SECTION 211000 - FIRE PROTECTION PIPING, HEADS AND SPECIALTIES

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, Section 210500 - Basic Fire Protection Materials and Methods, and other Sections in Division 21 specified herein.

1.2 DEFINITIONS

A. Pipe sizes used in this Section are nominal pipe size (NPS) specified in inches.

B. Working plans as used in this Section refer to documents (including drawings and calculations) prepared pursuant to requirements in NFPA-13 for obtaining approval of AHJ (Authority Having Jurisdiction).

C. NICET - National Institute for Certification in Engineering Technologies.

D. Other definitions for fire protection systems are included in referenced NFPA Standards.

E. FM – Factory Mutual Global insurance company

1.3 DESCRIPTION OF WORK

A. The work includes designing, providing and installing a complete and fully operable automatic sprinkler system as described in this Section of the Specification and as shown on the contract construction drawings and shall be in accordance with rules, regulations and standards as required by the authorities having jurisdiction.

1. State.
2. City.
3. Building Department.
4. Fire Prevention Division, Fire Marshal’s Office.
5. Factory Mutual Global insurance if declared by Owner.

B. Work includes but is not limited to the following:

1. Automatic Wet Type Sprinkler System.
2. Standpipes.
3. Piping
4. Sprinkler heads.
5. Remodeling of existing systems.
6. All cutting and patching.
7. Provide all pipe, fittings, sprinklers, valves, signs, flow switches, tamper switches, protective painting, test connections, drains and tests necessary to make the entire system complete and operative.

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8. Coordinate with plumbing contractor for capacity of all sprinkler main, test, and auxiliary drain connections.
9. Valve tags and instruction plates shall be mounted and/or hung per local fire department requirements.
10. All required fire extinguishers.
11. All sleeves and inserts.
12. Drain riser, minimum 3” diameter, shall be provided adjacent to each standpipe riser for testing and draining.
13. Provide hose valve with cap downstream of sprinkler system pressure reducing valves for the purpose of testing. Hose valve shall be sized to provide full flow through pressure reducing valve.
14. All trenching and backfilling, including culverts under rails and guard posts where required.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Division 09: Finishes of exposed materials.

B. Section 210500: Basic Materials and Methods.

C. Section 210548: Vibration Isolation for Fire Protection Equipment.

D. Section 210549: Seismic Restraint for Fire Protection Piping and Equipment.

E. Section 211316: Dry-Pipe Sprinkler Systems.

F. Section 213100: Fire Pumps.

G. Division 22: Coordination with Plumbing design for location and sizes of indirect sanitary sewage drainage termination, floor sinks and/or hub drains. Fire protection designer shall provide required locations of drain locations prior to installation of plumbing work.

H. Division 26: Electrical. Coordinate for electrical wiring of detectors, flow alarm switches, tamper switches, connection to VESDA system, fire alarm bell, connection by life safety section for remote monitoring and starting of fire pump, and power to fire pumps. All electrical devices used for this system shall be compatible with the fire alarm system. Coordinate with electrical for electric fire pump motor size and emergency generator sizing.

1.5 DESIGN DESCRIPTION

A. This section of the specification combined with any of the contract drawings are intended as a guide to establish a basis of design for the systems required

B. Contractor shall examine the existing conditions, the Architectural, Interior Design, Structural, Mechanical, Plumbing, and Electrical drawings, layout and install a complete hydraulically sized sprinkler system for all areas. Access and maintenance space shall be provided for all valves and equipment to be used.

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1. System shall start 5'-0" from perimeter wall and extend throughout the building. Fire main beyond 5'-0" perimeter is provided under Division 02 work. System shall start at connection to utility main, with double detector check backflow prevention assembly, and extend throughout the building.
2. Contractor shall contact Owner’s insurance agency to incorporate insurer’s design requirements in this layout document. Factory Mutual may review layout drawings and calculations. Incorporate all of their design criteria into documents.

C. Office Areas: The main building shall be served with a wet type sprinkler system. A main riser shall be located in the stairwells with sprinkler zone valves on each floor.

D. All areas shall be sprinklered as the construction progresses, including accessible pipe chases, elevator hoistways, etc. Provide shutoff valve with tamper switch for elevator hoistways. Provide shutoff valve with tamper switch for elevator machine room. Comply with NFPA 13 and Building Code.

E. Base Building construction shall include upright heads with tees with 1” outlets for future drop in areas with no ceiling. Areas with ceilings, including finished core areas, lobbies, corridors or as noted herein shall have concealed or recessed pendant heads installed as part of the base building construction. Unfinished areas shall be provided with upright type heads. Heads will be relocated to the finished ceiling tile under the tenant improvement contract.

F. Install standpipe risers in each of the stairwells with fire department valves on each floor level. Provide allowance for 500 gpm at 100 psig at most remote fire department valves. Fire department valves not in stairwell shall be housed in cabinets. Provide roof manifold at top of each standpipe.

G. Pressure restricting devices shall be installed on any branch outlet exceeding 100 psi.

H. All electrical devices used for this system shall be compatible with the fire alarm system as referred in Division 26 work.

1.6 HYDRAULIC DESIGN

A. The following hydraulic design criteria are based on NFPA-13 requirements and parameters. When FM standards are required, contractor shall adjust flow densities, classifications, and design as required by FM Global.

B. System shall be a straight line or gridded system per NFPA-13 with the following exceptions:

1. For all systems the design area shall be the hydraulically most demanding rectangular area.
2. Minimum pressure for any sprinkler head shall not be less than 7 psi.
3. Velocity in fire pump suction piping shall not exceed 15 feet per second.

