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SECTION 211000 - WATER-BASED FIRE-SUPPRESSION SYSTEMS

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes:

Fire-suppression piping, fittings, and appurtenances.

Hose connections and hose stations.

Manual control stations.

Control panels.

* + - * 1. Related Requirements:

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

Section 331415 "Site Water Distribution Piping" for site fire-suppression water-service and backflow prevention devices.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project. Include only essential definitions or acronyms not well understood by the affected industry or trade.

* + - * 1. Standard-Pressure Fire-Suppression System Piping: Piping designed to operate at working pressure of 175 psig maximum.

Some fire-protection products for high-pressure standpipe and sprinkler piping are only rated for 250 psig (1725 kPa). If 300 psig (2070 kPa) piping is required, verify product pressure ratings.

* + - * 1. High-Pressure Fire-Suppression System Piping: Piping designed to operate at working pressure higher than standard 175 psig, but not higher than [**250 psig**] [**300 psig**].
      1. ACTION SUBMITTALS

Action submittals are submittals requiring responsive action and return of reviewed documents to Contractor.

* + - * 1. Product Data:

For each type of product.

Include construction details, material descriptions, dimensions of individual components and profiles.

Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

* + - * 1. Shop Drawings:

Prepare in accordance with [**NFPA 13**] [**and**] [**NFPA 14**] section "Working Plans."

Include plans, elevations, and sections of the system piping and details.

Include detailed riser diagram and schematic diagram showing system supply, supply connection, devices, valves, pipe and fittings, as well as the delineation of the standard-pressure and high-pressure portions of the fire-suppression system.

Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Prepare computer-generated hydraulic calculations in accordance with the following:

Minimum operating pressure at hydraulically most remote fire hose valve is to be [**100 psig**] <**Insert pressure**>.

Name of hydraulic program used.

Water supply information, including fire hydrant flow test data report.

Submit documents and calculations [**signed and sealed by qualified professional engineer responsible for their preparation**] [**and**] [**prepared by NICET Level III-certified technician, "Water-Based Systems Layout."**] [**prepared by NICET Level IV-certified technician, "Water-Based Systems Layout."**] [**NICET certified-technician submittals are to include the following information on each drawing title block: technician's name, NICET certification number, and NICET certification specialty area and level.**]

Include diagrams for power, signal, and control wiring.

Retain "Delegated Design Submittals" Paragraph below if design performance requirements of this Section are designated in the Contract Documents by the engineer of record and are to be developed into Authority Having Jurisdiction (AHJ)-approved delegated design by Contractor. Professional engineer qualifications are specified in Section 014000 "Quality Requirements." See the Evaluations for website link for information on NICET certification programs. Verify requirements with the AHJ.

* + - * 1. Delegated Design Submittals: For fire-suppression 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.**] [**prepared by NICET Level III-certified technician, "Water-Based Systems Layout."**] [**prepared by NICET Level IV-certified technician, "Water-Based Systems Layout."**] [**NICET certified-technician submittals are to include the following information on each drawing title block: technician's name, NICET certification number, and NICET certification specialty area and level.**]
      1. INFORMATIONAL SUBMITTALS

Informational submittals are submittals that require review by Architect, but they do not require Architect's responsive action and return of reviewed documents to Contractor, provided submittals comply with requirements. If rejected, submittals with responsive action must be returned to Contractor.

Retain "Coordination Drawings" Paragraph below where coordination is required for efficient installation of products and materials by separate installers. Preparation of coordination drawings requires participation of each trade involved; coordinate with other Sections specifying products and materials to be included. See Section 013100 "Project Management and Coordination."

* + - * 1. Coordination Drawings: Fire-suppression system plans and sections, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinated with all building trades.

Retain "Seismic Qualification Certificates" Paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Certificates: For fire-suppression equipment, accessories, and components, from manufacturer.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

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

* + - * 1. Qualification Data: For qualified Installer[ **and professional engineer**] [ **and NICET-certified technician**].

Retain "Design Data" Paragraph below if Contractor's design is specified in "Performance Requirements" Article.

* + - * 1. Design Data: Approved fire-suppression piping working plans, prepared in accordance with [**NFPA 13**] [**and**] [**NFPA 14**], including documented approval by AHJs, and including hydraulic calculations if applicable.

Retain "Welding certificates" Paragraph below if retaining procedures for welder certification in "Quality Assurance" Article.

* + - * 1. Welding certificates.
        2. Field Test Reports:

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

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

Fire-hydrant flow test report.

