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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA-13930 (January 2004)
NASA - KSC
Superseding NASA-13930 (July 2003)

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13930

AUTOMATIC SPRINKLER AND STANDPIPE SYSTEMS

01/04

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NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION

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SECTION 13930

AUTOMATIC SPRINKLER AND STANDPIPE SYSTEMS
01/04

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NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers wet and dry fire protection sprinkler systems, hydrants, standpipe equipment, and firehose stations.

This is a performance based type of specification, with the Contractor responsible for providing professional engineering services associated with hydraulic calculations, head layout and detailed design. The preparer must estimate the system water flow demand requirements to determine the adequacy of the water supply and ascertain the need for a fire pump or water storage.

Drawings should include the following:

Current up-to-date water supply flow test data

Location and invert elevations of existing obstructions and utilities that are to be avoided during construction or are required to be plugged and abandoned or demolished and removed

Location of soil storage areas and spoil areas on government property where disposal of excess and waste material is permitted

Typical riser details

Areas to be sprinkled, hazard by class, water application density, hose requirements, temperature setting of heads, ceiling type, height, and any other special design criteria

Existing alarm-system connections

Location of fire pumps and controllers

Proper utilization and coordination of symbols, legends, or codes for various materials and classed

conditions as provided in the specifications
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PART 1 GENERAL

1.1 REFERENCES

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NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.
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The publications listed below form a part of this section to the extent referenced:

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 317	(1992) Manual of Steel Construction, Volume II, Connections

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A112.18.1M	(1996) Plumbing Fixture Fittings

ASME INTERNATIONAL (ASME)

ASME B16.34	(1996) Valves - Flanged, Threaded and Welding End
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B16.4	(1992) Gray Iron Threaded Fittings
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.1	(1995) Power Piping

ASTM INTERNATIONAL (ASTM)

ASTM A 126	(1995) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A 135	(2001) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1983; R 1990) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A 234/A 234M	(1996; Rev B) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated

	Temperatures
ASTM A 307	(1994) Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
ASTM A 53	(2001) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 563	(1994) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A 563M	(2000) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM A 795	(2000) Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM C 592	(1980) Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
ASTM D 2000	(1996) Standard Classification System for Rubber Products in Automotive Applications
ASTM F 568M	(1995) Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

FM GLOBAL (FM)

FM P7825	(2003) Approval Guide

MANUFACTURER'S STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(2002) Installation of Sprinkler Systems
NFPA 13E	(2000) Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems
NFPA 14	(2003) Standard for the Installation of Standpipe, Private Hydrants and Hose Systems
NFPA 1963	(1998) Screw Threads and Gaskets for Fire Hose Connections
NFPA 24	(2002) Standard for the Installation of

	Private Fire Service Mains and Their Appurtenances
NFPA 70	(2002) National Electrical Code
NFPA 72	(2002) National Fire Alarm Code
NFPA 75	(2003) Protection of Electronic Computer/Data Processing Equipment
NFPA 251	(1999) Methods of Tests of Fire Endurance of Building Construction and Materials

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	(2003; 4th Ed) Program Detail Manual Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL 6	(1997; 11th Ed) UL Standard for Safety - Rigid Metal Conduit
UL 193	(1993; 9th Ed) UL Standard for Alarm Valves for Fire Protection Service
UL FPED	(2003) Fire Protection Equipment Directory

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD 101	(1989; Rev B) Color Code For Pipelines and For Compressed Gas Cylinders

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD 595	(Rev B) Colors Used in Government Procurement
FS A-A-1922A	(1995) Shield, Expansion (Caulking Anchors, Single Lead)
FS A-A-1923A	(1995) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)
FS A-A-1924A	(1995) Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors)
FS A-A-1925A	(1995) Shield, Expansion (Nail Anchors)
FS A-A-55614	(1995) Shield, Expansion (Non-Drilling Expansion Anchors)
FS A-A-55615	(1995) Shield, Expansion (Wood Screw and Lag Bolt Self-Threading Anchors)

1.2 GENERAL

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NOTE: If Section 15003, "General Mechanical Provisions," is not included in the project specification, applicable requirements therefrom should be inserted and the following paragraph deleted.
****

Section 15003, GENERAL MECHANICAL PROVISIONS, applies to work specified in this section. Design and installation shall be in accordance with NFPA Standards. The interpretation of NFPA Standards rests with the [Kennedy Space Center][Cape Canaveral Air Station] Fire Protection Engineer who is the Authority Having Jurisdiction (AHJ), and whose opinion shall be final.

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

1.3 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01330, "Submittals," and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.
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The following shall be submitted in accordance with Section 01330, SUBMITTALS, in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Records of Existing Conditions and Contractor's State Certification shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

Fully verified and dated copies of all test data and results shall be submitted with a copy of the approved test procedure and any factory test information.

Contractor will provide one (1) copy of the test procedures and recording forms for the preliminary tests. For the final acceptance tests, the Contractor will provide ten (10) copies of the test procedures and recording forms.

SD-02 Shop Drawings

The following Diagrams, drawings and survey results shall be submitted in accordance with paragraph entitled, "General

Requirements," of this section.

Connection Diagrams
Schematics and Fabrication Drawings
As-Built Drawings
Fire Service Floor Plans
Records of Existing Conditions

Schematics and Fabrication Drawings shall be submitted for Automatic Sprinkler and Standpipe Systems in accordance with paragraph entitled, "General Requirements," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Piping Materials
Supporting Elements
Sprinkler Riser Equipment
Riser Alarm Equipment
Compressed Air Supply Equipment
Fire Department Connections
Standpipe Equipment
Fire Hose Cabinet Stations
Sprinkler Heads
Valves
Miscellaneous Materials
Identification Tags
Inspector's Test Valve
Sound Stopping
Fire Stopping

Equipment and performance data shall be submitted for Fire-Protection System consisting of information on useful life, system functional flows, safety features, and mechanical automated details.

