

1.4 MECHANICAL ENGINEERING

- A. I hereby certify that the mechanical portions of this Addendum #2 Project Specification were prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Alaska.



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**SECTION 21 00 00
GENERAL FIRE-PROTECTION REQUIREMENTS**

PART 1 GENERAL

1.01 GENERAL REFERENCES

- A. Contract Documents: Refer to complete set of Contract Documents for requirements that are related to or may affect the work described in this Section.
- B. Division 20, including all Common Mechanical Requirements in Section 20 00 00, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.
- C. Drawings
 - 1. Any drawings prepared by the Consultant are provided only to show the general features of the systems, and general concepts of the arrangement and locations of the sprinklers.
 - 2. Submit detailed AutoCAD and REVIT drawings of all fire suppression sprinkler systems, fire suppression standpipes, clean agent suppression systems, and other fire suppression or fire extinguishing systems, for both shop drawings and record drawings.
 - a. Shop drawings shall be signed and sealed by the Contractor's Supporting Professional Fire Protection Engineer (Delegated Design), including hydraulic calculations.
 - 3. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval.
 - 4. The Fire Suppression Contractor's Supporting Professional Fire Protection Engineer (Delegated Design) shall include for all sprinklers as required to fully comply with NFPA 13, local by-laws and the Provincial Building Code and Local Building By-Laws, whether or not they are indicated on the Consultant's, Architect's, or any other drawings.
 - 5. Indicate on the drawings all information required by the Authority Having Jurisdiction including features of the building construction, direction and size of beams, ceiling configurations, partition locations, as well as light fixtures (noting the depths of surface mounted light fixtures where these occur) and diffuser locations.
 - 6. Indicate the positions and elevations of the sprinklers with respect to the floor elevations; the temperature rating all sprinklers; the spacing and types of hangers; drains and low point drains; test and flushing connections; types of sprinkler alarms; locations and types of sprinkler control valves; backflow preventers and all other essential features of the piping systems.
 - 7. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval.

1.02 QUALITY ASSURANCE

- A. The Fire Suppression Contractor shall retain the services of a Supporting Professional Fire Protection Engineer (Delegated Design) to provide complete engineering design and field review services including signed and sealed CAD fire suppression drawings and hydraulic calculations.
- B. The Fire Suppression Contractor's Supporting Professional Fire Protection Engineer (Delegated Design) shall provide signed and sealed Letters of Assurance for the project as required by Provincial Building Code and Local Building By-Laws.
 - 1. Some Cities or Municipalities may allow sprinkler contractors to perform limited amounts of sprinkler work (such as the relocation or addition of a limited number of sprinklers) under a Trade Permit, without the requirement of submitting Letters of Assurance.

- a. Where this scenario is permitted by the City or Municipality, the sprinkler contractor may not, under the scope of this contract, break down the work and take out multiple Trade Permits to alleviate submitting the Letters of Assurance.
2. Where the project size is limited enough to consider the previous clause, Stantec still requires Letters of Assurance from a Contractor's Supporting Professional Fire Protection Engineer (Delegated Design) as specified.
 - a. If detailed calculations are not required for a project, then a signed and sealed letter from the Contractor's Supporting Professional Fire Protection Engineer (Delegated Design) confirming design approach (i.e., pipe schedule method) shall be submitted.
- C. The Fire Suppression Contractor shall retain the services of a Contractor's Supporting Professional Seismic Engineer (Delegated Design)
 1. This Seismic Engineer shall provide complete engineering design and field review services for all seismic restraints.
 - a. Refer to "Document Submittals" for additional information.
- D. Any drawings prepared by the Consultant are provided only to show the general features of the systems, and general concepts of the arrangement and locations of the sprinklers.

1.03 COORDINATION

- A. Divisions 20, 21, 22 and 23 are used to communicate the requirements for the total Mechanical scope of work. It is intended for these four Divisions to serve as a single document, communicating the Mechanical scope of work.
- B. Division 20 Specifications serve as common Mechanical requirements that apply to all Division 21, 22, and 23 Specifications and Scope of Work.
- C. All requirements of Division 20 Specifications shall apply to all Division 23 Specifications and Scope of Work, unless noted otherwise.

1.04 SCOPE OF WORK

- A. It is intended for the Division 20 Specifications to serve as common requirements that apply to all Division 21, 22, and 23 Specifications and Scope of Work. All requirements of the Division 20 Specifications shall apply to all Division 23 Specifications and Scope of Work, unless noted otherwise.
- B. It is intended for the Division 20, 21, 22, 23 scope of work to include complete and functional Mechanical systems - including all required materials, labor, equipment, and services necessary to achieve the desired final product. It is further intended for the Division 23 scope of work to include coordination with Divisions 21 and 22 for complete Fire Protection, Plumbing, and HVAC systems.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

**SECTION 21 05 00
COMMON WORK RESULTS FOR FIRE-PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hangers and supports.
 - 1. Metal Pipe Hangers and Supports
 - 2. Trapeze Pipe Hangers
 - 3. Metal Framing Systems
 - 4. Thermal Hanger-Shield Inserts
 - 5. Fastener Systems
 - 6. Pipe Stands
 - 7. Equipment Supports
 - 8. Materials
- B. General Duty Valves for Water-Based Fire-Protection Systems.
 - 1. Two-Piece Ball Valves with Indicators
 - 2. Bronze Butterfly Valves with Indicators
 - 3. Iron Butterfly Valves with Indicators
 - 4. Check Valves
 - 5. Bronze OS&Y Gate Valves
 - 6. Iron OS&Y Gate Valves
 - 7. NRS Gate Valves
 - 8. Indicator Posts
 - 9. Trim and Drain Valves
 - 10. Pressure Reducing Valves
- C. Backflow Prevention Assemblies.
 - 1. Reduced-Pressure, Backflow Prevention Assembly
 - 2. Double-Check, Backflow Preventer Assemblies
 - 3. Reduced-Pressure, Detector Backflow Prevention Assemblies
 - 4. Double-Check, Detector Backflow Prevention Assemblies
 - 5. Backflow Prevention Assembly Test Kits
- D. Identification for fire-protection piping and equipment.
 - 1. Equipment Labels
 - 2. Warning Signs and Labels
 - 3. Warning Tape
 - 4. Pipe Labels
 - 5. Stencils
 - 6. Valve Tags
 - 7. Warning Tags
 - 8. Identification Signs
 - 9. Fire Protection System Diagrams

1.02 GENERAL REFERENCES

- A. Contract Documents: Refer to complete set of Contract Documents for requirements that are related to or may affect the work described in this Section.
- B. Division 20, including all Common Mechanical Requirements in Section 20 00 00, apply to this Section. Requirements noted in this section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

- A. Contract Documents: Refer to complete set of Contract Documents for requirements that are related to or may affect the work described in this Section.
- B. Refer to and comply with Section 10 44 13 - Fire Protection Cabinets and Section 10 44 16 - Fire Extinguishers as applicable.
- C. Refer to and comply with Section 20 05 00 - Common Mechanical Work Results for sleeves, stack-sleeve fittings, sleeve-seal systems, escutcheons, floor plates, grout, and silicone sealants.
- D. Refer to and comply with Section 20 05 13 - Common Mechanical Motor Requirements for general motor requirements, motor characteristics, polyphase motors (1/2 HP and larger), polyphase motors with additional requirements, and single-phase motors (less than 1/2 HP).
- E. Refer to and comply with Section 20 05 33 - Heat Tracing as applicable.
- F. Refer to and comply with Section 20 05 48 - Vibration and Seismic Controls as applicable.
- G. Refer to and comply with Section 20 07 00 - Mechanical Insulation as applicable.
- H. Refer to and comply with Section 20 08 00 - Mechanical Commissioning as applicable.

1.04 REFERENCE STANDARDS

- A. ANSI Z535.1 - Standard for Safety Colors; Approved Edition.
- B. ASCE/SEI 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2016.
- C. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
- D. ASME A112.1.2 - x; x.
- E. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
- F. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
- G. ASME B31.9 - Building Services Piping; 2020.
- H. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies; 2021.
- I. ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assemblies; 2021.
- J. ASSE 1047 - Performance Requirements for Reduced Pressure Detector Backflow Prevention Assemblies; 2021.
- K. ASSE 1048 - Performance Requirements for Double Check Detector Backflow Prevention Assemblies; 2021e.
- L. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- M. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2025a.
- N. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.
- O. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- P. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).
- Q. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
- R. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2022.

- S. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- T. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
- U. AWWA C510 - Double Check-Valve Backflow Prevention Assembly; 2017 (Reaffirmed 2021).
- V. AWWA C511 - Reduced-Pressure Principle Backflow Prevention Assembly; 2017 (Reaffirmed 2021).
- W. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2024.
- X. AWWA C606 - Grooved and Shouldered Joints; 2022.
- Y. MFMA-4 - Metal Framing Standards Publication; 2004.
- Z. MFMA-103 - x; x.
- AA. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
- BB. MSS SP-69 - Pipe Hangers And Supports - Selection And Application; Approved Edition.
- CC. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2022.
- DD. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2024.
- EE. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection; 2022.
- FF. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; 2025.
- GG. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems; 2026.
- HH. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.
- II. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2024.
- JJ. UL 203 - Standard for Pipe Hanger Equipment for Fire Protection Service; Approved Edition.
- KK. UL 262 - Gate Valves for Fire-Protection Service; Current Edition, Including All Revisions.
- LL. UL 312 - Check Valves for Fire-Protection Service; Current Edition, Including All Revisions.
- MM. UL 789 - Indicator Posts for Fire-Protection Service; Current Edition, Including All Revisions.
- NN. UL 1091 - Standard for Butterfly Valves for Fire-Protection Service; Current Edition, Including All Revisions.

1.05 ABBREVIATIONS AND ACRONYMS

- A. EPDM: Ethylene propylene diene monomer.
- B. FM: Factory Mutual Global.
- C. GPM: Gallons (U.S.) per minute.
- D. NFPA: National Fire Protection Association.
- E. NPS: Nominal pipe size.
- F. NRS: Non-rising stem.
- G. OS&Y: Outside screw and yoke.
- H. PSIG: Pounds per square inch gauge.
- I. SBR: Styrene-butadiene rubber.
- J. UL: Underwriter's Laboratories.

1.06 DEFINITIONS

- A. High-Pressure Valves: Valves designed and listed to operate at a working pressure higher than standard 175 psig , but not higher than 300 psig as required by maximum local system pressure where installed.
- B. Standard-Pressure Valves: Valves designed and listed to operate at a working pressure of 175 psig maximum.