C. Fire Standpipes: Pipe schedule per IBC, Chapter 9 or hydraulically calculated at 500 GPM for first standpipe and 250 GPM for each additional standpipe.

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D. Total Combined Inside & Outside Hose Allowances: Hydraulic calculations shall include an allowance for hose streams, added at the point of connection to the water supply.

E. Safety Factor: 10 psi, or 10 percent of static and residual pressure, whichever is greater.

F. Sprinkler system Occupancy Hazard Classifications shall be approved by authorities having jurisdiction:

1. Air Distribution Plenums: Light Hazard (FM HC-1).
2. Automobile Parking Areas: Ordinary Hazard, Group 1 (FM HC-2).
3. Building Service Areas: Ordinary Hazard, Group 1 (FM HC-2).
4. Churches: Light Hazard (FM HC-1).
5. Corridors: Light Hazard (FM HC-1).
6. Dry Cleaners: Ordinary Hazard, Group 2 (FM HC-2).
7. Electrical Equipment Rooms: Ordinary Hazard, Group 1 (FM HC-2).
8. Fire Riser Room: Ordinary Hazard, Group 1 (FM HC-2).
9. General Storage Areas: Ordinary Hazard, Group 1 (FM HC-2).
10. Healthcare: Light Hazard (FM HC-1).
11. Kitchens (Non-Residential): Ordinary Hazard, Group 1 (FM HC-2).
12. Laundries: Ordinary Hazard, Group 1 (FM HC-2).
13. Libraries except Stack Areas: Light Hazard (FM HC-1).
14. Library Stack Areas: Ordinary Hazard, Group 2 (FM HC-2).
15. Loading Docks with Tractor Trailers: Ordinary Hazard, Group 2 (FM HC-3).
16. Machine Shops: Ordinary Hazard, Group 2 (FM HC-2).
17. MDF/IDF/Electronic Data Hall: Ordinary Hazard, Group 1 (FM HC-2).
18. Mechanical Equipment Rooms: Ordinary Hazard, Group 1 (FM HC-2).
19. Office and Public Areas: Light Hazard (FM HC-1).
20. Pump Room: Ordinary Hazard, Group 1 (FM HC-2).
21. Repair Garages: Ordinary Hazard, Group 2 (FM HC-3).
22. Residential Living Areas: Light Hazard (FM HC-1).
23. Restaurant Seating Areas: Light Hazard (FM HC-1).
24. Restaurant Service Areas: Ordinary Hazard, Group 1 (FM HC-2).

G. Minimum Density for Automatic-Sprinkler Piping Design shall comply with the following:

1. Light Hazard Areas: Water density of 0.10 GPM per square foot calculated for an area of 1500 square feet in the most remote location
2. Ordinary Group I Hazard Areas: Water density of 0.15 GPM per square foot calculated for an area of 1500 square feet in the most remote locations.
3. Ordinary Group II Hazard Areas: Water density of 0.20 GPM per square foot calculated for an area of 1500 square feet in the most remote locations.
4. Extra Group I Hazard Areas: Water density of 0.30 GPM per square foot calculated for an area of 2500 square feet in the most remote locations.
5. Extra Group II Hazard Areas: Water density of 0.40 GPM per square foot calculated for an area of 2500 square feet in the most remote locations.

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H. Head spacing shall not exceed the limits described in NFPA-13.

1. Light Hazard: 225 sq.ft. (for smooth ceiling).
2. Ordinary Hazard: 130 sq.ft.
3. Extra Hazard: 100 sq.ft.

I. Maximum floor areas protected by any one sprinkler system riser:

1. Light Hazard: 52,000 sq.ft.
2. Ordinary Hazard: 52,000 sq.ft.
3. Extra Hazard: 40,000 sq.ft.

J. Flow Data: Contractor is to verify flow data (static pressure, residual pressure and GPM flowing) available at site and provide design for available pressure and flow.

K. Other spacing requirements:

1. Maximum spacing between heads for Light Hazard and Ordinary Hazard shall not exceed 15 feet (4.6 m).
2. Maximum spacing between heads for Extra Hazard shall not exceed 12 feet (3.7 m).
3. The distance from sprinklers to walls shall not exceed 7.5 feet (2.3 m) for Light and Ordinary Hazard.
4. Sprinkler heads shall not be located closer than 4 inches (100 mm) from a wall.
5. Sprinklers shall not be spaced closer than 6 feet (1.8 m) on center.

1.7 QUALITY ASSURANCE

A. The Contractor for the fire protection installation shall be duly qualified Fire Protection Contractor, experienced and regularly engaged in the installation of fire protection systems with a license classification of C-16. Where local authorities require additional licensing of the Fire Protection Contractor, and/or workmen, such a license shall be mandatory for a prospective Contractor.

1. Contractor is to verify flow data (static pressure, residual pressure and GPM flowing) available at site and provide design for available pressure and flow.
2. The Fire Protection contractor shall be the Engineer of Record for the automatic sprinkler and standpipe system.
3. Permits - The Fire Protection Contractor shall obtain permits for the installation or construction as required for approval and installation of the fire protection system. The Fire Protection Contractor shall submit working plans to the authorities having jurisdiction to obtain approval.

B. Welding Standards:

1. Welding Qualifications:

a. Certification: Each welder shall have a current AWS QC7 welding certification with successful completion of written test and welding samples in compliance with AWS D1.1. The Owner’s Representative reserves the

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right to request sample coupon test welds of each welder to validate quality of welding work.