SD-05 Design Data

Design Analysis and Hydraulic Calculations shall be submitted for Automatic Sprinkler and Standpipe Systems in accordance with paragraph entitled, "System Requirements," of this section.

Hydraulic calculations shall be provided for the hydraulic remote area of each riser and each occupancy classification. Calculations shall be signed and sealed by a Professional Engineer, licensed to practice in Florida.

SD-06 Test Reports

Test Reports shall be submitted for the following tests in accordance with the paragraph entitled, "System Testing," of this section.

Pressure Tests
Air Tests
Valve-Operating Tests

Drainage Tests
Inspector's Test
System Operating Tests

SD-07 Certificates

Quality Assurance Plan shall be submitted in accordance with paragraph entitled, "Quality Assurance Plan," of this section.

Submit certification of test gauge accuracy per paragraph entitled, "Test Gauges".

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance with paragraph entitled, "Operation and Maintenance," of this section.

1.4 GENERAL REQUIREMENTS

Section 15003, GENERAL MECHANICAL PROVISIONS, applies to work specified in this section.

Connection Diagrams shall be submitted indicating the relations and connections of the following items. Drawings shall indicate the general physical layout of all controls, and internal tubing and wiring details.

Schematics and Fabrication Drawings shall be submitted for automatic sprinkler and standpipe systems, consisting of fabrication and assembly drawings to be performed in the shop, prior to installation and at the actual job site. Fabrication drawings shall meet all requirements in NFPA 13, stipulated for "working plans", to include a building cross-section. Working plans shall be signed and sealed by a Professional Engineer, licensed to practice in the State of Florida.

Working plans shall indicate all sprinkler and standpipe 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. For spaces with lay-in type ceilings, locate heads in center of tile, unless otherwise approved by the Contracting Officer. The design shall give 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 sprinkler and standpipe systems.

As-Built drawings shall be submitted for approval 21 days prior to the acceptance testing phase of the project as described in the paragraph entitled, "System Testing," of this specification section. Two (2) sets of magnetic media and hard copies of all new and revised software and drawings shall be provided with the submittal. As-Built drawings shall document final system configuration including deviations from and amendments to the drawings, and field installation changes, concealed and visible.

.DWG format computer generated floor plan layouts indicating all automatic sprinkler and standpipe system s components shall be provided.

As-built drawings and hydraulic calculations shall be signed and sealed by a Licensed Professional Engineer registered in the state of Florida.

Fire service floor plans shall indicate location of the wet-pipe and dry-pipe automatic sprinkler system, risers, standpipes, isolation valves, initiating devices, and the dry-pipe compressed air panel. Coordinate with 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 18 inches by 24 inches 457 by 610 millimeters in a painted metal frame with a plexiglass cover. The floor plan and it's location shall be submitted for approval to the Contracting Officer prior to installation.

Records of existing conditions shall be submitted 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 shall constitute acceptance of existing conditions.

1.5 SYSTEM REQUIREMENTS

The work includes designing and providing new automatic wet pipe sprinkler systems consisting of but is not limited to an easy riser type swing check valve, with all associated trim, including gauges, 2 inch DN 50 main drain connection, floor drains, flow switches, and sprinkler heads for the wet-pipe sprinkler system. [The work includes designing and providing new automatic dry-pipe sprinkler system(s) consisting of, but is not limited to, OS&Y isolation valve(s), dry-pipe valves, floor drains, inspector's test drain, flow switches and sprinkler heads.] The automatic sprinkler system(s) shall be hydraulically designed to meet density and area of coverage requirements using a UL listed or FM approved hydraulic design program. The design, equipment, materials, installation, workmanship, examination, inspection, and testing shall be in strict accordance with the required and advisory provisions of NFPA 13, NFPA 72, [NFPA 14], [NFPA 24], and [NFPA 75] except as modified herein. Each system shall include all materials, accessories, and equipment inside and outside the building to provide an operationally compliant system. The system design shall give full consideration to blind spaces, piping, electrical equipment, ductwork, and other construction and equipment in accordance with working plans to be submitted for approval prior to installation. Locate sprinkler heads in a consistent pattern with ceiling grids, lights, speakers, supply diffusers and return diffusers.

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

Design Analysis and Hydraulic Calculations shall be submitted for automatic sprinkler systems and standpipe systems to provide uniform distribution of water over the design area. Design data shall include design density, hydraulically most remote area, occupancy classification, sprinkler head orifice size and pipe velocities. The design density shall be specified in gpm per sq ft or L/m per sq m of floor area. Discharge from individual heads in the hydraulically most remote area shall be between 100 percent and 120 percent of the specified density.

Systems shall be designed such that pipe velocities do not exceed 20 feet per second 6.1 meters/second.

1.6 QUALITY ASSURANCE PLAN

Equipment to be provided under this specification shall be that manufactured sprinkler system equipment which meets the requirements of the section entitled, "System Requirements." It shall be the latest standard design, and shall be listed by Underwriters' Laboratories or approved by Factory Mutual and shall be suitable for the intended use.

Components installed under this contract cannot be more than one (1) year older than the date of installation.