* + - * 1. Field quality-control reports.
      1. CLOSEOUT SUBMITTALS
         1. Operation and Maintenance Data: For fire-suppression systems and specialties to include in emergency, operation, and maintenance manuals.
      2. MAINTENANCE MATERIAL SUBMITTALS
         1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

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.

System control valves.

* + - 1. QUALITY ASSURANCE

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

* + - * 1. Installer Qualifications:

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

Installer's responsibilities include designing, fabricating, and installing fire-suppression 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 or NICET-certified technician. Coordinate with "Delegated Design Submittals" Paragraph in "Action Submittals" Article. Verify requirements with AHJ.

Engineering Responsibility: Preparation of working plans, calculations, and field test reports by [**qualified professional engineer.**] [**NICET Level III-certified technician, "Water-Based Systems Layout."**] [**NICET Level IV-certified technician, "Water-Based Systems Layout."**]

Retain "Welding Qualifications" Paragraph below if shop or field welding is required. If retaining, also retain "Welding certificates" Paragraph in "Informational Submittals" Article.

* + - * 1. Welding Qualifications: Qualify procedures and operators in accordance with ASME Boiler and Pressure Vessel Code.
      1. FIELD CONDITIONS

Retain this article if interruption of existing fire-suppression service is required.

* + - * 1. Interruption of Existing Fire-Suppression Service: Do not interrupt fire-suppression service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fire-suppression service in accordance with requirements indicated:

Notify [**Architect**] [**Construction Manager**] [**Owner**] no fewer than [**seven**] <**Insert number**> days in advance of proposed interruption of fire-suppression service.

Do not proceed with interruption of fire-suppression service without [**Architect's**] [**Construction Manager's**] [**Owner's**] written permission.

1. PRODUCTS
   * + 1. SYSTEM DESCRIPTION

Revise paragraphs below as required for Project. If more than one is required, identify location of system on Project drawings.

* + - * 1. Automatic wet-type, [**Class I**] [**Class II**] [**Class III**] standpipe system.
        2. Automatic dry-type, [**Class I**] [**Class II**] [**Class III**] standpipe system.
        3. Semiautomatic dry-type, [**Class I**] [**Class II**] [**Class III**] standpipe system.
        4. Manual wet-type, Class I standpipe system.
        5. Manual dry-type, Class I standpipe system.
        6. Automatic combination wet-type standpipe sprinkler system.
        7. Automatic wet-pipe sprinkler system.
        8. Automatic dry-pipe sprinkler.
        9. Automatic deluge sprinkler system.
        10. Automatic single-interlock preaction sprinkler system.
        11. Automatic double-interlock preaction sprinkler system.
      1. PERFORMANCE REQUIREMENTS

Coordinate "Seismic Performance" Paragraph below with Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

* + - * 1. Seismic Performance: Fire-suppression system piping to withstand the effects of earthquake motions determined in accordance with [**NFPA 13**] [**NFPA 14**] [**and**] [**ASCE/SEI 7**] <**Insert standard**>. See Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
        2. Fire-Suppression System Components, Devices, and Accessories: Listed in ULSE's "Fire Protection Equipment Directory" and FM Approvals' "Approval Guide."
        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 "and ASME A17.1" option in first paragraph below if Project contains elevators and escalators.

* + - * 1. Fire-suppression system equipment, specialties, accessories, installation, and testing to comply with [**NFPA 13**] [**NFPA 13R**] [**NFPA 14**] [**NFPA 13D**] [**and**] [**ASME A17.1**] <**Insert standard**>.
        2. Standard-Pressure Piping System Component: Listed for 175 psig minimum working pressure.
        3. High-Pressure Piping System Component: Listed for [**250 psig** **minimum**] [**300 psig**] working pressure.

Retain "Delegated Design" Paragraph below if Contractor is required to assume responsibility for design. Coordinate with "Delegated Design Submittals" Paragraph in "Action Submittals" Article.

* + - * 1. Delegated Design: Engage a [**qualified professional engineer**] [**NICET Level III-certified technician, "Water-Based Systems Layout"**] [**NICET Level IV-certified technician, "Water-Based Systems Layout"**] to design fire-suppression systems.

Fire-Hydrant Flow Test:

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

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

Date: <**Insert test date**>.

Time: <**Insert time**> [**a.m.**] [**p.m.**]

Performed by: <**Insert operator's name**> of <**Insert firm**>.

Location of Residual Fire Hydrant R: <**Insert location**>.

Location of Flow Fire Hydrant F: <**Insert location**>.

Static Pressure at Residual Fire Hydrant R: <**Insert psig**>.

Measured Flow at Flow Fire Hydrant F: <**Insert gpm**>.

