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NATIONAL AERONAUTICS	**NASA/KSC-21 13 00.00 98 (February 2012)**
AND SPACE ADMINISTRATION	**----------**
Preparing Activity: KSC	**Superseding**
	NASA/KSC-21 13 00.00 98 (May 2011)

NASA/KSC GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2012

****

SECTION TABLE OF CONTENTS

DIVISION 21 - FIRE SUPPRESSION

SECTION 21 13 00.00 98

FIRE SUPPRESSION SPRINKLER SYSTEMS

02/12

PART 1 GENERAL

1.1 REQUIREMENTS
1.2 REFERENCES
1.3 ADMINISTRATIVE REQUIREMENTS
1.3.1 Pre-Installation Meeting
1.3.1.1 Shop Drawings
1.3.1.2 Manufacturer's Product Data
1.3.1.3 Fire-Protection System Performance Data
1.4 SUBMITTALS
1.5 QUALITY ASSURANCE PLAN
1.5.1 Services Of A Certified Automatic Sprinkler Specialist
1.6 PREDICTIVE TESTING AND INSPECTION TECHNOLOGY REQUIREMENTS

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION
2.1.1 Design Requirements
2.2 PIPING MATERIALS
2.2.1 Type BCS - Black Carbon Steel
2.3 SUPPORTING ELEMENTS
2.3.1 Building-Structure Attachments
2.3.1.1 Anchor Devices, Concrete and Masonry
2.3.1.2 Beam Clamps
2.3.1.3 C-Clamps
2.3.1.4 Inserts, Concrete
2.3.2 Horizontal-Pipe Attachments
2.3.2.1 Single Pipes
2.3.2.2 Parallel Fire-Protection Pipes
2.3.3 Vertical-Pipe Attachments
2.3.4 Hanger Rods and Fixtures
2.3.5 Supplementary Steel
2.4 SPRINKLER RISER EQUIPMENT
2.4.1 Standard Check Valve
2.4.2 Wet Pipe Valve
2.4.3 Dry Pipe Valve

2.5 COMPRESSED AIR SUPPLY EQUIPMENT
2.5.1 Floor Mounted Compressed Air Supply
2.6 COMPRESSED AIR BY-PASS LINE
2.7 LOW AIR PRESSURE SUPERVISORY SWITCH
2.8 WATER FLOW ALARM DEVICE
2.9 PRESSURE GAUGE
2.10 INSPECTOR'S TEST
2.11 CLASS 1 STANDPIPE
2.12 FIRE DEPARTMENT CONNECTIONS
2.12.1 Wall Siamese
2.12.2 Sidewalk Siamese
2.12.3 Wall Hydrant
2.12.4 Roof Manifold
2.13 SPRINKLER HEADS
2.13.1 Head Types
2.13.2 Temperature Rating
2.13.3 Spares
2.13.4 Head Protection
2.14 VALVES
2.14.1 Aboveground
2.15 MISCELLANEOUS MATERIALS
2.15.1 Bolting
2.15.2 Escutcheons
2.15.3 Flange Gaskets
2.15.4 Pipe-Thread Compounds
2.16 FIRE-PROTECTION SYSTEM IDENTIFICATION
2.16.1 Diagrams
2.16.2 Metal Tags
2.16.3 Service Labeling
2.17 PAINTING
2.18 MAIN DRAINS

PART 3 EXECUTION

3.1 GENERAL
3.2 ABOVEGROUND PIPING-SYSTEMS INSTALLATION
3.3 SOUND STOPPING
3.4 FIRE STOPPING
3.5 SLEEVES
3.6 ESCUTCHEONS
3.7 PAINTING
3.8 ELECTRICAL WORK
3.9 SYSTEM TESTING
3.9.1 Test Gages
3.9.2 Test and Acceptable Criteria
3.10 DISINFECTION
3.11 CLEANING AND ADJUSTING
3.12 AS-BUILT DRAWINGS
3.13 OPERATION AND MAINTENANCE

-- End of Section Table of Contents --

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SECTION 21 13 00.00 98

FIRE SUPPRESSION SPRINKLER SYSTEMS

02/12

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NOTE: This specification covers the requirements for 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. 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.

Include the following in the drawings:

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

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.

