SECTION 21 01 00
SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Piping, fitting and joining methods and ratings
2. Fire protection valves
3. Sprinkler specialty pipe fittings
4. Sprinklers
5. Preaction valve assemblies
6. Air compressors
7. Nitrogen generator system
8. Alarm devices
9. Pressure gauges

B. Meet the following performance requirements:

1. Section 21 00 10 – Basic Fire Protection Requirements

1.2 SYSTEM DESCRIPTIONS

A. Wet Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device.

B. Double Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure monitoring gas (nitrogen). The actuation of the fire detection system only, or the loss of monitoring pressure in the sprinkler system piping (from a leak or an open sprinkler) only, will not permit water into the system piping. Both the actuation of a fire detection system (generally two smoke detectors) and the opening of at least one sprinkler in the same area opens the deluge valve permitting water to flow into the sprinkler piping. Then water will discharge from sprinklers that have opened. Sprinklers open when heat melts fusible link or destroys frangible device.

1.3 PERFORMANCE REQUIREMENTS

A. The sprinkler system design shall be per the applicable local codes and be approved by the authorities having jurisdiction as well as the Architect.

B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Standard Pressure Piping and System Components: Listed for 175-psig maximum working pressure.

D. Occupancy hazard classifications and protection strategies are based on NFPA 13.

1. Margin of Safety for Available Water Flow and Pressure:
   a. 10 percent or 10 psi (whichever is greater) including the losses through water service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:
   a. Electrical Equipment Rooms: Ordinary Hazard, Group 1.

b. Computer Rooms: Ordinary Hazard, Group 1.
c. General Storage Areas and Loading Dock: Ordinary Hazard, Group 1.
d. Long Term Storage Rooms: Ordinary Hazard, Group 2.
e. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
f. Unoccupied Spaces: Ordinary Hazard, Group 1.
g. Offices, Corridors and Public Areas: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Light Hazard Occupancy: 0.10 gpm/sq. ft. over 1,500 sq. ft.
   b. Ordinary Hazard, Group 1 Occupancy: 0.15 gpm/sq. ft. over 1,500 sq. ft.
   c. Ordinary Hazard, Group 2 Occupancy: 0.20 gpm/sq. ft. over 1,500 sq. ft.
   d. Note: All double interlock preaction systems shall increase the area of operation as listed above by 30% without revising the density.
4. Maximum Protection Area per Sprinkler:
   a. Office, Corridors, Public Areas: 225 sq. ft. (standard coverage)
   b. Storage Areas: 130 sq. ft. (standard coverage) or 256 sq. ft. (16 ft. x 16 ft. extended coverage)
   c. Mechanical Equipment Rooms: 130 sq. ft. (standard coverage) or 256 sq. ft. (16 ft. x 16 ft. extended coverage)
   d. Electrical Equipment Rooms: 130 sq. ft. (standard coverage) or 256 sq. ft. (16 ft. x 16 ft. extended coverage)
   e. Unoccupied Shell or Flex Spaces: 130 sq. ft. (standard coverage) or 256 sq. ft. (16 ft. x 16 ft. extended coverage)
   f. Computer Room – Below Suspended Ceiling: 130 sq. ft. (standard coverage) or 256 sq. ft. (16 ft. x 16 ft. extended coverage)
   g. According to NFPA 13 recommendations unless otherwise indicated.
5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
   a. Light Hazard Occupancies: 250 gpm for 30 minutes (per FM Global).
   b. Ordinary Hazard Occupancies: 250 gpm for 60 minutes.

E. Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7. Conform to requirements indicated in Section 21 00 10.

1.4 SCOPE OF WORK

A. A current hydrant flow test performed on or near the project site shall be used as the basis of hydraulic design of the sprinkler system piping. Contact the local water authority for latest hydrant flow test results. Have test performed if available data is older than 12 months. Results of this test shall be used in the hydraulic calculations. Submit a copy of this test with the hydraulic calculations.

B. The work covered by this Specification is the modifying existing sprinkler systems to suit the new conditions. The existing space is protected with two dry pipe sprinkler systems and will be converted into three double interlock preaction sprinkler systems: two covering the Computer Room; one covering the Infrastructure Rooms. The South Corridor, Flex Spaces, Storage Rooms, and Preaction Closet will be protected by extending the existing wet pipe sprinkler system. The North Corridor and north PBB areas will be converted from dry pipe sprinkler systems to wet pipe systems at specific phases of tenant finish-out on the second floor, as indicated on the drawings.

C. Provide detail design of the piping systems in accordance with the referenced codes and standards, and submit the design to the Owner's Underwriter and to the local Fire Department for approval prior to fabrication or installation of any equipment or piping. The installation shall be made in accordance with the approved drawings, specifications, and applicable standards. All drawings shall be prepared and stamped by a Registered Fire Protection Engineer licensed in this State.

D. Sprinkler layout indicated on the drawings is a general arrangement only and shall not be used as a basis of bid. Contractor is responsible for a code compliant system. All contract documents must be reviewed for proper sprinkler placement relative to all other trades. Provide additional sprinklers and piping as required. Changes or modifications to the systems shall be submitted to the Architect for approval prior to pipe fabrication.