Residual Pressure at Residual Fire Hydrant R: <**Insert psig**>.

Retain first subparagraph below if Contractor is responsible for obtaining hydrant flow test data.

Perform fire-hydrant flow test and record the following conditions:

Date: <**Insert test date**>.

Time: <**Insert time**> [**a.m.**] [**p.m.**]

Performed by: <**Insert operator's name**> of <**Insert firm**>.

Location of Residual Fire Hydrant R: <**Insert location**>.

Location of Flow Fire Hydrant F: <**Insert location**>.

Static Pressure at Residual Fire Hydrant R: <**Insert psig**>.

Measured Flow at Flow Fire Hydrant F: <**Insert gpm**>.

Residual Pressure at Residual Fire Hydrant R: <**Insert psig**>.

Retain first subparagraph below if retaining either of above subparagraphs.

Fire-hydrant flow test must be performed within previous [**12**] <**Insert number**> months prior to completion of design documents and hydraulic calculations.

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

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

Sprinkler Occupancy Hazard Classifications:

Revise first 33 subparagraphs below to suit requirements of AHJs. See Annex A in NFPA 13 for recommended hazard classifications. Delete if information is included on Drawings.

Automobile Parking and Showrooms: [**Ordinary Hazard, Group 1**] <**Insert classification**>.

Churches: [**Light Hazard**] <**Insert classification**>.

Dry Cleaners: [**Ordinary Hazard, Group 2**] <**Insert classification**>.

Educational: [**Light Hazard**] <**Insert classification**>.

Electrical Equipment Rooms: [**Ordinary Hazard, Group 1**] <**Insert classification**>.

Elevator Machine Room and Hoistway: [**Ordinary Hazard, Group 1**] <**Insert classification**>.

Exterior and Interior Loading Docks, Handling Flammable/Combustible Liquids, Hazardous Materials, or Utilized for Storage: <**Insert classification**>.

Exterior Loading Docks, Only Handling Ordinary Combustibles: [**Ordinary Hazard, Group 2**] <**Insert classification**>.

General Storage Areas: [**Ordinary Hazard, Group 1**] <**Insert classification**>.

Hospitals, including Animal Hospitals and Veterinary Facilities: [**Light Hazard**] <**Insert classification**>.

Institutional: [**Light Hazard**] <**Insert classification**>.

Laundries: [**Ordinary Hazard, Group 1**] <**Insert classification**>.

Libraries, except Large Stack Rooms: [**Light Hazard**] <**Insert classification**>.

Libraries, Large Stack Rooms: [**Ordinary Hazard, Group 2**] <**Insert classification**>.

Machine Shops: [**Ordinary Hazard, Group 2**] <**Insert classification**>.

Mechanical Equipment Rooms: [**Ordinary Hazard, Group 1**] <**Insert classification**>.

Mercantile: [**Ordinary Hazard, Group 2**] <**Insert classification**>.

Museums: [**Light Hazard**] <**Insert classification**>.

Nursing or Convalescent Homes: [**Light Hazard**] <**Insert classification**>.

Offices, including Data Processing: [**Light Hazard**] <**Insert classification**>.

Plastics Processing Areas: [**Extra Hazard, Group 2**] <**Insert classification**>.

Post Offices: [**Ordinary Hazard, Group 2**] <**Insert classification**>.

Printing Plants: [**Extra Hazard, Group 1**] <**Insert classification**>.

Printing and Publishing: [**Ordinary Hazard, Group 2**] <**Insert classification**>.

Repair Garages: [**Ordinary Hazard, Group 2**] <**Insert classification**>.

Residential: [**Light Hazard**] <**Insert classification**>.

Restaurant Seating Areas: [**Light Hazard**] <**Insert classification**>.

Restaurant Service Areas: [**Ordinary Hazard, Group 1**] <**Insert classification**>.

Solvent Cleaning Areas: [**Extra Hazard, Group 2**] <**Insert classification**>.

Stages: [**Ordinary Hazard, Group 2**] <**Insert classification**>.

Theaters and Auditoriums, excluding Stages and Prosceniums: [**Light Hazard**] <**Insert classification**>.

Upholstering Plants: [**Extra Hazard, Group 1**] <**Insert classification**>.

<**Insert occupancy and hazard classification**>.

Minimum Density for Automatic-Sprinkler Piping Design:

Revise first seven subparagraphs below to suit requirements of AHJs. Values indicated should provide minimum required total flow for each hazard and group.

Residential (Dwelling) Occupancy: [**0.05 gpm/sq. ft. over 400 sq. ft.**] <**Insert value**> area.