Contractor shall prepare a test procedure and test record forms for conducting and recording complete tests on automatic sprinkler and standpipe systems installed in accordance with the hydraulic calculations, the installation drawings and these specifications. Contractor shall submit for approval the test procedure to the Contracting Officer at least 30 days prior to the preliminary system test described in the paragraph entitled, "System Testing," of this specification section. Test procedure shall identify each sprinkler and standpipe component to be tested, describe the initial condition, each step or function in the test, required test results, and equipment to be employed. Test forms with suitable spaces shall be provided for recording test results on all equipment, devices, and wiring to be tested. Test record forms will also have identified spaces for verification signatures of official witnesses and dates of the test.

Contractor shall submit proof that all components are Underwriter Laboratory (UL FPED) listed or Factory Mutual (FM P7825) approved for their intended use and function.

1.7 SERVICES OF A CERTIFIED AUTOMATIC SPRINKLER SPECIALIST

Services of a Certified Specialist thoroughly experienced in automatic sprinkler system installations shall be provided on site to perform or directly supervise the installation, make all necessary adjustments and perform all tests on the automatic sprinkler system at the site.

Sprinkler System Specialist shall be 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 will be considered. Evidence of the Contractors State Certification and the basis of certification shall be provided to the Contracting Officer and be approved by the Contracting Officer prior to any work being performed at Kennedy Space Center.

PART 2 PRODUCTS

2.1 GENERAL

Fire-protection system materials and equipment provided under this section shall conform to the requirements of Underwriters Laboratories (UL FPED) or the Factory Mutual (FM P7825) Approval Guide. [Materials and equipment furnished shall be compatible with the existing system.]

2.2 PIPING MATERIALS

2.2.1 Type BCS - Black Carbon Steel

Pipe 1/8 through 2 inches DN 6 through DN 50: Schedule 40 furnace butt weld black-carbon steel conforming to ASTM A 53, ASTM A 135, ASTM A 795, Type F furnace butt welded.

Pipe 2-1/2 through 8 inches DN 65 through DN 20: Schedule 40 seamless or electric-resistance welded black carbon steel, conforming to ASTM A 53, ASTM A 135, ASTM A 795, Type E (electric-resistance welded), Grade B, or Type S (seamless), Grade B.

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

Standard Pipe Couplings: Extra-heavy screwed black steel.

Fittings 2 inches and under DN 50 and under: 175 psi 1207 kilopascal working pressure, cast iron, screwed conforming to ASTM A 126, Class A, and ASME B16.4.

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

Elbows: Shall be of the long radius type.

Grooved pipe couplings (all sizes): 175-psig 1207 kilopascal minimum working pressure with a housing fabricated in two or more parts of black malleable-iron castings. Coupling gasket shall be molded of synthetic rubber, conforming to requirements of ASTM D 2000. Coupling bolts shall be oval-neck, track-head type with heavy hexagonal nuts, conforming to ASTM A 183

Grooved fittings (all sizes): 175-psig 1207 kilopascal working pressure fittings used with grooved couplings shall be fabricated of black malleable-iron castings, and be of the same manufacture as the pipe coupling. If a manufacturer's standard-size malleable-iron fitting pattern is not available, fabricated fittings shall be used; fittings shall be fabricated from Grade B seamless-steel pipe and long-radius seamless welding fittings, with wall thickness to match pipe, conforming to ASTM A 234/A 234M and ASME B16.9.

Bushings shall not be used, only pre-manufactured concentric or eccentric reducing fittings or reducing tees/elbows shall be used to reduce pipe size.

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

Non-grooved products which rely in any way upon gasketing, clamps, straps, or setscrews for maintaining system integrity shall not be used.

Adjustable "drop nipples" which utilize an O-ring type seal arrangement shall not be used.

****
NOTE: Select the following where dry-pipe systems are used, or corrosive conditions are anticipated, to specify hot dipped galvanized steel. For projects where both piping materials are required, identify where each type of piping material is to be used in Part 3 - Execution.
****

2.3 SUPPORTING ELEMENTS

Piping system components and miscellaneous supporting elements shall be provided, 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. Supporting elements shall be suitable for stresses imposed by systems pressures and temperatures, natural, and other external forces. An additional 250 pound 113 kilogram load shall be included at each anchor per NFPA 13.

****
NOTE: Refer to Section 15072, "Vibration Isolation for Air Conditioning Equipment," if design requires vibration isolation.
****

Supporting elements shall be FM approved or UL listed and shall conform to ASME B31.1, MSS SP-58, and ASME B16.34.

2.3.1 Building-Structure Attachments

2.3.1.1 Anchor Devices, Concrete and Masonry

Anchor devices shall conform to FS A-A-1922A, FS A-A-1923A, FS A-A-1924AA, FS A-A-1925A, FS A-A-55614 and FS 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

Cast-in floor-mounted equipment-anchor devices shall provide adjustable positions.

Powder-actuated anchoring devices shall not be used to support mechanical-systems components.

2.3.1.2 Beam Clamps

Beam clamps shall be center-loading Types 21, 28, 29, and 30, UL listed, cataloged, and load-rated commercially manufactured products.

Type 20 beam clamps may be used for pipe 2 inches DN 50 and under.

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

2.3.1.3 C-Clamps

****
NOTE: C-clamps, as a means of attaching hangers to structural steel, should be avoided. For metal building systems roofs, 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.
****

C-clamps shall not be used.

2.3.1.4 Inserts, Concrete

Concrete inserts shall be constructed in accordance with the requirements of MSS SP-58 for Type 18 or 19 and ASME B16.34. When applied to piping in sizes 2-inch DN 50 iron pipe size (ips) and larger, and where otherwise required by imposed loads, a 1-foot length of 1/2-inch 304.8 millimeter length of 12.7 millimeter reinforcing rod shall be inserted and wired through wing slots.