E. Provide and place into full operating condition a complete fire protection system as specified herein and indicated on the drawings. The systems shall include, but not be limited to, all piping, fittings, supports, hangers, valves, cabinets, sprinklers, system bracing, tamper and pressure switches, and all other accessories required to provide a complete and operable system. Division 28 shall provide detection devices and notification devices.

F. The work described hereinafter shall consist of installing piping, fittings, valves and appurtenances, sprinklers, supports and connections specified in this Section, including labor, materials, services, software, programming, and inspections and testing required providing a complete, operating system.

G. All devices shown on the plans shall be installed in accordance with the manufacturer's instructions. The plans provided with this specification are presented for construction planning. It is the responsibility of the Contractor to review these project drawings, visit the site, acquaint himself with existing conditions and proposed construction, and determine the required quantities of devices and specific optimum locations for same, consistent with the selected manufacturer's instructions and the code. As part of this project, the Contractor shall furnish and install all equipment indicated on the drawing set and described in this specification.

H. Furnish all labor and supervision, materials, equipment, and tools required for the design and installation of a complete automatic sprinkler system to serve the entire building. The sprinkler zones and piping layout shall take into consideration that the building will be occupied by several Data Center Users at a future date. The sprinkler system design needs to provide complete automatic sprinkler coverage that is easily converted to a preaction system as the building is occupied.

I. Piping network shall take into consideration future electrical gear installation and the future preaction zone requirements. Only sprinkler piping associated with a particular zone shall be installed over or within the limits of that particular zone.

J. Work shall include all necessary submittals for approval, securing of permits, installation, testing, and certification.

K. Provide bracing, anchors and supports for all sprinkler piping and equipment as required by the Building Code, local amendments, ASCE-7 and NFPA 13.

L. Design for sprinkler system shall be in accordance with NFPA 13 and the Owner's insurer: FM Global.

M. Sprinkler system design has been based on the Digital Engineering Guidelines (DEG). Changes or modifications to the system design shall be submitted to the Architect for approval prior to pipe fabrication and shall be prepared and stamped by a Registered Fire Protection Engineer licensed in this State.

N. Design for sprinkler system shall be in accordance with NFPA 13 Hydraulic Calculation Method.

O. Prepare all drawings, applications, and calculations as noted above, and obtain all approvals, permits, and tests, and shall pay all related fees.

P. Provide detailed design of the piping systems in accordance with the referenced codes and standards, and submit the design to the Architect, the Owner's Underwriter and to the local authorities having jurisdiction for approval prior to fabrication or installation of any equipment or piping. The installation shall be made in accordance with the approved drawings, specifications, and applicable standards.

Q. Be responsible for obtaining the approval of the sprinkler system design from all state and local authorities having jurisdiction, and from the Owner's insurance carrier, or the Owner's Safety Department.

R. Maintain a 10-psi safety factor between the sprinkler demand and the water supply.

S. All valves shall have supervisory switches that shall be connected to the Fire Alarm System under Division 28.

T. Service and maintenance in addition to warranty requirements:

1. Section 21 00 10 – Basic Fire Protection Requirements

1.5 RELATED SECTIONS

A. Section 21 00 10 – Basic Fire Protection Requirements

B. Section 28 31 12 – Digital, Addressable Fire Alarm System

1.6 REFERENCES

A. ANSI/ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, and 250.

B. ANSI/ASME B16.3 Malleable Iron Threaded Fittings, Class 150 and 300.

C. ANSI/ASME B16.5 Pipe Flanges and Flanged Fittings.

D. NFPA 13 Standard for the Installation of Sprinkler Systems.

E. FM Global Data Sheets.

F. Digital Realty Engineering Guidelines (DEG), latest edition.

1.7 SUBMITTALS

A. Refer to Section 01 33 00 – Submittal Procedures.

B. Submit design basis to Architect for approval prior to commencement of design. Submit shop drawings, product data, hydraulic calculations, and maintenance instructions to the local Fire Department and to the Owner's Underwriter prior to installation of system. Provide copy of approved submittal to Engineer.

1. Shop Drawings: Provide sprinkler piping drawings including connection to existing system, preaction valve installations, and distribution piping layout with sprinkler locations. Indicate pipe materials used, joining methods, supports, and wall penetration seals. Provide valve and control panel location, and any required field wiring details for installation.
2. Product Data: Provide manufacturer's catalog information for all equipment and materials to be used (pipe, sprinklers, preaction assemblies, hangers and accessories, etc).
3. All product data sheets shall indicate the system(s) for which the products are being submitted. Not all materials and joining methods are acceptable on all sprinkler system types. Cross out all options/sizes/accessories that are not included with the submittal. All

options not crossed out shall be deemed included without additional cost at the option of the Owner.

4. Calculations: Provide hydraulic calculations for each automatic sprinkler system. Include a copy of the water supply data used for the calculations.

C. Refer to Section 01 77 00 – Closeout Procedures.

D. Provide copy of completed and signed "Contractor's Material and Test Certificate for Aboveground Piping" (e.g., NFPA 13, 2010, Figure 24.1) to Engineer.

E. Submit Maintenance Instructions: Include installation instructions, spare parts lists, procedures, and treatment programs.

F. Submit record CAD drawings and final certification to the Owner and Engineer upon completion of installation and testing.