2. Welding Procedures:

   a. Steel Support Welding: All work shall be performed to meet or exceed the requirements of the American Welding Society AWS D1.1/D1.1M-Structural Welding Code-Steel.
   b. Pipe Welding: All work shall be performed to meet or exceed the requirements of the American Welding Society AWS B2.1 Specification for Welding Procedure and Performance Qualification and ASME Boiler & Pressure Vessel Code: Section IX “Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.”

1.8 SUBMITTALS

A. Product Data: Submit six copies of manufacturer’s technical data and installation instructions for fire protection materials and products.

1. Thirty days after the awarding of contract, contractor shall submit list of manufacturer’s names and model numbers for review and comment to Owner’s Representative. This list shall identify any prior approved substituted items contractor wishes to use. Do not submit technical data until list has been approved.
2. Prior to construction submit for review and comment items including but not be limited to the following:

   a. Coordinated layout drawings. Lettering shall be minimum 1/8" high.
   b. Sprinklers and escutcheons - designating area of use.
   c. Valves, valve boxes, flow switches, and tamper switches.
   d. Provide Fire Marshal approval numbers for flow switches and tamper switches.
   e. Pipe, fittings, sway bracing, inserts, anchors and hangers.
   f. Inspector’s test and drain station.
   g. Fire department connections.
   h. Hose valves, pressure relief valves, and pressure reducing valves
   i. Fire pumps with performance curve.

3. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

B. Working Plans: Prepare scaled working plans for fire protection pipe and fittings including, but not necessarily limited to, pipe and tube sizes, locations, and elevations and slopes of horizontal runs, wall and floor penetrations, and connections. Indicate interface between and spatial relationship to piping and adjacent equipment. Lettering shall be minimum 1/8” high.

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1. Spacing of fire sprinklers shall be coordinated with lights, air conditioning outlets, sound speakers, architectural reflected ceiling plan; obstruction from light fixtures and other architectural features; and sprinkler piping shall be coordinated with HVAC ductwork & piping, plumbing, electrical conduit, cable trays and structure prior to the installation. Drawings shall be composite type including mechanical, plumbing and lighting equipment with sprinkler and sprinkler drain piping.

C. Submittal Drawings: Submit shop drawings to Agency having jurisdiction for approval bearing engineer of record stamp bearing preparer's NICET stamp. Submit six approved copies, bearing stamp and/or signature of Authority Having Jurisdiction to the Owner's Representative for review and comment.

1. Contractor shall submit sprinkler head locations to architect for approval.
2. Each calculation shall include legible schematic of system showing all hydraulic reference points.

D. Hydraulic Calculations: Prepare hydraulic calculations of fire protection systems. Submit to Authority Having Jurisdiction for approval. Submit six approved copies, bearing stamp, and/or signature of Agency having jurisdiction to Owner's Representative for review and comment.

1. Contractor shall submit published piping friction loss data from manufacturer with hydraulic calculations.

E. Certificate of Installation: Submit certificate upon completion of fire protection piping work, which indicates that work has been tested in accordance with NFPA-13, and also that system is operational, complete, and has no defects.

F. Maintenance Data: Submit maintenance data and parts lists for fire protection materials and products. Include this data, product data, shop drawings, approval drawings, approval calculation, certificate of installation, and record drawings in maintenance manual; in accordance with requirements of the General Conditions and of Division 01.

G. Operating and Maintenance Instructions: Provide the Owner with three sets of operating and maintenance instructions covering completely the operation and maintenance of sprinkler equipment and controls. Manual shall be assembled in a 3-ring binder and arranged in following sections:

1. Site Utilities: Drawings showing location, size, depth of all connections, valve boxes, manholes, etc., as installed.
2. A chart tabulating all types of pipe fittings, valves, and piping specialties installed in each system.
3. A chart tabulating all pressures, valve settings for fire department and sprinkler pressure reducing valves. Provide pressure reducing valve flow test documentation.
4. Manufacturer's brochures of all sprinkler heads.
5. Manufacturer's brochures of fire pumps, jockey pump and controllers.
6. Tamper switches and flow switches.
7. Fire Department connections.

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8. Reproducible copies of approved working drawings prepared to facilitate the actual installation of ductwork and piping. Drawings shall indicate location of all concealed valves, and other apparatus.
9. Copy of NFPA-25 "Standard for Inspection, Testing and Maintenance of Water Based Fire Protection Systems."
10. Approval Calculations.
11. Certificate of Installation.
12. Guarantees.
13. The Contractor is responsible for proper instruction of Owner's personnel for operation and maintenance of all material, equipment and apparatus provided.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 01. Handle components carefully to prevent damage, denting, and scoring. Do not install damaged components. Damaged components shall be replaced with new components.

B. Store/protect products under provisions of Division 01. Store components in clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage.

1.10 WARRANTY

A. Provide minimum one-year warranty from date of Substantial Completion, including all parts, material, labor and travel.

B. Refer to Section 210500 for additional warranty and Substantial Completion requirements.

C. Contractor and Manufacturer warrant that, for a period of ten (10) years from the date of Substantial Completion, the entire system, including but not limited to the fittings and joints, will conform to the requirements of the Contract Documents, will be free from defects, and will not leak.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install all new material, equipment, and apparatus hereinafter specified unless specifically noted otherwise. All products to be commercial grade, new and of the manufacturer's latest design model. All material, equipment, and apparatus shall be identified by the manufacturer's name, nameplate, and pertinent data.

1. All pipe, pipe fittings and valves shall be manufactured in North America, or may be import products where manufacturers are specifically identified below. Alternatives may be acceptable, but must be submitted and approved by the Owner’s Representative prior to bidding.

