

SECTION 211000
FIRE SPRINKLER AND STANDPIPE SYSTEMS

PART I. GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. The most recent edition in effect at the design Notice To Proceed date shall be used.

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1015	Performance requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Assemblies
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AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	Hypochlorites
AWWA B301	Liquid Chlorine
AWWA C104/A21.4	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151/A21.51	Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines – Enamel and Tape – Hot Applied
AWWA C606	Grooved and Shouldered Joints
AWWA C651	Standard for Disinfecting Water Mains
AWWA C652	Disinfection of Water-Storage Facilities

ASME INTERNATIONAL

ASME B16.1	Gray Iron Threaded Fittings; Classes 25, 125 and 250
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ASME B16.11	Forged Fittings, Socket-Welding and Threaded
ASME B16.18	Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.3	Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.9	Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.2	Standard for Square and Hex Nuts

ASTM INTERNATIONAL (ASTM)

ASTM A135/A135M	Standard Specification for Electric-Resistance Welded Steel Pipe
ASTM A183	Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A193/A193M	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A449	Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A47/A47M	Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM A563	Standard Specification for Carbon and Alloy Steel Nuts

ASTM A795/A795M	Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B62	Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B75	Standard Specification for Seamless Copper Tube
ASTM B88	Standard Specification for Seamless Copper Water Tube
ASTM D2000	Standard Classification System for Rubber Products in Automotive Applications
ASTM F 436	Hardened Steel Washers
ASTM F 442/F 442M	Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
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MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71	Gray Iron Swing Check Valves, Flanged and Threaded Ends
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	Standard for the Installation of Sprinkler Systems
NFPA 14	Standard for the Installation of Standpipes and Hose Systems
NFPA 24	Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 72	National Fire Alarm Code
NFPA 241	Standard for Safeguarding Construction, Alteration, and Demolition Operations

**NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES
(NICET)**

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

NIH DRM	Design Requirements Manual
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UNDERWRITERS LABORATORIES (UL)

UL 668	Hose Valves for Fire-Protection Service
UL Bld Mat Dir	Building Materials Directory
UL Fire Prot Dir	Fire Protection Equipment Directory

1.2 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

Related Sections include the following:

- A. Division 07 Section "Firestopping Penetrations, Fire Resistive Joints and Perimeter Fire Barrier Systems" for firestopping penetrations in firewalls.
- B. Division 10 Section "Fire Extinguisher Cabinets" and "Fire Extinguishers" for cabinets and fire extinguishers.
- C. Division 21 Section "Electric-Drive, Centrifugal Fire Pumps" for fire pumps, pressure-maintenance pumps, and pump controllers.
- D. Division 21 Section "Clean-Agent Fire Extinguishing Systems" for extinguishing systems.
- E. Division 22 Section "Facility Water Distribution Piping" for piping outside the building.
- F. Division 28 Section "Fire Detection and Alarm" for alarm devices not specified in this Section.

1.3 SYSTEM TYPE

This Section includes the following fire-suppression piping inside the building:

A. Combined Standpipe and Sprinkler System

Fire-suppression system with both standpipe and sprinkler systems. Sprinkler system is supplied from standpipe system.

B. Automatic wet-type, Class [I] standpipe systems.

Includes DN 65 (NPS 2-1/2) hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.

C. Manual dry-type, Class [I] standpipe systems.

Includes DN 65 (NPS 2-1/2) hose connections. A standpipe system with no permanently attached water supply that relies exclusively on the fire department connection to supply the system demand.

D. Manual wet-type, Class [I] standpipe systems.

A standpipe system containing water at all times that relies exclusively on the fire department connection to supply the system demand.

E. Wet-pipe sprinkler systems.

Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

F. Dry-pipe sprinkler systems.

Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.

G. Single-interlock preaction sprinkler systems

A sprinkler system employing automatic sprinklers that are attached to a piping system that contains air that might or might not be under pressure, with a supplemental detection system installed in the same areas as the sprinklers. This system admits water into the system upon operation of detection devices.

H. Double-interlock preaction sprinkler systems

A sprinkler system employing automatic sprinklers that are attached to a piping system that contains air that might or might not be under pressure, with a supplemental detection system installed in the same areas as the sprinklers. This system admits water to sprinkler piping upon operation of both detection devices and automatic sprinklers.

1.4 DEFINITIONS

CR: Chlorosulfonated polyethylene synthetic rubber.

Underground Service-Entrance Piping: Underground service piping below the building.

MIC: Microbiologically Induced Corrosion.

