**********
**USACE / NAVFAC / AFCEC / NASA** | **UFGS-21 13 00.00 40 (August 2013)**
**Change 1 - 11/14**
**Preparing Activity: NASA** | **Superseding**
**UFGS-21 13 00.00 40 (August 2010)**

**UNIFIED FACILITIES GUIDE SPECIFICATIONS**

**References are in agreement with UMRL dated July 2022**
**********

SECTION TABLE OF CONTENTS

DIVISION 21 - FIRE SUPPRESSION

SECTION 21 13 00.00 40

FIRE-SUPPRESSION SPRINKLER SYSTEMS

**08/13, CHG 1: 11/14**

**********

| | |
|---|---|
| **USACE / NAVFAC / AFCEC / NASA** | **UFGS-21 13 00.00 40 (August 2013)** |
| | **Change 1 - 11/14** |
| | **----------** |
| **Preparing Activity: NASA** | **Superseding** |
| | **UFGS-21 13 00.00 40 (August 2010)** |

**UNIFIED FACILITIES GUIDE SPECIFICATIONS**

**References are in agreement with UMRL dated July 2022**

**********

SECTION 21 13 00.00 40

FIRE-SUPPRESSION SPRINKLER SYSTEMS
**08/13, CHG 1: 11/14**

**********

**NOTE: This guide specification covers the requirements for wet and dry fire protection sprinkler systems, hydrants, standpipe equipment, and firehose stations.**

**Drawings should include the following:**

**Data on subsurface soil conditions**

**Location and invert elevations of existing obstructions on the ground surface and existing underground structures and utilities that are to be avoided during construction or are required to be plugged and abandoned or demolished and removed**

**Invert elevations of all work to be connected to size, type, and extent of selected conduit**

**Typical cross-section for each nonspecified trench, bedding, and backfill condition, indicating conduit, bedding, and backfill material**

**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, temperature setting of heads, ceiling type, height, and any other special design criteria**

**Existing alarm-system connections**

**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 item(s) or insert appropriate information.**

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

**Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).**

**********

PART 1 GENERAL

**********

**NOTE: If Section 23 30 00 HVAC AIR DISTRIBUTION is not included in the project specification, applicable requirements therefrom should be inserted and the following paragraph deleted.**

**********

Section 23 30 00 HVAC AIR DISTRIBUTION applies to work specified in this section.

1.1 REFERENCES

**********

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

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

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

**********

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 (2007) Standard Definitions for Use in the

Design of Steel Structures

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|---|---|
| ASME A112.18.1/CSA B125.1 | (2018) Plumbing Supply Fittings |
| ASME B16.1 | (2020) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250 |
| ASME B16.3 | (2021) Malleable Iron Threaded Fittings, Classes 150 and 300 |
| ASME B16.4 | (2021) Gray Iron Threaded Fittings; Classes 125 and 250 |
| ASME B16.9 | (2018) Factory-Made Wrought Buttwelding Fittings |
| ASME B16.34 | (2021) Valves - Flanged, Threaded and Welding End |
| ASME B16.39 | (2020) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300 |
| ASME B31.1 | (2020) Power Piping |

AMERICAN WATER WORKS ASSOCIATION (AWWA)

| | |
|---|---|
| AWWA C104/A21.4 | (2016) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water |
| AWWA C110/A21.10 | (2012) Ductile-Iron and Gray-Iron Fittings for Water |
| AWWA C111/A21.11 | (2017) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings |
| AWWA C151/A21.51 | (2017) Ductile-Iron Pipe, Centrifugally Cast |

ASTM INTERNATIONAL (ASTM)

| | |
|---|---|
| ASTM A53/A53M | (2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |
| ASTM A126 | (2004; R 2019) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings |
| ASTM A135/A135M | (2021) Standard Specification for Electric-Resistance-Welded Steel Pipe |
| ASTM A183 | (2014; R 2020) Standard Specification for Carbon Steel Track Bolts and Nuts |
| ASTM A197/A197M | (2000; R 2019) Standard Specification for Cupola Malleable Iron |

| | |
|---|---|
| ASTM A234/A234M | (2019) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service |
| ASTM A307 | (2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength |
| ASTM A563 | (2015) Standard Specification for Carbon and Alloy Steel Nuts |
| ASTM A563M | (2007; R 2013) Standard Specification for Carbon and Alloy Steel Nuts (Metric) |
| ASTM A568/A568M | (2019a) Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for |
| ASTM A1008/A1008M | (2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable |
| ASTM B370 | (2022) Standard Specification for Copper Sheet and Strip for Building Construction |
| ASTM B749 | (2020) Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products |
| ASTM C592 | (2022a) Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) |
| ASTM C920 | (2018) Standard Specification for Elastomeric Joint Sealants |
| ASTM D2000 | (2018) Standard Classification System for Rubber Products in Automotive Applications |

FM GLOBAL (FM)

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

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

| | |
|---|---|
| ISO 898-1 | (2013) Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel — Part 1: Bolts, Screws and Studs with Specified Property Classes — Coarse Thread and Fine Pitch Thread |

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

| | |
|---|---|
| MSS SP-58 | (2018) 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 | (2022; ERTA 1 2021) Standard for the Installation of Sprinkler Systems |
| NFPA 13E | (2020) Recommended Practice for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems |
| NFPA 14 | (2019; TIA 19-1) Standard for the Installation of Standpipes and Hose Systems |
| NFPA 24 | (2022) Standard for the Installation of Private Fire Service Mains and Their Appurtenances |
| NFPA 70 | (2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code |
| NFPA 291 | (2022) Recommended Practice for Fire Flow Testing and Marking of Hydrants |
| NFPA 1961 | (2013) Standard on Fire Hose |
| NFPA 1963 | (2019) Standard for Fire Hose Connections |

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

| | |
|---|---|
| SAE AMS-STD-595A | (2017) Colors used in Government Procurement |