OR

2. Upon request, the Owner’s Representative shall be furnished certification by the manufacturer, stating samples representing each lot have been tested and

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inspected as indicated in governing ASTM specifications have been met. Certification shall be accompanied by test reports as prepared in accordance with relevant ASTM sections governing Test Methods and Inspection. Tension Tests reports shall include breaking load, machined diameter of the test bars, and calculated tensile strength. Certification shall include the legal name and address of the manufacturer.

B. All products to be UL listed and/or FM approved, except for items, which are not required to be listed by code.

C. All products shall be delivered and stored in original containers. Containers shall be clearly marked or stamped with manufacturer's name and rating.

D. The following items to be included but specified under Section 210500: Basic Fire Protection Materials and Methods.

1. Hangers and supports.
2. Escutcheons plates, flashings and sleeves.
3. Access panel and doors.
4. Identification markers and signs.
5. Expansion compensators and flexible connectors.
6. Anchors, and seismic restraints.
7. Excavation and backfill.

2.2 SPRINKLER HEADS - GENERAL

A. Sprinkler heads shall be regular automatic closed-type heads of ordinary degree temperature rating except that sprinkler heads installed near the heating equipment or in special occupancy areas shall be of the temperature rating as described in NFPA-13.

B. Provide quick response heads in all new light hazard occupancies.

C. For existing sprinkler systems, provide sprinkler heads with response type to match existing type unless otherwise noted.

D. Provide corrosion-resistant sprinkler heads where they are exposed to weather, moisture or corrosive vapors.

E. The Contractor shall furnish spare heads. The heads shall be packed in a suitable container and shall be representative of, and in proportion to, the number of each type and temperature rating head installed. In addition to the spare heads, the contractor shall furnish not less than two special sprinkler head wrenches. Refer to NFPA-13 section; "Stock of Spare Heads".

F. Provide escutcheon and minimum 1/4” clearance around penetrations through suspended ceilings per ASCE requirements.

G. Sprinkler heads installed shall be upright or pendent, as conditions require, and shall be of the following type and finish for the areas designated. Unless otherwise specified, sprinklers shall be small frame type, center bulb capsule for finished areas,

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fusible link for unfinished areas, and 1/2" orifice. Extended coverage heads not allowed in unfinished areas except garages.

H. Sprinkler heads shall have a standard or large orifice K-Factor of 5.6 or 8.0. Sprinkler heads shall be UL Listed and FM Approved.

I. Manufacturers: Viking, Tyco, Anvil, Reliable, Globe, Victaulic, Venus or equal. Viking models shown as basis of design.

J. Sprinkler head requirements for each area as follows:

BUILDING AREA	SPRINKLER HEAD STYLE	SPRINKLER HEAD FINISH	ESCUTCHEON FINISH	TEMPERATURE RATING (°F)
Unfinished Space, Exposed Ceiling Retail, Exposed Ceiling Office, Parking Structure, Mechanical Rooms	Upright/Pendant	Brass	None	155°F
Electrical, Switchgear, IDF/MDF, Telephone Equipment, and Computer Equipment Rooms without finished ceilings.	Upright	Brass	None	286°F
Finished Ceilings	Semi-recessed Pendant	White	White	155°F
Finished Ceilings in Conference Rooms and Lobbies	Concealed Pendant	Brass	White Cover Plate	155°F
Soffit & Sidewall	Flush Sidewall	White	White	155°F
Exterior Balconies & Overhangs	Dry Sidewall	Brass	Chrome	175°F
Grease Exhaust Duct	Standard Pendant	Electroless Nickel PTFE (ENT)	None	360°F

K. Quick response sprinkler heads for dry systems, preaction systems and areas subject to freezing:

1. Upright in exposed areas: Viking #VK184 (K Factor: 5.6)
2. Pendent in exposed areas with no ceilings. Viking #VK186 (K Factor: 5.6)
3. Pendent in exposed areas with ceilings. Viking #VK196 (K Factor: 5.6)
4. Sidewall: Viking #VK188 (K Factor: 5.6), #VK284 or #VK288 or #VK292 (K Factor: 8.0)

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5. Sidewall for extra hazard Standard Coverage Viking #VK2923 (K Factor: 5.6)
6. Standard Coverage Pendent in exposed area with ceiling Standard Coverage Flush Pendent Viking #VK482 (K Factor: 5.6)

2.3 PIPE AND FITTINGS - ABOVE GROUND

A. General: The piping products listed below by manufacturer's name and model numbers are the only acceptable materials listed for this project. Substitutions of pipe must be submitted and approved in writing by the Owner's Representative prior to bid.

B. Piping and fittings shall be new and clean prior to installation. Piping or fittings that show substantial rust or breaks in coating will be removed and replaced.

C. Steel Pipe and Fittings for wet systems:

1. All steel pipe material shall be corrosion-resistant with a black enamel coating or other corrosion-resistant coating with a corrosion resistance ratio (CRR) of 1 or more.
2. Schedule 40, Standard Weight, Black-Steel Pipe: ASTM A53/A53M. Pipe ends may be factory or field formed to match joining method.
3. Schedule 30, Black-Steel Pipe: ASTM A135/A135M; ASTM A795/A795M, or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30. Pipe ends may be factory or field formed to match joining method.
4. Thinwall Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
5. Schedule 10, Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, Schedule 10 for sizes NPS 5 (DN 125) and smaller; and NFPA-13 specified wall thickness for sizes NPS 6 to NPS 10 (DN 150 to DN 250), plain end.
6. Stainless Steel Pipe, Schedule 10S or 40S: Manufactured and installed per ASTM A312/312M.
7. Black-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.
8. Uncoated-Steel Couplings: ASTM A865/A865M, threaded.
9. Malleable Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
10. Cast Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
11. Malleable- or Ductile-Iron Unions: UL 860.
12. Cast-Iron Flanges: ASME 16.1, Class 125.
13. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
    a. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.
    b. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
    c. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

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d. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
e. Mechanical type flange fittings or joint restraint systems are not acceptable.

