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SECTION 211316 - DRY-PIPE SPRINKLER SYSTEMS

TIPS:

To view non-printing **Editor's Notes** that provide guidance for editing, click on MasterWorks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on MasterWorks/Supporting Information.

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

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

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinkler specialty pipe fittings.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

B. Related Requirements:

Retain subparagraph below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

1. Section 211119 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.
2. Section 210523 "Fire Protection Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.3 DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 175-psig (1200-kPa) maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Grooved joint couplings and fittings may be shown on Drawings and product submittals, and shall be specifically identified by the manufacturer's style or series designation.

B. Shop Drawings: For dry-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

Retain "Delegated-Design Submittal" Paragraph below if Work of this Section is required to withstand specific design loads and design responsibilities have been delegated to Contractor, or if structural data are required as another way to verify compliance with performance requirements. Professional engineer qualifications are specified in Section 014000 "Quality Requirements."

C. Delegated-Design Submittal: For dry-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

Retain "Coordination Drawings" Paragraph below for situations where limited space necessitates maximum utilization for efficient installation of different components or if coordination is required for installation of products and materials by separate installers. Coordinate paragraph with other Sections specifying products listed below. Preparation of coordination drawings requires the participation of each trade involved in installations within the limited space.

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. Compressed air piping.
3. HVAC hydronic piping.
4. Items penetrating finished ceiling including the following:
    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. <**Insert item**>.
5. <**Insert item**>.

Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

B. Qualification Data: For qualified Installer[**and professional engineer**].

C. Design Data:

Retain "Approved Sprinkler Piping Drawings" Subparagraph below if Contractor's design is specified in "Performance Requirements" Article.

1. Approved Sprinkler Piping Drawings: Working plans, prepared in accordance with NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
    a. Sprinklers shall be referred to on Drawings and other documentation by the manufacturer's model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations are not permitted.

Retain "Fire-hydrant flow test report" Paragraph below if report is specified in "Preparation" Article.

D. Fire-hydrant flow test report.

E. Field Test Reports:

Retain "Fire-hydrant flow test report" Subparagraph below if report is specified in Part 3 "Preparation" Article.

1. Fire-hydrant flow test report.
2. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For dry-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

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

1.8 QUALITY ASSURANCE

Retain "Installer Qualifications" Paragraph below if Contractor is required to assume responsibility for design of sprinkler systems.

A. Installer Qualifications:

Retain subparagraph below if Contractor is required to assume responsibility for engineering.

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

Retain "Engineering Responsibility" Subparagraph below if Contractor is required to engage a qualified professional engineer.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Date-Stamped Castings: All castings used for coupling housings, fittings, and valve bodies to be date stamped for quality assurance and traceability.

1.9 FIELD CONDITIONS

Retain this article if interruption of existing sprinkler service is required.

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service in accordance with requirements indicated:

1. Notify [**Architect**] [**Construction Manager**] [**Owner**] no fewer than [**two**] <**Insert number**> days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without [**Architect's**] [**Construction Manager's**] [**Owner's**] written permission.

PART 2 - PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Avitru. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

2.1 SYSTEM DESCRIPTIONS

A. Dry-Pipe Sprinkler System: 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.

B. Combined Dry-Pipe and Preaction Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Fire-detection system, located in same area as sprinklers, actuates tripping devices that open dry-pipe valve without loss of air pressure and actuates fire alarm. Water discharges from opened sprinklers.

C. Single-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of fire-detection system, located in same area as sprinklers, opens deluge valve, permitting water to flow into sprinkler piping and to discharge from opened sprinklers.

D. Double-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of a fire-detection system, located in same area as sprinklers, opens deluge valve, permitting water to flow into sprinkler piping. A closed solenoid valve in the sprinkler piping is opened by another fire-detection device; water will then discharge from opened sprinklers.

2.2 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.
2. NFPA 13R.

B. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.

Retain "Delegated Design" Paragraph below if Contractor is required to assume responsibility for design.

C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design dry-pipe sprinkler systems.

Retain data in first subparagraph below if known and if Owner wants to furnish test data to Contractor.

1. Available fire-hydrant flow test records indicate the following conditions:

   a. Date: <**Insert test date**>.
   b. Time: <**Insert time**> [**a.m.**] [**p.m.**]
   c. Performed by: <**Insert operator's name**> of <**Insert firm**>.
   d. Location of Residual Fire Hydrant R: <**Insert location**>.
   e. Location of Flow Fire Hydrant F: <**Insert location**>.
   f. Static Pressure at Residual Fire Hydrant R: <**Insert psig (kPa)**>.
   g. Measured Flow at Flow Fire Hydrant F: <**Insert gpm (L/s)**>.
   h. Residual Pressure at Residual Fire Hydrant R: <**Insert psig (kPa)**>.

D. Sprinkler system design shall be approved by authorities having jurisdiction.

The margin-of-safety requirement may not be required by authorities having jurisdiction. Retain "Margin of Safety for Available Water Flow and Pressure" to require the application of a margin of safety in the Contractor's design.