1.5 GENERAL REQUIREMENTS

- A. Except as modified herein, the system shall be designed and installed in accordance with **[NFPA 13] [NFPA 14]** and the NIH DRM. Pipe sizes shall be determined by **[hydraulic calculation][utilizing the existing building pipe sizes]**. Design all portions of the sprinkler system within the area of work indicated on the drawings including locating sprinklers, piping and equipment. The design of the sprinkler system shall be based on **[hydraulic calculations][existing building pipe sizes]**, and the other provisions specified herein.
- B. The Designer shall, to the extent possible, design the system so that air pockets within the pipe are minimized to prevent MIC.
- C. Sprinkler/standpipe system submittal shall be approved by the NIH Division of the Fire Marshal prior to installation.
- D. In the references listed above, the advisory provisions shall be considered mandatory as though the word “shall” had been substituted for “should” wherever it appears. All portions of the referenced NFPA National Fire Codes shall be followed including annexes, recommended practices, interim amendments, and formal interpretations. Reference to the “authority having jurisdiction” shall be interpreted to mean the NIH Division of the Fire Marshal.
- E. Contractor shall comply with the NIH Design Requirements Manual and NFPA 241 Safeguarding Construction, Alteration, and Demolition Operations while construction is underway to provide reasonable safety to life and property from fire. Contractor is responsible for ensuring that the applicable sections are reviewed and enacted.
- F. Sprinkler/standpipe system piping and fittings in areas subject to the elements, high humidity, or wash-down (e.g. parking garages, interior areas of vivaria, cagewashes, areas where steam valves discharge inside the room) shall be galvanized.

1.6 HYDRAULIC DESIGN

- A. Standpipe System Design Requirements
 - 1. Manual Wet Standpipe System Design. Provide a standpipe calculation demonstrating that the NFPA 14 required flow rates at a minimum residual pressure of 689 kPa (100 psig) can be obtained at the most remote hose valve with a flat supply pressure of 1,034 kPa (150 psi) at the fire department connection.
 - 2. Automatic Standpipe System Design. Where automatic standpipe systems are required per NFPA 14 these systems shall be hydraulically designed (including the design characteristics of the fire pump) to provide a residual pressure on the outlet side of the fire hose connection of the most remote DN 65 (NPS 2-1/2) inch hose connection of 448 kPa (65 psig) at system flow rates determined in accordance with NFPA 14. The hydraulic calculations for automatic standpipe systems are in addition to the requirement for manual standpipe system design calculations as described above.

3. **Stairway hose connections shall be located on the stairwell main floor landings.**

B. Sprinkler System Design Requirement

A minimum of a 10% or 69 kPa (10 psi) safety margin (whichever is greater) above the system pressure demand (including hose stream requirements) shall be provided in the hydraulic calculations of fire protection systems. A minimum of a 10% safety margin above the system flow demand (including hose stream requirements) shall also be provided in the hydraulic calculations. All flow test data shall be adjusted to the low hydraulic gradient. Water flow test data for the NIH Bethesda and NIHAC Poolesville campuses shall be provided by the NIH DFM upon request.

1. **[The system shall be hydraulically calculated in accordance with this specification and NFPA 13.] [New piping shall match existing building pipe sizes.]**
2. **All laboratory work areas shall be classified as Ordinary Hazard Group 2. All other areas shall be designed in accordance with the associated hazards per NFPA 13.**
3. **Sprinkler Hazard Classifications:** Hydraulically design the system to the minimum design area for the applicable hydraulic design curve.
4. **Hydraulic Calculations:**
 - a. Submit hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments as outlined in NFPA 13.
 - b. Calculations for new sprinkler systems (or portions thereof) in labs and office areas shall not use the room design method, quick response area reduction, or omit sprinklers in small rooms or closets.

- c. Calculations shall be based on the water supply data shown on the drawings to substantiate that the design area used in the calculations is the most hydraulically demanding.
- d. Calculations shall be based upon the maximum coverage area per sprinkler permitted by NFPA 13.
- e. No more than one hydraulically calculated pipe schedule per floor is permitted. Exceptions may be granted by the NIH Division of the Fire Marshal on a case-by-case basis where multiple hazard classifications exist on a single floor.

1.7 SEISMIC PERFORMANCE

Sprinkler/standpipe system piping shall be capable of withstanding the effects of earthquake motions determined in accordance with NFPA 13 and shall include materials, accessories, and equipment inside and outside the building necessary to provide each system complete and ready for use. Devices and equipment shall be UL Fire Protection Directory listed or FM approved for fire protection service.

1.8 SUBMITTALS

The contractor shall provide the following submittals to the project officer for review by the NIH DFM:

A. Product Data

- 1. Piping materials and sprinkler specialty fittings.
- 2. Pipe hangers and supports.
- 3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
- 4. Air compressors, including electrical data (e.g. wiring diagrams, voltage and current requirements, etc.).
- 5. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
- 6. Hose connections, including size, type, and finish.
- 7. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; escutcheon and marking; thread type; and finish.
- 8. Alarm and supervisory devices (e.g. flow switches, tamper switches, pressure switches, etc.), including electrical data.
- 9. Any other fire protection related equipment not specifically mentioned here.

B. Welding Certificates

Submit the name/company and documentation of certification of the proposed welding operator/process for review and approval by NIH DFM no later than [14] [____] days after the Notice to Proceed.

C. Designer Qualifications

Submit the name and documentation of certification of the proposed system designer for review and approval by NIH DFM no later than [14] [____] days after the Notice to Proceed.

D. Installer Qualifications

Submit the name and documentation of certification of the proposed installer for review and approval by NIH DFM no later than [14] [____] days after the Notice to Proceed.

E. NIH DFM Working Plans

Sprinkler shop drawings, prepared according to NFPA 13 and the NIH DRM, including **[hydraulic calculations] [seismic bracing calculations]**. Sprinkler shop drawings shall include a table indicating the number of sprinklers for each utilized pipe size.