U.S. DEPARTMENT OF DEFENSE (DOD)

| | |
|---|---|
| MIL-C-18480 | (1982; Rev B; Notice 2 2009) Coating Compound, Bituminous, Solvent, Coal-Tar Base |
| MIL-STD-101 | (2014; Rev C) Color Code for Pipelines and for Compressed Gas Cylinders |

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

| | |
|---|---|
| FS FF-S-325 | (Basic; Int Amd 3; Notices 3, 4) Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry) |
| FS WW-P-421 | (Rev D; Notice 1) Pipe, Cast, Gray and Ductile Iron, Pressure (For Water and Other Liquids) |

UNDERWRITERS LABORATORIES (UL)

| | |
|---|---|
| UL 6 | (2007; Reprint Sep 2019) UL Standard for Safety Electrical Rigid Metal Conduit-Steel |
| UL 19 | (2013) Lined Fire Hose and Hose Assemblies |

1.2 ADMINISTRATIVE REQUIREMENTS

Conduct a survey of the work area. Submit a record of existing conditions showing the results of the survey of work area conditions and features of existing structures and facilities within and adjacent to the jobsite. Commencement of work constitutes acceptance of existing conditions.

1.3 SUBMITTALS

**********

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

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

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

**Choose the first bracketed item for Navy, Air Force**

**and NASA projects, or choose the second bracketed item for Army projects.**

**********

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Record of Existing Conditions[; G[, [____]]]

SD-02 Shop Drawings

Supporting Elements[; G[, [____]]]

Fire-Department Connections[; G[, [____]]]

Fire Alarm System[; G[, [____]]]

Sprinkler Heads[; G[, [____]]]

Valves[; G[, [____]]]

SD-03 Product Data

Underground Piping Materials[; G[, [____]]]

Aboveground Piping Materials[; G[, [____]]]

Valves[; G[, [____]]]

Fire-Department Connections[; G[, [____]]]

Riser Alarm Equipment[; G[, [____]]]

Air Compressor[; G[, [____]]]

Standpipe Equipment and Fire Hose Cabinet Stations[; G[, [____]]]

Sprinkler Heads[; G[, [____]]]

Materials[; G[, [____]]]

Supporting Elements[; G[, [____]]]

Equipment and Performance Data[; G[, [____]]]

SD-05 Design Data

Design Analysis and Calculations[; G[, [____]]]

SD-06 Test Reports

Pressure Tests[; G[, [____]]]

System Operating Tests[; G[, [_____]]]

Air Tests[; G[, [_____]]]

Valve-Operating Tests[; G[, [_____]]]

Drainage Tests[; G[, [_____]]]

## 1.4 PREDICTIVE TESTING AND INSPECTION TECHNOLOGY REQUIREMENTS

**********

**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.**

**********

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 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

Provide design analysis and calculations in accordance with NFPA 13.

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

## 2.1 SYSTEM DESCRIPTION

Ensure fire-protection system materials and equipment provided under this section conform to the requirements of Underwriters Laboratories (UL) or the Factory Mutual (FM APP GUIDE).

Products with UL label or seal or listing in UL 6, and products with FM label or listed in the FM APP GUIDE are acceptable fire-protection system materials and equipment. Furnish materials and equipment compatible with existing system.

Submit equipment and performance data for fire protection sprinkler systems consisting of information on use life, system functional flows,

safety features, and mechanical automated details.

## 2.2 EQUIPMENT

### 2.2.1 Underground Piping Materials

Provide ells, tees, reducing tees, wyes, couplings, increasers, crosses, transitions, and end caps of the same type and class of material as the pipe or have equal or superior physical and chemical properties.

#### 2.2.1.1 Type Cast Iron Water Pipe

Provide mechanical joint or push-on cast-iron waterpipe, centrifugally cast, UL listed and labeled, conforming to FS WW-P-421 and, as applicable, to AWWA C151/A21.51, AWWA C110/A21.10, AWWA C111/A21.11. Use Class 150 piping. Ensure bell-and-spigot fittings conform to AWWA C110/A21.10.

For FS WW-P-421 wall-thickness criteria only, depth of cover is 1500 millimeter 5 feet unless drawings indicate less, in which case, drawing requirements apply. Field-laying conditions are B (flat-bottom trench, without blocks, tamped backfill).

Flanged cast-iron pipe fittings are Class 125 conforming to ASME B16.1.

Coat pipe and fittings on the [inside] and [outside] with a bituminous sealer in accordance with AWWA C104/A21.4.

[ Coat pipe and fittings on the inside with a mortar lining in accordance with AWWA C104/A21.4.

] Restraining joints against endwise separation due to internal pressure may be accomplished by a NFPA-recommended metal harness consisting of clamping devices and bolting or by hardened-metal retainers molded into a push-on gasket and engaged by a groove in the spigot end.

Where electrical continuity is indicated, supply the pipe with factory-brazed heavy cross section copper connectors to be joined with copper fasteners upon joint assembly. Connectors, as a minimum, are equal to No. 1/0.

#### 2.2.1.2 Type Ductile Iron Water Pipe

Provide mechanical-joint or push-on type ductile-iron water pipe, centrifugally cast, UL listed and labeled, conforming to applicable provisions of AWWA C111/A21.11, and AWWA C151/A21.51. Wall-thickness criteria is 1380 kilopascal 200-pounds per square inch (psi) working pressure plus 690 kilopascal 100-psi surge allowance, AASHTO H-20 loading with specified trench conditions. Ensure the gasket elastomer is chloroprene.

Coat pipe on the [inside] and [outside] with a bituminous sealer in accordance with AWWA C104/A21.4.

[ Coat pipe and fittings on the inside with a mortar lining in accordance with AWWA C104/A21.4.