1. Margin of Safety for Available Water Flow and Pressure: [**10**] [**20**] <**Insert number**> percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:

Revise first 19 subparagraphs below to suit requirements of authorities having jurisdiction. See Appendix A in NFPA 13 for recommended hazard classifications.

   a. Automobile Parking Areas: [**Ordinary Hazard, Group 1**] <**Insert classification**>.
   b. Building Service Areas: [**Ordinary Hazard, Group 1**] <**Insert classification**>.
   c. Churches: [**Light Hazard**] <**Insert classification**>.
   d. Electrical Equipment Rooms: [**Ordinary Hazard, Group 1**] <**Insert classification**>.
   e. Dry Cleaners: [**Ordinary Hazard, Group 2**] <**Insert classification**>.
   f. General Storage Areas: [**Ordinary Hazard, Group 1**] <**Insert classification**>.
   g. Laundries: [**Ordinary Hazard, Group 1**] <**Insert classification**>.
   h. Libraries except Stack Areas: [**Light Hazard**] <**Insert classification**>.
   i. Library Stack Areas: [**Ordinary Hazard, Group 2**] <**Insert classification**>.
   j. Machine Shops: [**Ordinary Hazard, Group 2**] <**Insert classification**>.
   k. Mechanical Equipment Rooms: [**Ordinary Hazard, Group 1**] <**Insert classification**>.

l. Office and Public Areas: [**Light Hazard**] <**Insert classification**>.
m. Plastics Processing Areas: [**Extra Hazard, Group 2**] <**Insert classification**>.
n. Printing Plants: [**Extra Hazard, Group 1**] <**Insert classification**>.
o. Repair Garages: [**Ordinary Hazard, Group 2**] <**Insert classification**>.
p. Restaurant Service Areas: [**Ordinary Hazard, Group 1**] <**Insert classification**>.
q. Solvent Cleaning Areas: [**Extra Hazard, Group 2**] <**Insert classification**>.
r. Upholstering Plants: [**Extra Hazard, Group 1**] <**Insert classification**>.
s. <**Insert classification**>.

3. Minimum Density for Automatic-Sprinkler Piping Design:

Revise first six subparagraphs below to suit requirements of authorities having jurisdiction. Values indicated should provide minimum required total flow for each hazard and group.

a. Light-Hazard Occupancy: [**0.10 gpm over 1500-sq. ft. (4.1 mm/min. over 139-sq. m)**] <**Insert value**> area.
b. Ordinary-Hazard, Group 1 Occupancy: [**0.15 gpm over 1500-sq. ft. (6.1 mm/min. over 139-sq. m)**] <**Insert value**> area.
c. Ordinary-Hazard, Group 2 Occupancy: [**0.20 gpm over 1500-sq. ft. (8.1 mm/min. over 139-sq. m)**] <**Insert value**> area.
d. Extra-Hazard, Group 1 Occupancy: [**0.30 gpm over 2500-sq. ft. (12.2 mm/min. over 232-sq. m)**] <**Insert value**> area.
e. Extra-Hazard, Group 2 Occupancy: [**0.40 gpm over 2500-sq. ft. (16.3 mm/min. over 232-sq. m)**] <**Insert value**> area.
f. Special Occupancy Hazard: As determined by authorities having jurisdiction.

Retain one of two "Maximum Protection Area per Sprinkler" subparagraphs below.

4. Maximum Protection Area per Sprinkler: In accordance with UL listing.
5. Maximum Protection Area per Sprinkler:

Revise first five subparagraphs below to suit requirements of authorities having jurisdiction.

a. Office Spaces: [**120 sq. ft. (11.1 sq. m)**] [**225 sq. ft. (20.9 sq. m)**] <**Insert dimension**>.
b. Storage Areas: [**130 sq. ft. (12.1 sq. m)**] <**Insert dimension**>.
c. Mechanical Equipment Rooms: [**130 sq. ft. (12.1 sq. m)**] <**Insert dimension**>.
d. Electrical Equipment Rooms: [**130 sq. ft. (12.1 sq. m)**] <**Insert dimension**>.
e. Other Areas: In accordance with NFPA 13 recommendations unless otherwise indicated.

Revise "Total Combined Hose-Stream Demand Requirement" Subparagraph below to suit requirements of authorities having jurisdiction.

6. Total Combined Hose-Stream Demand Requirement: In accordance with NFPA 13 unless otherwise indicated:

a. Light-Hazard Occupancies: [**100 gpm (6.3 L/s) for 30 minutes**] <**Insert requirement**>.
b. Ordinary-Hazard Occupancies: [**250 gpm (15.75 L/s) for 60 to 90 minutes**] <**Insert requirement**>.

c. Extra-Hazard Occupancies: [**500 gpm (31.5 L/s) for 90 to 120 minutes**] <**Insert requirement**>.
d. <**Insert requirement**>.

E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined in accordance with NFPA 13 and [**ASCE/SEI 7**] <**Insert requirement**>.

2.3 SOURCE LIMITATIONS

A. Source Limitations: Obtain all grooved joint couplings, fittings, valves, and specialties from single source. Obtain grooving tools from same source as grooved components.

2.4 STEEL PIPE AND FITTINGS

All steel piping in this article is suitable for 175-psig (1200-kPa) minimum working pressure.

Pipe in "Standard-Weight, Galvanized-Steel Pipe" Paragraph below is intended for use with flanged, cut- or roll-grooved, plain-end-pipe, and threaded joints. Pipe is available in NPS 1/8 to NPS 26 (DN 6 to DN 650). Match options for fitting and pipe finish.

A. Standard-Weight, Galvanized-Steel Pipe: ASTM A53/A53M, [**Type E**] <**Insert type**>, [**Grade B**] <**Insert grade**>. Pipe ends may be factory or field formed to match joining method.