14. Steel Welded Fittings: Comply with ASTM A234/A234M, ASME B16.9, ASME B16.25, and ASME B16.11.

a. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
b. Shop fabricated Bonney Forge “Weldolet” or “Thredolet” type fittings may be used in lieu of tee fittings, but field (site) welding will not be permitted.

15. Grooved-Joint, Steel-Pipe Appurtenances:

a. Pressure Rating: 175-psig (1200-kPA) minimum, and as required by the design.
b. Painted or Uncoated Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
c. 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.
d. Grooved joint couplings shall consist of two ASTM A 536 ductile iron housings, pressure-responsive, synthetic rubber gasket, and plated steel bolts and nuts.

1) Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. Tongue and recess rigid type couplings shall only be permitted if the contractor uses a torque wrench for installation. Required torque shall be in accordance with the manufacturer’s latest recommendations.

e. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig (1200-kPa) pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.
f. Use rigid type couplings where installation flexibility is not required.
g. Mechanical Couplings: Victaulic grooved couplings style 07, 75 or 77, or equal by Gruvlok.
h. Mechanical Bolted Branch Outlet: Victaulic style 920, or equal by Gruvlok. U-bolt mechanical tees are not acceptable. (Note to Editor: Vic 920 are acceptable per UL and FM, however, these are more susceptible to leakage for long term buildings that Glumac designs. This fitting uses a solid steel body to match the pipe diameter without the use of U-bolts. Refer to exclusions below if you have a job where you want to allow 920 type fitting, but generally we do not recommend using friction type clamps and prefer grooved, threaded, welded type fittings.)

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D. Copper Tube and Fittings for wet systems

1. Solder or brazed joints are NOT allowed for any copper tubing or piping systems
2. Mechanical pressed or grooved type joints shall be used for copper tubing and piping joints and fittings.
3. Seamless copper tube, pipe sizes up to 8":

    a. ASTM B88, Type K or L, hard temper. Type M is not allowed.
    b. Manufacturers: Mueller Streamline, Cerro Flow Products, or equal.

4. Mechanical Grooved Couplings and Fittings:

    a. Standard: UL 213
    b. Grooved-End Copper Fittings: ASTM B76 copper tube or ASTM B584 bronze castings.
    c. Manufacturers: Victaulic, Anvil, or equal.

5. Mechanical Pressure-Seal-Joint Couplings and Fittings:

    a. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
    b. Minimum 200 psig working pressure.
    c. Manufacturer: Viega or equal.

E. Dry Standpipe, Dry Sprinkler and Preaction Sprinkler Piping and Fittings:

1. All steel pipe material shall be corrosion-resistant with a black enamel coating or other corrosion-resistant coating with a corrosion resistance ratio (CRR) of 1 or more.
2. Schedule 40, Standard Weight Black-Steel Pipe: ASTM A53/A53M. Other pipe materials will not be accepted for these applications.
3. Pipe ends may be factory or field formed to match joining method.
4. Rolled groove fittings are not allowed in a dry or preaction sprinkler system per Factory Mutual.

F. Flexible sprinkler connector for ceiling adjustability, seismic accommodation, and ductwork sprinkler applications. Stainless steel flexible braided tubing, Factory Mutual approved, and compatible with FM and UL sprinkler heads. Rated working pressure to 175 psi. Hose lengths up to 72" maximum. Manufacturers: Flexhead (Anvil), Viking, Victaulic #VicFlex, or equal.

G. Dielectric Fittings:

1. Dielectric Waterways/Nipples:

    a. Provide standard products recommended by manufacturer for use in service indicated to effectively isolate steel, galvanized steel, and zinc plated steel from non-ferrous piping to prevent galvanic action and related corrosion.
    b. Comply with standard IAPMO PS 66.
    c. Electroplated steel waterway/nipple complying with ASTM F1545 or ASTM F492.

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d. Pressure Rating: 300 psig (2070 kPa) at 225°F (107°C).
e. End Connections: Male threaded or grooved.
f. Lining: Inert and noncorrosive, propylene.
g. Manufacturers: Mifab #MI-DE Series, Victaulic #Series 647, or equal.

2. Dielectric Flanges:

a. Provide standard products recommended by manufacturer for use in service indicated to effectively isolate steel, galvanized steel, and zinc plated steel from non-ferrous piping to prevent galvanic action and related corrosion.
b. Comply with standard ASSE 1079.
c. Factory-fabricated, bolted, companion-flange assembly.
d. Pressure Rating: 125 psig (860 kPa) minimum at 180°F (82°C).
e. End Connections: Solder or brazed joint copper alloy and threaded ferrous; or threaded solder-joint copper alloy and threaded ferrous.
f. Dielectric-Flange Insulating Kits:
g. Nonconducting materials for field assembly of companion flanges.

1) Gasket: Neoprene or phenolic.
2) Bolt Sleeves: Phenolic or polyethylene.
3) Washers: Phenolic with steel backing washers.

h. Manufacturers: Watts #LF3100 Series or equal.