2.3.2 Horizontal-Pipe Attachments

2.3.2.1 Single Pipes

Piping in sizes up to and including 2-inch DN 50 ips shall be supported by Type 1, 5, 6, 7, 9, 10, 11, or 12 solid, split-ring, or band type attachments.

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

2.3.2.2 Parallel Fire-Protection Pipes

Trapeze hangers fabricated from approved structural steel shapes, with U-bolts, shall be used when so specified. Structural-steel shapes shall conform to supplementary steel requirements or the support shall be of commercially available, approved proprietary-design rolled steel.

2.3.3 Vertical-Pipe Attachments

Single vertical-pipe attachments shall be Type 8.

2.3.4 Hanger Rods and Fixtures

Only circular solid cross section rod hangers shall be used to connect building structure attachments to pipe-support devices. Pipe, straps, or bars of equivalent strength shall be used for hangers.

Turnbuckles, swing eyes, and clevises shall be provided as required by support system to accommodate temperature changes, pipe accessibility, and adjustment for load and pitch.

2.3.5 Supplementary Steel

Where it is necessary to frame structural members between existing members or where structural members are used in lieu of commercially rated supports, such supplementary steel shall be designed and fabricated in accordance with AISC 317.

Supplementary steel shall be hot dipped galvanized or otherwise protected from corrosion as acceptable to the Contracting Officer.

2.4 SPRINKLER RISER EQUIPMENT

Riser alarm equipment shall be UL listed or FM approved for fire-protection use.

2.4.1 Standard Check Valve

Check valve shall be UL listed or FM approved standard swing-check type with elastomer-disc seat. Check valve shall have a ductile iron body with flanged or grooved ends and be of the clear opening type with flanged inspection and access cover plate for sizes 4 inches DN 100 and larger. Check valve shall be able to be installed vertically or horizontally, and be rated for 300 psi 2068 kilopascal working pressure. Clapper shall be type 304 stainless steel or bronze with field replaceable EDPM or Nitrite seal, with nickel or bronze seat. Spring, hinge shaft and retaining ring shall be stainless steel, the valve body shall be painted with a corrosion resistant non-lead coating.

2.4.2 Wet Pipe Valve

Wet Pipe valve shall be of the combination check valve/main drain type complete with standard accessories and trim , and shall include pressure gauges, 2 inch DN 50 main drain connection, flow switch tapping, and all necessary intercomponent water piping, fittings, and valves.

[Wet-pipe sprinkler systems shall utilize an UL listed or FM approved OS&Y isolation valve with tamper switches and flow switches for each floor, as indicated on the contract drawings, complete with standard accessories and trim necessary to give an alarm and trouble signal. Provide provisions for testing and draining the systems, and all necessary piping, fittings, and valves for proper operation of the systems.]

[/Wet-pipe sprinkler systems shall utilize a UL listed or FM approved alarm valve with 2-inch DN 50 main drain. The alarm valve shall comply with UL 193]

2.4.3 Dry Pipe Valve

Dry-pipe valve sprinkler systems shall be a UL listed or FM approved dry-pipe valve, complete with standard accessories and trim necessary to provide alarm, trouble and supervisory signals. Provide 2 inch DN 50 main drain connection, pressure gauges on the water side of the valve, air side of the valve, and on the compressor. Also provide provisions for testing and draining the system and all necessary water piping, fittings, quick opening devices and valves for proper operation of the system.

System shall include a supervisory indication alerting of a loss of air pressure.

2.5 COMPRESSED AIR SUPPLY EQUIPMENT

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NOTE: Select the type of air compressor to be used based upon the system size. Generally, riser mounted compressors have limited capacity and are only suited for use on small systems. Floor mounted compressors should be used for large systems. Where in doubt, seek direction from the AHJ.

****

Dry-pipe system air pressure shall be maintained by an independent air compressor mounted on the riser. Compressor shall be spring and elastomer vibration isolated from the riser, of oil-free construction, complete with adjustable setpoint low differential pressure switch, check valve, and necessary unloader and intercomponent piping and wiring. Spare inlet air filter media shall be provided.

Power for the compressed air system shall be supplied 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 3 feet 914 millimeter of the compressor. Paint the disconnect switch with two (2) coats of enamel, Color No. 11105 (red), and permanently affix a label which shall read, "Dry-Pipe Compressor Disconnect Switch - Fed from Panel [_____] CKT No.[_____]".

2.5.1 Floor Mounted Compressed Air Supply

Provide floor mounted compressed air system complete with air compressor, pressure gauges, pressure switches, air maintenance devices, desiccant air dryer and appurtenances. Compressed air system shall maintain [40] pounds [275] kilopascals per square inch air pressure on the dry-pipe system piping, and shall transmit a supervisory trouble alarm to the fire alarm control panel when pressure drops below [30] pounds [207] kilopascals per square inch. The pressure switch for controlling the compressor shall be field adjustable for both the "on" and "off" pressure settings. The air maintenance device with a by-pass line for fast filling the system shall include an air strainer, air pressure regulator, air restrictor, air check valve, and all other associated piping, valves and fittings. Compressor shall be spring and elastomer vibration isolated from the riser. Pressure gauges shall be air or oil type, calibrated in pounds per square inch. Power for the compressed air system shall be supplied 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 3 feet 914 millimeter of the compressor. Paint the disconnect switch with two (2) coats of enamel, Color No. 11105 (red) and permanently affix a label which shall read, "Dry-Pipe Compressor Disconnect Switch - Fed from Panel [_____] CKT No. [_____]."