Pipe in "Schedule 30, Galvanized-Steel Pipe" Paragraph below is intended for use with flanged, cut- or roll-grooved, plain-end-pipe, and threaded joints. Pipe is available in NPS 1/2 to NPS 10 (DN 15 to DN 250). Match options for fitting and pipe finish.

B. Schedule 30, Galvanized-Steel Pipe: ASTM A135/A135M; ASTM A795/A795M, [**Type E**] <**Insert type**>; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

Pipe in "Thinwall Galvanized-Steel Pipe" Paragraph below is intended for use with flanged, roll-grooved, plain-end-pipe, and threaded joints. Pipe is available in NPS 1/2 to NPS 10 (DN 15 to DN 250). Match options for fitting and pipe finish.

C. Thinwall Galvanized-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

Nipples in "Galvanized-Steel Pipe Nipples" Paragraph below are available in NPS 1/8 to NPS 12 (DN 6 to DN 300).

D. Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.

Couplings in "Galvanized-Steel Couplings" Paragraph below are available in NPS 1/8 to NPS 20 (DN 6 to DN 500).

E. Galvanized-Steel Couplings: ASTM A865/A865M, threaded.

Fittings in "Galvanized, Gray-Iron Threaded Fittings" Paragraph below are available in NPS 1/4 to NPS 12 (DN 8 to DN 300).

F. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

Unions in "Malleable- or Ductile-Iron Unions" Paragraph below are available in NPS 1/4 to NPS 3 (DN 8 to DN 80), but NFPA limits them to NPS 2 (DN 50) and smaller.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Grooved-Joint, Steel-Pipe Appurtenances:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Firelock or comparable product by one of the following:

   a. <**Insert manufacturer's name**>.

2. Pressure Rating: [**175-psig (1200-kPa)**] [**250-psig (1725-kPa)**] [**300-psig (2070-kPa)**] minimum.
3. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A536, ductile-iron casting, short-pattern, with flow equal to standard pattern; and dimensions matching steel pipe.

   a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; FireLock or comparable product by one of the following:

      1) <**Insert engineer-approved manufacturer's name**>.

   b. In sizes where short pattern fittings are not available, Victaulic standard fittings may be used.

AWWA C606 and UL 213 cover couplings in subparagraph below in NPS 3/4 to at least NPS 12 (DN 20 to at least DN 300).

4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket[**, FlushSeal for dry applications**], and ASTM A449 electroplated steel bolts and nuts.

   a. Rigid Type Couplings: Housings cast with offsetting, angle-pattern bolt pads to provide joint rigidity and support and hanging in accordance with NFPA 13. Couplings shall be fully installed at visual pad-to-pad offset contact. Tongue-and-recess type couplings, or any coupling that requires exact gapping of bolt pads at required torque ratings, are not permitted. Center leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth.

1) Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Style 009-EZ and Style 107N, Installation-Ready, or comparable product by one of the following:

a) <**Insert engineer-approved manufacturer's name**>.

2) Installation: Direct stab installation without field disassembly.

Retain one or both of two "Flexible Type" subparagraphs below.

b. Flexible Type: For use in locations where vibration attenuation and stress relief are required. Center leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth.

1) Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company Installation-Ready Style 177 or comparable product by one of the following:

a) <**Insert engineer-approved manufacturer's name**>.

2) Installation: Suitable for direct stab installation without field disassembly.

c. Flexible Type: For use in locations where vibration attenuation and stress relief are required.

1) Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company Style 75 and Style 77 or comparable product by one of the following:

a) <**Insert engineer-approved manufacturer's name**>.

d. Flange Adapter: For direct connection to ANSI Class 125 or 150 flanged components.

1) Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company: Style 741 and 744 or comparable product by one of the following:

a) <**Insert engineer-approved manufacturer's name**>.

Victaulic FireLock IGS System with Installation-Ready™ fittings and couplings may be used for NPS 1 (DN 25) Schedule 10 and Schedule 40 carbon steel pipe in fire protection applications. System rated for a working pressure to 365 psi (2517 kPa).

5. Fittings for Schedule [**40**] [**10**] Grooved End Steel Pipe:

a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Installation-Ready™ or comparable product by one of the following:

1) <**Insert engineer-approved manufacturer's name**>.

b. Sizes NPS 1-1/4 thru NPS 2-1/2 (DN 32 thru DN 65).
c. Ductile-iron housing conforming to ASTM A536, Grade 65-45-12.
d. Installation-Ready™ Ends: [**Orange enamel coated**] [**Red enamel coated**] [**galvanized**].
e. Prelubricated Grade E EPDM Type A gasket.
f. ASTM A449 electroplated steel bolts and nuts.
g. UL listed for a working pressure of 300 psi (2065 kPa) and FM approved for working pressures of 365 psi (2517 kPa).

I. Stainless Steel Pressure-Seal Fittings: FM-approved, 500-psig (3450-kPa) maximum pressure rating (FM approved 175-psig (1207-kPa)) with stainless steel housing, elastomer O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tool, Series PFT-510.

1. Pipe: Schedule 10S, Type 304/304L, conforming to ASTM A312.
2. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; "Vic-Press" system, or comparable product by one of the following:

a. <**Insert engineer-approved manufacture's name**>.

2.5 COPPER TUBE AND FITTINGS

All copper tubing in this article is suitable for 175-psig (1200-kPa) minimum working pressure.