1.07 PERFORMANCE REQUIREMENTS

- A. Hangers and Supports:
 - 1. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 - Quality Requirements, to design seismic bracing, trapeze pipe hangers and equipment supports, including comprehensive engineering analysis.
 - 2. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - a. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - c. Design seismic-restraint hangers and supports for piping and equipment meeting requirements of NFPA 13 and ASCE/SEI 7. Obtain approval from authorities having jurisdiction.
 - 3. NFPA Compliance: Comply with NFPA 13.
 - 4. UL Compliance: Comply with UL 203.
- B. General Duty Valves for Water-Based Fire Protection Systems:
 - 1. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark.
 - a. Fire Main Equipment: HAMV - Main Level
 - 1) Indicator Posts, Gate Valve: HCBZ - Level 1
 - 2) Ball Valves, System Control: HLUG - Level 3
 - 3) Butterfly Valves: HLXS - Level 3
 - 4) Check Valves: HMER - Level 3
 - 5) Gate Valves: HMRZ - Level 3
 - b. Sprinkler System & Water Spray System Devices: VDGT – Main Level
 - 1) Valves, Trim and Drain: VQGU – Level 1
 - 2. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
 - a. Automated Sprinkler Systems:
 - 1) Indicator posts.
 - 2) Valves.
 - (a) Gate valves.
 - (b) Check valves.
 - (c) Miscellaneous valves.
 - 3. ASME Compliance:
 - a. ASME B16.1 for flanges on iron valves.
 - b. ASME B1.20.1 for threads for threaded-end valves.
 - c. ASME B31.9 for building services piping valves.
 - 4. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
 - 5. NFPA Compliance for valves:
 - a. Comply with NFPA 13, NFPA 14, NFPA 20 and NFPA 24.
 - 6. Valve Pressure Ratings: Not less than the minimum pressure rating as required by the maximum system pressure at location of valve.
 - 7. Valve Sizes: Same as upstream piping unless otherwise indicated.

8. Valve Actuator Types:
 - a. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
 - b. Handwheel: For other than quarter-turn trim and drain valves.
 - c. Hand lever: For quarter-turn trim and drain valves NPS 2 and smaller.
9. Product Data:
 - a. For each type of product, excluding motors which are included in Part 1 of the fire-protection equipment Sections.
 - 1) Include construction details, material descriptions, and dimensions of components.
 - 2) Include operating characteristics and furnished accessories.
10. Shop Drawings: Signed and sealed by a qualified professional engineer. All hanger types and locations shall be indicated on the shop drawings. Provide Product Data for components and show fabrication and installation details and include calculations for the following:
 - a. Trapeze pipe hangers.
 - b. Metal framing systems.
 - c. Pipe stands.
 - d. Equipment supports.
 - e. Seismic supports.
11. Delegated-Design Submittal: For trapeze hangers and seismic bracing required to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of trapeze hangers.
 - b. Include design calculations for designing trapeze hangers.
12. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.
13. Valve numbering scheme.
14. Valve Schedules: Provide for fire-suppression piping systems. Include in operation and maintenance manuals.
15. Field quality-control reports.
16. Welding certificates.
17. Furnish copy of latest edition of NFPA 25 "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems."
18. After completing a fire-protection system installation, the Contractor shall submit to the authority having jurisdiction a written certification that the system has been installed in accordance with the approved plans and tested in accordance with NFPA 13 and manufacturer's recommendations.
19. Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, maintenance and repair data.
20. Record As-built drawings.
21. Record digital files.
 - a. Digital layout models.
 - b. Product data.
 - c. Final submittals with responses.

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity and possessing documentation proving successful completion of fire protection systems training.

- B. Codes and NFPA Standards: Materials, equipment and installation of hangers and supports for fire protection piping shall comply with NFPA 13, local building codes and the requirements of all Authorities Having Jurisdiction.
- C. Hangers and supports for fire protection piping shall be listed and labeled by Underwriters Laboratories and approved by FM Global.
- D. Steel pipe hangers and supports shall have the manufacturer's name, part number, and applicable size stamped in the part itself for identification.
- E. Hangers and supports shall be designed and manufactured in conformance with MSS SP 58.
- F. Certifications: Provide letters of certification as follows.
 - 1. Installer will utilize skilled workers holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed tradesperson.
- G. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- H. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

1.09 MOCK-UPS AND SAMPLES

- A. Samples: For color, letter style, and graphic representation required for each identification material and device.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and weld ends.
 - 3. Set valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.
- D. Protect flanges and specialties from moisture and dirt.

PART 2 PRODUCTS

2.01 HANGERS AND SUPPORTS

- A. Metal Pipe Hangers and Supports:
 - a. Anvil International.
 - b. Cooper B-Line.
 - c. Erico.
 - d. Hilti.
 - e. Tolco.
- 2. Carbon-Steel Pipe Hangers and Supports:
 - a. Description: Factory-fabricated components, NFPA approved, UL listed and FM approved for fire-suppression piping support.
 - b. Galvanized Metallic Coatings: Pre-galvanized or hot-dip galvanized.
 - c. Hanger Rods: Continuous-thread rod, nuts, and washer made of electro-galvanized carbon steel.
- 3. Stainless-Steel Pipe Hangers and Supports:
 - a. Description: Factory-fabricated components, NFPA approved, UL listed or FM approved for fire-suppression piping support.

- b. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- 4. Copper Pipe Hangers:
 - a. Description: Copper-coated steel, factory-fabricated components, NFPA approved, UL listed or FM approved for fire-suppression piping support.
 - b. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel
- B. Trapeze Pipe Hangers:
 - 1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with NFPA approved, UL listed and FM approved electro-galvanized carbon-steel hanger rods, nuts, saddles, and U-bolts
- C. Metal Framing Systems:
 - 1. MFMA Manufacturer Metal Framing Systems:
 - 1) B-line, an Eaton business.
 - 2) Flex-Strut Inc.
 - 3) Unistrut; Part of Atkore International.
 - b. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 - c. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
 - d. Channels: Continuous slotted carbon-steel channel with in-turned lips.
 - e. Channel Width: Selected for applicable load criteria.
 - f. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - g. Hanger Rods: Continuous-thread rod, nuts, and washer made of electro-galvanized carbon steel.
 - h. Metallic Coating: Pre-galvanized G90.
 - i. Paint Coating: Green epoxy, acrylic, or urethane.
 - 2. Non-MFMA Manufacturer Metal Framing Systems:
 - 1) Anvil International.
 - 2) ERICO International Corporation.
 - 3) PHD Manufacturing, Inc.
 - b. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 - c. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
 - d. Channels: Continuous slotted carbon-steel channel with in-turned lips.
 - e. Channel Width: Select for applicable load criteria.
 - f. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - g. Hanger Rods: Continuous-thread rod, nuts, and washer made of electro-galvanized carbon steel.
 - h. Metallic Coating: Pre-galvanized G90.
 - i. Paint Coating: Green epoxy, acrylic, or urethane.
- D. Thermal Hanger-Shield Inserts:
 - a. ERICO International Corporation.
 - b. National Pipe Hanger Corporation.
 - c. Pipe Shields Inc.
 - 2. Insulation-Insert Material: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.
 - 3. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
 - 4. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

5. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
- E. Fastener Systems:
1. Powder-Actuated Fasteners: NFPA-approved, UL-listed, and FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1) Hilti, Inc.
 - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.
 2. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, and FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1) B-line, an Eaton business.
 - 2) Hilti, Inc.
 - 3) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 4) MKT Fastening, LLC.
- b. Indoor Applications: Zinc-coated or Stainless steel.
- c. Outdoor Applications: Stainless steel.
- F. Pipe Stands:
1. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured electro-galvanized carbon steel components to support piping.
- G. Equipment Supports:
1. Design Mix for Concrete Pads: 5000-psi, 28-day compressive strength.
 2. Equipment Supports of Steel Construction: Shop- or field-fabricated assemblies made of manufactured electro-galvanized carbon steel components to support equipment.
- H. Materials:
1. Carbon Steel: ASTM A1011/A1011M.
 2. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.
 3. Stainless Steel: ASTM A240/A240M.
 4. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrinking and nonmetallic grout; suitable for interior and exterior applications.
 - a. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrinking and nonmetallic grout; suitable for interior and exterior applications.
 - b. Design Mix: 5000-psi, 28-day compressive strength.

2.02 GENERAL DUTY VALVES FOR WATER-BASED FIRE-PROTECTION SYSTEMS

- A. Two-Piece Ball Valves with Indicators:
- a. Ames Fire & Waterworks; A Watts Water Technologies Company.
 - b. NIBCO INC.
 - c. Victaulic Company.
2. Description:
- a. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
 - b. Body Design: Two piece.
 - c. Body Material: Forged brass or bronze.
 - d. Port Size: Full or standard.
 - e. Seats: PTFE.
 - f. Stem: Bronze or stainless steel.
 - g. Ball: Chrome-plated brass.

- h. Actuator: Worm gear or traveling nut.
 - i. Supervisory Switch: Internal or external.
 - j. End Connections for Valves NPS 1 through NPS 2 : Threaded ends.
 - k. End Connections for Valves NPS 2-1/2 : Grooved ends.
- B. Bronze Butterfly Valves with Indicators:
- a. Milwaukee Valve Company.
2. Description:
- a. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
 - b. Body Material: Bronze.
 - c. Seat Material: EPDM.
 - d. Stem Material: Bronze or stainless steel.
 - e. Disc: Bronze with EPDM coating.
 - f. Actuator: Worm gear or traveling nut.
 - g. Supervisory Switch: Internal.
 - h. Ends Connections for Valves NPS 1 through NPS 2 : Threaded ends.
 - i. Ends Connections for Valves NPS 2-1/2 : Grooved ends.
- C. Iron Butterfly Valves with Indicators:
- a. Kennedy Valve Company; a division of McWane, Inc.
 - b. NIBCO INC.
 - c. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
 - d. Victaulic Company.
 - e. Zurn Industries, LLC.
2. Description:
- a. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
 - b. Body Material: Cast or ductile iron [with nylon, EPDM, epoxy, or polyamide coating].
 - c. Seat Material: EPDM.
 - d. Stem: Stainless steel.
 - e. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
 - f. Actuator: Worm gear or traveling nut.
 - g. Supervisory Switch: Internal.
 - h. Body Design: Grooved-end connections.
- D. Check Valves:
- a. FEBCO; A WATTS Brand.
 - b. Fire Protection Products Inc (FPPI); a brand of Anvil International and Smith-Cooper International.
 - c. Mueller Co. LLC; Mueller Water Products, Inc.
 - d. NIBCO INC.
 - e. Reliable Automatic Sprinkler Co., Inc. (The).
 - f. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
 - g. United Brass Works, Inc.
 - h. Victaulic Company.
 - i. Viking Group Inc.
 - j. WATTS; A Watts Water Technologies Company.
 - k. Zurn Industries, LLC.
2. Description:
- a. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.