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PART 1 GENERAL

1.1 REQUIREMENTS

****

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

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[Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST 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 Station] Fire Protection Engineer who is the Authority Having Jurisdiction (AHJ), and whose opinion is 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. As defined under Florida Statutes, Chapter 471, all design work will be performed by a "delegated engineer", who is a Professional Engineer, licensed to practice in Florida and competent in fire protection engineering.

1.2 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 IRON AND STEEL INSTITUTE (AISI)

AISC/AISI 121	(2004) Standard Definitions for Use in the Design of Steel Structures

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606	(2011) Grooved and Shouldered Joints

ASME INTERNATIONAL (ASME)

ASME A112.18.1/CSA B125.1	(2011) Plumbing Supply Fittings
ASME B16.34	(2009; Supp 2010) Valves - Flanged, Threaded and Welding End
ASME B16.39	(2009) 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	(2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.1	(2010) Power Piping

ASTM INTERNATIONAL (ASTM)

ASTM A126	(2004; R 2009) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A135/A135M	(2009) Standard Specification for Electric-Resistance-Welded Steel Pipe
ASTM A183	(2003; R 2009) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A234/A234M	(2011a) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy

	Steel for Moderate and High Temperature Service
ASTM A307	(2010) 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) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A563M	(2007) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM A795/A795M	(2008) Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM C592	(2010) 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/
FM AS 4991	(2001) Approval of Firestop Contractors

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

MSS SP-58	(2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

RCBEA GUIDE	(2004) NASA Reliability Centered Building and Equipment Acceptance Guide

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(2010; Errata 10-1; TIA 10-1; TIA 11-2) Standard for the Installation of Sprinkler Systems

NFPA 13E	(2010) Recommended Practice for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems
NFPA 14	(2010) Standard for the Installation of Standpipes and Hose Systems
NFPA 1963	(2009; Errata 09-1) Standard for Fire Hose Connections
NFPA 24	(2010) 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	(2011; Errata 2 2012) National Electrical Code
NFPA 72	(2010; TIA 10-4) National Fire Alarm and Signaling Code
NFPA 75	(2009; TIA 12-1) Standard for the Protection of Information Technology Equipment

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	(2003) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101	(1970; Rev B) Color Code for Pipelines & 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 193	(2008) UL Standard for Alarm Valves for Fire Protection Service
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL Fire Prot Dir	(2012) Fire Protection Equipment Directory

1.3 ADMINISTRATIVE REQUIREMENTS

1.3.1 Pre-Installation Meeting

No later than [15] [30] [_____] calendar days of Contract Award, mandatory attendance is required at a pre-installation meeting. Submit the following to the Contracting Officer for review:

a. Contractor's State Certification

b. Factory test data, including fully verified and dated copies of all results with a copy of the approved test procedure and any other related information.

c. Quality Assurance Plan

d. Test procedures and recording forms for the preliminary tests

Provide one (1) copy of the test procedures and recording forms for the preliminary tests. For the final acceptance tests, provide ten (10) copies of the test procedures and recording forms. In each test procedure, 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. Provide test forms with suitable spaces for recording test results on all equipment, devices, and wiring to be tested. Provide test record forms that also have identified spaces for verification signatures of official witnesses and dates of the test.

1.3.1.1 Shop Drawings

Submit shop drawings for the following items in sufficient detail and scope to verify compliance with the requirements of the contract documents:

a. Records of Existing Conditions

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.

b. Schematics and Fabrication Drawings

Submit Schematics and Fabrication Drawings 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. Meet all requirements in NFPA 13 for fabrication drawings, stipulated for "working plans", to include a building cross-section. Provide working plans signed and sealed by a Professional Engineer, licensed to practice in the State of Florida.

Indicate on working plans 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."

c. Fire Service Floor Plans

Provide .DWG format computer generated floor plan layouts indicating all automatic sprinkler and standpipe systems components.

[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. In the design, 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.

] Indicate in the Fire Service Floor Plans, the 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 457 by 610 mm 18 by 24 inches in a painted metal frame with a Plexiglas cover. Submit the floor plan and it's location for approval to the Contracting Officer prior to installation.

d. Connection Diagrams

Submit Connection Diagrams indicating the relations and connections of the following items. Indicate on the drawings the general physical layout of all controls, and internal tubing and wiring details.

1.3.1.2 Manufacturer's Product Data

Submit Manufacturer's Catalog Data in sufficient detail and scope to verify compliance with the requirements of the contract documents.