F. Field Test Reports and Certificates

Indicate and interpret test results for compliance with performance requirements and as described in [NFPA 13] [NFPA 14]. Include "Contractor's Material and Test Certificate for Aboveground Piping" **[and "Contractor's Material and Test Certificate for Underground Piping"]**. Include all applicable test reports as follows:

1. Hydrostatic test.
2. Forward flow test.
3. Flushing test.
4. Valve trip test.
5. Main drain test.
6. Standpipe flow test.
7. Pressure reducing valve test.
8. Leakage test.
9. MIC treatment test.

G. As-Built Drawings

Prior to the scheduled date for the final acceptance test, contractor shall submit to the Project Officer hard copy red-line drawings reflecting actual installed conditions to the nearest inch. These drawings shall be verified for accuracy by NIH DFM at the final acceptance test.

After final acceptance of the system, as-built drawings shall be submitted to the Project Officer both as a hard copy and electronically both as .pdf and .dwg files.

H. Operation and Maintenance Manuals:

After final acceptance of the system, operation and maintenance manuals shall be submitted to NIH DFM. The operation and maintenance manual shall include the following components:

1. Warranty information.
2. Valves requiring maintenance.

3. [Air compressors.]
4. [MIC treatment system.]

I. Warranty Information

Provide one-year parts and labor warranty certificate. Include emergency contact information and commencement date of warranty.

1.9 QUALITY CONTROL

3.1 Qualifications

A. Sprinkler/Standpipe System Designer

Field survey, design, and preparation of the submittals required in this specification shall be performed and certified by an individual who is a registered professional engineer or who is certified as a Level III or IV Technician by the National Institute for Certification in Engineering Technologies (NICET) in Water-Based (formerly Automatic Sprinkler) Systems Layout. The individual shall have a minimum of 5 years of experience in the preparation of sprinkler shop drawings, hydraulic calculations, and field surveying, and shall be regularly engaged in the design and installation of the type and complexity of system specified in the contract documents. The system designer shall sign each drawing (with certification/license number) submitted for approval by the NIH DFM.

B. Sprinkler/Standpipe System Installer

The field sprinkler foreman shall hold a current valid Certificate from a nationally recognized sprinkler apprenticeship school or Government Agency, or be recognized as “journey level” by a local fire sprinkler labor Union. Where applicable, the installing contractor shall be licensed by the state in which the work is performed.

C. Welding

Welding processes and operators shall conform to ASME Boiler and Pressure Vessel Code: Section IX. All welding shall be performed in a shop. Field welding is not permitted. All welds shall be inspected prior to installation. All slag shall be removed from the interior of the pipe.

D. Delivery, Storage, and Handling

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

1.10 COORDINATION

Coordinate sprinkler/standpipe system installation with all other trades prior to shop drawing development and submittal. Changes to approved shop drawings that alter the performance of the sprinkler system (e.g. sprinkler spacing, hydraulics, etc.) shall be subject to resubmittal to the NIH DFM for reacceptance.

PART II. PRODUCTS

2.1 MATERIALS AND EQUIPMENT

All materials and equipment shall have been in satisfactory use for at least 2 years prior to bid opening. All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

Provide Materials and Equipment that have been tested by Underwriters Laboratories, Inc. and are listed in UL Fire Protection Directory or approved by Factory Mutual and listed in FM Approval Guide. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Protection Directory or FM Approval Guide.

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

2.2 STEEL PIPING COMPONENTS

Standard Piping System Component Working Pressure: Listed for at least 1207 kPa (175 psig). Pipe shall be marked with the name of the manufacturer, type of pipe, and ASTM designation.

Plain-end fittings with mechanical couplings or fittings that use steel gripping devices to bite into the pipe are not permitted.

All steel piping shall be Schedule 40.

A. Threaded-End, Standard-Weight Steel Pipe

ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, **[hot-dip galvanized where indicated and]** with factory- or field-formed threaded ends.

1. Malleable-Iron Threaded Fittings: ASME B16.3.
2. Gray-Iron Threaded Fittings: ASME B16.4.
3. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe **[hot-dip galvanized where indicated]**. Include ends matching joining method.
4. Steel Threaded Couplings: ASTM A 865 **[hot-dip galvanized-steel pipe where indicated]**.

B. Grooved-End, Standard-Weight Steel Pipe

ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, **[hot-dip galvanized where indicated and] with [factory- or field-formed, square-cut] [factory- or field-formed, square-cut- or roll] [factory- or field-formed, roll]-grooved ends.**

Grooved-Joint Piping Systems:

1. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
2. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gaskets listed for use with housing, and steel bolts and nuts. Nuts and bolts shall be heat-treated steel conforming to ASTM A183 and shall be cadmium plated or zinc electroplated.

C. Flanges

Flanges shall conform to NFPA 13 and ASME B16.1, ASME B16.25, or ASME B16.5. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm (1/16 inch) thick, and full face or self-centering flat ring type.

2.3 COPPER TUBE AND FITTINGS

A. Soft Copper Tube

[ASTM B 88, Type K (ASTM B 88M, Type A)] [ASTM B 88, Type K (ASTM B 88M, Type A) or ASTM B 88, Type L (ASTM B 88M, Type B)] [ASTM B 88, Type L (ASTM B 88M, Type B)], water tube, annealed temper.