- b. Type for fire department connections and general purpose: Single swing check.
 - c. Type for fire pump discharge: Fire pump discharge check valves shall be FM Global approved as "anti-water hammer" type.
 - d. Body Material: Cast iron, ductile iron, or bronze.
 - e. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
 - f. Clapper Seat: Brass, bronze, or stainless steel.
 - g. Hinge Shaft: Bronze or stainless steel.
 - h. Hinge Spring: Stainless steel.
 - i. End Connections: Flanged, grooved, or threaded.
- E. Bronze OS&Y Gate Valves:
- a. Milwaukee Valve Company.
 - b. NIBCO INC.
 - c. United Brass Works, Inc.
 - d. Zurn Industries, LLC.
2. Description:
- a. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
 - b. Body and Bonnet Material: Bronze or brass.
 - c. Wedge: One-piece bronze or brass.
 - d. Wedge Seat: Bronze.
 - e. Stem: Bronze or brass.
 - f. Packing: Non-asbestos PTFE.
 - g. Supervisory Switch: External.
 - h. End Connections: Threaded.
- F. Iron OS&Y Gate Valves:
- a. American Cast Iron Pipe Company.
 - b. Clow Valve Company; a subsidiary of McWane, Inc.
 - c. Hammond Valve.
 - d. Mueller Co. LLC; Mueller Water Products, Inc.
 - e. NIBCO INC.
 - f. Victaulic Company.
 - g. WATTS; A Watts Water Technologies Company.
 - h. Zurn Industries, LLC.
2. Description:
- a. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves)
 - b. Body and Bonnet Material: Cast or ductile iron.
 - c. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
 - d. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
 - e. Stem: Brass or bronze.
 - f. Packing: Non-asbestos PTFE.
 - g. Supervisory Switch: External.
 - h. End Connections: Flanged.
- G. NRS Gate Valves:
- a. American Cast Iron Pipe Company.
 - b. Clow Valve Company; a subsidiary of McWane, Inc.
 - c. Mueller Co. LLC; Mueller Water Products, Inc.
 - d. NIBCO INC.
 - e. Victaulic Company.
 - f. Zurn Industries, LLC.
2. Description:

- a. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
 - b. Body and Bonnet Material: Cast or ductile iron.
 - c. Wedge: Cast or ductile iron with elastomeric coating.
 - d. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
 - e. Stem: Brass or bronze.
 - f. Packing: Non-asbestos PTFE.
 - g. Supervisory Switch: External.
 - h. End Connections: Flanged.
- H. Indicator Posts:
- a. American Cast Iron Pipe Company.
 - b. Clow Valve Company; a subsidiary of McWane, Inc.
 - c. Mueller Co. LLC; Mueller Water Products, Inc.
 - d. NIBCO INC.
2. Description:
- a. Standard: UL 789 and FM Global standard for indicator posts.
 - b. Type: Underground.
 - c. Base Barrel Material: Cast or ductile iron.
 - d. Extension Barrel: Cast or ductile iron.
 - e. Cap: Cast or ductile iron.
 - f. Operation: Wrench.
- I. Trim and Drain Valves:
1. Ball Valves:
 - 1) Fire Protection Products Inc (FPPI); a brand of Anvil International and Smith-Cooper International.
 - 2) Fire-End & Croker Corporation.
 - 3) Milwaukee Valve Company.
 - 4) NIBCO INC.
 - 5) Potter Roemer LLC; a Division of Morris Group International.
 - 6) Red-White Valve Corp.
 - 7) Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
 - 8) Victaulic Company.
 - 9) WATTS; A Watts Water Technologies Company.
 - 10) Zurn Industries, LLC.
 - b. Description:
 - 1) Body Design: Two-piece.
 - 2) Body Material: Forged brass or bronze.
 - 3) Port size: Full or standard.
 - 4) Seats: PTFE.
 - 5) Stem: Bronze or stainless steel.
 - 6) Ball: Chrome-plated brass.
 - 7) Actuator: Hand lever.
 - 8) End Connections for Valves NPS 1 through NPS 2-1/2 : Threaded ends.
 - 9) End Connections for Valves NPS 1-1/4 and NPS 2-1/2 : Grooved ends.
2. Angle Valves:
- 1) Fire Protection Products Inc (FPPI); a brand of Anvil International and Smith-Cooper International.
 - 2) NIBCO INC.
 - 3) United Brass Works, Inc.
- b. Description:

- 1) Body Material: Brass or bronze.
 - 2) Ends: Threaded.
 - 3) Stem: Bronze.
 - 4) Disc: Bronze.
 - 5) Packing: Asbestos free.
 - 6) Handwheel: Malleable iron, bronze, or aluminum.
3. Globe Valves:
- 1) NIBCO INC.
 - 2) United Brass Works, Inc.
- b. Description:
- 1) Body Material: Bronze with integral seat and screw-in bonnet.
 - 2) Ends: Threaded.
 - 3) Stem: Bronze.
 - 4) Disc Holder and Nut: Bronze.
 - 5) Disc Seat: Nitrile.
 - 6) Packing: Asbestos free.
 - 7) Handwheel: Malleable iron, bronze, or aluminum.
- J. Pressure Reducing Valves:
- a. Bermad Inc.
 - b. Cla-Val Co.
 - c. Reliable Automatic Sprinkler Company, Inc.
 - d. Tyco Fire & Building Products.
 - e. Victaulic Company.
 - f. Viking Corporation.
2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping. UL listed and FM Global approved.
3. Main Valve Body: Cast or ductile iron with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
- a. Size: _____ .
 - b. Pattern: Globe-valve design.
 - c. Trim: Stainless steel.
4. Design Flow Rate: _____ .
5. Design Inlet Pressure: _____ .
6. Design Outlet Pressure Setting: _____ .
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.03 BACKFLOW PREVENTION ASSEMBLIES

- A. Reduced-Pressure, Backflow Prevention Assembly.
- a. Ames Company, Inc.
 - b. FEBCO, Division of Watts Water Technologies Inc.
 - c. Watts Regulator Company.
 - d. Zurn Water, LLC – Wilkins.
2. Standard: ASSE 1013 or AWWA C511.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle one-third of flow range.
5. Size: _____ .
6. Design Flow Rate: _____ .
7. Selected Unit Flow Range Limits: _____ .
8. Pressure Loss at Design Flow Rate: _____ .
9. Body Material: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.

10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 11. Configuration: Designed for horizontal, straight through flow.
 12. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
- B. Double-Check, Backflow Preventer Assemblies.
- a. Ames Company, Inc.
 - b. FEBCO, Division of Watts Water Technologies Inc.
 - c. Watts Regulator Company.
 - d. Zurn Water, LLC – Wilkins.
2. Standard: ASSE 1015 or AWWA C510.
 3. Operation: Continuous-pressure applications unless otherwise indicated.
 4. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
 5. Size: _____.
 6. Design Flow Rate: _____.
 7. Selected Unit Flow Range Limits: _____.
 8. Pressure Loss at Design Flow Rate: _____.
 9. Body Material: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 11. Configuration: Designed for horizontal, straight through flow.
 12. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
- C. Reduced-Pressure, Detector Backflow Prevention Assemblies:
- a. Ames Company, Inc.
 - b. FEBCO, Division of Watts Water Technologies Inc.
 - c. Watts Regulator Company.
 - d. Zurn Water, LLC – Wilkins.
2. Standards: ASSE 1047 and UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
 3. Operation: Continuous-pressure applications.
 4. Pressure Loss: 12 psig maximum, through middle one-third of flow range.
 5. Size: _____.
 6. Design Flow Rate: _____.
 7. Selected Unit Flow Range Limits: _____.
 8. Pressure Loss at Design Flow Rate: _____.
 9. Body Material: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
 10. End Connections: Flanged.
 11. Configuration: Designed for horizontal, straight through flow.
 12. Accessories:
 - a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
 - c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.
- D. Double-Check, Detector Backflow Prevention Assemblies:
- a. Ames Company, Inc.
 - b. FEBCO, Division of Watts Water Technologies Inc.
 - c. Watts Regulator Company.

- d. Zurn Water, LLC – Wilkins.
 2. Standards: ASSE 1048 and UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
 3. Operation: Continuous-pressure applications.
 4. Pressure Loss: 5 psig (35 kPa) maximum, through middle one-third of flow range.
 5. Size: _____.
 6. Design Flow Rate: _____.
 7. Selected Unit Flow Range Limits: _____.
 8. Pressure Loss at Design Flow Rate: _____.
 9. Body Material: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
 10. End Connections: Flanged.
 11. Configuration: Designed for horizontal, straight through flow.
 12. Accessories:
 - a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
 - b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.
- E. Backflow Prevention Assembly Test Kits:
- a. Ames Company, Inc.
 - b. FEBCO, Division of Watts Water Technologies Inc.
 - c. Watts Regulator Company.
 - d. Zurn Water, LLC – Wilkins.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions

2.04 IDENTIFICATION FOR FIRE-PROTECTION PIPING AND EQUIPMENT

- A. Equipment Labels:
1. Metal Labels for Equipment:
 - 1) Brady Corporation.
 - 2) Carlton Industries, LP.
 - 3) Champion America.
 - 4) Craftmark Pipe Markers.
 - 5) Emedco.
 - 6) Kolbi Pipe Marker Co.
 - 7) LEM Products Inc.
 - 8) Marking Services Inc.
 - 9) Pipemarker.com; Brimar Industries, Inc.
 - 10) Seton Identification Products; a Brady Corporation company.
 - b. Material and Thickness: Brass, 0.032 inch, stainless steel, 0.025 inch, aluminum, 0.032 inch or anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
 - c. Letter and Background Color: As indicated for specific application under Part 3.
 - d. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - e. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - f. Fasteners: Stainless-steel rivets or self-tapping screws.
 - g. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2. Plastic Labels for Equipment:
 - 1) Brady Corporation.
 - 2) Carlton Industries, LP.
 - 3) Champion America.
 - 4) Craftmark Pipe Markers.
 - 5) Emedco.
 - 6) Kolbi Pipe Marker Co.
 - 7) LEM Products Inc.
 - 8) Marking Services Inc.
 - 9) Pipemarket.com; Brimar Industries, Inc.
 - 10) Seton Identification Products; a Brady Corporation company.
 - b. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
 - c. Letter and Background Color: As indicated for specific application under Part 3.
 - d. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - e. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - f. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - g. Fasteners: Stainless-steel rivets or self-tapping screws.
 - h. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
3. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
 4. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.
- B. Warning Signs and Labels:
- a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. Champion America.
 - d. Craftmark Pipe Markers.
 - e. Emedco.
 - f. LEM Products Inc.
 - g. Marking Services Inc.
 - h. National Marker Company.
 - i. Pipemarket.com; Brimar Industries, Inc.
 - j. Seton Identification Products; a Brady Corporation company.
 - k. Stranco, Inc.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
 3. Letter and Background Color: As indicated for specific application under Part 3.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for

greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
 9. Label Content: Include caution and warning information, plus emergency notification instructions.
- C. Warning Tape:
- a. Brady Corporation.
 - b. Craftmark Pipe Markers.
 - c. National Marker Company.
 - d. Pipemarket.com; Brimar Industries, Inc.
 - e. Seton Identification Products; a Brady Corporation company.
2. Material: Vinyl.
 3. Minimum Thickness: 0.005 inch.
 4. Letter, Pattern, and Background Color: As indicated for specific application under Part 3.
 5. Waterproof Adhesive Backing: Suitable for indoor or outdoor use.
 6. Maximum Temperature: 160 deg F.
 7. Minimum Width: 4 inches.
- D. Pipe Labels:
- a. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
 - b. Brady Corporation.
 - c. Carlton Industries, LP.
 - d. Champion America.
 - e. Craftmark Pipe Markers.
 - f. Emedco.
 - g. Kolbi Pipe Marker Co.
 - h. LEM Products Inc.
 - i. Marking Services Inc.
 - j. Pipemarket.com; Brimar Industries, Inc.
 - k. Seton Identification Products; a Brady Corporation company.
2. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.
 3. Letter and Background Color: As indicated for specific application under Part 3.
 4. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
 5. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
 6. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - a. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
 - b. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
- E. Stencils:
- a. Craftmark Pipe Markers.
 - b. Kolbi Pipe Marker Co.
 - c. Marking Services Inc.
 - d. Pipemarket.com; Brimar Industries, Inc.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
 3. Stencil Material: Fiberboard or metal.
 4. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.

5. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.
- F. Valve Tags:
- a. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
 - b. Brady Corporation.
 - c. Carlton Industries, LP.
 - d. Champion America.
 - e. Craftmark Pipe Markers.
 - f. Emedco.
 - g. Kolbi Pipe Marker Co.
 - h. LEM Products Inc.
 - i. Marking Services Inc.
 - j. Pipemarker.com; Brimar Industries, Inc.
 - k. Seton Identification Products; a Brady Corporation company.
2. Description: Stamped or engraved with 1/4 inch letters for piping-system abbreviation and 1/2 inch numbers.
 - a. Tag Material: Brass, 0.032 inch, stainless steel, 0.025 inch, aluminum, 0.032 inch or anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
 - b. Fasteners: Brass wire-link chain or beaded chain.
 3. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - a. Include valve-tag schedule in operation and maintenance data.
- G. Warning Tags:
- a. Brady Corporation.
 - b. Champion America.
 - c. Craftmark Pipe Markers.
 - d. Emedco.
 - e. Kolbi Pipe Marker Co.
 - f. LEM Products Inc.
 - g. Marking Services Inc.
 - h. Pipemarker.com; Brimar Industries, Inc.
 - i. Seton Identification Products; a Brady Corporation company.
2. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - a. Size: 3 by 5-1/4 inches minimum.
 - b. Fasteners: Reinforced grommet and wire.
 - c. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
- H. Identification Signs:
1. Hydraulic Design Information Sign:
 - a. Identify all hydraulically designed sprinkler systems, in accordance with NFPA system requirements with a permanently marked (by engraving) weatherproof metal or rigid plastic sign. The signs shall be secured with corrosion resistant wire or chain. Such signs shall be located at the sprinkler system control valve supplying the corresponding hydraulically designed area.
 - b. The sign shall include the location of the design area, discharge densities over the design area, flow and residual pressure demand at the base of the riser, occupancy classification or commodity classification and maximum permitted storage height and configuration, hose stream allowance included in addition to the sprinkler demand, and the name of the installing contractor.

2. Identification of Valves:
 - a. All control, drain, and test connection valves shall be provided with a permanently marked (by engraving) weatherproof metal or rigid plastic identification signs. The identification signs shall be secured with corrosion resistant wire or chain.
 - b. The sign shall identify purpose of valve and the portion of the building served.
 3. General Information Sign:
 - a. Provide a general information sign, conforming to NFPA 13, used to determine system design basis and information relevant to the inspection, testing, and maintenance requirements required by NFPA 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems."
- I. Fire Protection System Diagrams:
1. Provide fire protection system diagrams, drawn to scale, framed and under glass to be permanently posted in a conspicuous location in the fire pump room. Diagrams shall show the water supply, fire pumps, fire department connections, sprinkler and standpipe mains, risers and all valves.

PART 3 EXECUTION

3.01 APPLICATION

- A. Hangers and Supports:
1. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 250 lb.
 2. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.
 3. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
 4. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
 5. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.
 6. Use galvanized or stainless-steel pipe hangers and attachments for hostile environment applications, including but not limited to outdoor areas, corrosive areas, high moisture areas, and over pools and in pool equipment rooms.
 7. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
 8. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 .
 - b. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
 - c. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes NPS 1/2 to NPS 8 .
 - d. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated stationary pipes NPS 3/8 to NPS 8 .
 - e. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes NPS 3/8 to NPS 3 .
 - f. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 .
 - g. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 , with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

- h. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 , with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - i. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 9. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 .
 - b. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
 10. Hanger-Rod Attachments: Comply with NFPA requirements.
 11. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - b. C-Clamps (MSS Type 23): For structural shapes.
 - c. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 12. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - b. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - c. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
 13. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
 14. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
 15. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- B. General Duty Valves:
1. Source limitations: Obtain each type of valve from single manufacturer.
 2. Control valves on the suction side of fire pumps shall be OS&Y type.
 3. Fire pump discharge check valve shall be Factory Mutual approved as an anti-water hammer check valve.

3.02 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.03 PREPARATION

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.04 INSTALLATION

- A. Hangers and Supports:

- 1. General:

- a. Sprinkler piping shall be supported from the building structure, which must support the added load of the water-filled pipe plus a minimum of 250 lb. applied at the point of hanging.
 - b. Do not support piping from other pipes, ductwork, other equipment, or anything else that is not part of the building structure.
 - c. Hanger rod sizes shall be in conformance with the requirements of NFPA 13.
 - d. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
 - e. Fasteners used to support sprinkler system piping shall not be attached to a ceiling of gypsum board or other similar soft material.
 - f. Distance between a hanger and the centerline of an upright sprinkler shall not be less than 3 inches.
 - g. The cumulative horizontal length of an unsupported arm-over to a sprinkler, sprinkler drop, or sprig shall not exceed 24 inches for steel pipe or 12 inches for copper pipe.
 - h. The cumulative horizontal length of an unsupported arm-over to a pendent sprinkler below a ceiling supplied from a branch line above the ceiling shall not exceed 12 inches for steel pipe or 6 inches for copper tube where the maximum static or flowing pressure, whichever is greater at the sprinkler exceeds 100 psi.
 - i. Sprigs 4 feet or longer shall be restrained against lateral movement.
 - j. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
 - k. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
 - l. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
 - m. Install hangers and supports to allow controlled movement of piping systems across building expansion joints, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
 - n. Install hangers and supports to allow controlled seismic movement of piping systems across seismic building expansion joints, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
 - o. Install lateral bracing with pipe hangers and supports to prevent swaying.

- 2. Riser Installation:

- a. Risers shall be supported by riser clamps or by hangers located on the horizontal piping connections within 24 inches of the centerline of the riser.
 - b. Riser clamps supporting risers by means of set screws shall not be used.
 - c. Riser clamps anchored to walls using hanger rods in the horizontal position shall not be permitted to vertically support risers.
 - d. In multistory buildings, riser supports shall be provided at the lowest level, at eMSS SP-58 very level above, above and below offsets, and at the top of the riser.
 - e. Supports above the lowest level shall also restrain the pipe to prevent movement by an upward thrust where flexible fittings are used.

- f. Where risers offset, the first ceiling level above the offset shall constitute the first level of riser support.
- g. Distance between supports for risers shall not exceed 15 feet.
- 3. Metal Trapeze Pipe-Hanger Installation:
 - a. Trapeze hangers shall be used where necessary to transfer loads to appropriate structural members. Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - b. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - c. Field fabricated from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
 - d. The minimum size of steel angle or pipe span between purlins or joists shall be such that section modulus shall not exceed section modulus of trapeze member as shown in the NFPA 13.
 - e. The trapeze member shall be secured to prevent slippage.
 - f. All components of each hanger assembly that attaches to the trapeze member shall be sized to support the suspended sprinkler pipes in accordance with NFPA 13.
 - g. Any other sizes or shapes giving greater section modulus than required by NFPA 13 shall be acceptable.
 - h. Sprinkler piping may be supported from trapeze hangers supporting both sprinkler piping and ductwork or equipment provided such trapeze hangers comply with NFPA 13 requirements for the total supported load of all equipment plus a minimum of 250 lb. and provided such trapeze hangers are supported from the building structure.
- 4. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.
- 5. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.
- 6. Fastener System:
 - a. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
 - b. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.
 - c. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
 - d. Provide inserts for placement in formwork before concrete is poured.
 - e. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - f. Where concrete slabs form finished ceilings, provide inserts to be flush with slab surface.
 - g. Powder-driven studs shall not be used in steel of less than 3/16 inch total thickness.
 - h. Increaser couplings shall be attached directly to the powder-driven studs.
 - i. Listed inserts in concrete and listed post-installed anchors to support hangers shall be used for mains and branch lines.
 - j. Post-installed anchors shall not be used in cinder concrete except for branch lines where the post-installed anchors are alternated with through-bolts or hangers attached to beams.

- k. Post-installed anchors shall be installed in a horizontal position in the sides of concrete beams.
 - l. Holes for post-installed anchors in the side of beams shall be above the centerline of the beam or above the bottom reinforcement steel rods.
 - m. Holes for post-installed anchors used in the vertical position shall be drilled to provide uniform contact with the shield over its entire circumference.
 - n. The depth of the post-installed anchor hole shall not be less than specified for the type of shield used.
 - o. Welding studs or other hanger parts shall not be attached by welding to steel less than U.S. Standard, 12 gauge.
7. Pipe Stands:
- a. Pipe stands shall be sized to support a minimum of 5 times the weight of the water-filled pipe, plus 250 lb.
 - b. Where pipe stands are utilized, they shall be approved.
8. Insulated Piping:
- a. Attach clamps and spacers to piping.
 - 1) Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - 2) Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
 - 3) Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - b. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 1) Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - c. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - d. Shield Dimensions for Pipe: Not less than the following:
 - 1) NPS 1/4 to NPS 3-1/2 : 12 inches long and 0.048 inch thick.
 - 2) NPS 4 : 12 inches long and 0.06 inch thick.
 - 3) NPS 5 and NPS 6 : 18 inches long and 0.06 inch thick.
 - 4) NPS 8 to NPS 14 : 24 inches long and 0.075 inch thick.
 - 5) NPS 16 to NPS 24 : 24 inches long and 0.105 inch thick.
 - e. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - f. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.
9. Plastic Piping:
- a. Rigid plastic pipe shall be supported by hangers with a welded-in support shield to spread the load bearing surface.
 - b. Flexible plastic (polyethylene, etc.) shall be supported continuously by an 18-gauge sheet metal.
10. Hangers for Wood Structural Members:
- a. Eye rods shall be secured with lock washers to prevent lateral motion.
 - b. Eye rods shall be backed with a large flat washer bearing directly against the structural member in addition to lock washer where eye rods are fastened to the wood structural member.
 - c. Minimum Coach Screw Rod Size: The size of coach screw rods shall not be less than 3/8 inch for pipe sizes supported up to 4 inches. Coach screw rods are not permitted for support pipes larger than 4 inches.
 - d. The minimum plank thickness and the minimum width of the lower face of beams or joists in which coach screw rods are installed shall be in accordance with NFPA 13.

11. Equipment Supports:
 - a. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
 - b. Grouting: Place grout under supports for equipment and make bearing surface smooth.
 - c. Provide lateral bracing, to prevent swaying, for equipment supports.
 12. Metal Fabrications:
 - a. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
 - b. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
 - c. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2) Obtain fusion without undercut or overlap.
 - 3) Remove welding flux immediately.
 - 4) Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.
 13. Flexible Sprinkler Hose Fittings:
 - a. Listed flexible sprinkler hose fittings and their anchoring components intended for use in installations connecting the sprinkler system piping to sprinklers shall be installed in accordance with the requirements of the listing, including any installation instructions.
 - b. Where flexible hose fittings exceed 6 feet in length and are supported by a suspended ceiling a hanger(s) attached to the structure shall be required to ensure that the maximum unsupported length does not exceed 6 ft.
 - c. Where flexible sprinkler hose fittings are used to connect sprinklers to branch lines in suspended ceilings, a label limiting relocation of the sprinkler shall be provided on the anchoring component.
- B. General Duty Valves for Water-Based Fire-Protection Systems:
1. General:
 - a. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
 - b. Install valves in horizontal piping with stem at or above the pipe center.
 - c. Install valves in position to allow full stem movement.
 - d. Install listed fire-protection shutoff valves supervised-open (except pump test connection valve which shall be supervised-closed), located to control sources of water supply except from fire-department connections.
 2. Pressure Reducing Valves:
 - a. Pressure gauges shall be installed on the inlet and outlet side of each pressure reducing valve.
 - b. A relief valve of not less than ½ inch in size shall be provided on discharge side of the valve.
 - c. A listed indicating valve shall be provided on the inlet side of each pressure reducing valve, unless the pressure reducing valve meets the listing requirements for use as an indicating valve.
 - d. Means shall be provided downstream of all pressure reducing valves for flow tests at system demand.
 3. Backflow Prevention Assemblies:

- a. Install backflow prevention assemblies in potable-water-supply sources for each fire-protection water supply connection.
 - b. Install backflow prevention assemblies of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
 - c. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Pipe Loops and Swing Connections:
1. Install pipe loops and offsets in accordance with NFPA 13 requirements for expansion and contraction compensation.
 2. Install seismic pipe loops and seismic offsets in accordance with NFPA 13 requirements for expansion and contraction compensation.