1.3.1.3 Fire-Protection System Performance Data

Submit Fire-Protection System Performance Data consisting of information on useful life, system functional flows, safety features, and mechanical automated details. As a minimum, include the following:

a. Design Analysis and Hydraulic Calculations

Provide hydraulic calculations for the hydraulic remote area of each riser

and each occupancy classification. Provide hydraulic calculations signed and sealed by a Professional Engineer, licensed to practice in Florida.

Include in the design data 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.

1.4 SUBMITTALS

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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.

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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 reviews the submittal for the Government.] 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]

Factory Test Data[; G]

Quality Assurance Plan[; G]

Test Procedures and Recording Forms for the Preliminary Tests[; G]

SD-02 Shop Drawings

Connection Diagrams[; G]

Schematics and Fabrication Drawings[; G]

As-Built Drawings[; G]

Fire Service Floor Plans[; G]

Records of Existing Conditions[; G]

SD-03 Product Data

Piping Materials[; G]

Supporting Elements[; G]

Sprinkler Riser Equipment[; G]

Riser Alarm Equipment[; G]

Compressed Air Supply Equipment[; G]

Fire Department Connections[; G]

Standpipe Equipment[; G]

Fire Hose Cabinet Stations[; G]

Sprinkler Heads[; G]

Valves[; G]

Miscellaneous Materials[; G]

Identification Tags[; G]

Inspector's Test Valve[; G]

Sound Stopping[; G]

Fire Stopping[; G]

Fire-Protection System Performance Data[; G]

SD-05 Design Data

Design Analysis and Hydraulic Calculations[; G]

SD-06 Test Reports

Pressure Tests[; G]

Air Tests[; G]

Valve-Operating Tests[; G]

Drainage Tests[; G]

Inspector's Test[; G]

System Operating Tests[; G]

SD-07 Certificates

Test Gauge Accuracy[; G]

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals[; G]

1.5 QUALITY ASSURANCE PLAN

Ensure all equipment provided under this sprinkler system specification is manufactured to meet the requirements of this paragraph. Provide system(s) that is (are) the latest standard design, that is listed by Underwriters' Laboratories or approved by Factory Mutual FM APP GUIDE, and is suitable for the intended use.

Components installed under this contract cannot be more than one (1) year older than the date of installation. Submit proof that all components are Underwriter Laboratory UL Fire Prot Dir listed or Factory Mutual FM APP GUIDE and FM AS 4991 approved for their intended use and function, and are installed per manufacturer instructions.[Provide materials and equipment furnished that are compatible with the existing system.]

Number all fittings and coupling that require a specific torque range and ensure the corresponding torque value is documented. Submit verification that all grooved clamp type couplings and fittings were installed in accordance with the manufacturer installation manual.

1.5.1 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, make all necessary adjustments and perform all tests on the automatic sprinkler system at the site.

Sprinkler System Specialist is 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.

Also consider certification of other recognized agencies with equivalent requirements. Provide evidence of the Contractors State Certification and the basis of certification to the Contracting Officer and approve by the Contracting Officer prior to any work being performed at Kennedy Space Center.

1.6 PREDICTIVE TESTING AND INSPECTION TECHNOLOGY REQUIREMENTS

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NOTE: The Predictive Testing and Inspection (PT&I) tests prescribed in Section 01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS are MANDATORY for all [NASA] [_____] assets and systems identified as Critical, Configured, or Mission Essential. If the system is non-critical, non-configured, and not mission essential, use sound engineering discretion to assess the value of adding these additional test and acceptance requirements. See Section 01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS for additional information regarding cost feasibility of PT&I.

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This section contains systems and/or equipment components regulated by NASA's Reliability Centered Building and Equipment Acceptance Program. This program requires the use of Predictive Testing and Inspection (PT&I) technologies in conformance with RCBEA GUIDE to ensure building equipment and systems installed by the Contractor have been installed properly and contain no identifiable defects that shorten the design life of a system and/or its components. Satisfactory completion of all acceptance requirements is required to obtain Government approval and acceptance of the Contractor's work.

Perform PT&I tests and provide submittals as specified in Section 01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide fire-protection system materials and equipment conforming to the requirements of Underwriters Laboratories UL Fire Prot Dir or the Factory Mutual FM APP GUIDE.[Provide materials and equipment compatible with the existing system.]