1.8 COORDINATION

A. Coordinate work under provisions indicated in Section 21 00 10.

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

1.9 QUALIFICATIONS / QUALITY ASSURANCE

A. Conform to requirements indicated in Section 21 00 10.

B. Perform all work in accordance with NFPA 13 and FM guidelines.

C. Valves shall bear FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

D. Materials and details of the installation shall be UL listed and FM approved.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site. Store products elevated off the slab and protected from dirt and debris. Store valves in shipping containers with labeling in place. Products shall not be left exposed to the weather.

B. Provide temporary end caps and closures on piping and fittings, temporary protective coating on case iron and steel valves, and temporary protective caps or clips on sprinklers. Maintain in place until installation.

C. Ensure on-time delivery of all materials and equipment required for the Project. All materials furnished or incorporated in the Work shall be new, unused, of best quality, and especially adapted for the service required. Whenever the characteristics of any material are not particularly specified, such material shall be utilized as is customary in first class work of a nature for which the material is employed.

D. Provide necessary means to properly stage and store all materials and equipment until time of use or installation on the Project. Coordinate all requirements with General Contractor.

E. Provide proper handling, rigging, and installing of all materials and equipment for the Project.

F. Owner reserves the right to reject any materials or equipment that is not properly stored in accordance with these specifications or the manufacturers' requirements.

G. Refer to Division 1 for additional delivery and storage requirements.

1.11 REGULATORY REQUIREMENTS

A. Conform to requirements indicated in Section 21 00 10 in addition to following:

1. Design for sprinkler system shall be in accordance with NFPA 13, state and local requirements, and the Owner's insurer: FM Global.
2. Perform all work in accordance with NFPA 13, FM guidelines, and local jurisdictional requirements.
3. Valves shall bear FM label or marking. Manufacturer's name and pressure rating shall be marked on valve body.
4. Submit as required here in and under Section 21 00 10.

1.12 EXTRA MATERIALS

A. Furnish under provisions indicated in Section 21 00 10

B. For each tenant, furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

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

1.13 PROJECT RECORD DOCUMENTS

A. Submit under provisions indicated in Section 21 00 10.

1.14 OPERATION AND MAINTENANCE DATA

A. Submit under provisions indicated in Section 21 00 10.

1.15 WARRANTY

A. Provide under provisions indicated in Section 21 00 10.

1.16 LEED / SUSTAINABILITY

A. Conform to requirements indicated in Section 21 00 10.

1.17 PROJECT CONDITIONS

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

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Schedule 40, Black Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Black Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard weight, seamless steel pipe with threaded ends.

C. Uncoated, Steel Couplings: ASTM A 865, threaded.

D. Uncoated, Gray Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

E. Malleable or Ductile Iron Unions: UL 860.

F. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

G. Grooved Joint, Steel Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Victaulic Company.
2. Pressure Rating: 175 psig minimum.
3. Uncoated, Grooved End Fittings for Steel Piping: ASTM A 47/A 47M, malleable iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Grooved End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel pipe dimensions. Include ferrous housing sections, EPDM rubber gasket, and bolts and nuts.

H. Steel Pressure-Seal Fittings: UL 213, FM approved, 175 psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

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

2.3 NITROGEN PIPING

A. Supply and Purity Sensing Tubing: Copper tubing complying with ASTM B 88, Type K ASTM B 88M, Type A.

B. Fittings: Cast-bronze solder fittings complying with ASME B16.18; or wrought-copper solder fittings complying with ASME B16.22, except forged-brass compression-type fittings at connections to equipment.

C. Joining Method: Soldered or brazed.

2.4 PIPING JOINING MATERIALS

A. Pipe Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast Iron and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
2. Class 250, Cast Iron and Class 300, Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

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

2.5 PRE-PIPED SPRINKLER SYSTEM CONTROL CABINETS

A. Basis of Design: FireFlex N_2-Blast Cabinet with integrated South-Tek N_2-Blast Nitrogen Generator.

B. Cabinet shall integrate a self-contained double interlock pre-action system, Electric/Pneu-Lectric release, and shall contain all hydraulic, pneumatic devices, and electrical components required for the control of a remote controlled preaction system. System shall include the following:

1. Sturdy free-standing 14 gauge steel cabinet measuring 54” x 31” x 77” for 4” & 6” systems.
2. Textured rust proof coating, inside and outside, fire red, oven baked polyester powder on phosphate base (powder coated).
3. Two locked access doors to reduce frontal clearance required for opening.
4. Individual access doors for the hydraulic section and the emergency release.
5. The cabinet shall have knock-outs for hydraulic and electrical connections.