1. Copper fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Brazing Filler Metals: AWS A5.8, BCuP-3 or BCuP-4.

B. Hard Copper Tube

[ASTM B 88, Type K (ASTM B 88M, Type A)] [ASTM B 88, Type K (ASTM B 88M, Type A) or ASTM B 88, Type L (ASTM B 88M, Type B)] [ASTM B 88, Type L (ASTM B 88M, Type B)], water tube, drawn temper.

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match tubing system.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket metal-to-metal seating surfaces, and solder-joint or threaded ends.
4. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.
5. Brazing Filler Metals: AWS A5.8, BCuP-3 or BCuP-4.

C. Grooved-End, Hard Copper Tube

[ASTM B 88, Type K (ASTM B 88M, Type A)] [ASTM B 88, Type K (ASTM B 88M, Type A) or ASTM B 88, Type L (ASTM B 88M, Type B)] [ASTM B 88, Type L (ASTM B 88M, Type B)], water tube, drawn temper; with factory- or field-formed, roll-grooved ends.

1. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.
2. Grooved-Joint Systems:
 - a. Grooved-End Copper Fittings: ASTM B 75 (ASTM B 75M), copper tube or ASTM B 584, bronze casting. Fittings may have ends factory or field expanded to steel-pipe OD if required for copper tube systems using grooved-end-pipe couplings.
 - b. Grooved-End-Tube Couplings: UL 213, rigid pattern, unless otherwise indicated; gasketed fitting equivalent to AWWA C606, but made to match copper-tube OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts. Use grooved-end-pipe couplings for tube and fitting that have expanded ends.

2.4 DIELECTRIC FITTINGS

Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.

A. Dielectric Unions

Factory-fabricated assembly, designed for 1724 kPa (250 psi) minimum working pressure at 82 deg C (180 deg F). Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.

B. Dielectric Flanges

Factory-fabricated companion-flange assembly, for 1207-kPa (175-psi) minimum working-pressure rating as required for piping system.

C. Dielectric Flange Insulation Kits

Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.

D. Dielectric Couplings

Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 2068 kPa (300 psi) working-pressure rating at 107 deg C (225 deg F).

E. Dielectric Nipples

Electroplated steel with inert and noncorrosive thermoplastic lining, with combination of threaded or grooved ends and 2070 kPa (300 psi) working-pressure rating at 107 deg C (225 deg F).

2.5 SPRINKLER SPECIALTY FITTINGS

Sprinkler specialty fittings shall be UL listed or FMG approved, with 1207 kPa (175 psi) minimum working-pressure rating, and made of materials compatible with piping.

A. Outlet Specialty Fittings

Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, or grooved outlets.

B. Sprinkler Drain and Alarm Test Fittings

Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.

C. Sprinkler Branch-Line Test Fittings

Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.

D. Sprinkler Inspector's Test Fitting

Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.

E. Dry-Pipe-System Fittings

UL listed for dry-pipe service.

2.6 PIPE HANGERS

Hangers shall be listed in UL Fire Protection Directory or FM Approval Guide and of the type suitable for the application, construction, and pipe type. Alternative hangers shall be permitted per NFPA 13.

Bolts shall conform to ASTM A449, Type 1 and shall extend no less than three full threads beyond the nut with bolts tightened to the required torque. Nuts shall be listed. Washers shall meet the requirements of ASTM F436/F436M. Flat circular washers shall be provided under all bolt heads and nuts.

2.7 FIRE-PROTECTION VALVES

Valves shall be UL listed or FMG approved, with **[1207 kPa (175 psi)] [1724 kPa (250 psi)] [2068 kPa (300 psi)]** minimum pressure rating. All valves controlling connections to water supplies and to supply pipes to sprinklers shall be listed indicating valves with integral indicating device and ends matching connecting piping.

A. Outside Stem and Yoke (OS&Y) Valves:

UL 262, OS&Y type. Bronze body with threaded ends or cast-iron body with flanged ends.

B. Butterfly Valves

Comply with UL 1091. Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.

C. Check Valves

Comply with UL 312, swing type, cast-iron body with flanged or grooved ends.

2.8 UNLISTED GENERAL-DUTY VALVES

These components do not affect system performance and are used in drain piping, drain valves, test connections, and trim piping,

A. Ball Valves: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig (4140-kPa) minimum CWP rating, blowout-proof stem, and threaded ends.

B. Check Valves: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

C. Gate Valves: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

D. Globe Valves: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.9 BACKFLOW PREVENTION

Double-check backflow prevention assembly shall comply with ASSE 1015. The assembly shall have a bronze, cast-iron, or stainless steel body. The assembly shall include pressure gauge test ports and shutoff valves on the inlet and outlet, 2-positive seating check valves for continuous pressure application, and four test cocks. Assemblies shall be rated for a working pressure of **[1207 kPa (175 psi)][1724 kPa (250psi)]**. The maximum pressure loss shall be 55 kPa (8 psi) at a flow rate equal to the sprinkler water demand, at the location of the assembly. A test port for a pressure gauge shall be provided both upstream and downstream of the double check backflow prevention assembly valves.

Provide forward flow test connections in accordance with NFPA 13. Provide one DN 65 (NPS 2-1/2) male NST thread per 15.8 L/s (250 GPM) of system demand.