2.1.1 Design Requirements

The work includes designing and providing new automatic wet pipe sprinkler systems consisting of but not limited to an easy riser type swing check valve, with all associated trim, including gauges, DN 50 2 inch 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 not limited to, OS&Y isolation valve(s), dry-pipe valves, floor drains, inspector's test drain, flow switches and sprinkler heads.] Hydraulically design the automatic sprinkler system(s) to meet density and area of coverage requirements using a UL listed or FM approved hydraulic design program. Provide the design, equipment, materials, installation, workmanship, examination, inspection, and testing 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. Include in each system all materials, accessories, and equipment inside and outside the building to provide an operationally compliant system. In the system design 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.

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

2.2 PIPING MATERIALS

2.2.1 Type BCS - Black Carbon Steel

Pipe DN 6 through DN 50 1/8 through 2 inches: Schedule 40 furnace butt welded or electric-resistance welded black-carbon steel conforming to ASTM A53/A53M, ASTM A135/A135M, ASTM A795/A795M, Type F (furnace butt welded) or Type E (electric-resistance welded), Grade B.

Pipe DN 65 through DN 20 2-1/2 through 8 inches: Schedule 40 seamless or electric-resistance welded black carbon steel, conforming to ASTM A53/A53M, ASTM A135/A135M, ASTM A795/A795M, Type E (electric-resistance welded), Grade B, or Type S (seamless), Grade B.

Unions DN 50 2 inches and under: 2068 kilopascal 300-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

Standard Pipe Couplings: Extra-heavy screwed black steel.

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

Fittings DN 65 2-1/2 inches and larger: 1207 kilopascal 175 psi working pressure, wrought steel, buttweld 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 6.35 cm 2-1/2 inch and larger: 1207 kilopascal 175 psig minimum working pressure with a housing fabricated in two or more parts of black malleable-iron castings. Ensure grooved couplings do not require a specific torque setting for housing bolt installation. Provide piping that is grooved in accordance with AWWA C606, or the manufacturer's specifications, for proper installation of the grooved couplings used. Provide couplings of the same part number for use on a single system.

Provide coupling gaskets of molded 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.

Grooved fittings 6.35 cm 2-1/2 inch and larger: 1207 kilopascal 175 psig working pressure fittings used with grooved couplings that are fabricated of black malleable-iron castings, and are of the same manufacture as the pipe couplings. If a manufacturer's standard-size malleable-iron fitting pattern is not available, use fabricated fittings; 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.

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

Pre-manufactured shaped welded outlets (weld-o-lets) can be used 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 setscrews for maintaining system integrity.

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

****

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

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 suitable for stresses imposed by systems pressures and temperatures, natural, and other external forces. 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 requires vibration isolation.
****

Provide FM approved or UL listed supporting elements conforming 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

Conform anchor devices 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-anchor devices.

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

2.3.1.2 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 can be used for pipe DN 50 2 inch and under.

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

2.3.1.3 C-Clamps

****
NOTE: Avoid C-clamps, as a means of attaching hangers to structural steel. 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.
****

Do not use C-clamps.

2.3.1.4 Inserts, Concrete

Provide concrete inserts in accordance with the requirements of MSS SP-58 for Type 18. When applied to piping in sizes DN 50 2-inch iron pipe size (ips) and larger, and where otherwise required by imposed loads, insert and wire a 304.8 mm length of 12.7 mm 1-foot length of 1/2-inch reinforcing rod through wing slots.

2.3.2 Horizontal-Pipe Attachments

2.3.2.1 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.

2.3.2.2 Parallel Fire-Protection Pipes

Use trapeze hangers fabricated from approved structural steel shapes, with U-bolts, when so specified. Provide structural-steel shapes that conform to supplementary steel requirements or provide supports that are commercially available, approved proprietary-design rolled steel.

2.3.3 Vertical-Pipe Attachments

Provide single Type 8 vertical-pipe attachments.

2.3.4 Hanger Rods and Fixtures

Use only circular solid cross section rod hangers to connect building structure attachments to pipe-support devices. Use 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.

2.3.5 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, design and fabricate such supplementary steel in accordance with AISC/AISI 121.

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

2.4 SPRINKLER RISER EQUIPMENT

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

2.4.1 Standard Check Valve

****
NOTE: This subpart is required for all new systems. Remove this subpart if no check valves are required for system modifications.
****

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. Provide check valve that is able to be installed vertically or horizontally, and that is rated for 2068 kilopascal 300 psi working pressure. Provide clapper that is type 304 stainless steel, Teflon-coated hot-rolled steel, ductile iron, coated ductile iron, or bronze with field replaceable EDPM or Nitrite seal, with nickel or bronze seat. Provide a valve with springs, hinge shafts and retaining rings that are stainless steel. Provide a valve that has a valve body manufacturer painted with a corrosion resistant non-lead coating.