C. Integrated Preaction System

1. Viking Deluge valve model F-1 for 1-1/2" (40 mm) through 6” (150mm) diameter c/w supervised butterfly control valve, releasing trim rated at 250 psi and all the necessary accessories. Trim shall include a mechanical latching device to prevent system from resetting in case of loss of power to the release solenoid. Systems provided with solenoid only, without this mechanical latching device, shall not be accepted. Every valve shall be clearly identified as to its operation with arrows indicating all positions to facilitate system operation.
2. Pressure gauges to indicate water supply, priming water of the system. Each pressure gauge must be provided with its own three-way valve.
3. Release trim with solenoid valve, and every supervisory and alarm device required shall be Schedule 40 galvanized steel. Black pipe will not be accepted.
4. Schedule 40 steel pipe header painted fire red, with grooved ends to be connected to supply water from either side.
5. Schedule 40 steel pipe drain manifold of 2" diameter painted fire red, with grooved ends for drain connections from either side.
6. Trim shall include properly identified contractor test ports factory mounted into the trim piping to facilitate system testing and commissioning.
7. Viking VFR-400 integrated control panel with emergency batteries factory-assembled inside the cabinet.
8. The system shall have an Integrated Releasing Circuit Disconnect Switch to allow the system to be tested without actuating the fire suppression system as required per NFPA 72. Operation of the Disconnect Switch shall cause a supervisory signal at the releasing service fire alarm control unit. The disconnect switch shall be a physical switch and not be accomplished by using software.
9. Field wiring terminal strips and junction box integrated with the cabinet for connection of field wiring. Standard factory-wired terminal strips to accept field installation of ARM-44 Relay Module, CA2Z Class initiating circuit module, RA-4410RC remote annunciator.

D. Nitrogen Generation System

1. Nitrogen Generation System shall include an integrated, oil-less air compressor complete with control panel located within the cabinet.
2. The N_2-Blast FPS - “Type 1” Nitrogen Generation System shall provide a minimum of 98% Nitrogen purity to the FPS. It shall include a Particulate and a Coalescing filter (internally mounted within the cabinet), sized properly for the required Compressed Air IN flow rates.
3. It shall provide a single (16) gallon Nitrogen Storage Tank which is DOT or ASME rated for 150 PSI and shall be provided with ASME rated 100 PSI Safety Relief valve, on/off valve and ¼” NPT I/O fitting.

4. A Viking D-2 Air Pressure Maintenance Device c/w trim shall be factory-installed and adjusted to regulate the nitrogen pressure in the FPS at the specified system pressure for a double interlock preaction system.
5. The Nitrogen Generation System shall be designed with an internal BlastOff™ - Leak Detection System and Fire Protection System Gas Purging Device.

E. Air Supply

1. Air compressor and supervisory trim shall be provided inside the cabinet and its pressure factory adjusted for the selected configuration. The air supply must be regulated and of the proper size to restore normal system air pressure within 30 minutes as per NFPA 13. This compressor shall be equipped with a factory-adjusted ON/OFF pressure switch tied into the sprinkler system piping. It shall be factory-set at 10 and 20 psi for the cut-in and cut-out pressures respectively.
2. If required by the size of the piping network, an accelerator device, Viking Model E-1 shall be factory installed in the air trim with its own pressure gauge and bypass valve, designed to increase the operating speed of the system.

F. AutoPurge System

1. Supply and install a N2 Blast AutoPurge System at a high point within the preaction system piping.
2. The AutoPurge System shall not require any electric connection AS or DC. The N2 Blast AutoPurge System shall have a connection allowing the Quick-Check Portable or Fixed Nitrogen Purity Sensor to attach within the FPS to ensure that proper Nitrogen purity levels have been attained.
3. The Sprinkler contractor shall adjust each N2 Blast AutoPurge System to purge the FPS per the manufacturer's specifications outlined within the sizing chart located on the device.

G. System drain

1. The single drain collector shall be connected to an open drain consisting of a vertical pipe with an air gap around the drain collector pipe.
2. The drain piping shall not be restricted or reduced and shall be of the same diameter as the drain collector.
3. Multiple drain collectors and open drain cups inside the cabinet will not be accepted.

H. System Options

1. Shut-off valve – Provide a Listed and Approved supervised butterfly valve installed on the system riser inside the cabinet for full flow test purposes. An integrated sight glass shall be part of this arrangement for visually confirming water flow through the main drain upon system actuation.
2. Semi flanged - Provide the system with a flanged inlet and riser connections and a threaded drain.
3. Use galvanized piping on water supply inlet manifold and riser outlet with galvanized pipe, cap and couplings.

I. Releasing Control Panel – Refer to Division 28

1. Preaction cabinet shall be remote controlled unit without integral control panel. Releasing control shall be by suite's Local Fire Alarm Control Panel (LFACP).

J. System Operation

1. The release control panel sequence of operation shall be programmed to perform the following:
   a. The activation of the detection condition AND the opening of an automatic sprinkler is necessary to cause the preaction valve actuation.
   b. The activation of the detection condition alone will sound an alarm and activate the alarm contacts connected to the fire alarm control panel but water will not enter the system piping.

c. The opening of an automatic sprinkler OR damage to system piping without the detection condition satisfied will activate the low air supervisory switch and supervisory contacts connected to the fire alarm control panel but will not cause the system piping to fill with water.
d. Activation of the detection condition AND the opening of an automatic sprinkler will activate the solenoid valve open causing the preaction valve to open and water to flow out of any open sprinklers. The water flow alarm pressure switch will activate.
e. Operation of the hydraulic emergency manual release will depressurize the priming chamber causing the preaction valve to open and allowing water to enter the system piping and water will discharge through any open sprinklers. The water flow alarm pressure switch will activate.

2. Detection condition:
   a. Detection of smoke at the full alarm level of the air aspirating fire detection system in the protected area is needed in order to get the "detection condition."