] Restraining joints against endwise separation due to internal pressure may be accomplished by using a metal harness consisting of clamping devices and bolting or by hardened-metal retainers molded into a pushon gasket and

engaged by a groove in the spigot end.

Where electrical continuity is indicated, supply the pipe with factory-brazed heavy cross section copper connectors to be joined with copper fasteners upon joint assembly. Connectors, at a minimum, are equal to No. 1/0.

### 2.2.2 Aboveground Piping Materials

#### 2.2.2.1 Type BCS - Black Carbon Steel

Pipe DN6 through DN40 1/8 through 1-1/2 inches: Schedule 40 furnace butt weld black-carbon steel conforming to ASTM A53/A53M, or ASTM A135/A135M, Type F furnace butt welded; Schedule 10 conforming to ASTM A135/A135M, Grade B.

Pipe DN50 through DN2062 through 8 inches, where indicated: Schedule 40 seamless or electric-resistance welded black carbon steel, conforming to ASTM A53/A53M or ASTM A135/A135M, Type E (electric-resistance welded), Grade B, or Type S (seamless), Grade B; Schedule 10 conforming to ASTM A135/A135M, Grade B.

Pipe DN250 10 inches and over: Schedule 30 black carbon steel conforming to ASTM A53/A53M, Type E (electric-resistance welded) or Type S (seamless).

Unions DN50 2 inches and under): 2068 kilopascal 300-pound 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.

Grooved pipe couplings (all sizes): 1207 kilopascal 175-psig minimum working pressure with a housing fabricated in two or more parts of black malleable-iron castings. Provide coupling gasket molded of synthetic rubber, conforming to requirements of ASTM D2000. Provide coupling bolts that are oval-neck, track-head type with heavy hexagonal nuts, conforming to ASTM A183.

Fittings DN100 4 inches and under: 1207 kilopascal 175-psig working pressure, cast iron, screwed, conforming to ASTM A126, Class A, and ASME B16.4.

Fittings DN150 6 inches and larger: 1207 kilopascal 175-psig working pressure, cast iron, conforming to ASTM A126, Class A, screwed, conforming to ASME B16.4, or flanged, conforming to ASME B16.1.

Fittings DN200 8 inches and under): Provide rolled-groove or mechanical locking (push-on) couplings. Provide rolled only grooves for rolled-groove type; cut grooving is not allowed. Ensure rolled grooves are dimensionally compatible with the couplings.

Grooved fittings (all sizes): 1207 kilopascal ensure 175-psig working pressure fittings used with grooved couplings are fabricated of black malleable-iron castings. 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.

2.2.2.2 Type GCS - Galvanized Carbon Steel

Pipe DN15 through DN250 1/2 through 10 inches and where indicated): Schedule 40 seamless or electric resistant welded galvanized steel conforming to ASTM A53/A53M, Type E (electric-resistance welded) or Type S (seamless). Type F (furnace butt welded continuous welded) is acceptable for sizes less than DN50 2 inches.

Fittings (all sizes): 1034 kilopascal 150-psig working pressure banded, galvanized, malleable, screwed, conforming to ASTM A197/A197M and ASME B16.3.

Fittings DN65 2-1/2 inches and over): 862 kilopascal 125-psig working pressure cast-iron flanges and flanged fittings conforming to ASTM A126, Class A and to ASME B16.1.

Grooved pipe couplings (all sizes): 1207 kilopascal 175-psig minimum working pressure with a housing fabricated in two or more parts of galvanized malleable-iron castings. Provide coupling gasket molded of synthetic rubber, conforming to requirements of ASTM D2000. Ensure coupling bolts are oval-neck, track-head type with heavy hexagonal nuts, conforming to ASTM A183.

Grooved fittings (all sizes): 1207 kilopascal ensure 175-psig working pressure fittings used with grooved couplings are fabricated of galvanized malleable-iron castings. 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.

Unions DN50 2 inches and under): 2070 kilopascal 300-psig working pressure female, screwed, galvanized malleable iron, with brass-to-seat and ground joint.

2.2.3 Supporting Elements

Provide piping system components and miscellaneous supporting elements, including, but not limited to, building-structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical-pipe attachments; horizontal-pipe attachments; restraining anchors; and guides. Ensure supporting elements are suitable for stresses imposed by systems pressures and temperatures, natural, and other external forces.

**********

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

**********

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

2.2.3.1 Building-Structure Attachments

For cast-in floor-mounted equipment-anchor devices, ensure adjustable positions are available.

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

a. Anchor Devices, Concrete and Masonry

(1) Ensure anchor devices conform to FS FF-S-325:

(2) Group I: Shield, expansion (lead, bolt, and stud anchors)

(3) Group II: Shield, expansion (bolt anchors), Type 2, Class 2, Style 1 or 2

(4) Group III: Shield, expansion (self drilling tubular expansion shell bolt anchors

b. Beam Clamps

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

(2) Use Type 20 beam clamps for pipe DN50 2 inches and under.

(3) Use two Type 25 beam clamps per point of pipe support.

c. C-Clamps

**********

**NOTE: C-clamps, as a means of attaching hangers to structural steel, should be avoided. Where used, consider vibration forces and single or accumulated load and resultant moment on structural steel.**

**********

(1) Ensure C-clamps are [not used.] [used to support piping sizes DN40 1-1/2 inches and smaller.] Use FM approved and UL listed C-clamps, with hardened cup-tip setscrew, locknut, and retaining strap. Retaining-strap section cannot be less than 6 by 25 millimeter 1/8 by 1 inch. Beam-flange thickness to which clamps are attached cannot exceed 15 millimeter 0.60 inch.

d. Concrete Inserts

(1) Construct concrete inserts in accordance with the requirements of MSS SP-58 for Type 18 and ASME B16.34. When applied to piping in sizes DN50 2-inch iron pipe size (ips) and larger, and where otherwise required by imposed loads, insert and wire a 300 millimeter length of 15 millimeter 1-foot length of 1/2-inch reinforcing rod through wing slots.