Tube in "Hard Copper Tube" Paragraph below is available in NPS 1/8 to NPS 12 (DN 6 to DN 300).

A. Hard Copper Tube: [**ASTM B88, Type L (ASTM B88M, Type B)**] [**and**] [**ASTM B88, Type M (ASTM B88M, Type C)**] water tube, drawn temper.

Fittings in "Cast-Copper, Solder-Joint Fittings" Paragraph below are available in NPS 1/4 to NPS 12 (DN 8 to DN 300).

B. Cast-Copper, Solder-Joint Fittings: ASME B16.18 pressure fittings.

Fittings in "Wrought-Copper, Solder-Joint Fittings" Paragraph below are available in NPS 1/4 to NPS 8 (DN 8 to DN 200).

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22 pressure fittings.

D. Grooved Joint Lubricant: Compatible with gasket elastomer and fluid media. Supplied by coupling manufacturer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Vic-Lube or comparable product by one of the following:

a. <**Insert engineer-approved manufacturer's name**>.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

Flanges in "Bronze Flanges" Paragraph below are available in NPS 1/2 to NPS 12 (DN 15 to DN 300).

F. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

1. Pipe-Flange Gasket Materials: [**AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick**] [**or**] [**ASME B16.21, nonmetallic and asbestos free**].

Unions in "Copper Unions" Paragraph below are available in NPS 1/4 to NPS 4 (DN 8 to DN 100), but NFPA limits them to NPS 2 (DN 50) and smaller.

G. 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.

Fittings in "Copper Pressure-Seal Fittings" Paragraph below are available in NPS 1/2 to NPS 4 (DN 15 to DN 100).

H. Copper Pressure-Seal Fittings:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Viega LLC.
b. <**Insert manufacturer's name**>.

2. Standard: UL 213.
3. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
4. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze fitting with EPDM-rubber O-ring seal in each end.

I. Grooved-Joint, Copper-Tube Appurtenances:

1. Grooved-End Copper Fittings: ASME B16.22 wrought copper and ASTM B75 (ASTM B75M), copper tube or ASME B16.18 and ASTM B584 bronze castings.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; "Copper-Connection" or comparable product by one of the following:

1) <**Insert engineer-approved manufacturer's name**>.

b. Fittings to be manufactured to copper tubing sizes.
c. Flaring tube or fitting ends to accommodate alternate-sized couplings is not permitted.

AWWA C606, in "Grooved-End-Tube Couplings" Subparagraph below, does not cover couplings for grooved-end copper tubing. One manufacturer makes this type coupling with dimensions for copper tube and fittings.

2. Grooved-End-Tube Couplings: To fit copper-tube dimensions, with design similar to AWWA C606. Include ferrous housing sections cast with offsetting, angle-pattern, bolt pads, EPDM-HP elastomer gasket suitable for hot and cold water, and electroplated bolts and nuts conforming to ASTM A449. Center leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Style 607H Installation-Ready, for direct stab installation without field disassembly:

1) <**Insert engineer-approved manufacturer's name**>.

b. Installation: Suitable for direct stab installation without field disassembly.

Extruded-tee connections in "Copper-Tube, Extruded-Tee Connections" Paragraph below can be used instead of tee fittings in copper tubing. Delete if not allowed by authorities having jurisdiction.

J. Copper-Tube, Extruded-Tee Connections:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. T-DRILL Industries Inc.
b. <**Insert manufacturer's name**>.

2. Description: Tee formed in copper tube in accordance with ASTM F2014.

2.6 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig (1200-kPa) minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

Valves in "Dry-Pipe Valves" Paragraph below are available in NPS 1-1/2 to NPS 8 (DN 40 to DN 200).

F. Dry-Pipe Valves:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Victaulic Style 768-NXT and Fire Pac Style 745 or comparable product by one of the following:

    a. <**Insert engineer-approved manufacturer's name**>.

2. Standard: UL 260.
3. Design: Fixed-pressure release at 7 psi (48 kPa).
4. Valve: Externally resettable.
5. Internal Components: Replaceable without removing the valve from the installed position.
6. Required air pressure: 13 psi (90 kPa).
7. 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.

Retain "Air-Pressure Maintenance Device" Subparagraph below if system uses air-pressure maintenance devices. If retaining, delete "Air Compressor" Subparagraph below.

8. Air-Pressure Maintenance Device:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

    a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Series 757/757P or comparable product by one of the following:

        1) <**Insert engineer-approved manufacturer's name**>.

9. Standard: UL 260.
10. Type: Automatic device to maintain minimum air pressure in piping.
11. 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 14- to 60-psig (95- to 410-kPa) adjustable range, and [**175-psig (1200-kPa)**] [**300-psig (2070-kPa)**] outlet pressure.

Retain "Air Compressor" Subparagraph below if system contains an air compressor. If retaining, delete "Air-Pressure Maintenance Device" Subparagraph above.

12. Air Compressor:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Gast Manufacturing Inc.
        2) <**Insert engineer-approved manufacturer's name**>.

    b. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

Motor characteristics, such as NEMA designation, temperature rating, service factor, enclosure type, and efficiency, are specified in Section 210513 "Common Motor Requirements for Fire Suppression Equipment." If different characteristics are required, insert subparagraphs below to suit Project.

c. Motor Horsepower: Fractional.
d. Power: 120-V ac, 60 Hz, single phase.

Valves in "Deluge Valves" Paragraph below are available in NPS 1-1/2 to NPS 8 (DN 40 to DN 200).