Light-Hazard Occupancy: [**0.10 gpm/sq. ft. over 1500 sq. ft.**] <**Insert value**> area.

Ordinary-Hazard, Group 1 Occupancy: [**0.15 gpm/sq. ft. over 1500 sq. ft.**] <**Insert value**> area.

Ordinary-Hazard, Group 2 Occupancy: [**0.20 gpm/sq. ft. over 1500 sq. ft.**] <**Insert value**> area.

Extra-Hazard, Group 1 Occupancy: [**0.30 gpm/sq. ft. over 2500 sq. ft.**] <**Insert value**> area.

Extra-Hazard, Group 2 Occupancy: [**0.40 gpm/sq. ft. over 2500 sq. ft.**] <**Insert value**> area.

Special Occupancy Hazard: As determined by AHJs.

Minimum Density for Deluge-Sprinkler Piping Design:

Revise first five subparagraphs below to suit requirements of AHJs. Values indicated should provide minimum required total flow for each hazard and group.

Ordinary-Hazard, Group 1 Occupancy: [**0.15 gpm/sq. ft.**] <**Insert value**> over entire area.

Ordinary-Hazard, Group 2 Occupancy: [**0.20 gpm/sq. ft.**] <**Insert value**> over entire area.

Extra-Hazard, Group 1 Occupancy: [**0.30 gpm/sq. ft.**] <**Insert value**> over entire area.

Extra-Hazard, Group 2 Occupancy: [**0.40 gpm/sq. ft.**] <**Insert value**> over entire area.

Special Occupancy Hazard: As determined by AHJs.

Retain one of first two subparagraphs below.

Maximum protection area per sprinkler in accordance with ULSE listing.

Maximum Protection Area per Sprinkler:

Revise first six subparagraphs below to suit requirements of AHJs.

Residential Areas: [**400 sq. ft.**] <**Insert dimension**>.

Office Spaces: [**120 sq. ft.**] [**225 sq. ft.**] <**Insert dimension**>.

Storage Areas: [**130 sq. ft.**] <**Insert dimension**>.

Mechanical Equipment Rooms: [**130 sq. ft.**] <**Insert dimension**>.

Electrical Equipment Rooms: [**130 sq. ft.**] <**Insert dimension**>.

Other Areas: In accordance with [**NFPA 13**] [**NFPA 13R**] [**NFPA 13D**] recommendations unless otherwise indicated.

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

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

Light-Hazard Occupancies: [**100 gpm for 30 minutes**] <**Insert requirement**>.

Ordinary-Hazard Occupancies: [**250 gpm for 60 to 90 minutes**] <**Insert requirement**>.

Extra-Hazard Occupancies: [**500 gpm for 90 to 120 minutes**] <**Insert requirement**>.

Minimum residual pressure at each hose-connection outlet is as follows:

NPS 1-1/2 (DN 40) Hose Connections: [**65 psig**] <**Insert value**>.

NPS 2-1/2 (DN 65) Hose Connections: [**100 psig**] <**Insert value**>.

* + - * 1. Obtain documented approval of fire-suppression system design from AHJs.
      1. HOSE CONNECTIONS AND HOSE STATIONS
         1. Hose Connections, Nonadjustable Valve:

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

Basis-of-Design Product: Subject to compliance with requirements, provide **Zurn Industries, LLC; Model ZW4000** or comparable product by one of the following:

<**Insert manufacturer's name**>

Standard: UL 668.

Description: Fire hose valve for connecting fire hose.

Pressure Rating: 300 psig minimum.

Material: Brass or bronze.

Size: NPS 1-1/2 or NPS 2-1/2, as indicated.

Inlet: Female pipe threads.

Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads in accordance with NFPA 1963 and matching local fire department threads.

Pattern: [**Angle**] [**or**] [**gate**].

Finish: [**Polished chrome plated**] [**Rough brass or bronze**] [**Rough chrome plated**].

* + - 1. MANUAL CONTROL STATIONS

Retain this article for dry-type standpipe system piping and preaction sprinkler system piping; delete if using "Control Panels" Article or if control stations are specified in Section 284600 "Fire Detection and Alarm" or Section 284614 "Single- and Multiple-Station Alarms."

* + - * 1. Listed in ULSE's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide"
        2. Description: For hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve.
        3. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.
      1. CONTROL PANELS

Retain this article for dry-pipe and combination dry-pipe and preaction sprinkler system piping; delete if using "Manual Control Stations" Article or if controls are specified in Section 284600 "Fire Detection and Alarm" or Section 284614 "Single- and Multiple-Station Alarms."

