or construction-surface penetrations occur between occupied spaces. Apply elastomer caulk to a depth of [12.7 mm 1/2-inch](#) where sleeves or construction-surface penetrations occur between conditioned and unconditioned spaces. Caulk the space between the pipe, bare or insulated, and the inside of the pipe sleeve or construction-surface penetration. Provide oil and grease free surfaces before caulking.

Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

Where piping penetrates fire rated walls, partition, or any floor, sleeve with a penetration protected with a UL approved penetration assembly, with a rating not less than that of the wall/floor penetrated. Install sleeves for fire rated penetrations that meet the requirements of the UL approved penetration assembly.

3.1.5 Escutcheons

Install escutcheons at penetrations of piping into finished areas. Install escutcheons on both sides of the partition where finished areas are separated by partitions through which piping passes. Install plates where suspended ceilings are installed, at the underside only of such ceilings. Install chrome-plate escutcheons in occupied spaces and conceal openings in building construction. Firmly attach escutcheons.

3.1.6 Painting

Bring manufacturer's standard-finish equipment surfaces damaged during construction to as-new condition by touchup or repainting to the satisfaction of the Contracting Officer, or replaced with new undamaged equipment at no additional cost to the Government.

Clean hangers, supports, and other iron work in concealed spaces and paint with one coat of primer paint.

Apply two coats of enamel, color No. 11105 (red) to all automatic sprinkler and standpipe system piping, valves, and appurtenances, in accordance with [MIL-STD-101](#) and [FED-STD-595](#).

3.1.7 Electrical Work

Electrical work is specified in DIVISION 26 ELECTRICAL for control system wiring and provide under Section [21 09 00.00 98 PREACTION CONTROL SYSTEMS](#) and this section in accordance with [UL 6](#) and [NFPA 70](#). Use rigid metal conduit or intermediate metal conduit. Use of electrical metallic tubing can be used in dry locations not enclosed in concrete or where not subject to mechanical damage.

Supervise all control and isolation valves using a tamper switch.

3.2 FIELD QUALITY CONTROL

3.2.1 System testing

Test completed systems prior to acceptance of the work in the presence of the Contracting Officer. Provide certificates of testing upon approval.

Conduct hydrostatic **pressure tests** unless otherwise specified. Only use potable water for testing.

Perform **system operating tests, air tests, pneumatic tests, valve operating tests, inspector's valve station tests, and drainage tests** for the preaction systems.

Provide full opening of the inspector's test connection, after the solenoid valve has been released (manually or automatically) to cause the preaction valve to trip and deliver a steady stream of water at the test outlet through a calibrated orifice (equivalent in diameter to a single system sprinkler head) within sixty (60) seconds. If a steady stream at the outlet can not be delivered within the 60 seconds; install an accelerator(s) per the manufacturer's requirements to meet the 60 second discharge time in accordance with NSS 1740.118719.11 NASA Safety Standard for Fire Protection.

Government will supply testing water at a location determined by the Contracting Officer, but the Contractor is responsible for approved disposal of test water.

Prepare and maintain test records of piping-system tests. Ensure records show personnel responsibilities, dates, test-gage identification numbers, ambient and test-water temperatures, pressure ranges, rates of pressure drops, and leakage rates. Each test acceptance requires the signature of the Contracting Officer.

3.2.2 Test Gauges

Provide test gauges that have **115 mm 4-1/2-inch** dials or larger with accuracy of plus or minus 1/2 of 1 percent of full-scale range and dial graduations and pointer width compatible with readability to within one-half of the accuracy extremes. Provide maximum permissible scale range for a given test to be such that the pointer during a test has a starting position at midpoint of the dial or within the middle third of the scale range. Ensure certification of accuracy and correction table bear a date within 90 days prior to the test, test gage number, and the project number.

3.2.3 Test and Acceptable Criteria

Test aboveground systems at **1378 kilopascal 200 psi** or where the maximum normal working pressure exceeds **1034 kilopascal 150 psi**. Test the system at the maximum normal working pressure plus **344 kilopascal 50 psi**. Maintain the applied pressure without further addition of test media for not less than 2 hours. Maximum allowable pressure drop is **0 kilopascal 0 psi**.

[Test underground systems, rubber-jointed ferrous-pipe water systems at **1378 kilopascal 200 psi** or where the maximum normal working pressure exceeds **1034 kilopascal 150 psi**. Test the system at the maximum normal working pressure plus **344 kilopascal 50 psi**. Maintain the applied test pressure for not less than 2 hours. Maximum allowable pressure drop is **14**

kilopascal 2 psi.

-] Perform air pressure leakage test at 275 kilopascal's 40 psi for preaction systems. Maintain the applied pressure without further addition of test media for not less than 24 hours. Provide maximum allowable pressure drop to be 10.3 kilopascal's 1-1/2 psi.

Test backflow prevention into connected potable-water systems and system devices for proper functioning under conditions normal to their application.

Repair dripping or weeping joints.

3.2.4 Disinfection

Disinfect water piping, including valves, fittings, and other devices, with a solution of chlorine and water. Provide solution that contains not less than 50 parts per million (ppm) of available chlorine. Hold solution for a period of not less than 8 hours, at which time the solution contains a minimum residue of 2 ppm of available chlorine or re-disinfect the system. Flush thoroughly after successful disinfection, the piping before placing into service. Water for disinfection and flushing will be furnished by the Government.

3.3 ADJUSTING AND CLEANING

Clean all parts of the installation prior to the completion of work. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that has accumulated from the installation and testing of the system. Adjust automatic control devices for proper operation.

3.4 CLOSEOUT ACTIVITIES

Submit [as-built drawings](#) for approval 21 days prior to the acceptance testing phase of the project as described in the paragraph SYSTEM TESTING. Provide two (2) sets of magnetic media and hard copies of all new and revised software and drawings with the submittal. On as-built drawings document final system configuration including deviations from and amendments to the drawings, and field installation changes, concealed and visible.

Provide .DWG Format computer generated floor plan layouts indicating all wet pipe sprinkler system components.

Provide, sign and seal as-built drawings and [hydraulic calculations](#) by a Licensed Professional Engineer registered in the state of Florida.

3.4.1 Operation and Maintenance

Submit [operations and maintenance manuals](#) prior to acceptance tests being performed. Group manuals by technical sections consisting of manufacturer's standard brochures, schematics, procedures, recommended spare parts, recommended test equipment, and safety precautions.

-- End of Section --