G. Deluge Valves:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Victaulic Style 769N-FireLock-NXT and Fire Pac Style 745 or comparable product by one of the following:

   a. BERMAD Control Valves.
   b. <**Insert engineer-approved manufacturer's name**>.

2. Standard: UL 260.
3. Design: Fixed-pressure release at 7 psi (48 kPa).
4. Valve: Externally resettable.
5. Internal Components: Replaceable without removing the valve from the installed position.
6. Include trim sets for alarm-test bypass, drain, electrical water-flow alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, and fill-line attachment with strainer.
7. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.

Retain "Air-Pressure Maintenance Device" Subparagraph below if system uses air-pressure maintenance devices. If retaining, delete "Air Compressor" Subparagraph below.

8. Air-Pressure Maintenance Device:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

   a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; <**product name or designation**> or comparable product by one of the following:

      1) <**Insert engineer-approved manufacturer's name**>.

   b. Standard: UL 260.
   c. Type: Automatic device to maintain minimum air pressure in piping.

d. 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 14- to 60-psig (95- to 410-kPa) adjustable range, and [**175-psig (1200-kPa)**] [**300-psig (2070-kPa)**] outlet pressure.

Retain "Air Compressor" Subparagraph below if system contains an air compressor. If retaining, delete "Air-Pressure Maintenance Device" Subparagraph above.

9. Air Compressor:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Gast Manufacturing Inc.
2) <**Insert engineer-approved manufacturer's name**>.

10. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
11. Motor Horsepower: Fractional.
12. Power: 120-V ac, 60 Hz, single phase.
13. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

H. Automatic (Ball Drip) Drain Valves:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Reliable Automatic Sprinkler Co., Inc. (The).
b. <**Insert manufacturer's name**>.

2. Standard: UL 1726.
3. Pressure Rating: 175-psig (1200-kPa) minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4 (DN 20).
6. End Connections: Threaded.

2.7 SPRINKLER PIPING SPECIALTIES

A. General Requirements for Dry-Pipe System Fittings: [**UL listed**] <**Insert standard**> for dry-pipe service.

Fittings in "Branch Outlet Fittings" Paragraph below are available in at least NPS 2 to NPS 8 (DN 50 to DN 200) main sizes, with NPS 1/2 to NPS 4 (DN 15 to DN 100) outlets or branches.

B. Branch Outlet Fittings:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Style 920/920N or comparable product by one of the following:

   a. <**Insert engineer-approved manufacturer's name**>.

2. Standard: UL 213.
3. Pressure Rating: [**175-psig (1200-kPa) minimum**] [**300 psig (2070 kPa)**].
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

Assemblies in "Flow Detection and Test Assemblies" Paragraph below are available in NPS 3/4 to NPS 2 (DN 20 to DN 50).

C. Flow Detection and Test Assemblies:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Zone Control Riser Module Series 747M or comparable product by one of the following:

   a. <**Insert engineer-approved manufacturer's name**>.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: [**175-psig (1200-kPa) minimum**] [**300 psig (2070 kPa)**].
4. Body Material: Cast- or ductile-iron housing with cast-bronze orifice, sight glass, integral test valve, and waterflow detector.
5. Size: Same as connected piping.
6. Inlet and Outlet: Grooved ends.

Testers in "Branch Line Testers" Paragraph below are available in NPS sizes required for a single sprinkler.

D. Branch Line Testers:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AGF Manufacturing, Inc.
b. Elkhart Brass Mfg. Co., Inc.
c. Fire-End & Croker Corporation.
d. Potter Electric Signal Company, LLC.
e. Potter Roemer LLC.
f. <**Insert manufacturer's name**>.

2. Standard: UL 199.
3. Pressure Rating: 175-psig (1200-kPa) minimum.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

Fittings in "Sprinkler Inspector's Test Fittings" Paragraph below are available in NPS 3/4 to NPS 2 (DN 20 to DN 50).

E. Sprinkler Inspector's Test Fittings:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; TestMaster II, Style 720 or comparable product by one of the following:

a. <**Insert engineer-approved manufacturer's name**>.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 300 psig (2070 kPa).
4. Body Material: Cast-bronze housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved end.

Nipples in "Adjustable Drop Nipples" Paragraph below are available in NPS sizes required for a single sprinkler.

F. Adjustable Drop Nipples:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aegis Technologies, Inc.
b. CECA, LLC.
c. Corcoran Piping System Co.
d. Merit Manufacturing.
e. <**Insert manufacturer's name**>.

2. Standard: UL 1474.
3. Pressure Rating: [**250-psig (1725-kPa) minimum**] [**300 psig (2070 kPa)**].
4. Body Material: Steel pipe with EPDM O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

G. Flexible Sprinkler Hose Fittings:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Vic-Flex or comparable product by one of the following:
   a. <**Insert engineer-approved manufacturer's name**>.

2. Type: Fully stainless steel flexible hose [**with captured coupling Style 108**] for connection to sprinkler, and with one-piece open-gate "Series AB1" bracket for connection to ceiling grid. The bracket shall allow installation before the ceiling tile is in place.
3. Bend radius to 2 inches (51 mm) for proper installation in confined spaces.
4. Pressure Rating: 175-psig (1200-kPa) minimum.
5. Size: Same as connected piping, for sprinkler.

In lieu of rigid connections to dry sprinkler heads, a Victaulic VicFlex™ dry sprinkler, Model VS1, may be used.