2.4.2 Wet Pipe Valve

Provide wet pipe valve that is of the combination check valve/main drain type complete with standard accessories and trim, including pressure gauges, DN 50 2-inch main drain connection, flow switch tapping, and all necessary intercomponent water piping, fittings, and valves. Component requirements for Standard Check Valves also apply to Wet Pipe Valves.

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

][Provide wet-pipe sprinkler systems with a UL listed or FM approved alarm valve with DN 50 2-inch main drain. Provide alarm valve that complies with UL 193

]2.4.3 Dry Pipe Valve

****
NOTE: This subpart is required if a dry pipe system is to be installed. If only a dry pipe system is to be installed, remove requirements for wet pipe valves in the preceding subpart.
****

Provide a dry-pipe sprinkler system that has a UL listed or FM approved

dry-pipe valve, complete with standard accessories and trim necessary to provide alarm, trouble and supervisory signals. Provide DN 50 a dry-pipe valve with a 2 inch main drain connection and pressure gauges on the water side of the valve, air side of the valve, and 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.

Provide an air pressure switch capable of giving supervisory indication of a loss of air pressure.

2.5 COMPRESSED AIR SUPPLY EQUIPMENT

****
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. Use floor mounted compressors for large systems. Where in doubt, seek direction from the AHJ.
****

Provide an independent air compressor mounted on the riser to maintain dry-pipe system air pressure. Provide an oil-less air compressor that is spring and elastomer vibration isolated from the riser, complete with adjustable setpoint low differential 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 (2) coats of enamel, Color No. 11105 (red), and permanently affix a label which reads, "Dry-Pipe Compressor Disconnect Switch - Fed from Panel [_____] CKT No.[_____]".

2.5.1 Floor Mounted Compressed Air Supply

Provide a floor-mounted compressed air system complete with air compressor, pressure gauges, pressure switches, air maintenance devices, desiccant air dryer and appurtenances. Provide compressed air system that maintains 275 kilopascal's 40 pounds per square inch air pressure on the dry-pipe system piping, and transmits a supervisory trouble alarm to the fire alarm control panel when pressure drops below 207 kilopascal's 30 pounds per square inch. Include a pressure switch for controlling the compressor that is field adjustable for both the "on" and "off" pressure settings. In an air maintenance device with a by-pass line for fast filling the system include an air strainer, air pressure regulator, air restrictor, air check valve, and all other associated piping, valves and fittings. Provide compressor that is spring and elastomer vibration isolated from the riser. Provide pressure gauges that are air or oil type, and 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 (2) coats of enamel, Color No. 11105 (red) and permanently affix a

label which reads, "Dry-Pipe Compressor Disconnect Switch - Fed from Panel [_____] CKT No. [_____]."

2.6 COMPRESSED AIR BY-PASS LINE

Provide air supply line for each dry-pipe valve with an orifice union with a 6 mm 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.

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 207 kilopascal's 30 psig. 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

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 switch that has an integral field adjustable 0-90 second retard feature, and activates within 60 seconds, plus or minus ten (10) seconds upon opening of the inspectors test station.

Provide water flow alarm device that has a design working pressure of 2068 kilopascal 300 psi, include two (2) sets of single pole, double throw contacts rated for not less than 2.0 amps at 30 VC. Provide housing that is die cast, suitable for both indoor and outdoor use and includes knockouts for conduit connections.

2.9 PRESSURE GAUGE

Provide pressure gauge with a [_____] minimum 89 mm 3.5 inch 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, 2068 kilopascal 300 psi working pressure, and three-way globe style gauge isolation valve with plugged end.

2.10 INSPECTOR'S TEST

Provide an inspector's test valve that is a three-position (OFF-TEST-DRAIN) combination test, drain, and pressure relief device with bronze body, bronze ball valve, one quarter turn handle, integral sight glass (on discharge side), and internal corrosion resistant orifice, sized to match the sprinkler head orifice size. Ensure pressure relief device is factory set to relieve pressure at 1206 kilopascal 175 psi.