2.10 SPECIALTY VALVES

A. Dry-Pipe Valves: Comply with UL 260, differential type; with bronze seat with O-ring seals, single-hinge pin, and latch design. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

- B. Pressure-Regulating Valves: Comply with UL 1468, brass or bronze, 2758-kPa (400-psi) maximum rating. Include NPT female inlet and male outlet, adjustable setting feature, and straight or 90-degree-angle pattern design as indicated.
- C. Preaction/Deluge Valves
- D. Test and Drain Valves

2.11 SPRINKLERS

Sprinklers shall be UL listed or FMG approved, with **[1207 kPa (175 psi)] [1724 kPa (250 psi) minimum] [2068 kPa (300 psi)]** minimum pressure rating.

- A. Sprinkler temperature ratings: Ordinary temperature sprinklers shall be used throughout all NIH facilities/occupancies except for the following:
 - 1. High-temperature sprinklers rated at 141°C (286°F) shall be used in autoclave areas, mechanical rooms, electrical rooms/closets, electrical switchgear and transformer rooms, LAN rooms/closets, cage wash rooms, and any other areas in which high temperatures are routinely experienced.
 - 2. Other temperature ratings as required by NFPA 13.
- B. Quick-response sprinklers shall be used throughout all NIH facilities, unless otherwise prohibited by NFPA 13. Standard response sprinklers may be used in extra hazard occupancies at the discretion of the designer.
- C. Automatic Sprinklers with heat-responsive element shall comply with the following:
 - 1. UL 199, for nonresidential applications.
 - 2. UL 1767, for early-suppression, fast-response applications.
 - a. Sprinkler Types and Categories: Nominal 12.7-mm (1/2-in.) orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
- D. Sprinkler types, features, and options as follows:
 - 1. Concealed ceiling sprinklers, including cover plate.
 - 2. Extended-coverage sprinklers. Sprinklers shall have a **[chrome-plated] [brass] [custom painted] [white]** [] finish.
 - 3. Flush ceiling sprinklers, including escutcheon. Sprinklers shall have a **[chrome-plated] [brass] [custom painted] [white]** [] finish.
 - 4. Institutional sprinklers, made with a small, breakaway projection. Sprinklers shall have a **[chrome-plated] [brass] [custom painted] [white]** [] finish.

5. Pendent sprinklers. Sprinklers shall have a **[chrome-plated] [brass] [custom painted] [white]** [] finish. Dry-type sprinklers. Sprinklers shall be **[pendent] [upright] [sidewall]** as indicated. Assembly shall be integral with escutcheon. Sprinklers shall have a **[chrome-plated] [brass] [custom painted] [white]** [] finish.
 6. Recessed sprinklers, including escutcheon. Sprinklers shall have a **[chrome-plated] [brass] [custom painted] [white]** [] finish.
 7. Sidewall sprinklers. Sprinklers shall have a **[chrome-plated] [brass] [custom painted] [white]** [] finish. Sidewall, dry-type sprinklers. Sprinklers shall have a **[chrome-plated] [brass] [custom painted] [white]** [] finish.
 8. Upright sprinklers. Sprinklers shall have a **[chrome-plated] [brass] [custom painted] [white]** [] finish.
 9. **[In areas with ceilings designed for water wash-down or cleanrooms, gasketed concealed sprinklers shall be provided.] [In areas with ceilings designed for water wash-down where intermediate or high temperature sprinklers are required, or where pressure differentials are a concern, the piping drop shall extend through the penetration sufficient to allow for application of a visible seal. Escutcheons shall not be provided, however a flat solid stainless steel plate or washer that is tight-fitting against the pipe may be utilized bedded in sealant and sealed to the pipe circumference.]**
- E. Special Coatings: **[Wax], [lead], and [corrosion-resistant paint]**.
- F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications.
1. Flush Type: Two-piece escutcheon with **[chrome-plated] [brass] [custom painted] [white]** [] finish.
 2. Recessed Type: Two-piece escutcheon with **[chrome-plated] [brass] [custom painted] [white]** [] finish.
 3. Concealed Type: Cover plates with a **[chrome-plated] [brass] [custom painted] [white]** finish.
- G. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler. Guards shall be specifically listed for the sprinkler on which they are being installed.

2.12 SPRINKLER CABINET

Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of spare sprinklers as required by NFPA 13 and sprinkler wrench for each type of sprinkler.

2.13 FIRE DEPARTMENT HOSE CONNECTIONS

UL 668, brass or bronze, 2068 kPa (300 psi) minimum pressure rating, hose connections for connecting fire hose. Include angle or gate pattern design; NPT standard thread female inlet and NST standard thread male hose outlet; and lugged cap, gasket, and chain. Hose connections shall be DN 65 (NPS 2-1/2).

- A. Valve Operation: Nonadjustable type, unless field-adjustable pressure-regulating type is indicated.
- B. Finish: **[Rough brass] [Polished brass] [Rough chrome] [Polished chrome]**.