3.05 PAINTING

- A. Hangers and Supports:
1. Touchup:
 - a. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1) Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
 2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.06 IDENTIFICATION

- A. General:
1. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.
 2. Coordinate installation of identifying devices with locations of access panels and doors.
 3. Install identifying devices before installing acoustical ceilings and similar concealment.
 4. Locate identifying devices so that they are readily visible from the point of normal approach.
- B. Equipment Labels, Warning Signs, and Labels:
1. Permanently fasten labels on each item of fire-suppression equipment.
 2. Sign and Label Colors: White letters on an ANSI Z535.1 safety-red background.
 3. Locate equipment labels where accessible and visible.
 4. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.
- C. Warning Tape:
1. Warning Tape Color and Pattern: Yellow background with black diagonal stripes.
 2. Install warning tape on pipes and ducts, with cross-designated walkways providing less than 6 ft. of clearance.
 3. Locate tape so as to be readily visible from the point of normal approach.
- D. Pipe Labels:
1. Install pipe labels showing service and flow direction with permanent adhesive on pipes.
 2. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 - a. Identification Paint: Use for contrasting background.
 - b. Stencil Paint: Use for pipe marking.

3. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - a. Within 3 ft. of each valve and control device.
 - b. At access doors, manholes, and similar access points that permit a view of concealed piping.
 - c. Within 3 ft. of equipment items and other points of origination and termination.
 - d. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.
 4. Flow Direction Arrows: Provide arrows to indicate direction of flow in pipes including pipes where flow is allowed in both directions.
 5. Fire Protection Pipe Label Color: White letters on an ANSI Z535.1 safety-red background.
- E. Valve Tags:
1. Install tags on valves and control devices in fire protection piping systems. List tagged valves in a valve-tag schedule in the operating and maintenance manual. Include the identification "FPV" on all fire-protection system valve tags.
 2. Valve tag size and shape: 2 inches, round.
 3. Valve-Tag Color: White letters on an ANSI Z535.1 safety-red background.
- F. Warning Tags:
1. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background.
 2. Attach warning tags, with proper message, to equipment and other items where required by NFPA standards, drawings and/or specifications.

3.07 ADJUSTING

- A. Hangers:
1. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
 2. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

END OF SECTION

SECTION 21 11 00
FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe and Fittings
 - 1. Ductile-iron pipe and fittings.
 - 2. PVC pipe and fittings.
 - 3. Steel pipe and fittings.
 - 4. Copper tube and fittings.
 - 5. PE pipe and fittings.
- B. Special pipe fittings.
 - 1. Ductile-iron flexible expansion joints.
 - 2. Ductile-iron deflection fittings.
 - 3. Joint restraint devices.
- C. Encasement for piping, fittings and valves.
- D. Joining materials.
- E. Valves.
 - 1. Check valves.
 - 2. NRS gate valves.
 - 3. Indicator posts.
 - 4. Iron OS&Y gate valves.
 - 5. Iron butterfly valves with indicators.
- F. Piping Specialties.
- G. Corporation valves.
- H. Curb valves.
- I. Detector check valves.
- J. Water meters.
- K. Detector-type water meters.
- L. Backflow prevention assemblies.
 - 1. Reduced-pressure-principle backflow prevention assemblies.
 - 2. Double-check backflow prevention assemblies.
 - 3. Reduced-pressure-detector backflow prevention assemblies.
 - 4. Double-check-detector backflow prevention assemblies.
- M. Water meter boxes.
- N. Concrete vaults.
- O. Protective enclosures.
- P. Alarm devices.

1.02 GENERAL REFERENCES

- A. Contract Documents: Refer to complete set of Contract Documents for requirements that are related to or may affect the work described in this Section.
- B. Division 20, including all Common Mechanical Requirements in Section 20 00 00, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

- A. Section 20 05 00 - Common Mechanical Work Results for sleeves, stack-sleeve fittings, sleeve-seal systems, escutcheons, floor plates, grout, and silicone sealants.
- B. Section 20 05 13 - Common Mechanical Motor Requirements for general motor requirements, motor characteristics, polyphase motors (1/2 HP and larger), polyphase motors with additional requirements, and single-phase motors (less than 1/2 HP).
- C. Section 20 05 33 - Heat Tracing for heat tracing used on fire protection piping.
- D. Section 20 05 48 - Vibration and Seismic Controls.
- E. Section 20 07 00 - Mechanical Insulation for insulation used on fire protection piping and equipment.
- F. Section 21 05 00 - Common Work Results For Fire-Protection for fire protection hangers and supports, general duty valves and identification for above ground fire-protection piping and equipment.
- G. Section 21 10 00 - Water-Based Fire-Protection Systems for fire department connections and above-ground black steel piping.
- H. Section 21 11 16 - Facility Fire Hydrants for AWWA and UL-listed, dry- and wet-barrel fire hydrants.
- I. Section 21 31 13 - Fire Pumps, Pressure Maintenance Pumps, and Controllers for fire pumps, pressure maintenance pumps, and their associated controllers used for water-based fire protection systems.
- J. Section 28 46 00 - Fire Alarm Systems for connection to supervisory and alarm devices, and for fire detection devices for fire protection system release.

1.04 REFERENCE STANDARDS

1.05 ABBREVIATIONS AND ACRONYMS

- A. AHJ: Authority Having Jurisdiction.
- B. FM: Factory Mutual Global.
- C. GPM: Gallons (U.S.) per minute.
- D. NFPA: National Fire Protection Association.
- E. NPS: Nominal pipe size.
- F. PSIG: Pounds per square inch gauge.
- G. UL: Underwriters Laboratories.

1.06 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
 - 2. Comply with local building codes and standards of all authorities having jurisdiction for underground fire-suppression piping, including materials, hose threads, installation, and testing.
- B. Materials shall bear label, stamp, or other markings of specified testing agency.
- C. 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. All materials and equipment shall be UL listed and approved by FM Global. Comply with UL's "Fire Protection Equipment Directory" and Factory Mutual "Approval Guide" for fire-service-main products.

- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for underground fire-suppression piping and private fire service main piping.
1. Product Data:
 - a. For each type of product.
 - 1) Include construction details, material descriptions, dimensions of individual components and profiles.
 - 2) Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 2. Shop Drawings:
 - a. Prepare in accordance with NFPA 24.
 - 1) Include plans, elevations, sections, and pipe restraint details.
 - 2) Include dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3) Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
 - b. Include diagrams for power, signal, and control wiring.
 3. Delegated-Design Submittal: For underground fire suppression piping systems and private fire service mains indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation or prepared by NICET certified technician, "Water-Based Systems Layout" with appropriate certified NICET level as required by the local jurisdiction. NICET certified technician submittals are to include the following information on each drawing title block: technician's name, NICET certification number, NICET certification specialty area and level.
 4. Coordination Drawings: Fire-protection system plans and sections, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinated with all site and building trades.
 5. Seismic Qualification Certificates: For fire-protection equipment, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 6. Qualification Data: For Installer, professional engineer, and NICET certified technician.
 7. Design Data: Working plans, prepared according to NFPA 24, including documented approval by AHJs, and including hydraulic calculations.
 8. Welding certificates.
 9. Field Test Reports:
 - a. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 24. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
 - b. Fire-hydrant test report.
 10. Field quality-control reports.
 11. Furnish copy of latest edition of NFPA 25 "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems."
 12. After completing an underground fire-protection piping main or private fire service main system installation, the Contractor shall submit to the authority having jurisdiction a written certification that the system has been installed in accordance with the approved plans and tested in accordance with NFPA 24 and manufacturer's recommendations.

13. Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, maintenance data, and repair data.
14. Record As-built drawings.
15. Record digital files.
 - a. Digital layout models.
 - b. Product data.
 - c. Final submittals with responses.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Installer's responsibilities include designing, fabricating, and installing underground fire-protection piping and private fire service mains and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer or NICET certified technician "Water-Based Systems Layout" with appropriate certified NICET level as required by the local jurisdiction.
 - b. An experienced installer who has designed, installed, and obtained approvals for underground fire-protection piping systems similar to that indicated for this Project.
 - c. Prior to commencing work, submit data showing that the Contractor has successfully installed underground fire-protection piping and private fire service main systems of the same type and design as specified herein, or that they have a firm contractual agreement with a subcontractor having the required experience. Include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system and certify that the system has performed satisfactorily for a period of at least 18 months.
 - d. Qualifications of System Technician: Installation drawings, shop drawing and as-built drawings shall be prepared, by or under the supervision of, an individual who is experienced with the types of works specified herein. Contractor shall submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of drawings.
- B. Welding Qualifications: Quality procedures and operations in accordance with ASME Boiler and Pressure Vessel Code.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Preparation for Transport: Prepare valves according to the following:
 1. Ensure that valves are dry and internally protected against rust and corrosion.
 2. Protect valves against damage to threaded ends and flange faces.
 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves according to the following:
 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored materials from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

- F. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.09 PROJECT CONDITIONS

- A. Interruption of Existing Fire Protection Water-Service Piping: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
1. Notify Engineer no fewer than two days in advance of proposed interruption of service.
 2. Do not proceed with interruption of service without Engineer 's written permission.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

- A. Ductile-Iron Pipe and Fittings
1. Ductile iron pipe and fittings shall be bituminous coated outside per ANSI 21.1 and cement mortar lined inside with seal coat in accordance with American National Standard for Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water, ANSI/AWWA C104/A21.4
 2. Mechanical-Joint, Ductile-Iron Pipe: ANSI/AWWA C151, with mechanical-joint bell and plain spigot end. Minimum class 350.
 3. Push-on-Joint, Ductile-Iron Pipe: ANSI/AWWA C151, with push-on-joint bell and plain spigot end. Minimum class 350.
 4. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and Stainless-Steel bolts.
 5. Push-on-Joint, Ductile-Iron Fittings: AWWA C153/A21.53, ductile-iron compact pattern.
 - a. Gaskets: AWWA C111/A21.11, rubber.
 6. Flanges: ASME B16.1 Class 125 and 250, cast iron.
- B. PVC Pipe and Fittings
1. PVC Pipe: AWWA C900, UL 1285, DR 14, 300 psi rated with bell end with gasket, and with spigot end.
 2. Fittings: PVC Pipe shall use ductile iron mechanical joint fittings.
- C. Steel Pipe and Fittings
1. Where externally coated and wrapped and internally and externally galvanized, schedule 40 steel pipe shall be permitted to be used for underground piping between the check valve and the outside hose coupling for the fire department connection.
 - a. Coatings shall comply with AWWA C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines Enamel and Tape – Hot Applied. Coating is also required for clamps, tie rods, and all bolted joint accessories and fittings.
 - b. Wrapping shall comply with AWWA C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe Systems. High-density polyethylene tubes or sheets with a minimum nominal thickness of ,0.004 in. or low-density polyethylene tubes or sheets with a minimum nominal thickness of 0.008 in. shall be used for the wrapping. Wrapping shall also extend around all clamps, tie rods and all bolted joint accessories and fittings.
 2. Standard Weight, Schedule 40 Galvanized Steel Pipe: ASTM A53/A53M, Type E, Grade B., seamless may be used for piping in vaults or for portions of water service piping installed entirely aboveground. Pipe ends may be factory or field formed to match joining method.
 3. Cast-Iron Flanges: ASME 16.1, Class 250, galvanized.
 4. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150 and 300, galvanized.
 - 1) Anvil International, Inc.
 - 2) Star

- 3) Stockham
- b. Pressure Rating: 250 psig (1725 kPa) minimum.
- 5. Copper Tube and Fittings
 - a. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A), water tube, annealed temper.
 - b. Hard Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A), water tube, drawn temper.
 - c. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
 - d. 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.
- 6. PE Pipe and Fittings
 - a. PE Fire-Service Pipe: FM Global approved, with minimum thickness equivalent to Class 150.
 - b. Molded PE Fittings: FM Global approved; PE butt-fusion type, made to match PE pipe dimensions and class.