2.11 CLASS 1 STANDPIPE

Provide an automatic Class 1 standpipe system as established by NFPA 14, with DN 65 2-1/2 inch, 1206 kilopascal's 175-psi hose connections in the stairwells, at the locations indicated on the contract drawings. Hydraulically design the standpipe systems to provide a minimum water flow rate of 1892 liters/min 500 gpm, with a minimum residual pressure of 689 kilopascal's 100 psig at the outlet of the two (2) hydraulically most remote DN 65 2-1/2 inch hose connections. Base hydraulic calculations and

pipe sizes for the standpipe system on providing 1892 liters/min 500 gpm for the first standpipe and 946 liters/min 250 gpm from the most remote valve on each additional standpipe, with the total not to exceed 4731 liters/min 1250 gpm.

****
NOTE: Rewrite the following for dry systems.
****

2.12 FIRE DEPARTMENT CONNECTIONS

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

2.12.1 Wall Siamese

Provide unit that has a cast brass or bronze flush-mounted escutcheon-plate with two DN 65 2-1/2inch, fire-department, swivel, female inlets; double-clapper valves; rocker-lug caps and chains; and cast-in function-identifying lettering. Provide model that has chrome-plated or polished surface finish in accordance with ASME A112.18.1/CSA B125.1.

2.12.2 Sidewalk Siamese

Provide unit that is cast brass or bronze with two DN 65 2-1/2inch, fire-department, swivel, female inlets; double-clapper valves; rocker-lug caps and chains; and cast-in function-identifying lettering. Provide model with Chrome-plated or polished surface finish 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 0.508 mm 20-mil thick bituminous coating.

2.12.3 Wall Hydrant

Provide unit that has a cast brass or bronze flush-mounted escutcheon-plate with two DN 65 2-1/2 inch, fire-department, male outlets; rocker-lug caps and chains; and cast-in function-identifying lettering. Provide model with chrome-plated or polished surface finish in accordance with ASME A112.18.1/CSA B125.1.

2.12.4 Roof Manifold

Provide unit that is cast brass or bronze, horizontal type, with two DN 65, 1206 kilopascal 2 1/2-inch 175 psi, rated hose valves fitted with rocker-lug caps and chains. Provide model with rough body finish and polished trim.

2.13 SPRINKLER HEADS

2.13.1 Head Types

Use standard 12.7 mm 1/2-inch orifice sprinkler heads, except that 13.5 mm 17/32-inch heads can be used where required by hydraulic calculation.

For heads required to be concealed where the appearance of a smooth ceiling is required use concealed pendent type heads with a low profile, small

diameter cover plate with a factory applied finish to match suspended ceiling tiles.

For heads required to be located in the center of the suspended ceiling tiles, use return bends or an FM approved flex head commercial ceiling sprinkler assembly with a maximum overall length of 2.1 m 7 feet.

Provide [upright] [pendant] [sidewall] type heads in unfinished areas or above suspended ceilings. Provide sidewall type heads in elevator pits. Provide [upright][pendant] type heads at the top of elevator shafts.

Provide semi-recessed or flush pendent type heads in finished areas with suspended ceilings. Provide heads and escutcheon plates that are chrome-plated brass. Sidewall type heads can be used where indicated on the drawings, or in locations as defined by NFPA 13.

Do not use pendant sprinkler heads in dry-pipe sprinkler systems, except where dry pendant type heads are acceptable.

Where needed, provide corrosion-resistant heads that are wax-coated, Nickel-Teflon coated, or manufacturer coated with an equivalent UL listed or FM approved corrosion-resistant coating.

2.13.2 Temperature Rating

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

2.13.3 Spares

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

2.13.4 Head Protection

Protect heads with paper or plastic bags during painting operations. Immediately remove protection upon finishing painting operations.

Provide steel wire head guards wherever mechanical damage could occur. Provide head guards UL listed or FM approved for use with the sprinkler heads installed. Provide head guards with a manufacturer applied red finish, except where head guards UL listed or FM approved for use with the sprinkler heads installed do not come in a manufacturer applied red finish.

Provide water shields of cold rolled galvanized steel, and install on all heads located beneath other heads within their spray areas. Provide shields with red finish.

2.14 VALVES

2.14.1 Aboveground

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

Provide FM approved ball valves, DN 50 2 inches and under, rate 2070 kilopascald to 300 psi, with provisions to wire or lock handle in place

where a critical alarm function is isolated.