2.14 FIRE DEPARTMENT (SIAMESE) CONNECTIONS

- A. Wall-Type, Fire Department Connection: UL 405, **[1207 kPa (175 psi) minimum] [2068 kPa (300 psi)]** pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with NST standard thread according to NFPA 1963, outlet with NPT standard thread, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking **[AUTO SPKR][AUTO SPKR STANDPIPE]**. All Fire Department Connections shall be the double clapper type.
 - 1. Type: **[Flush with square or rectangular escutcheon plate.] [Exposed with round escutcheon plate.]**
 - 2. Number of Inlets: **[two] [three] [four] [Insert other]**
 - 3. Finish: **[Polished chrome-plated] [Rough chrome-plated] [Polished brass] [Rough brass]**.
- B. Exposed, Freestanding-Type, Fire Department Connection: UL 405, [1207 kPa (175 psi) minimum] [2068 kPa (300 psi)] pressure rating; with corrosion-resistant-metal body, brass inlets with NST standard thread according to NFPA 1963, and bottom outlet with NPT standard thread. Include brass lugged caps, gaskets, and brass chains; brass lugged swivel connection and drop clapper for each hose-connection inlet; 457.2-mm (18-inch-) high, sleeve; and round, floor, escutcheon plate with marking **[AUTO SPKR][AUTO SPKR STANDPIPE]**. All Fire Department Connections shall be the double clapper type.
 - 1. Finish Including Sleeve and escutcheon: **[Polished chrome-plated] [Rough chrome-plated] [Polished brass] [Rough brass]**.
- C. Signage for wall type and freestanding FDCs
 - 1. An 18" by 18" weatherproof sign with white background and capitalized red block lettering shall be installed for each FDC.
 - a. Wall mounted FDC: The sign shall be located on the building above the FDC.
 - b. Detached FDC: The sign shall be installed on posts behind the FDC.
 - 2. For interconnected systems the wording shall be as follows:

FIRE DEPT.
AUTO-SPRINKLER
STANDPIPE
CONNECTION

- a. There shall be a 2" space between the top border and the first line, 3.5" space between lines 1 and 2, 2" space between lines 2 through 4, and 2" space between line 4 and the bottom border. "FIRE DEPT." text shall be 2" in height. All other text shall be 1.5" in height.
- b. Non-combined sprinkler/standpipe systems and dry systems shall have the wording changed respectively while keeping the same text height as the interconnected systems.

2.15 ELECTRICAL COMPONENTS

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 1724 kPa (250 psi) pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element that is adjustable from 0 to 90 seconds to prevent false signals.. The switch shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.
- C. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature that is adjustable from 0 to 90 seconds to prevent false signals. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
- D. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
- E. Air Compressor: Comply with UL 753, fractional horsepower, 120-V ac, 60 Hz, single phase.
- F. Hi-Low Pressure Switch: Switch shall send a signal upon system pressure dropping below or increasing above pre-set values indicated on the dry-pipe valve manufacturer's product data.

2.16 AIR MAINTENANCE DEVICES

Air-Pressure Maintenance Device: Comply with UL 260, automatic device to maintain correct air pressure in piping. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 96.5- to 4144-kPa (14- to 60-psi) adjustable range, and 1207 kPa (175 psi) maximum inlet pressure.

2.17 PRESSURE GAUGES

UL 393, 90- to 115-mm- (3-1/2- to 4-1/2-inch-) diameter, dial pressure gauge with range of **[0 to 1724 kPa (0 to 250 psi) minimum] [0 to 2068 kPa (0 to 300 psi)]**. The water system piping shall include caption "WATER" on dial face. The air system piping shall include caption "AIR" on dial face.

2.18 IDENTIFICATION SIGNS

- A. Valve identification sign shall be minimum 150 mm wide by 50 mm high (6 in. wide by 2 in. high) with baked enamel finish on minimum 1.214 mm 18 gauge steel or 0.6 mm (0.024 in.) aluminum with red letters on a white background or white letters on a red background. Wording of sign shall include, but not be limited to, “main drain”, “auxiliary drain”, “inspector’s test”, “alarm test”, and similar wording as required to identify operational components.
- B. Hydraulic information sign shall be enamel baked finish on minimum 1.214 mm 18 gauge steel or 0.6 mm (0.024 in.) aluminum with red letters on a white background or white letters on a red background. Information provided on the sign shall be in accordance with NFPA 13 and shall be completed utilizing custom label makers.

PART III. EXECUTION

3.1 PREPARATION

Prepare and submit sprinkler shop drawings utilizing **[existing building pipe sizes] [hydraulic calculations]**. Hydraulic calculations shall be provided in any situation that creates a more hydraulically demanding system. Sprinkler system product data and working plans, including hydraulic calculations (where applicable), shall be approved by the NIH DFM before work begins.

Prior to requesting an in-progress close-in inspection or final closeout inspection by the NIH DFM, the Contractor shall provide the NIH Project Officer revised system as-built drawings indicating all field modifications to the NIH DFM approved drawings in accordance with the applicable contract specifications. All modifications to the NIH DFM approved shop drawings are subject to review by the NIH DFM to ensure code compliance prior to final acceptance by the Government.

3.2 EXAMINATION

Prior to installation, contractor is responsible for verifying the system can be installed as designed. Verify all existing conditions, dimensions, and locations, including, but not limited to, walls, utilities, sprinkler components, etc. After becoming familiar with all details of the work, advise the Project Officer of any discrepancy between the contract drawings and the actual conditions before performing the work. Failure to bring any discrepancy to the Project Officer will not alleviate the contractor’s responsibility from installing a compliant system at no additional cost.