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

Listed in ULSE's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide" when used with thermal detectors and Class A detector circuit wiring.

Electrical characteristics are 120 V ac, 60 Hz, with 24 V dc rechargeable batteries.

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 "Manual Control Stations, Electric Operation" or "Manual Control Stations, Hydraulic Operation" Paragraph below.

* + - * 1. 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.
        2. Manual Control Stations, Hydraulic Operation: Provide union, NPS 1/2 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.
        3. Panel Components:

Power supply.

Battery charger.

Standby batteries.

Field-wiring terminal strip.

Electrically supervised solenoid valves and polarized fire-alarm bell.

Lamp test facility.

Single-pole, double-throw auxiliary alarm contacts.

Rectifier.

1. EXECUTION
   * + 1. PREPARATION

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

* + - * 1. Perform fire-hydrant flow test. Use results for system design calculations required in "Quality Assurance" Article.

Flow test is to be performed to meet the criteria established by [**NFPA 13**] [**and**] [**NFPA 14**].

Flow test is to be conducted in accordance with NFPA 291.

Test is to be performed during a period of ordinary demand for the water system.

To obtain satisfactory test results of expected flow or rated capacities, sufficient discharge should be achieved to cause drop of at least 10 percent.

Pitot readings are to be taken at the 2-1/2-inch orifice connection.

The pitot reading is to range from 10 to 35 psig.

Open additional hydrant outlets as needed to control pitot readings.

The pitot pressure and corresponding residual pressure readings are to be taken consecutively as pressure fluctuates between a high number and low number.

* + - * 1. Flow Test Data Written Report:

Flow data report is to be written in accordance with NFPA 291.

Flow data report is to include a copy of all flow data recorded during the test, including a site plan showing the tested fire hydrants with respect to the fire water service to the building. Site plan is to indicate which hydrant was flowed and which hydrant was used for pressure reading. Provide date of test, name of testing agency, and name of individual performing test.

* + - * 1. Water Supply Curve: Provide water supply curve based on the lowest supply for a given set of test data. For a given residual pressure reading, the supply is to be graphed utilizing the corresponding pitot pressure/flow reading and static pressure reading.
        2. Documentation is to include calibration certifications for gauges used in the flow tests. The certifications are to be from within the previous six (6) months from a reputable agency recognized for certifying pressure gauges.
        3. Report flow test results promptly and in writing. A copy of the flow test data report is to be submitted with the hydraulic calculations.
      1. INSTALLATION OF FIRE-SUPPRESSION WATER-SERVICE PIPING

Retain this article and delete "Installation of Domestic Water-Supply Connections" Article if connection to building's fire-suppression water-service piping is required.

* + - * 1. Comply with requirements for fire-suppression water-service piping in Section 331415 "Site Water Distribution Piping."
      1. INSTALLATION OF DOMESTIC WATER-SUPPLY CONNECTIONS

Retain this article and delete "Installation of Fire-Suppression Water-Service Piping" Article if connection to building's domestic water-distribution piping is required.

* + - * 1. Connect fire-suppression water piping to building's interior domestic water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."
        2. Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Section 331415 "Site Water Distribution Piping."
      1. INSTALLATION OF FIRE-SUPPRESSION PIPING
         1. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

Deviations from approved working plans for piping require written approval from AHJs. File written approval with Architect before deviating from approved working plans.

Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

* + - * 1. Piping Standard: Comply with [**NFPA 13**] [**and**] [**NFPA 14**] requirements for installation of fire-suppression piping.

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

* + - * 1. Install seismic restraints on piping. Comply with NFPA standards requirements for seismic-restraint device materials and installation.
        2. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
        3. Install unions adjacent to each valve in pipes NPS 2 and smaller.
        4. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
        5. Install inspector's test connections in sprinkler system piping, complete with shutoff valve, and sized and located in accordance with NFPA 13.
        6. Install fire-suppression system piping with drains for complete system drainage. Extend drain piping to exterior of building where possible.
        7. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
        8. Install automatic (ball drip) drain valve at each check valve for fire department connection, to drain piping between fire department connection and check valve. Install drain piping to and spill over floor drain or to exterior of building.
        9. Install alarm devices in piping systems.

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

* + - * 1. Install hangers and supports for fire-suppression piping in accordance with NFPA standards. Comply with requirements for hanger materials in NFPA standards. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
        2. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe/sprinkler supply. Include pressure gauges with connection not less than 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 are not subject to freezing.
        3. Pressurize and check [**dry-pipe**] [**preaction**] standpipe or sprinkler system piping and [**air-pressure maintenance devices**] [**air compressors**].
        4. Fill wet-type fire-suppression system piping with water.
        5. Drain dry-type fire-suppression system piping.