Provide gate valves that are of the outside screw and yoke configuration with cast iron body and wedge and bronze yoke bushing, seat ring and face ring. Provide gate valves with a solid wedge, constructed of cast iron or bronze. Provide valves that have flanged or grooved ends and are rated for 1206 kilopascal 175 psi non-shock cold water.

Provide angle valves (for main drain) of the screwed or union bonnet type that have bodies constructed of bronze with a bronze disk. Provide angle valves having rubber disk seats and screwed ends rated for 1206 kilopascal 175 psi non-shock cold water.

Supervise all control and isolation valves using a tamper switch, except for post indicator valves and OS&Y valves on double check valve assemblies backflow prevention, unless otherwise directed by the AHJ.

2.15 MISCELLANEOUS MATERIALS

2.15.1 Bolting

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

2.15.2 Escutcheons

Provide escutcheons manufactured from ferrous metals. Provide only chrome-plated escutcheons, except when AISI 300 series corrosion-resistant steel is provided. Provide metals and finishes conforming 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 internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.15.3 Flange Gaskets

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

2.15.4 Pipe-Thread Compounds

Use tetrafluoroethylene tape or other suitable compounds.

2.16 FIRE-PROTECTION SYSTEM IDENTIFICATION

Provide a coordinated system of piping and equipment identification 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, bring existing layouts 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

Provide chart listing of equipment by designation number and show pertinent data. Provide diagrams that are neat, mechanical drawings mounted in extruded aluminum frames, with 3 mm 1/8-inch thick acrylic plastic protection. Provide at a location directed by the Contracting Officer. Provide minimum of one mounted chart and diagram, plus one extra copy of each, for each fire-protection system.

2.16.2 Metal Tags

Install Identification tags made of brass or aluminum and indicating function of valve or similar component on each system device. Provide tags that are not less than 50 mm 2 inches in diameter and that have stamped markings.

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-gage galvanized wire.

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

2.16.3 Service Labeling

Label piping, including that concealed in accessible spaces, to designate service. Provide labels with an arrow or arrows to indicate flow direction. Provide labels or tag designations 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

Provide labels and arrows 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, locate labels at a distance visible to each other, but in no case can the distance between labels exceed 12.2 m 40 feet.

Provide label lettering to be 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-gage aluminum sheet that is attached to the pipe with 2.7 mm 12-gage galvanized wire. Provide labels that are legible from the primary service and operating area.

Provide labels that are made of self-sticking plastic film designed for permanent installation. Provide labels that have red letters on white background.

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

2.17 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.

2.18 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]. Select discharge location to avoid creating a nuisance or hazardous condition and that is 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.

Sleeve and caulk penetrations of exterior walls. Provide penetrations of exterior walls no greater than 610 mm 24 inches and no less than 152 mm 6 inches above grade. Provide drain lines that terminate in a 45 or 90 degree elbow turned down discharging to an 450 mm 18 inch concrete splash block.

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

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 who will be notified by the Contractor 48 hours in advance of the start of work.

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

Riser locations, pipe sizes, and the number of risers shown on the drawings is approximate in nature. Coordinate final riser quantity and location with the building construction, system design, Code requirements, and water

supply limitations and maintenance requirements. The number of risers shown on the documents are the minimum to be provided. Indicate on Contractor's shop drawing submittal the exact location and number of risers 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

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

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

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

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

PIPE SIZE (INCHES)	ROD SIZE (INCHES)	HANGER SPACING FOR STEEL PIPE (FEET)
5	1/2	15
6	1/2	15
8	1/2	15

Support vertical risers at the base where possible and at intervals specified. Guide piping for lateral stability as necessary. Place clamps under fittings wherever possible. Support carbon-steel 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, irrational, 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 DN 65 2-1/2 inch fire hose connection valves for the Class I standpipe at 1.21 m 4'-0" above the finished floor, measured from the top of the valve discharge outlet.

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

Install grooved couplings in accordance with manufacturer's instructions and provide means for the government inspector to access and verify proper installation. Provide access to piping materials prior to installation for the government inspector to verify proper grooves exist on all piping with grooved ends.