2.2.3.2 Horizontal-Pipe Attachments

a. Single Pipes

(1) Support piping in sizes up to and including DN50 2-inch ips by using Type 1, 5, 6, 7, 9, 10, 11, or 12 solid, split-ring, or band type attachments.

(2) Support piping in sizes DN65 2-1/2 inches and larger by using

Type 1, 2, 3, or 4 attachments or with Type 41 or Type 49 pipe rolls.

b. Parallel Fire-Protection Pipes

(1) Use trapeze hangers fabricated from approved structural steel shapes, with U-bolts, when so specified. Ensure structural-steel shapes conform to supplementary steel requirements or the support is commercially available, approved proprietary-design rolled steel.

2.2.3.3 Vertical-Pipe Attachments

Provide Type B single vertical-pipe attachments.

2.2.3.4 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.

2.2.3.5 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 such supplementary steel and fabricate in accordance with AISC/AISI 121.

2.2.4 Fire-Department Connections

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

2.2.4.1 Wall Siamese

Provide cast brass or bronze flush-mounted escutcheon-plate units, with two DN65 2-1/2-inch, fire-department, swivel, female inlets; double-clapper valves; rocker-lug caps and chains; and cast-in function-identifying lettering. Provide a unit with a chrome-plated or polished surface finish. Ensure chrome plate is in accordance with ASME A112.18.1/CSA B125.1.

2.2.4.2 Sidewalk Siamese

Provide cast brass or bronze unit, with two DN65 2-1/2-inch, fire-department, swivel, female inlets; double-clapper valves; rocker-lug caps and chains; and cast-in function-identifying lettering. Provide a unit with a chrome-plated or polished surface finish. Ensure chrome plate is 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 millimeter 20-mil thick

bituminous coating.

2.2.4.3 Wall Hydrant

Provide a cast brass or bronze flush-mounted escutcheon-plate unit with two DN65 2-1/2-inch, fire-department, male outlets; rocker lug caps and chains; and cast-in function-identifying lettering. Provide a unit with a chrome-plated or polished surface finish. Ensure chrome plate is in accordance with ASME A112.18.1/CSA B125.1.

2.2.4.4 Roof Manifold

Provide a cast brass or bronze, horizontal unit, with two DN65, 1200 kilopascal 2-1/2-inch, 175-pound rated hose valves fitted with rocker-lug caps and chains. Finish is rough body with polished trim.

2.2.4.5 Fire Hydrants

Provide dry-barrel type hydrants, with low-profile and modern appearance. Design hydrants to remain closed if hydrant barrel is sheared or damaged. Select hydrants that have two DN65 2-1/2-inch, hose outlets and one DN115 4-1/2-inch hose outlet complete with non-binding caps and cap chains. Ensure hydrant direction of opening is counterclockwise. Ensure surface is filled, primed, and finished with a multiple-coat high-gloss weather-resistant enamel. All surfaces below grade receive a coating of bitumen not less than 0.508 millimeter 20 mils thick. Exercise care not to plug barrel drainage provisions. Ensure hydrant color is standard for the project site.

2.2.5 Riser Alarm Equipment

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

2.2.5.1 Wet-Pipe Alarm Check Valve

Provide wet-pipe alarm check valve, complete with standard accessories and trim necessary to give an alarm and includes pressure gages, retard chamber, testing provisions, and all necessary intercomponent piping, fittings, and valves. Ensure pilot valve and clapper have individual elastomer seats.

2.2.5.2 Standard Check Valve

Provide FM-approved or UL-listed standard swing-check valves with elastomer-disc seat. Provide pressure gages on both sides of the clapper. Water-flow alarm is a vane type.

2.2.5.3 Dry-Pipe Alarm Check Valve

Provide a dry-pipe alarm check valve, complete with standard accessories and trim necessary to give an alarm. Ensure the valve includes pressure gages, accelerator, priming provisions, testing provisions, and all necessary intercomponent compressed-air and water piping, fittings, and valves.

Ensure the system includes a trouble alarm indicating a loss of air pressure.

2.2.5.4 Water-Flow Alarm Device

Ensure water-flow alarm devices are UL listed for the particular type of system.

a. Water Motor Gong Local Alarm

(1) Assembly includes a gong with an aluminum or chrome-plated brass hood with nonstaining weather-resistant mounting. Water motor shaft has tetrafluoroethylene bearings and an inlet strainer. Ensure the waste water drains as indicated.

[ (2) Ensure weather-exposed units are weatherproof and provided with a weather hood. Construct assembly of nonstaining materials.

] b. Pressure Switch Remote Alarm

(1) Wire the pressure switch to make or break a circuit depending on rise or fall of water pressure.

c. Vane-Type Flow Alarm

(1) Ensure the vane-type flow alarm makes or breaks an alarm circuit upon deflection by a volume of flowing water that equals or exceeds the capacity of a single sprinkler. Ensure alarm has an instant-recycle pneumatic-retard time delay.

d. Electric Motor Gong

**********
**NOTE: Rewrite following for dc systems.**
**********

(1) Provide an electric motor gong with a 150 millimeter 6-inch diameter bell, synchronous-motor type.

2.2.6 Dry-Pipe Maintenance Air

2.2.6.1 Independent Source

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

2.2.6.2 Continuous Source

Maintain the dry-pipe system air pressure by an adjustable set point low-differential-diaphragm pressure-reducing valve connected to 690 kilopascal 100 psig facility compressed-air system to maintain air side of dry-pipe valve. Construct unit entirely of nonferrous-metal with a replaceable cartridge inlet-air filter. Provide a complete air-maintenance device with intercomponent piping, fittings, and valves. Provide spare inlet-air filter media.