H. Piping and Fittings – Not Allowed:

1. Galvanized steel piping is not allowed due to corrosion potential. However, with pre-approval prior to bid, the use of galvanized steel in a dry or preaction system may be proposed when connected to a nitrogen source as a supervisory gas.
2. Copper pipe with soldered or brazed joints and fittings.
3. Pipe that is lighter gauge than Schedule 30 steel with threaded fittings is not allowed.
4. Schedule 5 piping and fittings are not allowed.
5. Threadable lightwall pipe is not allowed.
6. Mechanical “gripping teeth” type fittings are not allowed.
7. Mechanical “clamping” type tee fittings are not allowed.
8. Quick disconnect, boltless, snap-joint, field drilling or welding of any main or branch lines, and any device specifically prohibited by the local authority having jurisdiction is not allowed.
9. Unions are not allowed for any size pipe.
10. Plain end fittings are not allowed.

2.4 PIPE AND FITTINGS - UNDERGROUND

A. Ductile Iron Pipe and Fittings, Class 52 or better (outside of building envelope)

1. Ductile iron pipe, pressure class 350 psi, compliant with ANSI/AWWA C151/A21.51. Fittings compliant with ANSI/AWWA C110/A21.10.

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2. Mechanical or Tyton joint fittings. Rubber gasket shall comply with ANSI/AWWA C111/A21.11.
3. External pipe coating shall be asphaltic coating per ANSI/AWWA C151/A21.51 and ANSI/AWWA C110/A21.10 for fittings. Or, field wrapped with double layers of 2" wide, 20 mil vinyl tape, with 50% overlap.
4. Interior pipe shall be cement-mortar lined in accordance with ANSI/AWWA C104/A21.14.
5. Piping shall be field wrapped in approved 8-mil polyethylene encasement per AWWA/ANSI C105/A21.5. Method A and B use polyethylene tubes and Method C uses polyethylene sheets.
6. Manufacturer: United States Pipe and Foundry, Pacific States Cast Iron Pipe Co., McWane Cast Iron Pipe Co., or equal.

B. Polyvinyl Chloride (PVC) Plastic Pipe (outside of building envelope):

1. Pipe and fittings: Pipe shall conform to AWWA C900 and shall be plain end or gasket bell-end, pressure Class 150 with cast-iron-pipe-equivalent OD. Fittings shall be gray-iron or ductile-iron conforming to AWWA C110, and shall have cement lining conforming to AWWA C104, standard thickness.
2. Joints and Jointing Material: Joints for pipe shall be push on joints as specified in ASTM D3139. Joints between pipe and metal fittings, valves, and other accessories shall be push on joints as specified in ASTM D3139 or shall be compression type joints / mechanical joints as respectively specified in ASTM D3139 and AWWA C111. Provide each joint connection with an elastomeric gasket suitable for bell or coupling or push-on joints with which it is to be used.
3. Transition from PVC to ductile iron pipe shall occur a minimum of 5 feet from building.

C. In-Building Riser:

1. Continuous pipe riser and elbow designed for use to connect site water supply line from outside the building to the water system inside the building to meet NFPA-13 and NFPA-24.
2. Pipe: 304 stainless steel compliant with ASTM A312 and rated for 200 psi working pressure. Sizes 4” to 10”. Minimum six (6) foot vertical riser and minimum six (6) foot horizontal leg.
3. Gasket: SBR, UL listed.
4. Grooved coupling: Ductile iron body with EPDM gasket.
5. Provide tie-rods and concrete thrust blocks as required in field.
6. External pipe coating shall be field wrapped with double layers of 2" wide, 20 mil vinyl tape, with 50% overlap. Piping shall be field wrapped in approved 8-mil polyethylene encasement per AWWA/ANSI C105/A21.5. Method A and B use polyethylene tubes and Method C uses polyethylene sheets.
7. Manufacturers: Zurn Wilkins #WBR, Ames Watts #IBR, or equal.

D. All underground piping for fire mains shall be installed, clamped, anchored, flushed and hydrostatically pressure tested according to the requirements of the authorities and/or

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Agencies Having Jurisdiction, and NFPA-13, NFPA-24 and Factory Mutual Handbook of Industrial Loss Prevention.

E. Anchor underground riser stub to nearest underground connection by means of rodding. Retaining glands with setscrews above grade are not allowed.

2.5 RODS AND CLAMPS

A. Socket clamps shall be stainless steel; four bolt type, equipped with stainless steel socket clamp washers and nuts. Manufacturers: Grinnell Fig. 595 and 594, Elcen Fig. 37 and 37X, or equal.

B. Rods shall be stainless steel, 3/4" diameter.

2.6 VALVING

A. 2" or Smaller:

1. Control Valve: OS&Y rising stem type gate or globe valve, bronze body, bonnet and disc, copper alloy stem, threaded ends, 175 psig WOG min. Provide with tamper switch.
2. Check Valve: Swing check type with bronze body, cap and disc, threaded ends, 175 psig WOG min.
3. Drip Valve: 3/4", cast brass automatic ball drip type, threaded ends, 175 psig WOG min.
4. Testing Valve: 1-1/4", test and drain, sight glass, 1/2" test orifice, lever operated, 300 psi WOG. Drain to mop sink or drain riser.
5. Main Drain Valve: 2", angle gate valve, bronze body, copper alloy stem, threaded ends, 175 psi WOG. Drain to mop sink or drain riser.
6. Manufacturer: Grinnell, Victaulic, Stockham, Milwaukee, Mueller, Nibco, United Brass Works, Kennedy, Elkart or AGF.