2.6 COMPRESSED AIR BY-PASS LINE

Air supply line for each dry-pipe valve shall be provided with an orifice union with a 1/8 inch 6 millimeter orifice corrosion-resistant steel plate, externally identified, and a 1/2 inch 13 millimeter [3/4 inch][19 millimeter] three-valve by-pass around the orifice union.

2.7 LOW AIR PRESSURE SUPERVISORY SWITCH

Provide low air pressure supervisory switch for the dry=pipe 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 [30] psig [207] kilopascals. Provide a bleeder valve in the airline ahead of the switch for testing operation of the low air pressure switch.

2.8 WATER FLOW ALARM DEVICE

Water flow alarm devices shall be UL listed for the particular type of system. Water flow switch shall be wired to make or break a circuit on rise of water pressure. Water flow switch shall have an integral field adjustable 0-90 second retard feature, and shall activate within 60 seconds, plus or minus ten (10) seconds upon opening of the inspectors test station.

Water flow alarm device shall have a design working pressure of 300 psi 2068 kilopascal, include two (2) sets of single pole, double throw contacts rated for not less than 2.0 amps at 30 VDC. Housing shall be die cast, suitable for both indoor and outdoor use and include knockouts for conduit connections.

2.9 PRESSURE GAUGE

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

2.10 INSPECTOR'S TEST

The inspector's test valve shall be a combination test and drain device (OFF-TEST-DRAIN), bronze body, bronze ball valve, one quarter turn handle, integral sightglass (on discharge side), and internal corrosion resistant orifice, sized to match the sprinkler head orifice size.

2.11 CLASS 1 STANDPIPE

Provide an automatic Class 1 standpipe system as established by NFPA 14, with 2-1/2 inch DN 65, 175-psi 1206 kilopascals hose connections in the stairwells, at the locations indicated on the contract drawings. The standpipe systems shall be hydraulically designed to provide a minimum water flow rate of 500 gpm 1892 liters/min, with a minimum residual pressure of 100 psig 689 kilopascals at the outlet of the two (2) hydraulically most remote 2-1/2 inch DN 65 hose connections. Hydraulic calculations and pipe sizes for the standpipe system shall be based on providing 500 gpm 1892 liters/min for the first standpipe and 250 gpm 946liters/min from the most remote valve on each additional standpipe, with the total not to exceed 1250 gpm 4731 liters/min.

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NOTE: Rewrite following for dry systems.

****

2.12 FIRE DEPARTMENT CONNECTIONS

Hose connections shall have National Fire hose standard-thread form and rocker lugs in accordance with NFPA 1963. Hose connection sizes and threads shall be compatible with the equipment used by the fire department serving the facility.

2.12.1 Wall Siamese

Unit shall be cast brass or bronze flush-mounted escutcheon-plate type, with two 2 1/2-inch DN 65, fire-department, swivel, female inlets; double-clapper valves; rocker-lug caps and chains; and cast-in function-identifying lettering. Finish shall be chrome-plated or polished surface. Chrome plate shall be in accordance with ANSI A112.18.1M.

2.12.2 Sidewalk Siamese

Unit shall be cast brass or bronze, with two 2 1/2-inch DN 65, fire-department, swivel, female inlets; double-clapper valves; rocker-lug caps and chains; and cast-in function-identifying lettering. Finish shall be chrome-plated or polished surface. Chrome plate shall be in accordance with ANSI A112.18.1M. Unit shall be mounted on a Schedule 40 ASTM A 53 galvanized carbon-steel pipe with red-enameled finish on prime-coated surface. All surfaces embedded in concrete or below grade shall be protected with a 20-mil 0.508 millimeter thick bituminous coating.

2.12.3 Wall Hydrant

Unit shall be cast brass or bronze flush-mounted escutcheon-plate type with two 2 1/2-inch DN 65, fire-department, male outlets; rocker-lug caps and chains; and cast-in function-identifying lettering. Finish shall be chrome-plated or polished surface. Chrome plate shall be in accordance with ANSI A112.18.1M.

2.12.4 Roof Manifold

Unit shall be cast brass or bronze, horizontal type, with two 2 1/2-inch, 175-pound DN 65, 1206 kilopascal, rated hose valves fitted with rocker-lug caps and chains. Finish shall be rough body with polished trim.

2.13 SPRINKLER HEADS

2.13.1 Head Types

Standard 1/2-inch 12.7 millimeter orifice sprinkler heads shall be used, except that 17/32 inch 13.5 millimeter heads may be used where required by hydraulic calculation.

Heads required to be concealed where the appearance of a smooth ceiling is required shall use concealed pendent type heads with a low profile, small diameter cover plate with a factory applied finish to match suspended ceiling tiles.

Heads required to be located in the center of the suspended ceiling tiles shall use return bends or FM approved FlexHead commercial ceiling sprinkler assembly with a maximum overall length of 7 feet 2.1 meters.

Heads in unfinished areas or above suspended ceilings shall be [upright] [pendant] [sidewall] type. Heads located in elevator pits shall be

sidewall type. Heads located at the top of elevator shafts shall be [upright][pendant] type.

Heads in finished areas installed in suspended ceilings shall be flush or pendant type. Heads and escutcheon plates shall be chrome-plated brass. Sidewall type heads may be used where indicated on the drawings, or locations as defined by NFPA 13.

Pendant sprinkler heads shall not be used in dry-pipe sprinkler systems, except that dry pendant type heads are acceptable.

Corrosion-resistant heads shall be wax-coated.