2.2.6.3 Retard Orifice

Provide an air-supply line near each dry-pipe valve with an orifice union with a 3 millimeter 1/8-inch orifice corrosion-resistant steel plate, externally identified, and a DN15 1/2-inch three-valve bypass around the orifice union.

2.2.7 Standpipe Equipment and Fire Hose Cabinet Stations

2.2.7.1 Fire Hose Cabinet Stations

Furnish fire hose cabinet stations with cabinet, firehose rack, DN40 1-1/2-inch hose, valve, and spanner wrench.

2.2.7.2 Firehose Racks and Hoses

Provide rack-and-hose assemblies, nipple mounted, swinging, semiautomatic, and red enameled. Fit racks with spring-friction retainer clip.

Ensure hoses are DN40 1-1/2-inch diameter, 20 meter 75-feet long, cotton-polyester jacketed, rubber lined, mildew-proof, conforming to NFPA 1961, and UL approved for rack service. Use rocker-lug type couplings. Provide a spanner, mounted in clips, at each rack.

Provide polished brass rack valves, 1200 kilopascal 175-psi rated, DN65 2-1/2-inch angle valve with 65 millimeter 2-1/2-inch female to 40 millimeter1-1/2-inch male reducer, and fitted with automatic drain-vent device.

Provide hose nozzles that are DN40 1-1/2-inch chemical hose thread, polished brass, adjustable fog, off-and-on solid-stream type.

2.2.7.3 Standpipe-Mounted Hose Racks and Hoses

Select hose racks suitable for specified hose length. Provide red enameled racks and accessories, designed for standpipe mounting at an elevation high enough to avoid damage. Provide suitable clips or spring-loaded retainers to prevent hoses from unwinding and hoses and nozzles from swinging from their mounted position until placed into service.

Provide rack hoses that are DN40 1-1/2-inch diameter, 30 meter 100-foot long, cotton-polyester jacketed, rubber lined and mildew-proof, conforming to [NFPA 1961] [UL 19]. Use rocker-lug type couplings. Provide a spanner, mounted in clips, at each rack.

Provide a polished brass rack valve, 1200 kilopascal 175-psi rated, DN65 2-1/2-inch angle valve with 65 millimeter 2-1/2-inch female to 40 millimeter1-1/2-inch male reducer, and fitted with automatic drain-vent device.

Provide a hose nozzle that is DN40 1-1/2-inch chemical hose thread, polished brass, adjustable fog, off-and-on solid-stream type.

2.2.7.4 Hose Reels and Hoses

Provide red enameled hose reels, frames, and accessories, suitable for specified hose diameter and length. Fit reels with a swivel and piping to allow continuous flow through hoses. Provide friction brakes to prevent

hoses from accidentally unwinding.

Provide hoses with an 40 millimeter 1-1/2-inch inside diameter, 45 millimeter 1-3/4-inch outside diameter, 3-braid, single-jacket, 2070 kilopascal 300-psiworking pressure, 30 meter 100 feet long, hard rubber or heavy duty synthetic cover, non-collapsible, and fitted with couplings. Hoses are red covered, flexible, nonkinking, and weigh not over 35 kilogram per 30 meter 75 pounds per 100 feet.

Provide hole type couplings, one female swivel and one male, both with chemical hose thread (M44 - 3.175 male) (1-3/4-inch outside diameter - 8 NH male threads per inch).

Ensure the reel control valve is 1200 kilopascal 175-psi rated, quarter-turn, ball- or butterfly-valve, for quick-opening operation.

Provide a hose nozzle that is DN40 1-1/2-inch chemical hose thread, polished brass, adjustable fog, off-and-on solid-stream type.

2.2.7.5 Standpipe Valve

Provide a DN65 2-1/2-inch angle hose valve, 1200 kilopascal 175-psi rated, with 65 millimeter 2-1/2-inch female to 40 millimeter 1-1/2-inch male reducer, 40 millimeter 1-1/2-inch cap and chain, and chrome-plated polished brass.

In multistory buildings with fire pumps, include a valve orifice plate to restrict discharge pressure to 450 kilopascal 65 psig.

2.2.7.6 Fire-Hose Cabinet

Provide a recessed heavy-gage steel cabinet body with primed surfaces and baked white enamel interior.

[ Cabinet door and trim 450 kilopascalis 1-1/4-inch 32 millimeter projecting type, of commercial quality cold-rolled steel, conforming to ASTM A1008/A1008M, stretcher-leveled to standards of flatness in accordance with ASTM A568/A568M, and furniture-quality construction with continuous hinge and prime coat.

][Ensure cabinet door and trim is 32 millimeter 1-1/4-inch projecting type, of AISI Type 302 corrosion-resistant steel, with No. 4 finish on all surfaces, including faces and edges exposed to view. Remove weld burns and smooth radii developed. Control warping of edges, especially those which mate to wall, to prevent gaps. Provide continuous corrosion-resistant steel hinges, and door pulls that are 115 millimeter 4-1/2-inch satin finish, chrome-plated brass or corrosion-resistant steel, enclosed, file-cabinet type.

] Fit the door with full size 6 millimeter 1/4-inch thick safety or tempered glass and dual friction latches.

Size cabinet to accommodate the valve, rack, hose, and either one 9.5 liter 2-1/2-gallon air-pressurized water fire extinguisher or one 7 kilogram 15-pound carbon-dioxide extinguisher. Extinguisher will be furnished by the Government.

### 2.2.8 Sprinkler Heads

#### 2.2.8.1 Head Types

Use standard 13 millimeter 1/2-inch orifice sprinkler heads. Heads are automatic on-off type. Install on-off type heads only in wet-pipe systems.

Ensure heads in finished areas below suspended ceilings are flush chrome-plated brass. Provide escutcheon plate of baked enamel finished to match ceiling.

Furnish flush or pendant heads in finished areas below suspended ceiling. Ensure heads and escutcheon plates are chrome-plated brass.