K. The cabinet assembly shall be pre-assembled, pre-wired and factory tested under ISO-9001 conditions.

L. The system shall be complete in all ways and shall incorporate all components required for complete system operation.

2.6 LISTED FIRE PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating for Standard Pressure Piping: 175 psig.

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Anvil International, Inc.
   b. Victaulic Company.
2. Standard: UL 1091 except with ball instead of disc.
3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile iron body with grooved ends.
5. Valves NPS 3: Ductile iron body with grooved ends.

C. Bronze Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Fivalco Inc.
   b. Global Safety Products, Inc.
   c. Milwaukee Valve Company.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

D. Check Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AFAC Inc.
   b. American Cast Iron Pipe Company; Waterous Company Subsidiary.

c. Anvil International, Inc.
d. Clow Valve Company; a division of McWane, Inc.
e. Crane Co.; Crane Valve Group; Crane Valves.
f. Crane Co.; Crane Valve Group; Jenkins Valves.
g. Crane Co.; Crane Valve Group; Stockham Division.
h. Fire-End & Croker Corporation.
i. Fire Protection Products, Inc.
j. Fivalco Inc.
k. Globe Fire Sprinkler Corporation.
l. Groeniger & Company.
m. Kennedy Valve; a division of McWane, Inc.
n. Matco-Norca.
o. Metraflex, Inc.
p. Milwaukee Valve Company.
q. Mueller Co.; Water Products Division.
r. NIBCO INC.
s. Potter Roemer.
t. Reliable Automatic Sprinkler Co., Inc.
u. Shurjoint Piping Products.
v. Tyco Fire & Building Products LP.
w. United Brass Works, Inc.
x. Venus Fire Protection Ltd.
y. Victaulic Company.
z. Viking Corporation.
aa. Watts Water Technologies, Inc.

2. Standard: UL 312
3. Pressure Rating: 250 psig minimum.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

E. Bronze OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Stockham Division.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. United Brass Works, Inc.
2. Standard: UL 262.
3. Pressure Rating: 175 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

F. Iron OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
   b. American Valve, Inc.
   c. Clow Valve Company; a division of McWane, Inc.
   d. Crane Co.; Crane Valve Group; Crane Valves.
   e. Crane Co.; Crane Valve Group; Jenkins Valves.
   f. Crane Co.; Crane Valve Group; Stockham Division.
   g. Hammond Valve.

h. Milwaukee Valve Company.
i. Mueller Co.; Water Products Division.
j. NIBCO INC.
k. Shurjoint Piping Products.
l. Tyco Fire & Building Products LP.
m. United Brass Works, Inc.
n. Watts Water Technologies, Inc.

2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

G. Indicating-Type Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Anvil International, Inc.
   b. Fivalco Inc.
   c. Global Safety Products, Inc.
   d. Kennedy Valve; a division of McWane, Inc.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Shurjoint Piping Products.
   h. Tyco Fire & Building Products LP.
   i. Victaulic Company.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig minimum.
4. Valves NPS 2-1/2 and Larger:
   a. Valve Type: Butterfly.
   b. Body Material: Cast or ductile iron.
   c. End Connections: Flanged or grooved.
5. Valve Operation: Integral electrical, 115 VAC, prewired, two-circuit, supervisory switch visual indicating device.

2.7 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL “Fire Protection Equipment Directory” listing or FM Global “Approval Guide.”
2. Pressure Rating: 175 psig minimum.
3. Inspector’s test connection valves shall be lockable in the closed position.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Fire Protection Products, Inc.
   b. United Brass Works, Inc.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Affiliated Distributors.
   b. Anvil International, Inc.
   c. Barnett.

d. Conbraco Industries, Inc.; Apollo Valves.
e. Fire-End & Croker Corporation.
f. Fire Protection Products, Inc.
g. Flowserve.
h. FNW.
i. Jomar International, Ltd.
j. Kennedy Valve; a division of McWane, Inc.
k. Kitz Corporation.
l. Legend Valve.
m. Metso Automation USA Inc.
n. Milwaukee Valve Company.
o. NIBCO INC.
p. Potter Roemer.
q. Red-White Valve Corporation.
r. Southern Manufacturing Group.
s. Stewart, M. A. and Sons Ltd.
t. Tyco Fire & Building Products LP.
u. Victaulic Company.
v. Watts Water Technologies, Inc.

D. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Fire Protection Products, Inc.
   b. United Brass Works, Inc.

E. Plug Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Southern Manufacturing Group.

2.8 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:
   a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AFAC Inc.
   b. Globe Fire Sprinkler Corporation.
   c. Reliable Automatic Sprinkler Co., Inc.
   d. Tyco Fire & Building Products LP.
   e. Venus Fire Protection Ltd.
   f. Victaulic Company.
   g. Viking Corporation.
2. Standard: UL 193.

3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

C. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AFAC Inc.
   b. Reliable Automatic Sprinkler Co., Inc.
   c. Tyco Fire & Building Products LP.
2. Standard: UL 1726.
3. Pressure Rating: 175 psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.
7. Finish: Polished brass

2.9 SPRINKLER SPECIALTY PIPE FITTINGS

A. General Requirements for System Fittings: UL listed for fire protection service.

B. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AGF Manufacturing Inc.
   b. Triple R Specialty.
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.
   e. Viking Corporation.
2. Standard: UL "Fire Protection Equipment Directory" listing or FM Global "Approval Guide."
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.
7. Provide with lockable capabilities.

C. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. CECA, LLC.
   b. Corcoran Piping System Co.
   c. Merit Manufacturing; a division of Anvil International, Inc.
2. Standard: UL 1474.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Steel pipe with EPDM O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

2.10 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc.
3. Tyco Fire & Building Products LP.
4. Victaulic Company.
5. Viking Corporation.

B. General Requirements:

1. Standard: UL "Fire Protection Equipment Directory" listing or FM Global "Approval Guide."
2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. Office Areas, Corridors, Common Spaces: Nominal 1/2-inch orifice with discharge coefficient K of 5.6, and for "Ordinary" (165°F) temperature classification rating unless otherwise indicated or required by application.
3. Computer Rooms, MEP Galleries, UPS Rooms, MCS Closets, MMR Rooms, POP Rooms: Nominal 3/4-inch orifice with discharge coefficient K of 8.0 or 14.0 as indicated on drawings, and for "Intermediate" (200°F) temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes:

1. Upright – Finished Area: Chrome.
2. Upright – Unfinished Area: Brass.
3. Pendent: White, or as otherwise indicated on the drawings.

E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for recessed pendent sprinklers are specified with sprinklers.

1. Ceiling Mounted (Extended Coverage) – Computer Room: Recessed (Tyco Style 60), white finish to match ceiling, unless noted otherwise.
2. Ceiling Mounted (Standard): Concealed, white finish to match ceiling, unless noted otherwise.

F. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Reliable Automatic Sprinkler Co., Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.
   d. Viking Corporation.
2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.11 ALARM DEVICES

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

B. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Fire-Lite Alarms; a Honeywell company.
b. Notifier; a Honeywell company.
c. Potter Electric Signal Company.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 6-inch minimum diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.

C. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AFAC Inc.
   b. Barksdale, Inc.
   c. Detroit Switch, Inc.
   d. Potter Electric Signal Company.
   e. System Sensor; a Honeywell company.
   f. Tyco Fire & Building Products LP.
   g. United Electric Controls Co.
   h. Viking Corporation.
2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

D. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Fire-Lite Alarms; a Honeywell company.
   b. Kennedy Valve; a division of McWane, Inc.
   c. Potter Electric Signal Company.
   d. System Sensor; a Honeywell company.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

2.12 PRESSURE GAUGES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AMETEK, Inc.; U.S. Gauge Division.
2. Ashcroft, Inc.
3. Brecco Corporation.
4. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gauge Range: 0 to 250 psig minimum.

E. Water System Piping Gauge: Include “WATER” or “AIR/WATER” label on dial face.

F. Air System Piping Gauge: Include retard feature and “AIR” or “AIR/WATER” label on dial face.

2.13 WALL ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One-Piece, Cast Brass Escutcheons: Polished chrome plated finish with set screws.

C. One-Piece, Deep Pattern Escutcheons: Deep drawn, box shaped brass with chrome plated finish.

D. One-Piece, Stamped Steel Escutcheons: Chrome plated finish with set screw or spring clips.

E. Split Casting, Cast Brass Escutcheons: Polished chrome plated finish with concealed hinge and set screw.

F. Split Plate, Stamped Steel Escutcheons: Chrome plated finish with concealed hinge, set screw or spring clips.

2.14 SLEEVES

A. Cast Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Galvanized Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.

2.15 GROUT

A. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic cement grout.

B. Characteristics: Nonshrink, and recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.16 PIPE HANGERS AND SUPPORTS

A. Reference manufacturer's requirements.

B. Provide in accordance with referenced standards.

C. All pipe, fittings, hangers and supports shall meet the seismic requirements as referenced in this standard under Part 1, Seismic Performance.

1. C-clamps shall have a restraining strap when used for supporting dead loads. Lock nuts not approved for restraint
2. C-type clamps (with or without restraining straps) shall not be used to attach braces to the building structure
3. Hanger rods less than 3/8 inch diameter are not permitted.

2.17 ACCESS DOORS

A. Furnish access doors for concealed valves, cleanouts, and to concealed parts of the plumbing system that require accessibility for proper operation, maintenance, and repair. Doors are not required for suspended acoustical ceilings with lift-out panels.

B. Access doors shall be of the proper size for respective concealed items, with minimum size exclusive of other requirements, 18" x 18". Access door shall be flush type, with No. 16 U.S. Standard Gauge Steel door and trim, concealed hinges and screwdriver operated stainless steel cam lock. Access door shall be shop painted with one coat of zinc chromate primer.

2.18 SPRINKLER SYSTEM IDENTIFICATION SIGNS

A. A coordinated system of piping and equipment identification shall be provided which includes the following:

1. Framed and plastic protective diagrammatic layout of all piping systems, identifying and locating piping, equipment, and valves.
2. Metal tag identified major valves, piping system components and equipment.
3. Metal identification plate at controlling alarm valve identifying system and area protected.
4. Service labeled piping.

B. Diagrams:

1. Chart listing of equipment shall be by designation number and shall show pertinent data. Diagrams shall be neat, mechanical drawings mounted in extruded aluminum frames, will 1/8 inch thick acrylic plastic protection.
2. Location shall be as directed by the Owner's Representative. Typical location shall be in the sprinkler riser room.
3. A minimum of one mounted chart and diagram, plus one extra copy of each, shall be provided for each fire protection system.