2.02 SPECIAL PIPE FITTINGS

- A. Ductile-Iron Flexible Expansion Joints:
 - a. EBAA Iron, Inc.
 - b. Romac Industries, Inc.
 - c. Star Pipe Products.
 - d. Zurn Industries, LLC.
- 2. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153/A21.53. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111/A21.11, ductile-iron glands, rubber gaskets, and stainless-steel bolts.
- 3. Pressure Rating: 250 psig
- B. Ductile-Iron Deflection Fittings:
 - a. EBAA Iron, Inc.
- 2. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153/A21.53. Include AWWA C111/A21.11, ductile-iron glands, rubber gaskets, and stainless-steel bolts.
- 3. Pressure Rating: 250 psig minimum.
- C. Joint Restraint Devices
 - a. EBAA Iron, Inc.
- 2. Mechanical Joint Restraint Device Description:
 - a. Restraint devices shall be UL listed and FM Global approved.
 - b. Restraint devices for nominal pipe sizes 4 inch through 12 inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10.
 - c. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536.
 - d. Mechanical joint restraint for ductile iron pipe shall be Megalug Series 1100 produced by EBAA Iron Inc. or approved equal.
 - e. Mechanical joint restraint for PVC pipe shall be Series 2000PV produced by EBAA Iron Inc. or approved equal.
- 3. PVC Bell and Spigot Joint Restraint Device Description.
 - a. Restraint devices shall be FM Global approved.

- b. The restraint shall be manufactured of ductile iron conforming to ASTM A536.
 - c. A split serrated ring shall be used to grip the plain-end of the pipe. A split serrated ring shall also be used to grip the barrel of the pipe behind the bell, and a sufficient number of bolts shall be used to connect the restraint rings. The combination shall be Series 1900 produced by EBAA Iron Inc. or approved equal.
4. Joint Restraint Devices Coating System.
- a. All wedge assemblies and related parts shall be processed through a phosphate wash, rinse and drying operation prior to coating application. The coating shall consist of a minimum of two coats of liquid thermoset epoxy coating with heat cure to follow each coat.
 - b. All casting bodies shall be surface pretreated with a phosphate wash, rinse and sealer before drying. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact and UV resistance.
 - c. The coating system shall be MEGA-BOND by EBAA Iron, Inc. or approved equal. Requests for approved equal must submit coating material and process details for review prior to bid.

2.03 ENCASEMENT FOR PIPING, FITTINGS, AND VALVES

- A. Standard: {RS#2296} or AWWA C105/A21.5.
- B. Material: Linear low-density PE film of 0.008-inch (0.20-mm) minimum thickness or high-density, cross-laminated PE film of 0.004-inch (0.10-mm) minimum thickness.
- C. Form: Tube.
- D. Color: Black.

2.04 JOINING MATERIALS

- A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.

2.05 VALVES

- A. General Requirements for Valves
 - 1. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
 - a. Main Level: HAMV - Fire Main Equipment.
 - 1) Level 1: HCBZ - Indicator Posts, Gate Valve.
 - 2) Level 1: HLOT - Valves.
 - (a) Level 3: HLUG - Ball Valves, System Control.
 - (b) Level 3: HLXS - Butterfly Valves.
 - (c) Level 3: HMER - Check Valves.
 - (d) Level 3: HMRZ - Gate Valves.
 - b. Main Level: VDGT - Sprinkler System & Water Spray System Devices.
 - 1) Level 1: VQGU - Valves, Trim and Drain.
 - 2. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
 - a. Automated Sprinkler Systems:
 - 1) Indicator posts.
 - 2) Valves.
 - (a) Gate valves.
 - (b) Check valves.
 - (1) Single check valves.
 - (c) Miscellaneous valves.
 - 3. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

4. ASME Compliance:
 - a. ASME B16.1 for flanges on iron valves.
 - b. ASME B1.20.1 for threads for threaded-end valves.
 - c. ASME B31.9 for building services piping valves.
 5. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
 6. NFPA Compliance: Comply with NFPA 13, NFPA 20 and NFPA 24 for valves.
 7. Valve Pressure Ratings:
 - a. Not less than 175 psig
 - b. Not less than 250 psig
 - c. Not less than 300 psig
 - d. Not less than 350 psig
 8. Valve Sizes: Same as upstream piping unless otherwise indicated.
- B. Check Valves
- a. Anvil International.
 - b. Fivalco Inc.
 - c. Kennedy Valve Company; a division of McWane, Inc.
 - d. Mueller Co.
 - e. NIBCO INC.
 - f. Reliable Automatic Sprinkler Co., Inc. (The).
 - g. Tyco Fire Products LP.
 - h. United Brass Works, Inc.
 - i. Victaulic Company.
2. Description:
- a. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
 - b. Type: Single swing check.
 - c. Body Material: Cast iron, ductile iron, or bronze.
 - d. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
 - e. Clapper Seat: Brass, bronze, or stainless steel.
 - f. Hinge Shaft: Bronze or stainless steel.
 - g. Hinge Spring: Stainless steel.
 - h. End Connections: Flanged, grooved, or threaded.
- C. NRS Gate Valves
- a. Clow Valve Company; a subsidiary of McWane, Inc.
 - b. Kennedy Valve Company; a division of McWane, Inc.
 - c. Mueller Co.
 - d. NIBCO INC.
2. Description:
- a. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
 - b. Body and Bonnet Material: Cast or ductile iron.
 - c. Wedge: Cast or ductile iron with elastomeric coating.
 - d. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
 - e. Stem: Brass or bronze.
 - f. Packing: Non-asbestos PTFE.
 - g. Supervisory Switch: External.
 - h. End Connections: Mechanical Joint.
- D. Indicator Posts
- a. Clow Valve Company; a subsidiary of McWane, Inc.
 - b. Kennedy Valve Company; a division of McWane, Inc.

- c. Mueller Co.
- d. NIBCO INC.
- 2. Description:
 - a. Standard: UL 789 and FM Global standard for indicator posts.
 - b. Type: Underground.
 - c. Base Barrel Material: Cast or ductile iron.
 - d. Extension Barrel: Cast or ductile iron.
 - e. Cap: Cast or ductile iron.
 - f. Operation: Wrench.
- E. Iron OS&Y Gate Valves
 - a. Kennedy Valve Company; a division of McWane, Inc.
 - b. Mueller Co.
 - c. NIBCO INC.
 - d. Victaulic Company.
 - 2. Description:
 - a. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves)
 - b. Body and Bonnet Material: Cast or ductile iron.
 - c. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
 - d. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
 - e. Stem: Brass or bronze.
 - f. Packing: Non-asbestos PTFE.
 - g. Supervisory Switch: External.
 - h. End Connections: Flanged.
- F. Iron Butterfly Valves with Indicators
 - a. Anvil International.
 - b. Kennedy Valve Company; a division of McWane, Inc.
 - c. NIBCO INC.
 - d. Tyco Fire Products LP.
 - e. Victaulic Company.
 - 2. Description:
 - a. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
 - b. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
 - c. Seat Material: EPDM.
 - d. Stem: Stainless steel.
 - e. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
 - f. Actuator: Worm gear or traveling nut.
 - g. Supervisory Switch: Internal.
 - h. Body Design: Lug or wafer.

2.06 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:
 - a. Dresser, Inc.
 - b. Ford Meter Box Company, Inc. (The).
 - c. Jay R. Smith Mfg. Co.
 - d. JCM Industries, Inc.
 - e. Romac Industries, Inc.

2. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.
3. Standard: AWWA C219.
4. Center-Sleeve Material: Manufacturer's standard.
5. Gasket Material: Natural or synthetic rubber.
6. Pressure Rating: 200 psig (1380 kPa) minimum.
7. Metal Component Finish: Corrosion-resistant coating or material.

2.07 CORPORATION VALVES

1. Ford Meter Box Company, Inc. (The).
 2. Jones, James Company.
 3. Master Meter, Inc.
 4. Mueller Co.
 5. Red Hed Manufacturing Company; a division of Everett J. Prescott, Inc.
- B. Corporation Valves: Comply with AWWA C800. Include saddle and valve compatible with tapping machine and manifold.
1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
 2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
 3. Retain if utility company requires multiple connections.
 4. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.
- C. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.08 CURB VALVES

1. Ford Meter Box Company, Inc. (The).
 2. Jones, James Company.
 3. Master Meter, Inc.
 4. Mueller Co.
 5. Red Hed Manufacturing Company; a division of Everett J. Prescott, Inc.
- B. Curb Valves: Comply with AWWA C800 for high-pressure, service-line valves. Valve has bronze body, ground-key plug or ball, wide tee head, and inlet and outlet matching service piping material.
- C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
1. Shutoff Rods: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.
- D. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.09 DETECTOR CHECK VALVES

1. Ames Fire & Waterworks.
2. FEBCO.
3. Kennedy Valve Company; a division of McWane, Inc.
4. Mueller Co.
5. Viking Corporation.
6. Watts; a Watts Water Technologies company.

7. Zurn Industries, LLC.
- B. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
- C. Standards: UL 312 and FM Global's "Approval Guide."
- D. Pressure Rating: 175 psig
- E. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

2.10 WATER METERS

- A. Water meters are furnished by utility company.
 1. Badger Meter, Inc.
 2. Hays Fluid Controls.
 3. Mueller Co.
 4. Neptune Technology Group Inc.
 5. Sensus Metering Systems.
- B. Displacement-Type Water Meters:
 1. Description: With bronze main case.
 2. Standard: AWWA C700.
 3. Registration: Flow in gallons (liters).
- C. Turbine-Type Water Meters:
 1. Standard: AWWA C701.
 2. Registration: Flow in gallons (liters).
- D. Compound-Type Water Meters:
 1. Standard: AWWA C702.
 2. Registration: Flow in gallons (liters).
- E. Remote Registration System:
 1. Description: Utility company's standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
 2. Standard: AWWA C706.
 3. Registration: Flow in gallons (liters).
- F. Remote Registration System:
 1. Description: Utility company's standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
 2. Standard: AWWA C707.
 3. Registration: Flow in gallons (liters).
 4. Data-Acquisition Units: Comply with utility company's requirements for type and quantity.
 5. Visible Display Units: Comply with utility company's requirements for type and quantity.