Ensure heads in unfinished areas below suspended ceilings are pendant type. Heads in all other locations are [upright] [pendant] [sidewall] type.

Ensure corrosion-resistant heads are lead-coated.

#### 2.2.8.2 Temperature Rating

Fusible links are for ordinary hazard, except where otherwise indicated.

#### 2.2.8.3 Spares

Furnish spares for each type of sprinkler head, complete with appropriate storage cabinet and wrench.

#### 2.2.8.4 Head Protection

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

Provide head guards wherever mechanical damage could occur. Guard finish is red enamel.

### 2.2.9 Valves

#### 2.2.9.1 Post Indicator Valve Assembly (PIV)

Assembly consists of a standard FM-approved or UL-listed inside-screw gate valve with an above-grade post indicator or a completely factory-assembled FM-approved quarter-turn valve and above-grade post indicator-operator. Direction to open is counterclockwise.

Quarter-turn valve is a wafer-type butterfly valve, rated at 1200 kilopascal175 psi, elastomer-lined and sealed. Ensure the liner acts as a gasket between ASME B16.1, Class 125 or Class 250 flanges. Ensure post has a fail-safe feature to keep valve intact in case of breaking off above grade. Provide a worm-gear operator with permanently oil-lubricated watertight gear case complete with handle.

Apply a coating of bitumen not less than 0.508 millimeter 20 mils thick on surfaces below grade. Fill, prime and finish above grade surfaces with a multiple coat of high-gloss, weather-resistant, red enamel.

Fit post indicator valves to accommodate electrical supervisory switches.

Provide electrical supervisory switches for interconnection to the

building fire alarm system. Ensure switches and connections meet the requirements of Section 28 31 13.00 40 FIRE DETECTION AND ALARM CONTROL, GUI, AND LOGIC SYSTEMS.

2.2.9.2 Fire-Hydrant Service Valves

Provide fire-hydrant service valves that are standard FM-approved or UL-listed inside-screw gate valve, with valve box connection flange.

2.2.9.3 Valve Boxes

Install valve boxes with not less than 5 millimeter 3/16-inch thick cast-iron construction with locking cover that has a cast-in identification legend. Select adjustable extension type boxes with screw- or slide-type adjustment. Fit the base flange to the valve flange. Ensure the full extended length of box is greater than required by depth of cover by not less than 100 millimeter 4 inches. Supply one valve-operating wrench for each size valve nut. Provide guide rings where operating rods are longer than 2 meter 6 feet.

2.2.9.4 Aboveground Valves

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

Ensure ball valves, DN50 2 inches and under, are FM approved, rated 2070 kilopascal 300 psi, with provisions to wire or lock handle in place where critical alarm function may be isolated.

Ensure butterfly valves, DN150, DN200, and DN250 6-, 8-, and 10-inch are FM approved, rated 1200 kilopascal 175 psi, cast-iron bodied wafer type, with elastomer liners and seals. Ensure liners act as a gasket between standard piping-system flanges. Provide a worm-gear operator, with permanently lubricated gears, and oiltight and watertight case, complete with handle and automatic position indication.

2.2.10 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.

2.3 MATERIALS

2.3.1 Bituminous Coating

Bituminous coating is a solvent cutback, heavy-bodied material to produce not less than a 0.305 millimeter 12-mil dry-film thickness in one coat and is as recommended by the conduit manufacturer for compatibility with factory coating and rubber joints.

For previously coal-tar-coated and for uncoated ferrous surfaces underground, ensure the bituminous coating is a solvent cutback coal-tar type, conforming to MIL-C-18480.

2.3.2 Bolting

Ensure flange and general-purpose bolting is hex-head and conforms to

ISO 898-1 ASTM A307, Grade B. Ensure heavy hex-nuts conform to ASTM A563M, ASTM A563. Square-head bolts and nuts are not acceptable.

2.3.3 Elastomer Caulk

Use two component polysulfide- or polyurethane-base elastomer-caulking material, conforming to ASTM C920.

2.3.4 Escutcheons

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

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

2.3.5 Flashing

2.3.5.1 Lead

Ensure sheet lead conforms to ASTM B749, and weighs not less than 20 kilogram per square meter 4 pounds per square foot.

2.3.5.2 Copper

Ensure sheet copper conforms to ASTM B370 and weighs not less than 4.88 kilogram per square meter 16 ounces per square foot.

2.3.6 Flange Gaskets

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

2.3.7 Pipe-Thread Compounds

Use tetrafluoroethylene tape or other suitable compounds.

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 PREPARATION

3.1.1 Painting

If manufacturer's standard-finish equipment surfaces are damaged during construction, bring 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.

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

Apply two coats of enamel paint to all firex piping, valves, and appurtenances, including hose racks and reels, but excluding hoses, hose nozzles and siamese connections. Use paint color No. 11105 (red) in accordance with MIL-STD-101 and SAE AMS-STD-595A.

## 3.2 INSTALLATION

Ensure installation of system materials and equipment is in accordance with the recommendations and provisions of NFPA 13, NFPA 13E, NFPA 14, and NFPA 24. Perform work in the presence of the Contracting Officer. Notify the Contracting Officer 48 hours in advance of the start of work.

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

### 3.2.1 Underground Piping Installation

Ensure installation of piping materials conforms to the written or published instructions of the manufacturer.

For pipes passing through walls below grade and ground-floor slab, insert the pipe through pipe sleeves one size larger than pipe. Caulk the pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.

In fill areas, ensure the pipe passing under or through building grade beams has a minimum clearance of 100 millimeter 4 inches in all directions.

For rubber- or elastomer-jointed piping embedded in concrete walls, install a joint within 150 millimeter 6 inches of the face of the wall capable of absorbing movement without leakage.

Use extended-joint or flange-bolt pipe when penetrating earth or concrete grade to a height 150 millimeter 6 inches above the grade.