6. Sprinkler to provide a vertical or horizontal flexible connection with a bend radius to 2 inches (51 mm) and allow for up to 4 bends.

2.8 SPRINKLERS

Coordinate this article with "Sprinkler Schedule" Article.

Retain "Basis-of-Design Product" Paragraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

A. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; <**Insert product name or designation**> or comparable product by one of the following:

1. <**Insert engineer-approved manufacturer's name**>.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig (1200-kPa) maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig (1200-kPa) minimum.

E. Pressure Rating for High-Pressure Automatic Sprinklers: [**250-psig (1725-kPa) minimum**] [**300 psig (2070 kPa)**].

F. Sprinklers shall be glass bulb type, with hex shaped wrench boss integrally cast into the sprinkler head to reduce the risk of damage during installation.

1. Wrenches shall be provided by the sprinkler manufacturer that directly engage the wrench boss cast in the sprinkler body.

a. Basis-of-Design: Subject to compliance with requirements, provide Victaulic Company <**Insert product name or designation**> or comparable product to one of the following:

1) <**Insert engineer-approved manufacturer's name**>.

2. Sprinklers with rubber O-rings are not permitted.

G. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: [**UL 199**] <**Insert standard**>.
2. Residential Applications: [**UL 1626**] <**Insert standard**>.
3. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

If more than one sprinkler finish is required in "Sprinkler Finishes" Paragraph below, indicate where each finish is required in "Sprinkler Schedule" Article.

H. Sprinkler Finishes: [**Chrome plated**] [**bronze**] [**and**] [**painted**].

If more than one special sprinkler coating is required in "Special Coatings" Paragraph below, indicate where each coating is required in "Sprinkler Schedule" Article.

I. Special Coatings: [**Wax**] [**lead**] [**and**] [**corrosion-resistant paint**] [**Nickel-Teflon**].

J. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: [**Chrome-plated steel, one piece, flat**] [**Chrome-plated steel, two piece, with 1-inch (25-mm) vertical adjustment**] [**Plastic, white finish, one piece, flat**].
2. Sidewall Mounting: [**Chrome-plated steel**] [**Plastic, white finish**], one piece, flat.
3. Escutcheons: Listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.

K. Sprinkler Guards:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; <**product name or designation**> or comparable product by one of the following:

a. <**Insert engineer-approved manufacturer's name**>.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.
4. Guards: Listed, supplied, and approved for use with the sprinkler by sprinkler manufacturer.

2.9 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

Retain remaining paragraphs if devices are specified in this Section, or delete if devices are specified in Section 284621.11 "Addressable Fire-Alarm Systems" or Section 284621.13 "Conventional Fire-Alarm Systems."

B. Water-Motor-Operated Alarm:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Style 760 or comparable product by one of the following:

a. <**Insert engineer-approved manufacturer's name**>.

2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 10-inch (250-mm) diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4 (DN 20).
8. Outlet: NPS 1 (DN 25) drain connection.

C. Electrically Operated Alarm Bell:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Notifier.
c. Potter Electric Signal Company, LLC.
d. System Sensor.
e. <**Insert engineer-approved manufacturer's name**>.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.

4. Size: [**6-inch (150-mm) minimum**] [**8-inch (200-mm) minimum**] [**10-inch (250-mm)**] diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Pressure Switches:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Potter Electric Signal Company, LLC.
    b. System Sensor.
    c. Viking Corporation.
    d. <**Insert engineer-approved manufacturer's name**>.

2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

Retain "Manufacturers" Subparagraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Potter Electric Signal Company, LLC.
    b. System Sensor.
    c. <**Insert engineer-approved manufacturer's name**>.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

2.10 MANUAL CONTROL STATIONS

Retain this article for combination dry-pipe and preaction sprinkler system piping; delete if using "Control Panels" Article or if control stations are specified in Section 284621.11 "Addressable Fire-Alarm Systems" or Section 284621.13 "Conventional Fire-Alarm Systems."

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve.

B. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.11 CONTROL PANELS

Retain this article for dry-pipe and combination dry-pipe and preaction sprinkler system piping; delete if using "Manual Control Stations" paragraph above or if controls are specified in Section 284621.11 "Addressable Fire-Alarm Systems" or Section 284621.13 "Conventional Fire-Alarm Systems."

A. Description: Single-area, two-area, or single-area cross-zoned type control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves.

1. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" when used with thermal detectors and Class A detector circuit wiring.
2. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

Retain one of two "Manual Control Stations" paragraphs below.

B. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

C. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

D. Panels Components:

1. Power supply.
2. Battery charger.
3. Standby batteries.
4. Field-wiring terminal strip.
5. Electrically supervised solenoid valves and polarized fire-alarm bell.
6. Lamp test facility.
7. Single-pole, double-throw auxiliary alarm contacts.
8. Rectifier.

2.12 PRESSURE GAGES

Retain "Manufacturers" Paragraph below and list of manufacturers to require products from manufacturers listed or a comparable product from other manufacturers.

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AGF Manufacturing, Inc.
2. AMETEK, Inc.
3. Ashcroft Inc.
4. Brecco Corporation.
5. WIKA Instrument Corporation.
6. <**Insert manufacturer's name**>.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.