2.13.2 Temperature Rating

Fusible links shall be ordinary temperature classification, except where otherwise indicated, or locations as defined in NFPA 13 requiring intermediate or high temperature heads.

2.13.3 Spares

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

2.13.4 Head Protection

Heads shall be protected with paper or plastic bags during painting operations. Protection shall be removed immediately upon finishing painting operations.

Head guards shall be constructed of steel wire provided wherever mechanical damage could occur. Guard finish shall be red enamel.

Water shields shall be constructed of cold rolled galvanized steel, and installed on all heads located beneath other heads within their spray areas. Shield finish shall be red enamel.

2.14 VALVES

2.14.1 Aboveground

Gate, globe, and check valves (all sizes) shall be FM approved or UL listed.

Ball valves, 2 inches DN 50 and under, shall be FM approved, rated 300 psi 2070 kilopascal, with provisions to wire or lock handle in place where critical alarm function may be isolated.

Gate valves shall be of the outside screw and yoke configuration, cast iron body and wedge, bronze yoke bushing, seat ring and face ring. Wedge shall be solid and shall be constructed of cast iron or bronze. Valves shall be flanged or grooved and rated for 175 psi 1206 kilopascal non-shock cold water.

Angle valves (for main drain) shall have bodies constructed of bronze with bronze disk, screwed or union bonnet type. Disk seat shall be rubber. Valves shall have screwed ends and be rated for 175 psi 1206 kilopascal non-shock cold water.

All control and isolation valves shall be supervised using a tamper switch, except for post indicator valves and OS&Y valves on double detector check valve assemblies, unless otherwise directed by the AHJ.

2.15 MISCELLANEOUS MATERIALS

2.15.1 Bolting

Flange and general-purpose bolting shall be hex-head and shall conform to ASTM A 307, Grade B ASTM F 568M, Class 4.8 or higher. Heavy hex-nuts shall conform to ASTM A 563 and ASTM A 563M. Square-head bolts and nuts are not acceptable.

2.15.2 Escutcheons

Escutcheons shall be manufactured from ferrous metals and shall be chrome-plated, except when AISI 300 series corrosion-resistant steel is provided. Metals and finish shall conform to ANSI A112.18.1M.

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

2.15.3 Flange Gaskets

Gaskets shall be suitable for the intended use and shall contain no asbestos.

2.15.4 Pipe-Thread Compounds

Tetrafluoroethylene tape or other suitable compounds shall be used.

2.16 FIRE-PROTECTION SYSTEM IDENTIFICATION

A coordinated system of piping and equipment identification shall be provided which includes the following:

Framed and plastic-protected diagrammatic layout of all piping systems, identifying and locating piping, equipment, and valves. Where existing systems are being modified, existing layouts shall be brought up to date.

Metal-tag-identified major valves, piping-system components, and equipment

Metal identification plate at controlling alarm valve identifying system and area protected

Service-labeled piping

2.16.1 Diagrams

Chart listing of equipment shall be by designation number and shall show pertinent data. Diagrams shall be neat, mechanical drawings mounted in extruded aluminum frames, with 1/8-inch 3 millimeter thick acrylic plastic protection. Location shall be as directed by the Contracting Officer. A minimum of one mounted chart and diagram, plus one extra copy of each,

shall be provided for each fire-protection system.

2.16.2 Metal Tags

Identification tags made of brass or aluminum and indicating function of valve or similar component, shall be installed on such system devices. Tags shall be not less than 2 inches 50 millimeter in diameter and marking shall be stamped.

Equipment shall be provided with metal identification tags bearing an equipment designation number matching the drawing or diagram designations.

Tags shall be secured to valve or equipment items with 12-gage 2.7 millimeter galvanized wire.

Risers shall be provided with a stamped metal tag containing the hydraulic design data. Main drain and inspectors test stations shall also be identified using metal nameplates with minimum 2 inch 50 millimeter high lettering chained to the valve.

2.16.3 Service Labeling

Piping, including that concealed in accessible spaces, shall be labeled to designate service. Each label shall include an arrow or arrows to indicate flow direction. Labels or tag designations shall be as follows:

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

Piping shall be labeled and arrowed in accordance with the following:

Each point of entry and exit through walls

Each change in direction

In congested or hidden areas, at each point required to clarify service or indicate hazard

In long straight runs, labels shall be located at a distance visible to each other, but in no case shall the distance between labels exceed 40 feet 12.2 meter.

Label lettering shall be 2 inches 50 millimeter high. Where the size of pipes is 2-1/2-inch 65 millimeter outside diameter and smaller, labels shall be attached to 16-gage 1.6 millimeter aluminum sheet which shall be attached to the pipe with 12-gage 2.7 millimeter galvanized wire. Labels shall be legible from the primary service and operating area.

Labels shall be made of self-sticking plastic film designed for permanent installation. Labels shall have red letters on white background.

Label and valve tag schedule above shall not be construed as defining or limiting the work. All piping systems shall be labeled.

2.17 PAINTING

Equipment of the manufacturer's standard product shall be furnished with the manufacturer's standard finish coat.

Other mechanical equipment shall be furnished with a shop-applied prime paint.

2.18 MAIN DRAINS

Provide dedicated drain piping at riser [to discharge to the building exterior][or][to discharge to sight cones attached to drains of adequate size to readily accept the full flow from each drain under maximum pressure]. Discharge location shall be selected to avoid creating a nuisance or hazardous condition and shall be acceptable to the Contracting Officer. For multi-story buildings using a common drain system, increase drain size by one pipe size as required by NFPA.