C. Metal Tags:

1. Valve identification shall be a minimum 6 inches wide by 2 inches high with enamel baked finish on minimum 18 gauge steel or .024 inch aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not limited to "MAIN DRAIN," "AUXILIARY DRAIN," "INSPECTOR'S TEST," "ALARM TEST," ALARM LINE," and similar wording as required to identify operational components.
2. Identify the overall system, such as "Double Interlock Preaction System" or "Wet Sprinkler System". Identification shall be a minimum 6 inches wide by 2 inches high with enamel baked finish on minimum 18 gauge steel or .024 inch aluminum with red letters on a white background or white letters on red background.
3. Risers shall be provided with a stamped metal tag containing the hydraulic design data.

D. Service Labeling:

1. Piping, including that concealed in accessible spaces, shall be labeled to designate service. Each label shall include an arrow or arrows to indicate flow direction. Labels or tag designation shall be as follows:

Service	Label or Tag Designation
Main sprinkler supply	MAIN SPRINKLER SUPPLY
Sprinkler riser number	SPRINKLER RISER NO.
Sprinkler Branch	SPRINKLER BRANCH
Standpipe	STANDPIPE

2. Piping shall be labeled and arrowed in accordance with the following:
   a. Each point of entry and exit through walls
   b. Each change of direction
   c. In congested or hidden areas, at each point required to clarify service or indicate hazard.
   d. In long straight runs, labels shall be located at a distance visible to each other, but in no case shall the distance between labels exceed 40 feet.
3. Label lettering shall be approximately 1-1/2 to 2 inches high based on outside pipe diameter. Labels shall be legible from the primary service and operating level.

4. Pipe Markers cylindrically coiled printed plastic sheets that snap around pipes with OD up to 5.875". Use flat strap-around markers are designed for pipes with OD of 6" to 10" and are fastened onto the pipes heavy duty nylon ties.
5. Labels shall have red letters on white background.

E. Label and valve tag schedule above shall not be construed as defining or limiting the work. All piping systems shall be labeled.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in “Quality Assurance” Article.

B. Report test results promptly and in writing.

3.2 WATER SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping.

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

3.3 SPRINKLER SCHEDULE

A. Use sprinkler types for the following applications:

1. Common areas with suspended ceiling – standard spray concealed with matching flat cover plate escutcheon.
2. Common areas without ceiling – standard spray upright
3. Computer Rooms – extended coverage recessed pendent (16’-0”x16’-0” maximum spacing) on return bends, white with matching escutcheon
4. Infrastructure Rooms - extended coverage upright
5. Storage Rooms – extended coverage upright

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

1. Concealed Sprinklers: Rough brass with custom factory-painted white cover plate, unless noted otherwise. Color to be selected by the Architect.
2. Recessed Sprinklers (Computer Room): White with matching white recessed escutcheon, intermediate temperature (200°F) rating.
3. Upright Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

3.4 PIPING INSTALLATION

A. General:

1. All equipment, distribution piping and fittings shall be installed in strict accordance with the manufacturer's requirements, NFPA 13 and approved piping standards and guidelines.
2. All distribution piping shall be installed by qualified individuals using good, accepted practices and quality workmanship procedures.
3. All piping shall be adequately supported and anchored at all directional changes.
4. All piping shall be reamed, blown clear and swabbed with suitable solvents to remove burrs, mill varnish and cutting oils before assembly.
5. All male pipe threads shall be sealed with Teflon tape pipe sealant applied in accordance with the manufacturer's requirements and good piping practices.

6. All piping shall be positively sloped to the riser or low point drain as indicated on the drawings.
7. Each zone shall consist of a completely separate riser (after main entry inside sprinkler riser room) with separate automatic sprinkler valve and trim.
8. Piping serving each zone shall be completely independent of the other zones.
9. No piping shall pass above “other sprinkler zones” unless specifically indicated on the drawings.

B. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Slope piping and arrange systems to drain at low points.

C. Install exposed sprinkler system mains and branch lines as high as possible.

D. Install sleeves for piping penetrations of walls, ceilings, and floors.

E. Install escutcheons for piping penetrations of walls, ceilings, and floors.

F. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13 for hanger materials.

G. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.

H. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval, revised piping plans and hydraulic calculations with Architect before deviating from approved working plans.

I. Install capped or plugged tee outlet connections on Shell space branch lines as indicated on plans for future sprinkler installation with suite build out.

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

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

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

M. Install unions adjacent to each valve in pipes NPS 2 and smaller.

N. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

O. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13. Inspector’s test discharge shall be piped to the exterior.

P. Install sprinkler piping with drains for complete system drainage. Main drains shall be piped to the exterior.

Q. Drain preaction sprinkler piping systems.

R. Pressurize and check preaction sprinkler system piping, air pressure maintenance devices and air compressors.

3.5 PIPING SCHEDULE

A. Wet Pipe Sprinkler Systems:

1. Standard pressure, wet pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
   a. Schedule 40, black steel pipe with threaded ends; uncoated, gray iron threaded fittings; and threaded joints.
2. Standard pressure, wet pipe sprinkler system, NPS 2-1/2 to NPS 8, shall be one of the following:
   a. Schedule 40, black steel pipe with threaded ends; uncoated, gray iron threaded fittings; and threaded joints.
   b. Schedule 40, black steel pipe with roll grooved ends; uncoated, grooved end fittings for steel piping; grooved end pipe couplings for steel piping; and grooved joints.