As a general rule, electric heat tracing to prevent freezing of fire-suppression piping is not typically considered an acceptable solution for protection. Confirm acceptability with AHJ and any special requirements prior to using this method.

Install electric heating cables and pipe insulation on fire-suppression piping in areas subject to freezing. Comply with requirements for heating cables in Section 210533 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Section 210700 "Fire-Suppression Systems Insulation."

* + - * 1. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210500 "Common Work Results for Fire-Suppression Piping."

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

* + - * 1. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210500 "Common Work Results for Fire-Suppression Piping."
        2. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210500 "Common Work Results for Fire-Suppression Piping."
      1. INSTALLATION OF PIPING JOINTS
         1. 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.
         2. Install unions adjacent to each valve in pipes NPS 2 and smaller.
         3. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
         4. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
         5. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
         6. 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.
         7. 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:

Apply appropriate tape or thread compound to external pipe threads.

Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

* + - * 1. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
        2. Steel-Piping, Pressure-Sealed Joints: Join steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
        3. Welded Joints: Construct joints in accordance with AWS D10.12M/D10.12, using qualified processes and welding operators in accordance with "Quality Assurance" Article.

Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

* + - * 1. 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.
        2. Steel-Piping, Roll-Grooved Joints: Roll rounded-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 grooved joints.
        3. Brazed Joints: Join copper tube and fittings in accordance with Copper Development Association's "Copper Tube Handbook," "Brazed Joints" chapter.
        4. 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.
        5. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.
        6. 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.
        7. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
        8. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:

Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.

CPVC Piping: Join in accordance with ASTM D2846/D2846M Appendix.

* + - 1. INSTALLATION OF FIRE DEPARTMENT CONNECTIONS
         1. Install wall-type fire department connections.
         2. Install yard-type fire department connections in concrete slab support. Comply with requirements for concrete in Section 033000 "Cast-in-Place Concrete."
         3. Install [**two**] [**three**] <**Insert number**> protective pipe bollards [**around**] [**on sides of**] each fire department connection. Comply with requirements for bollards in Section 055000 "Metal Fabrications."
         4. Install automatic (ball-drip) drain valve at each check valve for fire department connection.
      2. INSTALLATION OF HOSE CONNECTIONS AND HOSE STATIONS
         1. Examine roughing-in for hose connections and hose stations to verify actual locations of piping connections before installation.
         2. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and hose stations are to be installed.
         3. Proceed with installation only after unsatisfactory conditions have been corrected.

Indicate hose-connection and hose-station locations, sizes, and special devices on Drawings.

* + - * 1. Install hose connections adjacent to standpipes.
        2. Install freestanding hose connections and hose stations for access and minimum passage restriction.
        3. Install NPS 1-1/2 hose-connection and hose-station valves with flow-restricting device unless otherwise indicated.
        4. Install NPS 2-1/2 hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 reducer adapter and flow-restricting device unless otherwise indicated.
        5. Install wall-mounted-type hose connections and wall-mounted, rack hose stations 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. Comply with requirements for cabinets in Section 104413 "Fire Protection Cabinets."
        6. Install freestanding hose stations with support or bracket attached to standpipe.
        7. Install hose-reel hose stations on wall with bracket.
      1. INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

ULSE listing requires that DecoShield Systems' system be installed in accordance with manufacturer's installation manual and NFPA 13, NFPA 13D, or NFPA 13R, for supporting system.

* + - * 1. Install cover system, brackets, and cover components for sprinkler piping in accordance with manufacturer's installation manual and in accordance with NFPA 13 or NFPA 13R for supports.
      1. INSTALLATION OF VALVES AND SPECIALTIES
         1. Install listed fire-suppression system control valves, trim and drain valves, specialty valves and trim, controls, and specialties in accordance with manufacturer's installation instructions, NFPA standards, and AHJ.
         2. Install listed fire-suppression system shutoff valves in supervised open position, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
         3. System Control Valves:

Retain one or more of subparagraphs below as required for Project.

Install alarm valves with bypass check valve and retarding chamber drain-line connection.

Install [**dry-pipe**] [**and**] [**preaction**] valves with trim sets for air supply, drain, priming level, alarm connections, ball-drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.

Retain first subparagraph below or retain second and third subparagraphs.

Install air compressor and compressed-air-supply piping.