D. Pressure Gage Range: [**0- to 250-psig (0- to 1725-kPa) minimum**] [**0 to 300 psig (0 to 2070 kPa)**].

E. Label: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gage: Include[**retard feature and**] "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

Retain this article if fire-hydrant flow test is required or if Owner has not provided flow information.

A. Perform fire-hydrant flow test in accordance with NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

Retain this article and delete "Water-Supply Connections" Article below if connection to building's water-service piping is required.

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements in Section 211100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.

Retain one of two paragraphs below. Backflow preventers are recommended and are usually required by authorities having jurisdiction.

B. Install shutoff valve,[**backflow preventer,**] pressure gage, drain, and other accessories indicated at connection to water-service piping.[**Comply with requirements for backflow preventers in Section 211100 "Facility Fire-Suppression Water-Service Piping."**]

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 WATER-SUPPLY CONNECTIONS

Retain this article and delete "Service-Entrance Piping" Article above if connection to building's water-distribution piping is required.

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."

Retain one of two paragraphs below. Backflow preventers are recommended and are usually required by authorities having jurisdiction.

B. Install shutoff valve,[**backflow preventer,**] pressure gage, drain, and other accessories indicated at connection to water-distribution piping.[**Comply with requirements in Section 221119 "Domestic Water Piping Specialties" for backflow preventers.**]

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.4 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

Retain first paragraph below if piping is required to withstand seismic design loads.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

G. Unions and flanges for servicing and disconnect are not required in installations using grooved joint couplings. (The couplings shall serve as disconnect points.)

H. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located in accordance with NFPA 13.

I. Install sprinkler piping with drains for complete system drainage.

J. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

K. Install automatic (ball drip) drain valves to drain piping between fire department connections and check valves. Drain to floor drain or to outside building.

Retain one of two paragraphs below.

L. Connect compressed-air supply to dry-pipe sprinkler piping.

M. Connect air compressor to the following piping and wiring:

1. Pressure gages and controls.
2. Electrical power system.
3. Fire-alarm devices, including low-pressure alarm.

N. Install alarm devices in piping systems.

Pipe hangers specified in NFPA 13 meet minimum pipe hanger requirements and may be inadequate in areas where seismic events are likely or for special conditions.

O. Install hangers and supports for sprinkler system piping in accordance with NFPA 13. Comply with requirements in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

P. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

Q. Drain dry-pipe sprinkler piping.

R. Pressurize and check dry-pipe sprinkler system piping and [**air-pressure maintenance devices**] [**air compressors**].

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Retain first paragraph below for piping that penetrates an exterior concrete wall or concrete slab.

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.5 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts in accordance with ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings in accordance with AWWA C606 for steel-pipe joints.

1. Ensure grooved ends are clean and free from indentations, projections, or roll marks.
2. Use gaskets molded and produced by coupling manufacturer of an elastomer suitable for intended service.
3. On-Site Training: Training for contractor's field personnel in use of grooving tools and installation of product shall be provided by coupling manufacturer's factory-trained representative. (Distributor's representative is not considered qualified to conduct the training.)
4. Jobsite Visitation: Manufacturer's representative shall periodically visit jobsite to ensure best practices in grooved product installation are being followed.

Where required, retain the subparagraphs below:

5. The installing contractor shall be certified by the grooved coupling manufacturer for the installation of their product. A manufacturer's factory-trained representative (direct employee) shall provide on-site certification training for the installing contractor's field personnel in the use of grooving tools, application of groove, and product installation.

6. A field training program must be designed, developed, administered, and evaluated in accordance with the ANSI/IACET Standard for Continuing Education and Training (IACET-International Association for Continuing Education and Training).
7. All installation professionals and pipe fitters must be able to provide proof of successful course completion upon request.

J. Brazed Joints: Join copper tube and fittings in accordance with CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

K. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings in accordance with AWWA C606 for steel-pipe grooved joints.

1. Ensure grooved ends are clean and free from indentations, projections, or roll marks.
2. Use gaskets molded and produced by coupling manufacturer of an elastomer suitable for intended service.
3. On-Site Training: Training for contractor's field personnel in use of grooving tools and installation of product shall be provided by coupling manufacturer's factory-trained representative. (Distributor's representative is not considered qualified to conduct the training.)
4. Jobsite Visitation: Manufacturer's representative shall periodically visit jobsite to ensure best practices in grooved product installation are being followed.

Where required, retain the subparagraphs below:

5. The installing contractor shall be certified by the grooved coupling manufacturer for the installation of their product. A manufacturer's factory-trained representative (direct employee) shall provide on-site certification training for the installing contractor's field personnel in the use of grooving tools, application of groove, and product installation.
6. A field training program must be designed, developed, administered, and evaluated in accordance with the ANSI/IACET Standard for Continuing Education and Training (IACET-International Association for Continuing Education and Training).
7. All installation professionals and pipe fitters must be able to provide proof of successful course completion upon request.

L. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.

M. Extruded-Tee Connections: Form tee in copper tube in accordance with ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.6 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties in accordance with NFPA 13 and authorities having jurisdiction.

B. 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.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install [**dry-pipe**] [**and**] [**deluge**] valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

Retain first subparagraph below or retain second and third subparagraphs.

a. Install air compressor and compressed-air-supply piping.
b. Install air-pressure maintenance device with 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 [**14- to 60-psig (95- to 410-kPa)**] <**Insert value**> adjustable range; and [**175-psig (1200-kPa)**] <**Insert value**> maximum inlet pressure.
c. Install compressed-air-supply piping from building's compressed-air piping system.