Penetration of exterior walls shall be sleeved and caulked and be no greater than 24 inches 610 millimeter and no less than 6 inches 152 millimeter above grade. Drain lines to terminate in a 45 or 90 degree elbow turned down discharging to a 18 inch 450 millimeter concrete splashblock.

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 GENERAL

Installation of system materials and equipment shall be in accordance with the recommendations and provisions of NFPA 13, NFPA 13E, NFPA 14, and NFPA 24, and related Codes and Standards contained herein. Work shall be performed in the presence of the Contracting Officer who shall be notified by the Contractor 48 hours in advance of the start of work.

All installation work shall be performed 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, and shall be coordinated with the building construction, system design, Code requirements, and water supply limitations and maintenance requirements. The number of risers shown on the documents shall be considered the minimum to be provided. The exact location and number shall be reflected on the Contractor's shop drawing submittal and shall be as approved by the Contracting Officer.

For heads which could be damaged, provide wire head guards. For heads located beneath other heads where the spray from the upper head could cool the lower head, provide water shields. For locations where existing

building elements could disrupt sprinkler or nozzle spray patterns, provide multiple levels of protection.

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

3.2 ABOVEGROUND PIPING-SYSTEMS INSTALLATION

Piping shall run parallel with the lines of the building. Piping and components shall be spaced and installed so that a threaded pipe fitting may be removed between adjacent pipes and so that there will be not less than 1/2 inch 12.7 millimeter of clear space between the finished surface and other work and between the finished surface of parallel adjacent piping. Hangers on different adjacent service lines running parallel shall be arranged to be in line with each other and parallel to the lines of the building.

Load rating for pipe-hanger supports shall be based on all lines filled with water. Deflection per span shall not exceed slope gradient of pipe. Schedule 40 and heavier ferrous pipe supports shall be in accordance with the following minimum rod size and maximum allowable hanger spacing. For concentrated loads such as valves, allowable span shall be reduced proportionately.

PIPE SIZE (INCHES)	ROD SIZE (INCHES)	HANGER SPACING FOR STEEL PIPE (FEET)
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

PIPE SIZE (DN) (MILLIMETER)	ROD SIZE (MILLIMETER)	HANGER SPACING FOR STEEL PIPE (MILLIMETER)
25	10	2400
32	10	3600
40	10	4500
65 to 90	10	4500
125	15	4500
150	15	4500
200	15	4500

Vertical risers shall be supported at the base where possible and at intervals specified. Piping shall be guided for lateral stability as necessary. Clamps shall be placed under fittings wherever possible. Carbon-steel pipe shall be supported at each floor at not more than 15 feet 4.5 meter intervals for pipe 2 inches DN 50 and smaller, and at not more than20 feet 6.1 meter intervals for pipe 2-1/2 inches DN 65 and larger.

Piping shall be securely supported with allowance for thrust forces and thermal expansion and contraction and shall not be subject to mechanical, chemical, vibrational, or other damage, in conformance with ASME B31.1.

Extend riser main drain piping full size to discharge outdoors in a location approved by the Contracting Officer.

Install 2-1/2 inch DN 65 fire hose connection valves for the Class I standpipe at 4'-0" 1.21 meters above the finished floor, measured from the top of the valve discharge outlet.

Install piping level or sloped back towards the riser or the auxiliary drains to allow for drainage. Where trapped piping is unavoidable, provide auxiliary drains.

Locate inspectors test valve approximately 5 feet 1.5 meters 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. Inspectors test shall [discharge to the building exterior][or][discharge to a drain location sized to accommodate the full flow] without resulting in property damage. Discharge to janitors sinks and similar locations shall not be permitted.

Penetrations of exterior walls shall be no greater than 24 inches 610 millimeter and no less than 6 inches 152 millimeter above grade, and be sleeved and caulked. Inspector test discharge shall terminate in a 45 or 90 degree elbow turned down, discharging to an 18 inch 450 millimeter concrete splashblock. Size inspectors test lines to be capable of development of the design flow from one sprinkler without creating excessive back pressure.

3.3 SOUND STOPPING

Effective sound stopping and adequate operating clearance shall be provided to prevent structure contact where piping penetrates walls, floors, or ceilings; into occupied spaces adjacent to equipment rooms; 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. Penetrations shall be finished to be compatible with surface being penetrated.

Sound stopping and vapor-barrier sealing of pipe shafts, and large floor and wall openings may be accomplished by packing with properly supported mineral fiber insulation or by foaming-in-place with self-extinguishing, 2-pound 0.9 kilogram density polyurethane foam to a depth not less than 6 inches 152 millimeter. Foam shall be finished with a rasp. Vapor barrier shall be not less than 1/8-inch 3 millimeter thickness of vinyl mastic applied to visible and accessible surfaces.

3.4 FIRE STOPPING

Through-penetrations in fire walls, partitions, or any floors to allow passage of cables, ducts, pipes and conduits shall be sealed 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. For sealing purposes, all floors shall be considered to have a fire-resistance rating of 2 hours. Openings no longer required shall be sealed with a material of equal or greater fire resistance to that of the walls, partitions, or floors.

3.5 SLEEVES

Sleeves shall be provided where piping passes through roofs, masonry or concrete walls, or floors.

Sleeves passing through steel decks shall be continuously welded or brazed to the deck.

Sleeves extending through floors, roofs, or load-bearing walls, and sleeves through fire barriers shall be continuous and fabricated from Schedule 40 steel pipe with welded anchor lugs. Other sleeves shall be formed by molded linear polyethylene liners or similar materials that are removable. Diameter of sleeves shall be large enough to accommodate pipe, insulation, and jacketing without touching the sleeve, and additionally shall provide a minimum 3/8-inch 10 millimeter clearance. Sleeve shall accommodate mechanical and thermal motion of pipe to preclude transmission of vibration to walls and generation of noise.