Locate inspector's test valve approximately 1.5 m 5 feet above finished floor. Provide inspector's test valve for each sprinkler system, or portion thereof equipped with an alarm device, for testing purposes. Locate inspector's test valve at the hydraulically most remote portion of the sprinkler system. Provide inspector's test piping that [discharges to the building exterior][or][discharges 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 that are no greater than 610 mm 24 inches and no less than 152 mm 6 inches above grade, and are sleeved and caulked. Terminate inspector's test discharge in a 45 or 90 degree elbow turned down, discharging to an 450 mm 18 inch concrete splash block. Size inspector's test lines to be capable of development of the design flow from one sprinkler without creating excessive back pressure.

3.3 SOUND STOPPING

Provide effective sound stopping and adequate operating clearance 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. Finish penetrations to be compatible with surface being penetrated.

Sound stopping and vapor-barrier sealing of pipe shafts and large floor and wall openings can be accomplished 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. Finish foam with a rasp. Provide vapor barrier that is not less than 3 mm 1/8-inch thickness of vinyl mastic applied to visible and accessible surfaces.

3.4 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. For sealing purposes, 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.

3.5 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 fabricated from Schedule 40 steel pipe with welded anchor lugs. Form other sleeves by molded linear polyethylene liners or similar materials that are removable. Provide sleeves with diameters 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 solid the space between a pipe and the inside of a pipe sleeve or a construction surface penetration 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. Where sleeves or construction-surface penetrations occur between conditioned and unconditioned spaces, fill the space between a pipe, bare or insulated, and the inside of a pipe sleeve or construction-surface penetration with an elastomer caulk to a depth of 12.7 mm 1/2 inch. Provide oil and grease free surfaces to be caulked.

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

3.6 ESCUTCHEONS

Provide escutcheons at penetrations of piping into finished areas. Where finished areas are separated by partitions through which piping passes,

provide escutcheons on both sides of the partition. Where suspended ceilings are installed, provide plates at the underside only of such ceilings. Provide escutcheons that are chrome plated in occupied spaces and that conceal openings in building construction. Firmly attach escutcheons.

3.7 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 replace with new undamaged equipment at no additional cost to the Government.

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

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

3.8 ELECTRICAL WORK

Provide electrical work that is specified in DIVISION 26 ELECTRICAL for control system wiring under Section 28 31 00.00 98 FIRE DETECTION AND ALARM and this section in accordance with UL 6 and NFPA 70. Use rigid metal conduit or intermediate metal conduit, except that electrical metallic tubing can 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, test completed systems in the presence of the Contracting Officer. Upon approval, provide certificates of testing.

Provide hydrostatic Pressure tests, unless otherwise specified. Use only potable water for testing.

[Perform System operating tests, Air tests, Valve-operating tests, and Drainage tests for dry-pipe systems.

] Full opening of the inspector's test connection has to 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, install air accelerator(s) per the manufacturer's requirements to meet the 60 second discharge time in accordance with NS'S 8719.11, 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. Provide records that 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.

3.9.1 Test Gages

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. Include maximum permissible scale range for a given test to be such that the pointer during a test can only have a starting position at midpoint of the dial or within the middle third of the scale range. For each test gage, include a table indicating test gauge accuracy certification and corrections made within 90 days prior to the test, the test gage number, and the project number.

3.9.2 Test and Acceptable Criteria

Hydrostatically test above ground 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's 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.

Dry pipe systems also require an air pressure leakage test at 275 kilopascal's 40 psi. Maintain the applied pressure without further addition of test media for not less than 24 hours. Maximum allowable pressure drop is 10.3 kilopascal's 1-1/2 psi.

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

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

Repair dripping or weeping joints.

3.10 DISINFECTION

Disinfect water piping, including valves, fittings, and other devices, with a solution of chlorine and water. Solution cannot contain 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 has to contain a minimum residue of 2 ppm of available chlorine or the system will be re-disinfected. After successful disinfections, thoroughly flush the piping before placing into service. Water for disinfecting, and flushing will be furnished by the Government.

3.11 CLEANING AND ADJUSTING

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

3.12 AS-BUILT DRAWINGS

Submit As-Built drawings for approval 21 days prior to the acceptance testing phase of the project as described in the paragraph entitled, "System Testing," of this section. Provide two (2) sets of magnetic media as-built drawings in .DWG or .DGN electronic format, and hard copies of all new and revised software and drawings with the submittal. Document on as-Built drawings the final system configuration including deviations from and amendments to the drawings, and field installation changes, concealed and visible.

3.13 OPERATION AND MAINTENANCE

Submit 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. Submit this information prior to performing acceptance tests.

-- End of Section --