Install air-pressure maintenance device with shutoff valves to permit servicing without shutting down system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with [**14 to 60 psig**] <**Insert value**> adjustable range; and [**175 psig**] <**Insert value**> maximum inlet pressure.

Install compressed-air-supply piping from building's compressed-air piping system.

Install deluge valves with trim sets for drain, priming level, alarm connections, ball-drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.

* + - * 1. Air Vent:

Provide at least one air vent at high point in each wet-pipe fire-suppression system in accordance with NFPA standards. Connect vent into top of fire-suppression piping.

Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.

Delete subparagraph below if dual air vents are specified in "Automatic Air Vent Assembly" Paragraph in "Fire-Suppression Piping Specialties" Article, or if air vent assembly configuration is such that manufacturer does not require piping of air vent to drain.

Pipe from outlet of air vent to drain.

* + - 1. INSTALLATION OF SPRINKLERS

Coordinate this article with Drawings.

* + - * 1. Install sprinklers in suspended ceilings symmetrically in center of[ **narrow dimension of**] acoustical ceiling panels within tolerance of [**1/2 inch**] <**Insert dimension**>. Coordinate entire pattern of sprinkler locations with approved reflected ceiling plan.

Caution: Dry-type sprinklers in first paragraph below can be used with wet-pipe sprinkler systems. Typical applications would be in freezer boxes and at loading docks where dry-type sprinkler supply pipe extends into a heated place and connects to wet-pipe system.

* + - * 1. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
        2. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.
      1. INSTALLATION OF NITROGEN GENERATOR WITH PURGE/VENT SYSTEM

Retain this article if either "Dry-Sprinkler System Nitrogen Generator with Purge/Vent" or "Preaction Sprinkler System Nitrogen Generator with Purge/Vent" articles is retained.

* + - * 1. Install in accordance with manufacturer's written installation instructions.
        2. Locate purge vent/valve in accordance with manufacturer's written installation instructions.

Retain paragraph below if nitrogen generator system is retained under Part 2 products and if building is provided with BAS.

* + - * 1. Route alarm signals in code-approved electrical conduit from nitrogen generator system control panel to the supervisory circuit of BAS.
      1. IDENTIFICATION
         1. Install labeling and pipe markers on equipment and piping in accordance with requirements for identification specified in Section 210553 "Identification for Fire-Suppression Piping and Equipment."
         2. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
      2. FIELD QUALITY CONTROL

Retain first paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform tests and inspections.

Retain first paragraph below to describe tests and inspections to be performed.

* + - * 1. Perform the following tests and inspections[ **with the assistance of a factory-authorized service representative**]:

Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

Flush, test, and inspect fire-suppression systems in accordance with NFPA standards.

Energize circuits to electrical equipment and devices.

Start and run air compressors.

Coordinate with fire-alarm tests. Operate as required.

Coordinate with fire-pump tests. Operate as required.

Verify that equipment hose threads are same as local fire department equipment.

Verify that sprinklers' original factory finish has not been contaminated with dirt, debris, or paint. Sprinklers containing other-than-original factory finish are to be considered defective and replaced with new products. Repair and/or cleaning is not acceptable.

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

* + - * 1. Fire-suppression piping system will be considered defective if it does not pass tests and inspections.
        2. Fire-suppression piping system components considered defective during testing will be replaced with new components. Repair of defective components is not acceptable.
        3. Prepare test and inspection reports.
      1. CLEANING
         1. Clean dirt and debris from fire-suppression system piping, system control valves, sprinklers, and associated components.
         2. 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.
      2. DEMONSTRATION
         1. [**Engage a factory-authorized service representative to train**] [**Train**] Owner's maintenance personnel to adjust, operate, and maintain [**system control valves**] [**and**] [**pressure-maintenance pumps**].
      3. PIPING SCHEDULE

Many pipe materials are available for wet-pipe sprinkler system piping applications. Review NFPA sprinkler standards, ULSE's "Fire Protection Equipment Directory," and FM Approvals' "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 this article to require selected products to be used in indicated applications; delete to allow Contractor to choose among various products acceptable to AHJs, or if delegating fire-suppression system design to Contractor.

If this article is retained, coordinate with materials specified in Part 2.

* + - * 1. 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.
        2. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
        3. 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 first paragraph below for CPVC pipe and fittings.

* + - * 1. CPVC pipe, [**Schedule 40**] [**Schedule 80**] CPVC fittings, and solvent-cemented joints may be used for light-hazard and residential occupancies.
        2. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2 (DN 50) and Smaller, to Be One of the Following:

Retain one or more of 14 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.

Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.

Schedule 40, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.