3.3 INSTALLATION REQUIREMENTS

Furnish piping offsets, fittings, and any other accessories as required to provide a complete installation and to eliminate interference with other construction. Install sprinkler system over and under ducts, piping and platforms when such equipment can negatively affect or disrupt the sprinkler discharge pattern and coverage. Provide sprinkler [**and standpipe**] system as indicated above in Section 1.3 "SYSTEM TYPE" in [**all areas of the building**] [**areas indicated on the drawings**] [_____]. All sprinkler pipe, valves and fittings are prohibited from being installed within or partially within walls, bulkheads, ceilings, architectural features, etc. Provide a minimum 2-inch clearance around all operable sprinkler system components. All piping and system components shall be installed plumb and parallel to architectural features.

Provide an express drain riser adjacent to the system riser for all new systems. Pipe the drain to an adequately sized sanitary drain. In no situation shall a drain be piped into a storm drain. If necessary, the drain may be piped to the exterior if a concrete splash pad is provided.

Ensure all piping is free of debris prior to installation. Interior walls and coatings of piping shall be preserved.

3.4 VALVE APPLICATIONS

Drawings indicate valve types to be used. Where specific valve types are not indicated, utilize butterfly valves where listed indicating valves complying with this specification are required unless prohibited by NFPA. Unlisted valves are permitted to be ball, butterfly, or gate as permitted by NFPA.

3.5 JOINT CONSTRUCTION

All joints shall be installed in accordance with the manufacturer's installation requirements and NFPA 13.

- A. Mechanically Formed: Use UL-listed tool and procedure. Remove all burs and coupons prior to installation. Hang coupon in vicinity of installation.
- B. Welded Joints: Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe. Remove all slag from piping prior to installation.
- C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. The diameter of grooves made in the field shall be measured using a method specifically approved by the coupling manufacturer for the intended application.
 - 1. Steel Pipe: Cut-groove or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
 - 2. Copper Tube: Roll-groove tubing. Use grooved-end fittings and grooved-end-tube couplings.
 - 3. Dry-Pipe Systems: Cut-groove only. Use fittings and gaskets listed for dry-pipe service.

- D. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- E. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.

3.6 WATER-SUPPLY CONNECTION

Connect fire-suppression piping to building's interior water distribution piping.

Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water distribution piping.

3.7 PIPING INSTALLATION

All sprinkler and standpipe system piping and components shall be installed in accordance with **[NFPA 13]** **[NFPA 14]**.

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Project Officer before deviating from approved working plans.
- B. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- C. A union, a grooved joint, or a flanged connection shall be provided adjacent to each valve, apparatus, or equipment.
- D. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located in accordance with NFPA 13.
- E. Install sprinkler piping with drains for complete system drainage.
- F. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- G. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- H. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than DN 8 (NPS 1/4) and with soft metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they will not be subject to freezing.
- I. Install exposed piping without diminishing exit access widths, stair landing widths, or access to equipment. Exposed horizontal piping, including drain piping, shall be installed to provide a minimum 2030mm (6'-8") headroom for egress.

- J. Cutting or drilling structural members for passage of pipes or for pipe-hanger fastenings is not permitted without prior approval by a licensed structural engineer. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled.

3.8 VALVE INSTALLATION

Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to **[NFPA 13]** **[NFPA 13 and NFPA 14]** **[NFPA 14]** and authorities having jurisdiction.

- A. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- B. Install control valves a minimum of 1.8 m (5'-3") and a maximum of 2.3 m (7'-5") above the floor
- C. Where valves are located above hard ceilings access shall be provided by a minimum of 0.46 m by 0.46 m (18 in. by 18 in.).
- D. Specialty Valves:
 - 1. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
 - a. Air-Pressure Maintenance Devices for Dry-Pipe Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with **[96.5- to 414-kPa (14- to 60-psig)]** **[Insert other]** adjustable range; and **[1207 kPa (175 psi)]** **[Insert other]** maximum inlet pressure.
 - b. **[Install air compressor and compressed-air supply piping.]** **[Install compressed-air supply piping from building's compressed-air piping system.]**
 - c. Provide label at dry-pipe valve indicating air compressor on/off settings, low air signal setting, and dry-pipe valve trip pressure settings.

3.9 SPRINKLER APPLICATIONS

Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:

- A. Rooms without Ceilings: **[Insert sprinkler type]**.
- B. Rooms with Suspended Ceilings: **[Pendent sprinklers]** **[Recessed sprinklers]** **[Flush sprinklers]** **[Concealed sprinklers]** **[Pendent, recessed, flush, and concealed sprinklers, as indicated]**.
- C. Wall Mounting: Sidewall sprinklers.
- D. Spaces Subject to Freezing: **[Upright sprinklers]** **[Pendent, dry sprinklers]** **[Sidewall, dry sprinklers]** **[Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated]** **[Insert other]**.
- E. Deluge-Sprinkler Systems: **[Upright]** **[Upright and pendent]** **[Pendent]**, open sprinklers.