3.7 SPRINKLER INSTALLATION

Coordinate this article with Drawings.

A. Install sprinklers in suspended ceilings in center of[**narrow dimension of**] acoustical ceiling panels.

B. Install sprinklers with water supply from heated space. Do not install pendent or sidewall sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

D. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

E. Sprinkler bulb protector shall be removed by hand. Do not use any tools or devices that could damage the bulb.

3.8 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping in accordance with requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

Retain "Perform the following tests and inspections" Paragraph below to require Contractor to perform tests and inspections.

A. Perform the following tests and inspections[**with the assistance of a factory-authorized service representative**]:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems in accordance with NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire department equipment.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.11 DEMONSTRATION AND TRAINING

A. On-Site Training: Training for contractor's field personnel in use of grooving tools and installation of product shall be provided by coupling manufacturer's factory-trained representative. (Distributor's representative is not considered qualified to conduct the training.)

B. Jobsite Visitation: Manufacturer's representative shall periodically visit jobsite to ensure best practices in grooved product installation are being followed.

C. [**Engage a factory-authorized service representative to train**] [**Train**] Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.12 PIPING SCHEDULE

Many pipe materials are available for dry-pipe sprinkler system piping applications. Review NFPA sprinkler standards, UL's "Fire Protection Equipment Directory," and FM Global's "Approval Guide" for materials suitable for different applications, pipe sizes, and joining methods. Applications in this Section are those generally used; other combinations may be required. Use of the "Steel Pipe Schedule" in the "Approval Guide" is recommended.

Retain piping applications in this article. Coordinate with materials specified in Part 2.

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with [**threaded ends, cast-iron threaded fittings, and threaded**] [**grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved**] joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Copper-tube, extruded-tee connections may be used for tee branches in copper tubing instead of specified copper fittings. Branch-connection joints must be brazed.

Retain second option in first paragraph below to allow Contractor to select piping materials from those retained.

D. Standard-pressure, dry-pipe sprinkler system, [**NPS 2 (DN 50) and smaller**] <**Insert pipe size range**>, shall be[**one of**] the following:

Retain one or more of six subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

1. [**Standard-weight**] [**or**] [**Schedule 30**], galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. [**Standard-weight**] [**or**] [**Schedule 30**], galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Schedule 10S stainless steel pipe; stainless steel pressure-seal fittings; and pressure-sealed joints.
4. [**Type L (Type B)**] [**Type M (Type C)**], hard copper tube with plain ends; [**cast-**] [**or**] [**wrought-**]copper, solder-joint fittings; and brazed joints.
5. [**Type L (Type B)**] [**Type M (Type C)**], hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
6. NPS 2 (DN 50), [**Type L (Type B)**] [**Type M (Type C)**], hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

Retain second option in first paragraph below to allow Contractor to select piping materials from those retained.

E. Standard-pressure, dry-pipe sprinkler system, [**NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**] <**Insert pipe size range**>, shall be[**one of**] the following:

Retain one or more of five subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

1. [**Standard-weight**] [**or**] [**Schedule 30**], galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. [**Standard-weight**] [**or**] [**Schedule 30**], galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. [**Type L (Type B)**] [**Type M (Type C)**], hard copper tube with plain ends; [**cast-**] [**or**] [**wrought-**]copper, solder-joint fittings; and brazed joints.
4. [**Type L (Type B)**] [**Type M (Type C)**], hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
5. [**Type L (Type B)**] [**Type M (Type C)**], hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

Retain second option in paragraph below to allow Contractor to select piping materials from those retained.

F. Standard-pressure, dry-pipe sprinkler system, [**NPS 5 and NPS 6 (DN 125 and DN 150)**] <**Insert pipe size range**>, shall be[**one of**] the following:

Retain one or more of four subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

1. [**Standard-weight**] [**or**] [**Schedule 30**], galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. [**Standard-weight**] [**or**] [**Schedule 30**], galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. [**Type L (Type B)**] [**Type M (Type C)**], hard copper tube with plain ends; [**cast-**] [**or**] [**wrought-**]copper, solder-joint fittings; and brazed joints.
4. [**Type L (Type B)**] [**Type M (Type C)**], hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

3.13 SPRINKLER SCHEDULE

Retain this article to require selected products to be used in indicated applications; delete to allow Contractor to choose among various products acceptable to authorities having jurisdiction, or if delegating sprinkler system design to Contractor. In accordance with NFPA 13, Drawings shall indicate sprinkler make, type, model, and nominal k-factor, including sprinkler identification number.

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: [**Upright sprinklers**] <**Insert type**>.
2. Rooms with Suspended Ceilings: [**Dry pendent sprinklers**] [**Dry recessed sprinklers**] [**Dry flush sprinklers**] [**Dry concealed sprinklers**] [**Dry pendent, recessed, flush, and concealed sprinklers as indicated**].
3. Wall Mounting: Dry sidewall sprinklers.

4. Spaces Subject to Freezing: [**Upright sprinklers**] [**Dry pendent sprinklers**] [**Dry sidewall sprinklers**] [**Upright, dry pendent sprinklers; and dry sidewall sprinklers as indicated**] <**Insert type**>.
5. Special Applications: [**Extended-coverage and quick-response sprinklers where indicated**] <**Insert type**>.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. [**Upright**] [**Pendent**] [**and**] [**Sidewall**] Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211316