B. Preaction Sprinkler System using Nitrogen:

1. Standard pressure, NPS 8 and smaller, shall be the following:
   a. Schedule 40, black steel piping with threaded ends. Uncoated gray iron threaded or welded fittings and joints.
   b. Schedule 40, black steel pipe with roll grooved ends; uncoated, grooved end fittings for steel piping; grooved end pipe couplings for steel piping; and grooved joints.

3.6 JOINT CONSTRUCTION

A. Refer to Pipe Schedule for applicable piping and joining methods for each system type.

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

C. Install unions adjacent to each valve in pipes NPS 2 and smaller.

D. Install reducing fittings for reduction in pipe sizes. Avoid the use of bushings.

E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

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

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

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

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

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

J. Steel Piping, Roll Grooved Joints: Roll rounded edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved end fittings according to AWWA C606 for steel pipe grooved joints.

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

3.7 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire protection shutoff valves supervised open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain line connection.
3. Preaction and Dry Pipe Valves: Install in vertical position, in proper direction of flow, and in main supply to sprinkler system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment
    a. Install air compressor and compressed air supply piping.
    b. Air Pressure Maintenance Device: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.

3.8 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings centered in 24”x24” suspended ceiling tiles or centered in the quarter points of 24”x48” suspended ceiling tiles, unless indicated otherwise. Refer to drawings for details.

B. Install upright sprinklers on 1” outlets (to be converted to pendent mounted sprinklers in the future).

C. Where required install sprinklers above and below duct work as defined in NFPA 13

D. Upright and pendent sprinklers shall be installed as to avoid obstructions of the spray pattern and if required install additional sprinklers based on the obstructions as defined in NFPA 13.

3.9 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls and ceilings.

B. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Bare Piping at Wall Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece or split casting, cast brass with polished chrome-plated finish.
4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome plated finish.
5. Bare Piping in Equipment Rooms: One piece, stamped steel with set screw or spring clips.

3.10 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in partitions, roofs, and walls.

B. Sleeves are not required for core drilled holes.

C. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.

D. Install sleeves in new partitions and walls as they are built.

E. For interior wall penetrations, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section “Joint Sealants.”

F. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section “Joint Sealants.”

G. Seal space outside of sleeves in concrete slabs and walls with grout.

H. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe unless otherwise indicated.

I. Install sleeve materials according to the following applications:

1. Sleeves for Piping Passing through Concrete Floor Slabs:
   a. Galvanized-steel pipe
2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe.
   a. Extend sleeves 2 inches above finished floor level.
   b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements for flashing in Division 1.
3. Sleeves for Piping Passing through Gypsum Board Partitions:
   a. Galvanized steel pipe sleeves for pipes smaller than NPS 6.
   b. Galvanized steel sheet sleeves for pipes NPS 6 and larger.
4. Sleeves for Piping Passing through Exterior Concrete Walls:
   a. Galvanized steel pipe sleeves for pipes smaller than NPS 6.
   b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
   c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe when sleeve seals are used.
5. Sleeves for Piping Passing through Interior Concrete Walls:
   a. Galvanized steel pipe sleeves for pipes smaller than NPS 6.
   b. Galvanized steel sheet sleeves for pipes NPS 6 and larger.

J. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section “Penetration Firestopping” for firestop materials and installations.

3.11 SLEEVE SEAL INSTALLATION

A. Install sleeve seals in sleeves in exterior concrete walls at water service piping entries into building.

B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.12 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section “Identification for Electrical Systems.”

3.13 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Final Acceptance Test shall begin only when the Preliminary Test Report has been approved.
2. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Flush, test, and inspect sprinkler systems according to NFPA 13, “Systems Acceptance” Chapter.
5. Above ground piping shall be hydrostatically tested in accordance with NFPA 13. A two hour hydrostatic test is required at not less than 200 psi, but at least 50 psi above the maximum expected static pressure, with no pressure loss.
6. As specified in NFPA 13, an air pressure leakage test at 50 psi shall be conducted for 24 hours on dry and preaction systems. There shall be no drop in pressure in excess of 1.5 psi for 24 hours. The air pressure test is in addition to the required hydrostatic test.
7. Energize circuits to electrical equipment and devices.
8. Start and run air compressors.
9. Coordinate with fire-alarm tests. Operate as required. The detection and control system shall be subjected to functional and operational performance tests including test of each installed initiating device, system actuation device and notification device.
10. Each water control valve shall be independently trip-tested in accordance with the manufacture’s published instructions.
11. As-Built Drawings and previous test results shall be available at the time of testing.

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

D. Prepare test and inspection reports.

E. Upon acceptance by the Architect / Engineer and the Owner’s Representative, the completed system(s) shall be placed into service.

3.14 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.15 DEMONSTRATION TRAINING & INTEGRATED TESTING

A. Train Owner’s maintenance personnel to adjust, operate, and maintain specialty valves.

B. Include sufficient man-hours to assist in the Owner’s Level 5 Integrated Systems Testing.

END OF SECTION