Space between a pipe and the inside of a pipe sleeve or a construction surface penetration shall be packed solid with mineral fiber conforming to ASTM C 592 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. Where sleeves or construction-surface penetrations occur between conditioned and unconditioned spaces, the space between a pipe, bare or insulated, and the inside of a pipe sleeve or construction-surface penetration shall be filled with an elastomer calk to a depth of 1/2 inch 12.7 millimeter. Surfaces to be calked shall be oil- and grease-free.

Exterior wall sleeves shall be calked watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

3.6 ESCUTCHEONS

Escutcheons shall be provided at penetrations of piping into finished areas. Where finished areas are separated by partitions through which piping passes, escutcheons shall be provided on both sides of the partition. Where suspended ceilings are installed, plates shall be provided at the underside only of such ceilings. Escutcheons shall be chrome plated in occupied spaces and shall conceal openings in building construction. Escutcheons shall be firmly attached.

3.7 PAINTING

Manufacturer's standard-finish equipment surfaces damaged during construction shall be brought 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.

Pipe hangers, supports, and other iron work in concealed spaces shall be thoroughly cleaned and painted with one coat of primer paint.

All automatic sprinkler and standpipe system piping, valves, and appurtenances, shall receive two coats of enamel, color No. 11105 (red) in accordance with MIL-STD 101 and FED-STD 595.

3.8 ELECTRICAL WORK

Electrical work is specified in Division 16, "Electrical," for control system wiring which shall be provided under Section 13850 FIRE ALARM AND DETECTION SYSTEMS and this section in accordance with UL 6 and NFPA 70. Rigid metal conduit or intermediate metal conduit shall be used, except that electrical metallic tubing may be used in dry locations not enclosed in concrete or where not subject to mechanical damage.

3.9 SYSTEM TESTING

Prior to acceptance of the work, completed systems shall be tested in the presence of the Contracting Officer. Upon approval, certificates of testing shall be provided.

Pressure tests shall be hydrostatic, unless otherwise specified. Only potable water shall be used for testing.

[System operating tests, Air tests, Valve-operating tests, and Drainage tests shall be performed for dry-pipe systems.]

Full opening of the inspector's test connection, shall activate the riser water flow alarm device indicator and deliver a steady stream of water at the test outlet through a calibrated orifice equivalent in diameter to a single system sprinkler head. [On dry-pipe systems, if a steady stream at the outlet can not be delivered within the 60 seconds, accelerator(s) shall be installed per the manufacturer's requirements to meet the 60 second discharge time in accordance with NSS 8719.11, NASA Safety Standard for Fire Protection.]

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

Contractor shall prepare and maintain test records of piping-system tests. Records shall 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 shall require the signature of the Contracting Officer.

3.9.1 Test Gages

Test gages, to be acceptable, shall have 4-1/2-inch 115 millimeter 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. Maximum permissible scale range for a given test shall be such that the pointer during a test shall have a starting position at midpoint of the dial or within the middle third of the scale range. Certification of accuracy and correction table shall bear a date within 90 days prior to the test, test gage number, and the project number.

3.9.2 Test and Acceptable Criteria

Above ground systems shall be hydrostatically tested at 200 psi 1378 kilopascals or where the maximum normal working pressure exceeds 150 psi 1034 kilopascals, the system shall be tested at the maximum normal working pressure plus 50 psi 344 kilopascals. The applied pressure shall be maintained without further addition of test media, for not less than 2 hours. Maximum allowable pressure drop shall be 0 psi 0 kilopascal.

Dry pipe systems shall also require an air pressure leakage test at 40 psi 275 kilopascals. The applied pressure shall be maintained without further addition of test media for not less than 24 hours. Maximum allowable pressure drop shall be 1-1/2 psi 10.3 kilopascals.

Underground systems, rubber jointed ferrous-pipe water systems shall be tested at 200 psi 1378 kilopascals, or where the maximum normal working pressure exceeds 150 psi 1034 kilopascals, the system shall be tested at the maximum normal working pressure plus 50 psi 344 kilopascals. The applied test pressure shall be maintained for not less than 2 hours. Maximum allowable pressure drop shall be 2 psi 14 kilopascals.

Backflow prevention into connected potable-water systems and system devices shall be tested for proper functioning under conditions normal to their application.

Dripping or weeping joints shall be repaired.

3.10 DISINFECTION

Water piping, including valves, fittings, and other devices, shall be disinfected with a solution of chlorine and water. Solution shall contain not less than 50 parts per million (ppm) of available chlorine. Solution shall be held for a period of not less than 8 hours, at which time the solution shall contain a minimum residue of 2 ppm of available chlorine or the system shall be re-disinfected. After successful disinfection the piping shall be thoroughly flushed before placing into service. Water for disinfection, and flushing will be furnished by the Government.

3.11 CLEANING AND ADJUSTING

At the completion of the work, all parts of the installation shall be thoroughly cleaned. Equipment, pipes, valves, and fittings shall be cleaned of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system. Automatic control devices shall be adjusted for proper operation.

3.12 OPERATION AND MAINTENANCE

Operation and Maintenance Manuals, grouped by technical sections consisting of manufacturer's standard brochures, schematics, procedures, recommended spare parts, recommended test equipment, and safety precautions. This information shall be submitted prior to acceptance tests being performed.

-- End of Section --