2.11 DETECTOR-TYPE WATER METERS

1. Badger Meter, Inc.
2. Mueller Co.
3. Neptune Technology Group Inc.
4. Sensus Metering Systems.
- B. AWWA, Detector Check Water Meters:
 1. Description: Main line, turbine meter with second meter on bypass.
 2. Standard: AWWA C703.
 3. Registration: Flow in gallons (liters).

4. Pressure Rating: 150 psig
 5. Bypass Meter: AWWA C701, turbine-type, bronze case.
 - a. Size: At least one-half nominal size of main-line meter.
- C. Fire-Protection, Detector Check Water Meters:
1. Description: Main-line turbine meter with strainer and second meter on bypass.
 2. Standards: UL's "Fire Protection Equipment Directory" listing and FM Global's "Approval Guide."
 3. Registration: Flow in gallons (liters).
 4. Pressure Rating: 175 psig minimum.
 5. Bypass Meter: AWWA C701, turbine-type, bronze case.
 - a. Size: At least NPS 2
- D. Remote Registration System:
1. Description: Utility company's standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
 2. Standard: AWWA C706.
 3. Registration: Flow in gallons (liters).
- E. Remote Registration System:
1. Description: Utility company's standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
 2. Standard: AWWA C707 .
 3. Registration: Flow in gallons (liters).
 4. Data-Acquisition Units: Comply with utility company's requirements for type and quantity.
 5. Visible Display Units: Comply with utility company's requirements for type and quantity.

2.12 BACKFLOW PREVENTION ASSEMBLIES

- A. Reduced-Pressure-Principle Backflow Prevention Assemblies:
- a. Ames Fire & Waterworks.
 - b. Apollo Valves; Conbraco Industries, Inc.
 - c. FEBCO.
 - d. Mueller Co.
 - e. Watts; a Watts Water Technologies company.
2. Standard: ASSE 1013.
 3. Operation: Continuous-pressure applications.
 4. Pressure Loss: 12 psig (83 kPa) maximum, through middle one-third of flow range.
 5. Size: NPS _____ (DN _____).
 6. Design Flow Rate: _____ gpm (_____ L/s).
 7. Selected Unit Flow Range Limits: _____.
 8. Pressure Loss at Design Flow Rate: _____ for NPS 2 and smaller; _____ for NPS 2-1/2 and larger.
 9. Body Material: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 11. Configuration: Designed for horizontal, straight through flow.
 12. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
- B. Double-Check Backflow Prevention Assemblies:
- a. Ames Fire & Waterworks.
 - b. Apollo Valves; Conbraco Industries, Inc.

- c. Flomatic Corporation.
 - d. Mueller Co.
 - e. Watts; a Watts Water Technologies company.
 2. Standard: ASSE 1015.
 3. Operation: Continuous-pressure applications unless otherwise indicated.
 4. Pressure Loss: 5 psig (35 kPa) maximum, through middle one-third of flow range.
 5. Size: _____.
 6. Design Flow Rate: _____.
 7. Selected Unit Flow Range Limits: _____.
 8. Pressure Loss at Design Flow Rate: _____ for NPS 2 and smaller; _____ for NPS 2-1/2 and larger.
 9. Body Material: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
 10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 11. Configuration: Designed for horizontal, straight through flow.
 12. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
- C. Reduced-Pressure-Detector Backflow Preventer Assemblies:
- a. Ames Fire & Waterworks.
 - b. Apollo Valves; Conbraco Industries, Inc.
 - c. FEBCO.
 - d. Watts; a Watts Water Technologies company.
 2. Standards: ASSE 1047 and UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
 3. Operation: Continuous-pressure applications.
 4. Pressure Loss: 12 psig (83 kPa) maximum, through middle one-third of flow range.
 5. Size: _____.
 6. Design Flow Rate: _____.
 7. Selected Unit Flow Range Limits: _____.
 8. Pressure Loss at Design Flow Rate: _____.
 9. Body Material: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
 10. End Connections: Flanged.
 11. Configuration: Designed for horizontal, straight through flow.
 12. Accessories:
 - a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
 - c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.
- D. Double-Check Detector Backflow Prevention Assemblies:
- a. Ames Fire & Waterworks.
 - b. Apollo Valves; Conbraco Industries, Inc.
 - c. FEBCO.
 - d. Mueller Co.
 - e. Watts; a Watts Water Technologies company.
 2. Standards: ASSE 1048 and UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
 3. Operation: Continuous-pressure applications.
 4. Pressure Loss: 5 psig (35 kPa) maximum, through middle one-third of flow range.
 5. Size: _____.

6. Design Flow Rate: _____.
 7. Selected Unit Flow Range Limits: _____.
 8. Pressure Loss at Design Flow Rate: _____.
 9. Body Material: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
 10. End Connections: Flanged.
 11. Configuration: Designed for horizontal, straight through Insert configuration flow.
 12. Accessories:
 - a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
 - b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.
- E. Backflow Preventer Test Kits:
- a. Apollo Valves; Conbraco Industries, Inc.
 - b. FEBCO.
 - c. Watts; a Watts Water Technologies company.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.13 WATER METER BOXES

- A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" on cover; and with slotted, open-bottom base section of length to fit over service piping.
1. Option: Base section may be cast-iron, PVC, clay, or other pipe.
- B. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" on top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.
- C. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" on cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches square.

2.14 CONCRETE VAULTS

- A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C857, and made according to ASTM C858.
- B. Ladder: ASTM A36/A36M, steel ladder; or PE-encased steel steps.
- C. Manhole: ASTM A48/A48M, Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.
1. Dimension: 24-inch minimum diameter unless otherwise indicated.
- D. Manhole: ASTM A536, Grade 60-40-18, ductile-iron traffic frame and cover.
1. Dimension: 24-inch minimum diameter unless otherwise indicated.
- E. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.15 PROTECTIVE ENCLOSURES

- A. Freeze-Protection Enclosures:
- a. Aqua Shield.
 - b. G&C Enclosures.
 - c. Hot Box: Hubbell Power Systems, Inc.
 - d. Watts; a Watts Water Technologies company.

2. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F when external temperatures reach as low as .minus 34 deg F
 3. Standard: ASSE 1060.
 4. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
 - a. Housing: Reinforced -aluminum Insert housing construction.
 - 1) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
 - 2) Drain opening for units with drain connection.
 - 3) Access doors with locking devices.
 - 4) Insulation inside housing.
 - 5) Anchoring devices for attaching housing to concrete base.
 - b. Electric heating cable or heater with self-limiting temperature control.
 5. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
 - a. Housing: Reinforced -aluminum Insert housing construction.
 - 1) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
 - 2) Drain opening for units with drain connection.
 - 3) Access doors with locking devices.
 - 4) Insulation inside housing.
 - 5) Anchoring devices for attaching housing to concrete base.
 - b. Electric heating cable or heater with self-limiting temperature control.
- B. Weather-Resistant Enclosures:
- a. AquaShield.
 - b. G&C Enclosures.
 - c. Hot Box: Hubbell Power Systems, Inc.
 - d. Watts; a Watts Water Technologies company.
 2. Description: Uninsulated enclosure designed to protect aboveground water piping, equipment, or specialties from weather and damage.
 3. Standard: ASSE 1060.
 4. Class III: For equipment or devices other than pressure or atmospheric vacuum breakers.
 - a. Housing: Reinforced -aluminum Insert housing construction.
 - 1) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
 - 2) Drain opening for units with drain connection.
 - 3) Access doors with locking devices.
 - 4) Anchoring devices for attaching housing to concrete base.
 5. Class III-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
 - a. Housing: Reinforced -aluminum Insert housing construction.
 - 1) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
 - 2) Drain opening for units with drain connection.
 - 3) Access doors with locking devices.
 - 4) Anchoring devices for attaching housing to concrete base.

C. Expanded-Metal Enclosures:

 - a. Backflow Prevention Device InnClosures, Inc.
 - b. BF Products Inc.
 - c. Cross Brothers Inc.

- d. GuardShack Enclosures.
2. Description: Enclosure designed to protect aboveground water piping, equipment, or specialties from damage.
3. Material: ASTM F1267, expanded-metal side and top panels, of weight and with reinforcement of same metal at edges as required for rigidity.
4. Type: I, expanded.
5. Class: 1, uncoated carbon steel.
6. Finish: Manufacturer's enamel paint.
7. Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
8. Locking device.
9. Lugs or devices for securing enclosure to base.
10. Enclosure Bases: 4 inch (100 mm) minimum thickness precast concrete, of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

2.16 ALARM DEVICES

- A. General: UL 753 and FM Global's "Approval Guide" listing, of types and sizes to mate and match piping and equipment.
- B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig working pressure; designed for horizontal or vertical installation; with two single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.
- C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.
- D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 EXECUTION

3.01 APPLICATION

- A. Piping Application
 1. Underground fire-protection water-service piping NPS 2 (DN 50) and smaller shall be the following:
 - a. Hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) ; wrought-copper, solder-joint fittings; and brazed joints.
 2. Underground fire-protection water-service piping NPS 3 shall be one of the following:
 - a. Hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) ; wrought-copper, solder-joint fittings; and brazed joints.
 - b. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
 - c. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and gasketed joints.
 3. Underground fire-protection water-service piping NPS 4 shall be one of the following:
 - a. Hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A)ASTM B 88, Type K (ASTM B 88M, Type A) joints.
 - b. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
 - c. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and gasketed joints.
 - d. PVC, Class 150 pipe listed for fire-protection service; PVC fittings of same class as pipe; and gasketed joints.

4. Underground fire-protection piping NPS 6 to NPS 12 (DN 150 to DN 300) shall be one of the following:
 - a. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
 - b. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and gasketed joints.
 - c. PVC, Class 150 pipe listed for fire-protection service; PVC fittings of same class as pipe; and gasketed joints.
 5. Aboveground fire-protection piping NPS 2 (DN 50) and smaller shall be hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) ; wrought- or cast-copper-alloy, solder-joint fittings; and brazed joints.
 6. Aboveground fire-protection piping NPS 3 and NPS 4 (DN 80 and DN 100) shall be one of the following:
 - a. Hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) ; wrought-copper, solder-joint fittings; and brazed joints.
 - b. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
 - c. Schedule 40 black steel pipe, grooved or flanged.
 7. Aboveground fire-suppression piping NPS 5 to NPS 12 (DN 125 to DN 300) shall be one of the following:
 - a. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
 - b. Schedule 40 black steel pipe, grooved or flanged.
 8. Underslab fire-suppression piping NPS 2 (DN 50) and smaller shall be hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) ; wrought-copper, solder-joint fittings; and brazed joints.
 9. Underslab fire-protection piping NPS 3 and NPS 4 (DN 80 and DN 100) shall be one of the following:
 - a. Hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solder-joint fittings; and brazed joints.
 - b. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and restrained, gasketed joints.
 - c. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and restrained, gasketed joints.
 10. Underslab fire-protection piping NPS 6 to NPS 12 (DN 150 to DN 300) shall be one of the following:
 - a. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and restrained, gasketed joints.
 - b. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and restrained, gasketed joints.
- B. Valve Application
1. Underground fire-protection water-service shutoff valves NPS 2 and smaller shall be corporation valves or curb valves with ends compatible with piping.
 2. Meter box fire-protection water-service shutoff valves NPS 2 and smaller shall be meter valves.
 3. Vault fire-protection water-service shutoff valves NPS 2 and smaller shall be Class 125, MSS, bronze, nonrising stem or UL-listed or FM Global-approved, OS&Y, bronze, gate valves.
 4. Underground fire-suppression water-service shutoff valves NPS 3 and larger shall be one of the following:
 - a. 200-psig , AWWA, iron, nonrising-stem, metal-seated gate valves.
 - b. 250-psig , AWWA, iron, nonrising-stem, resilient-seated gate valves.