Support underground piping below supported or suspended slabs from the slab with a minimum of two supports per length of pipe. Protect supports with a coating of bitumen.

On excavations near and below building footings, use the backfilling material consisting of 13.8 Megapascal 2,000-psi cured-strength concrete, poured or pressure-grouted up to the level of the footing.

After piping has been inspected, and not less than 48 hours prior to being lowered into a trench, coat external surfaces of the piping, valves, valve operators, and valve boxes with a compatible bituminous coating suitable for protection against brackish ground water. Apply coating in accordance with the manufacturer's instructions to a dry-film thickness of not less than 0.305 millimeter 12 mils.

#### 3.2.1.1 Cast Iron and Ductile Iron Pipe Construction Tolerances

Ensure maximum deviation from design elevation at any point along piping does not exceed 65 millimeter 2-1/2 inches for all sizes of piping.

Maximum deviation from line at the end of an 5.5 meter 18-foot length of piping is 65 millimeter 2-1/2 inches and cumulatively does not exceed 150 millimeter 6 inches. Make corrections from line within preceding

tolerances at a rate not to exceed 65 millimeter 2-1/2 inches for any one length of piping.

Ensure maximum deflection for curves for 5.5 meter 18-foot lengths of cast ferrous pipe is in accordance with NFPA 24.

When the alignment requires deflections in excess of the above limitations, furnish special bends or a sufficient number of shorter lengths of pipe to provide angular deflections within established limits, as approved.

3.2.1.2 Fire Hydrants

Set hydrant outlet elevations between 600 millimeter 24 inches, minimum, to 900 millimeter, 36 inches, maximum, above grade. Face the DN115 4-1/2-inch outlet toward the road or area of access.

3.2.1.3 Valve Boxes

Set valve and valve boxes plumb. Center valve boxes on the valves. Where feasible, locate valves outside traffic areas. Carefully tamp soil around each valve box to a distance of 1.2 meter 4 feet on all sides of the box or to the undisturbed trench face when less than 1.2 meter 4 feet.

[ Install Class 3000A concrete slabs 600 millimeter square by 100 millimeter 2 feet square by 4 inches thick to protect valve boxes, unless other protection is indicated.

]3.2.1.4 Thrust Blocks

Construct 20 Megapascal 3,000-psi cured-strength thrust blocks to absorb hydraulic thrust at caps, plugs, and at system change-of-direction fittings. Place concrete against undisturbed soil, with an area sufficient to provide load transmittal.

3.2.2 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 may be removed between adjacent pipes and so that there is not less than 13 millimeter 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 the load rating for pipe-hanger supports on all lines filled with water. Deflection per span cannot not exceed slope gradient of pipe. Ensure Schedule 40 and heavier ferrous pipe supports are in accordance with the following minimum rod size and maximum allowable hanger spacing. For concentrated loads such as valves, reduce the allowable span proportionately.

| PIPE SIZE (DN) (MILLIMETER) | ROD SIZE (MILLIMETER) | HANGER SPACING FOR STEEL PIPE (MILLIMETER) |
|---|---|---|
| Up to 25 | 10 | 2400 |

| PIPE SIZE (DN) (MILLIMETER) | ROD SIZE (MILLIMETER) | HANGER SPACING FOR STEEL PIPE (MILLIMETER) |
|---|---|---|
| 32 | 10 | 3600 |
| 40 | 10 | 4500 |
| 65 to 90 | 10 | 4500 |
| 125 | 15 | 4500 |
| 100 | 15 | 4500 |
| 150 | 15 | 4500 |

| PIPE SIZE (INCHES) | ROD SIZE (INCHES) | HANGER SPACING FOR STEEL PIPE (FEET) |
|---|---|---|
| Up to 1 | 3/8 | 8 |
| 1-1/4 | 3/8 | 12 |
| 1-1/2 | 3/8 | 15 |
| 2-1/2 to 3-1/2 | 3/8 | 15 |
| 5 | 1/2 | 15 |
| 6 | 1/2 | 15 |
| 8 | 1/2 | 15 |

Support vertical risers at the base where possible and at intervals specified. Guide piping for lateral stability as necessary. Place clamps under fittings wherever possible. Support carbon-steel pipe at each floor at not more than 4.5 meter 15-foot intervals for pipe DN50 2 inches and smaller, and at not more than 6.1 meter 20-foot intervals for pipe DN65 2-1/2 inches and larger.

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

### 3.2.3 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. Construct penetrations with finishes 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, 0.9 kilogram 2-pound density polyurethane foam to a depth not less than 150 millimeter 6 inches. Finish foam with a rasp. Ensure vapor barrier is not less than 3 millimeter 1/8-inch thickness of vinyl mastic applied to visible and accessible surfaces. Where fire stopping is a consideration, use only mineral fiber, and, in addition, cover openings with 1.6 millimeter16-gage sheet metal.

### 3.2.4 Sleeves

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

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

Install sleeves that are continuous when extending through floors, roofs, or load-bearing walls, and sleeves through fire barriers. Fabricate sleeves from Schedule 40 steel pipe with welded anchor lugs. Form other sleeves by molded linear polyethylene liners or similar materials that are removable. Ensure diameter of sleeves is large enough to accommodate pipe, insulation, and jacketing without touching the sleeve, and additionally provides a minimum 10 millimeter 3/8-inch clearance. Install sleeve to accommodate mechanical and thermal motion of pipe and 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 or 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. Use a mineral fiber conforming to ASTM C592. 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 15 millimeter 1/2 inch. Ensure surfaces are oil- and grease-free before caulking.

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

### 3.2.5 Escutcheons

Install 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, attach plates at the underside only of such ceilings. Use chrome plated escutcheons in occupied spaces and conceal openings in building construction. Ensure escutcheons are firmly attached.