B. 2-1/2" or Larger:

1. Control Valve: Grooved butterfly valve with tamper switch, ductile iron body, aluminum bronze disc, stainless steel stem and EPDM Liner, 200 psig WOG min, Victaulic 700.
2. Control Valve: OS&Y rising stem type gate valve, cast iron body and bonnet, bronze stem, seat and disc, flanged ends, 175 psig WOG min. Provide with tamper switch.
3. Check Valve: Swing check type with cast iron body, bolted cap and disc, flanged or grooved ends, 175 psig WOG min.
4. Manufacturer: Grinnell, Victaulic, Stockham, Milwaukee, Mueller, Nibco, Kennedy, Elkart or AGF.

2.7 EXPANSION LOOPS

A. Flexible Expansion Joint/Seismic Connector for Steel Pipe: Stainless steel hose and braid, carbon steel 180° return, UL and FM approved, and grooved or welded end

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fittings. Maximum 4” movement in all directions. Provide steel supports to prevent sagging as required. Manufacturers: Metraflex #Fireloop MLUGFM series or equal.

2.8 WET SPRINKLER ALARM CHECK VALVE

A. Contractor shall provide, where required, a completely engineered horizontal wet alarm check valve, retarding chamber, and trim assembly. Viking #H-2, Star or Reliable.

2.9 UNDERGROUND WATER VALVE

A. Resilient seated gate, valve, non-rising stem, 2" square valve nut, ductile iron construction with epoxy coated surfaces, both interior and exterior, 250 psi, mechanical joint ends. Provide yard box and cover.

B. Manufactures: American Darling, Clow, Dresser, U.S. Pipe, or equal.

2.10 VALVE BOXES

A. Cast iron valve boxes for shutoff valves buried in ground shall be complete with bellbottoms, extension piece, top and cover. Boxes shall be suitable for the types of valves with which they are used. All valve boxes shall have a concrete collar flush with grade.

B. Lids shall have the applicable letters embossed upon the top surface. Tagging shall match existing lids.

C. Manufacturers: Tyler, ITT Grinnell, or equal.

2.11 PRESSURE REDUCING VALVES

A. Sprinkler System: Rough bronze body with red enameled hand wheel with integral check valve of the pressure reducing type. Outlet pressure shall not exceed 165 psig at maximum system pressures. Pressure settings to be field adjustable.

1. Manufacturers: Zurn #Z-3004

B. Fire Service: 150 class pressure rating, cast iron body with brass main valve trim, control system cast bronze with stainless steel trim

1. Manufacturers: Cla-Val #90-21UL or equal.

2.12 PRESSURE RELIEF VALVE

A. Provide 3/4" pressure relief valve on discharge side of Sprinkler system pressure reducing valve. Set to a maximum of 175 psi.

1. Manufacturers: Zurn #P1000A or equal.

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2.13 BACKFLOW PREVENTER

A. Provide listed backflow prevention device as required by local codes and ordinances. Backflow prevention devices installed in the vertical position shall be approved for that orientation.

B. Double check detector check valve assembly: Epoxy coated, ductile iron construction, 175 psig working pressure, complete with two spring loaded "Y" type check valves, "Y" strainer with hose bibb on suction side of assembly, two OS&Y gate valves, test cocks, bypass water meter and bypass doublecheck. Manufacturers: Ames Model 3001SS, Febco #856-DCDA, Watts #709-DCDA-OSY, Wilkins #950DA or equal

C. Reduced pressure backflow preventer: Ductile iron construction, 150 psig working pressure, complete with two spring loaded "Y" type check valves, "Y" strainer with hose bibb on suction side of assembly, one differential relief valve, two OS&Y gate valves and test cocks. Unit shall be tapped on both sides to accommodate installation of test cocks. Manufacturer: Febco #860 RPA, Wilkins #975DA, Watts #909-RPDA or equal.

D. Detector check valve assemblies: Ductile iron construction, 150 psig working pressure, complete with spring loaded check valve, two OS&Y gate valves and four test cocks. Manufacturer: Febco #800 or equal.

2.14 INTEGRAL INSPECTORS ALARM TEST AND SYSTEM DRAIN

A. Combination system alarm test module with drain and visible orifice insert/sight glass for testing system alarm:

1. Threaded or grooved inlet and outlet connections.
2. Bronze body.
3. Malleable iron hand wheel.
4. EPDM valve seats.
5. Maximum working pressure 300 psi.
6. Test port orifice sizes: K5.6 or K8.0.
7. FM listed.
8. 1/2” pressure relief valve, 175 psi rating.
9. Alarm test module manufacturer: Victaulic TestMaster II #Serie 720 or equal.
10. Pressure relief valve manufacturer: Watts Regulator #FP 53L or equal

B. Water pressure gauge, range 0-300, in 5 psig increments, brass case, 3-1/2" diameter (minimum), 1/4" NPT male pipe connection, UL listed. Locate pressure gage on riser per code. Manufacturer: Star Sprinkler, Ashcroft or equal.

C. Pressure gauge test valve, brass 1/4" screwed ends, 300 psig WOG. Manufacturer: United or equal.

D. All relief, main, auxiliary and equipment drain piping shall be routed separately to floor sink(s) or other approved locations. Coordinate with plumbing design for location of floor sinks or other approved drain locations.

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2.15 TAMPER SWITCHES

A. Switch shall be mounted so as not to interfere with normal operation of the valve and be adjusted to operate when handle of valve has traveled more than one-fifth the distance of its normal operating position. Electrical Contractor shall provide conduit from switch to fire alarm panel.