- c. 175 psig (1200 kPa), UL-listed or FM Global-approved, iron, nonrising-stem gate valves.
5. Indicator-post underground fire-protection water-service valves NPS 3 and larger shall be 175 psig (1200 kPa), UL-listed and FM Global-approved, iron, nonrising-stem gate valves with indicator-post flange.
6. Standard-pressure, aboveground fire-protection water-service shutoff valves NPS 3 and larger shall be one of the following:
 - a. 175 psig (1200 kPa) , UL-listed and FM Global approved iron OS&Y gate valves.
 - b. 175 psig (1200 kPa), UL-listed and FM Global approved iron butterfly valves.
7. Fire-protection water-service check valves NPS 3 and larger shall be one of the following:
 - a. UL-listed and FM Global approved check valves.
 - b. UL-listed and FM Global approved detector check valves.

3.02 INSTALLATION

A. Piping Installation

1. Comply with NFPA 24 for underground fire-service-main piping materials and installation.
2. Comply with excavating, trenching, and backfilling requirements in Section 31 20 00 - Earth Moving.
3. Mains: Water and fire mains running parallel shall be laid at least 10 feet apart horizontally, with the water main at a higher elevation than the top of the fire line. Water and fire mains shall be laid in separate trenches in all cases. Where water and fire mains are laid closer than 10 feet or where they are crossing, the bottom of the water main shall be at least 12" higher than the top of the fire line, otherwise, the fire line shall be of pressure class pipe, or shall be encased in concrete, within 10 feet either side of the water main.
4. Service Lines: Water and fire service lines shall not be laid in the same trench, unless the bottom of the water line, at all points, is at least 12" above the top of the fire line, and the water line shall be laid on a solid shelf excavated at one side of the common trench. Where water and fire service lines cross, the bottom of the water line shall be at least 12" higher than the top of the fire line.
5. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
 - a. Install encasement for piping according to ASTM A674 or AWWA C105/A21.5.
 - b. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: ULC 194.
 - c. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.
6. Install PVC, AWWA pipe according to ASTM F645 and AWWA M23 .
 - a. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D2774 or ASTM D3139.
7. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
 - a. Install encasement for tubing according to ASTM A674 or AWWA C105/A21.5.
 - b. Copper-Tubing, Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
8. Install PE pipe in accordance with ASTM D2774 and ASTM F645.
9. Bury piping with depth of cover over top at least 30 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration, and according to the following:
 - a. Under Driveways: With at least 36 inches (910 mm) of cover over top.
 - b. Under Railroad Tracks: With at least 48 inches (1220 mm) of cover over top.
 - c. In Loose Gravelly Soil and Rock: With at least 12 inches (300 mm) of additional cover.
10. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

11. Encase all underground ductile iron pipe, steel pipe and fittings with polyethylene tube in accordance with AWWA C105/A21.5, American National Standard for Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids. Tube length shall provide at least one (1) foot of overlap at each joint of pipe. Tape joints with minimum 2" width, plastic back adhesive tape.
 12. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.
 13. Install unions adjacent to each valve in tubing NPS 2 and smaller.
 14. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
 15. Ream ends of tubes and remove burrs.
 16. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.
 17. All mechanical joint fittings shall be supported meeting instructions of pipe and fitting manufacturers.
 18. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.
 19. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.
 20. Do not use flanges or unions for underground piping.
 21. Where black or galvanized steel is allowed, comply with requirements for fire-protection piping in Section 21 10 00 - Water-Based Fire-Protection Systems.
- B. Anchorage Installation
1. Anchorage, General: Install fire and water-distribution piping with restrained joints at all horizontal and vertical changes in direction. Anchorages and restrained-joint types that may be used include the following:
 - a. Concrete thrust blocks.
 - b. Locking mechanical joints.
 - c. Set-screw mechanical retainer glands.
 - d. Bolted flanged joints.
 - e. Heat-fused joints.
 - f. Pipe clamps and tie rods.
 2. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:
 - a. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 - b. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
 3. Install joint restraint devices at every mechanical joint connection and at every push-on pipe connection. Thrust blocks shall be installed at all changes of direction even with the required joint restraints installed.
 4. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.
- C. Valve Installation
1. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
 2. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
 3. UL-Listed and FM Global approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
 4. UL-Listed and FM Global approved Valves Other Than Gate Valves: Comply with NFPA 24.
 5. MSS Valves: Install as component of connected piping system.

6. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.
 7. Support valves and piping, not direct buried, on concrete piers. Comply with requirements for concrete piers in Section 03 30 00 - Cast-in-Place Concrete.
- D. Indicator Post Installation
1. Install indicator posts over valves on fire protection lines. Posts shall be bolted to the flange at the top of the valve and shall be installed plumb and true to the elevations indicated. The bury line on the indicator post shall match the final grade at the location of the indicator post. Paint indicator posts per specification Division 9 Section "Painting". Indicator posts installed on fire protection mains shall be painted red. Indicator posts shall be installed such that grade mark is level with the finish grade. Indicator posts installed on fire protection mains shall be installed with the following provisions: a $\frac{3}{4}$ " inch rigid metal conduit stubbed up through the concrete collar to facilitate the installation of an electric valve supervision switch in accordance with the contract documents.
 2. Indicator post valves shall be set so that the top of the post is 36 inches above grade.
 3. Bollards shall be installed around post indicator valves. Bollards shall be constructed of 8" schedule 40 steel pipes, set into a concrete base in surrounding grade to a minimum depth of 6 feet and extending a minimum height of 4 feet above grade. Bollards shall be concrete filled and shall have a smooth rounded concrete top. Bollards shall be painted safety yellow.
- E. Sleeve Installation
1. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in 20 05 00 - Common Mechanical Work Results.
- F. Fire Department Connection Installation
1. Install ball drip valves at each check valve for fire-department connection to mains.
 2. Install protective pipe bollards on two sides of each freestanding fire-department connection. Bollards shall be constructed of 8" schedule 40 steel pipes, set into a concrete base in surrounding grade to a minimum depth of 6 feet and extending a minimum height of 4 feet above grade. Bollards shall be concrete filled and shall have a smooth rounded concrete top. Bollards shall be painted safety yellow.
- G. Detector Check Valve Installation
1. Install aboveground.
 2. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.
 3. Support detector check valves and piping on concrete piers. Comply with requirements for concrete piers in Section 03 30 00 - Cast-in-Place Concrete.
- H. Water Meter Installation
1. Install water meters, piping, and specialties according to utility company's written instructions.
 2. Water Meters: Install displacement-type water meters NPS 2 and smaller in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets, and include valved bypass around meters unless prohibited by authorities having jurisdiction.
 3. Water Meters: Install compound-type water meters NPS 3 and larger in meter vaults. Include shutoff valves on water meter inlets and outlets, and include valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.
 4. Water Meters: Install detector-type water meters in meter vault according to AWWA M6. Include shutoff valves on water meter inlets and outlets, and include full-size valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.
 5. Support water meters and piping NPS 3 and larger on concrete piers. Comply with requirements for concrete piers in Section 03 30 00 - Cast-in-Place Concrete.
 6. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

- I. Backflow Prevention Assemblies Installation
 - 1. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
 - 2. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
 - 3. Do not install bypass piping around backflow preventers.
 - 4. Support NPS 2-1/2 and larger backflow preventers and piping on concrete piers. Comply with requirements for concrete piers in Section 03 30 00 - Cast-in-Place Concrete.
- J. Water Meter Box Installation
 - 1. Install water meter boxes in paved areas flush with surface.
 - 2. Install water meter boxes in grass or earth areas with top 2 inches (50 mm) above surface.
- K. Concrete Vault Installation
 - 1. Install precast concrete vaults according to ASTM C891.
- L. Protective Enclosure Installation
 - 1. Install concrete base level and with top approximately 2 inches (50 mm) above grade.
 - 2. Install protective enclosure over valves and equipment.
 - 3. Anchor protective enclosure to concrete base.
- M. Alarm Device Installation
 - 1. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.
 - 2. Supervisory Switches: Supervise valves in open position.
 - a. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
 - b. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.
 - 3. Locking and Sealing: Secure unsupervised valves as follows:
 - a. Valves: Install chain and padlock on open OS&Y gate valve.
 - b. Post Indicators: Install padlock on wrench on indicator post.
 - 4. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.
 - 5. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

3.03 CONNECTIONS

- A. Piping Connections
 - 1. Extend underground fire-protection piping and connect to water-supply source and building fire-suppression piping systems at locations and pipe sizes indicated.
 - a. Terminate underground fire-suppression piping within the building at the floor slab until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material.
 - b. Connect to interior building fire-protection piping systems when installed.
 - 2. Connect fire-suppression water-service piping to utility water main. Use tapping sleeve and tapping valve.
 - a. Water-Main Connection: Arrange with water utility company for tap of size and in location indicated in water main.
 - b. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
 - c. Make connections larger than NPS 2 with tapping machine according to the following:
 - 1) Install tapping sleeve and tapping valve according to MSS SP-60.

- 2) Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
- 3) Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
- 4) Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- d. Make connections NPS 2 and smaller with drilling machine according to the following:
 - 1) Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company's standards.
 - 2) Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
 - 3) Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
 - 4) Install corporation valves into service-saddle assemblies.
 - 5) Install manifold for multiple taps in water main.
 - 6) Install curb valve in water-service piping with head pointing up and with service box.
3. Connect waste piping from concrete vault drains to sanitary sewerage system. Comply with requirements in Section 22 13 13 "Facility Sanitary Sewers" for connection to sanitary sewer.
- B. Electrical Connections
 1. Connect alarm devices to building's fire-alarm system. Wiring and fire-alarm devices are specified in Section 28 46 00 - Fire Alarm Systems.

3.04 FIELD QUALITY CONTROL

- A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.
- B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.
 1. Increase pressure in 50 psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- D. Prepare test and inspection reports.

3.05 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground fire-suppression piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 31 20 00 - Earth Moving.
- B. Permanently attach equipment nameplate or marker indicating plastic fire-protection water-service piping or fire-protection piping with electrically insulated fittings, on main electrical meter panel. Comply with requirements for identifying devices in Section 21 05 00 - Common Work Results For Fire-Protection.

3.06 CLEANING

- A. Clean and disinfect fire-protection piping as follows:

1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure as described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure as described in AWWA C651 or do as follows:
 - a. AWWA C651 Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow it to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm chlorine; isolate and allow it to stand for three hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

END OF SECTION