### 3.2.6 Flashings

Install flashings at systems penetrations of building boundaries as indicated.

### 3.2.7 Electrical Work

Electrical work is specified in DIVISION 26 ELECTRICAL except for control and fire alarm wiring which is provided under this section in accordance with NFPA 70. Use rigid metal conduit or intermediate metal conduit, except that electrical metallic tubing may be used in dry locations not enclosed in concrete or where not subject to mechanical damage.

Furnish motors, controllers, contactors, and disconnects with their respective pieces of equipment, except that controllers indicated as part of the motor control centers are provided under Section 26 24 19.00 40 MOTOR CONTROL CENTERS. Ensure motors, controllers, contactors, and disconnects conform to and have electrical connections provided under Section 26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL. Ensure controllers and contactors have maximum 120-volt control circuits, and auxiliary contacts for use with the controls furnished.

## 3.3 FIELD QUALITY CONTROL

### 3.3.1 Fire-Protection System Identification

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

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

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

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

d. Service-labeled piping.

e. Use color coding for flow-capacity identification of fire hydrants only. Ensure color coding is accordance with NFPA 291. Number post-indicator valves, hydrants, and other components as an extension of existing systems.

#### 3.3.1.1 Diagrams

Chart listing of equipment is by designation number and shows pertinent data. Mount mechanical drawings in extruded aluminum frames with 3 millimeter 1/8-inch thick acrylic plastic protection. Location is as directed by the Contracting Officer. Provide a minimum of one mounted chart and diagram, plus one extra copy of each, for each fire-protection system.

#### 3.3.1.2 Metal Tags

Install identification tags made of brass or aluminum and indicating function of valve or similar component, on such system devices. furnish tags not less than 50 millimeter 2 inches in diameter with a stamped marking.

Install equipment with metal identification tags that bear an equipment

designation number matching the drawing or diagram designations.

Secure tags to valve or equipment items with 2.7 millimeter 12-gage galvanized wire.

3.3.1.3 Service Labeling

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

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

Label piping and arrow in accordance with the following:

a. Each point of entry and exit through walls.

b. Each change in direction.

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

d. In long straight runs, locate labels at a distance visible to each other, but in no case have the distance between labels exceed 12.2 meter40 feet.

e. Ensure lettering is 2 inches high. Where the size of pipes is 65 millimeter 2-1/2-inch outside diameter and smaller, attach labels to 1.6 millimeter 16-gage aluminum sheet and attach to the pipe with 2.7 millimeter 12-gage galvanized wire. Ensure labels are legible from the primary service and operating area.

f. Make labels of self-sticking plastic film designed for permanent installation. Provide labels with red letters on white background.

g. The label and valve tag schedule above is not construed as defining or limiting the work. Label all piping.

3.3.2 Branch-Line Testers

Ensure branch-line testers permit testing and flushing lines without shutdown of system or loss of fire-protection capability. Fit line testers with chain-attached caps.

Install line testers where indicated and on most remote branch lines being served by cross mains, so that testing may be accomplished at the dead corners of each sprinkler system.

### 3.3.3 System Testing

**********
**NOTE: If the specified system is identified as critical, configured, or mission essential, use Section 01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS to establish predictive and acceptance testing criteria, above and beyond that listed below.**
**********

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

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

Prior to acceptance of the work, test completed systems in the presence of the Contracting Officer. Upon approval, provide certificates of testing.

Conduct a hydrostatic test, unless otherwise specified. Use only potable water for testing.

Perform air tests, valve-operating tests, and drainage tests for dry-pipe systems.

Perform full-flow system operating tests for standpipe systems.

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

### 3.3.4 Test Gages

Acceptable test gages have 115 millimeter 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. Maximum permissible scale range for a given test is such that the pointer during a test has a starting position at midpoint of the dial or within the middle third of the scale range. Ensure the Certification of accuracy and correction table has: a date within 90 calendar days prior to the test, the test gage number, and the project number.

### 3.3.5 Pneumatic Testing

Perform pneumatic Pressure Tests when freezing conditions may occur and upon prior approval by the Contracting Officer. Use oil-free compressed air used for testing. Pneumatic testing includes swabbing all joints under a test pressure of 34 kilopascal 5 psig with a standard high film strength soap solution and observing for bubbles.

Duration of the test will be determined by the Contracting Officer and will be for 2 hours, minimum, to 24 hours, maximum. Test may be terminated by direction of the Contracting Officer at any point during this period after it has been determined that the permissible leakage rate

has not been exceeded.

3.3.6 Test and Acceptable Criteria

Perform above ground systems pressure tests at 1380 kilopascal 200 psi and maintain the applied pressure without further addition of test media for not less than 2 hours. No pressure drop is allowed.

Test underground rubber-jointed ferrous-pipe water systems at 1380 kilopascal 200 psi, and maintain the applied test pressure for not less than 2 hours. Maximum allowable pressure drop is 14 kilopascal 2 psi. After satisfactory hydrostatic testing, test piping for leakage as follows:

a. Duration of each leakage test is not less than 2 hours; during the test, subject the main to 1380 kilopascal 200 psi pressure based on the elevation of the lowest section under test and corrected to the elevation of the test gage.

b. Leakage is defined as the quantity of water supplied into the laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

c. No piping installation will be accepted if the leakage in gallons per hour exceeds 2.04 0.00054 times the number of joints in the length of the pipe line tested times the nominal diameter of the pipe in inches times the square root of the average test pressure expressed as psig. Amount of leakage at the joints cannot exceed 1.89 liter 2 quarts per 100 joints regardless of pipe diameter.

d. Apply hydrostatic tests to piping with concrete thrust blocking only after the concrete has cured for more than 7 calendar days.

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

] Repair dripping or weeping joints.

3.4 ADJUSTING AND CLEANING

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

3.5 PROTECTION

3.5.1 Disinfection

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

-- End of Section --