Schedule 40, galvanized-steel pipe with plain ends; galvanized, plain-end-pipe fittings; and twist-locked joints.

Schedule 40, black-steel pipe with [**cut-**] [**or**] [**roll-**]grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

[**Schedule 10**] [**or**] [**engineered light-wall**], steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

[**Schedule 10**] [**or**] [**engineered light-wall**], steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.

[**Schedule 10**] [**or**] [**engineered light-wall**], steel pipe with plain ends; welding fittings; and welded joints.

[**Schedule 40**] [**or**] [**Schedule 10S**] steel pipe; steel pressure-seal fittings; and pressure-sealed joints.

[**Type L**] [**Type M**], hard copper tube with plain ends; [**cast-**] [**or**] [**wrought-**]copper, solder-joint fittings; and brazed joints.

[**Type L**] [**Type M**], hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.

NPS 2, [**Type L**] [**Type M**], hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

* + - * 1. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), to Be One of the Following:

Retain one or more of 10 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.

Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.

Schedule 40, black-steel pipe with [**cut-**] [**or**] [**roll-**]grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

[**Schedule 10**] [**or**] [**engineered light-wall**], steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

[**Schedule 10**] [**or**] [**engineered light-wall**], steel pipe with plain ends; welding fittings; and welded joints.

[**Type L**] [**Type M**], hard copper tube with plain ends; [**cast-**] [**or**] [**wrought-**]copper, solder-joint fittings; and brazed joints.

[**Type L**] [**Type M**], hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.

[**Type L**] [**Type M**], hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

* + - * 1. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 5 (DN 125) and Larger, to Be One of the Following:

Retain one or more of nine 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.

Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.

Schedule 40, black-steel pipe with [**cut-**] [**or**] [**roll-**]grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

[**Schedule 10**] [**or**] [**engineered light-wall**], steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

[**Schedule 10**] [**or**] [**engineered light-wall**], steel pipe with plain ends; welding fittings; and welded joints.

[**Type L**] [**Type M**], hard copper tube with plain ends; [**cast-**] [**or**] [**wrought-**]copper, solder-joint fittings; and brazed joints.

[**Type L**] [**Type M**], hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

* + - * 1. High-Pressure, Wet-Pipe Sprinkler System, NPS 4 (DN 100) and Smaller, to 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.

Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.

Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

[**Schedule 10**] [**or**] [**engineered light-wall**], steel pipe with plain ends; welding fittings; and welded joints.

* + - * 1. High-Pressure, Wet-Pipe Sprinkler System, NPS 5 (DN 125) and Larger, to 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.

Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.

Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

[**Schedule 10**] [**or**] [**engineered light-wall**], steel pipe with plain ends; welding fittings; and welded joints.

* + - 1. 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 AHJs, or if delegating sprinkler system design to Contractor. According to NFPA 13, Drawings are to indicate sprinkler make, type, model, and nominal k-factor, including sprinkler identification number.

* + - * 1. Use sprinkler types in subparagraphs below for the following applications:

Rooms without Ceilings: [**Upright sprinklers**] <**Insert type**>.

Rooms with Suspended Ceilings: [**Pendent sprinklers**] [**Recessed sprinklers**] [**Flat concealed sprinklers**] [**Vertical sidewall sprinklers**] [**Pendent, recessed, flat concealed, vertical sidewall sprinklers as indicated**].

Wall Mounting: [**Horizontal sidewall sprinklers**] [**Flat concealed sidewall sprinklers**] [**Horizontal sidewall, flat concealed sidewall sprinklers as indicated**].

Spaces Subject to Freezing: [**Upright sprinklers**] [**Dry pendent sprinklers**] [**Dry sidewall sprinklers**] [**Upright sprinklers, dry pendent sprinklers, and dry sidewall sprinklers as indicated**].

Deluge-Sprinkler Systems: [**Upright**] [**and**] [**pendent**], open sprinklers.

Special Applications: [**Extended-coverage, flow-control, and quick-response sprinklers where indicated**] [**Attic sprinklers**] [**Combustible concealed space sprinklers**] [**Institutional space sprinklers**] <**Insert type**>.

* + - * 1. Provide sprinkler types in subparagraphs below with finishes indicated.

Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces and locations not generally exposed to view; and wax coated where exposed to acids, chemicals, or other corrosive fumes.

Recessed Sprinklers: Bright chrome, with [**bright chrome**] [**factory-painted white**] escutcheon.

Flat Concealed Sprinklers: Rough brass, with factory-painted white cover plate.

Residential Sprinklers: Dull chrome.

END OF SECTION 211000