- F. Special Applications: **[Extended-coverage, and quick-response sprinklers where indicated] [Insert other].**
- G. Sprinkler Finishes:
1. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; corrosion-resistant where exposed to acids, chemicals, or other corrosive fumes.
 2. Concealed Sprinklers: Rough brass, with factory-painted white cover plate. Gasketed concealed sprinklers shall be provided in wash-down and cleanrooms.
 3. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 4. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 5. Residential Sprinklers: Dull chrome.

3.10 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of **[narrow dimension of]** acoustical ceiling panels and tiles.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.
- C. Where pendent sprinklers are installed directly on branch lines, 25.4 mm (1 in.) outlets shall be provided with a 25.4 mm (1 inch) nipple and reducer to permit connection of longer 25.4 mm (1 in.) sprigs or drops in the future.
- D. Install approved sprinkler guards on sprinklers in elevator machine rooms, obstruction sprinklers located below ducts or other obstructions, in other locations identified in NFPA 13 and in other locations noted on the drawings.

3.11 FIRE DEPARTMENT STANDPIPE HOSE OUTLET INSTALLATION

- A. Install hose connections adjacent to standpipes, unless otherwise indicated.
- B. Standpipe hose connections shall be installed between 0.91 m and 1.52 m (3 ft and 5 ft) AFF.
- C. Install freestanding hose connections for access and minimum passage restriction.
- D. Install DN 65 (NPS 2-1/2) hose connections with threaded reducer adapter, unless otherwise indicated.
- E. Install wall-mounting-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Refer to Division 10 Section "Fire Extinguisher Cabinets" for cabinets.

3.12 FDC INSTALLATION

- A. **[Install wall-type, fire department connections in vertical wall.]**
- B. **[Install freestanding-type, fire department connections in level surface.]**

1. Install protective pipe bollards on **[two] [three] [Insert other]** sides of each fire department connection. **[Refer to Division 05 Section "Metal Fabrications" for pipe bollards.]**
- C. Fire department connections shall be installed between 457 mm and 914 mm (18 in. and 36 in.) above the finished grade.
- D. Install ball drip valve at each check valve for fire department connection. Pipe ball drip to exterior or to a floor drain.

3.13 CONNECTIONS

Drawings indicate general arrangement of piping, fittings, and specialties. Install piping adjacent to equipment to allow service and maintenance. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.

- A. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- B. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- C. Connect excess-pressure pumps to the following piping and wiring:
 1. Sprinkler system, hydraulically.
 2. Pressure gages and controls, hydraulically.
 3. Electrical power system.
 4. Alarm device accessories for pump.
 5. Fire alarm.
- D. Connect compressed-air supply to dry-pipe sprinkler piping.
- E. Connect air compressor to the following piping and wiring:
 1. Pressure gauges and controls.
 2. Electrical power system.
 3. Fire alarm devices, including low-pressure alarm.
- F. Electrical Connections: Power wiring is specified in Division 26.
- G. Connect alarm devices to fire alarm.
- H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- J. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.14 PAINTING, LABELING AND IDENTIFICATION

All concealed sprinkler piping and sprinkler piping in the stairwells, storage rooms, mechanical rooms, and utility rooms shall be painted red enamel. All other exposed sprinkler piping (outside the stairwells) shall be painted to match the existing ceiling, and red enamel bands 0.1 m wide shall be painted at 3.0 m intervals. In aesthetically sensitive areas, exposed sprinkler piping shall be painted to match the existing ceiling without red enamel bands. Valves, inspector test assemblies, low-point drains, and auxiliary drains shall be provided with red enamel bands.

Install labeling and pipe markers on equipment and piping according to requirements in [NFPA 13] [NFPA 13 and NFPA 14] [NFPA 14].

3.15 FIELD QUALITY CONTROL

Prior to the Contractor conducting a final acceptance test of any fire protection system to be witnessed by the Division of the Fire Marshal, the Contractor shall provide a letter of certification to the NIH Project Officer certifying the system installation is complete, operating properly, and the entire system has been pretested and is ready for final acceptance testing in accordance with the applicable contract specifications and code requirements. Any discrepancy between the in-field installation and the approved shop drawings shall be brought to the attention of the Project Officer in writing, no later than three working days after the discrepancy is discovered.

Perform the following field tests and inspections and prepare test reports. Report test results promptly and in writing to Contracting Officer and authorities having jurisdiction.

- A. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Energize circuits to electrical equipment and devices.
- D. Start and run air compressors.
- E. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
- F. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
- G. Coordinate with fire alarm tests. Operate as required.
- H. Coordinate with fire-pump tests. Operate as required.
- I. Verify that equipment hose threads are same as local fire department equipment.
- J. Final Acceptance Test

Begin the Final Acceptance Test only when the Preliminary Test Report has been approved. Submit proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests, and proposed date and time to begin the Test, submitted with the procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates. The Contractor shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. Submit as-built shop drawings, no later than 14 days after completion of the Final Tests, updated to reflect as-built conditions after all related work is completed. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received. Submit the completed Final Acceptance Test Report no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Contractor.

3.16 CLEANING AND PROTECTION

Clean dirt and debris from sprinklers. Remove and replace sprinklers with paint other than factory finish. Protect sprinklers from damage until Substantial Completion.

3.17 DEMONSTRATION

Engage a factory-authorized service representative to train NIH's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 211000