B. Housing shall be of aluminum, acid-treated, primed and finished in baked red enamel. Removal of housing shall cause switch to operate. Inside shall be single pole, double throw micro switch with connection for electrical conduit.

C. Install on all control valves.

D. Manufacturer: Potter-Electric, Notifier, Ellenco, Simplex, or equal.

2.16 WATER FLOW ALARM - VANE TYPE

A. Indicator shall be for either vertical or horizontal installation. Indicator shall not be installed in a fitting that changes direction of water flow and shall have a sensitivity setting to signal any flow of water that equals or exceeds the discharge from one sprinkler head. Provide retarding device to prevent false alarms from line surges.

B. Whenever a water flow alarm is installed in the piping system, an approved floor control valve shall be provided upstream of the alarm indicator. In addition, a drain is required downstream of the alarm indicator.

C. Each water flow alarm shall be wired to a Fire System. All wiring and conduits as required will be provided under Division 26. An alarm will automatically activate the local fire alarm system.

D. Manufacturer: Potter Electric Signal Company, Notifier, Simplex, or equal.

2.17 AUTOMATIC MAIN LINE AIR VENT

A. Automatic in-line air vent with enlarged air collection chamber.

B. Pressure Rating: 300 psig (2070 kPa) minimum.

C. Separation Chamber:

1. Carbon steel body with threaded fitting for cast bronze air scoop attachment.
2. Powder coated safety red color.
3. Inlet and outlet size to match sprinkler pipe line sizes with grooved ends.

D. Automatic Air Vent Valve:

1. Body Material: Forged brass body.
2. Components: Integrated ball valve, stainless steel strainer, purge valve with hose connection, threaded cap with lanyard, automatic air vent.
3. Inlet Size: 1-inch NPT.
4. Outlet Size: 3/4-inch NPT.

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5. Drainage Piping: Field provided 1/2 to 3/4 inch copper tubing for discharge of the automatic air vent valve and route to approved plumbing receptacle or to the exterior landscaping.

E. Manufacturer: AGF Manufacturing PURGEnVENT #7950ILV or equal.

2.18 MANUAL BRANCH LINE AIR VENT

A. Pressure Rating: 300 psig (2070 kPa) minimum.

B. Manual Air Vent Valve:

1. Body Material: Forged brass body.
2. Components: Integrated ball valve, stainless steel strainer, threaded cap with lanyard, polypropylene float.
3. Inlet Size: 1/2-inch NPT.
4. Outlet Size: 1/2-inch NPT.

C. Manufacturer: AGF Manufacturing PURGEnVENT #7910MAV or equal.

2.19 EXTERIOR ALARM

A. Electric bell, 8” or 10" diameter, UL listed, weatherproof backbox housing. Minimum dB ratings per UL Standard 464. Indoor or outdoor use from -40°F to 150°F (-40° to 66°C). 24 or 120 volt as required by fire alarm design. Manufacturer: Potter Electric Signal Company #PDC or PBA series, Notifier, Simplex, or equal.

B. Electric Horn: Weatherproof with backbox, indoor or outdoor use, horn and strobe, 120 VAC. Manufacturer: Potter Electric Signal Company, Notifier, Simplex, or equal.

2.20 FIRE HOSE CABINETS

A. Refer to Architectural and Mechanical Drawings for exact location and elevations.

B. Cabinets shall be recessed, semi-recessed, or surface mounted as indicated on Architectural Drawings. Cabinets shall be 20-gauge steel construction, 28" wide by 39" high by 8" deep overall dimensions with full glass door panel, identifying decal, and gray enamel factory prime finish. All components shall have a rough chrome finish. Provide with the following:

1. 1-1/2" stamped valve escutcheon.
2. 2-1/2" angle valve.
3. Baked enamel steel hose rack.
4. 1-1/2" brass rack nipple.
5. 1-1/2" x 100'-0" of single jacket polyethylene lined hose.
6. Cast brass couplings.
7. Fog nozzle.

C. Manufacturer: Croker, Larsen’s J & L or Potter-Roemer.

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2.21 FIRE DEPARTMENT VALVE CABINETS

A. Refer to Architectural and Mechanical drawings for exact location and elevation of each cabinet.

B. Cabinets shall be 18" x 18" inside box dimensions, recessed, 20-gauge steel with full glass door and 2-1/2" fire department valve with rough chrome finish. Cabinets shall have a factory prime finish.

C. Manufacturer: Crocker, Larsen's J & L or Potter-Roemer.

2.22 FIRE DEPARTMENT CONNECTIONS

A. Flush wall mounted unit or freestanding unit with individual clapper valves, plugs and chains, locations as indicated on drawings. Escutcheon plate to be lettered as follows; "AUTO SPRINKLER", "DRY STANDPIPE" or "AUTO SPRINKLER AND STANDPIPE". Unit shall be polished chrome or brass finish, mounted 36" above finished grade. Number of inlets required shall be in accordance with regulations of the Fire Marshal or local fire department.

2.23 FIRE DEPARTMENT HOSE VALVES

A. Fire Department Valves: 2-1/2" or 3" outlets as required by local fire department, brass construction female to male angle valve with cap and chain, rough chrome finish and mounted 48" above finished floor.

B. Pressure Reducing Fire Department Valves: 2-1/2" or 3" outlets as required by local fire department, tamper proof, automatic pressure reducing, all brass male to female angle, rated at 400 psig rough brass finish, mounted 48" above finished floor.

C. Manufacturer: Croker, Elkhart, Powhattan Brass, Potter-Roemer or Zurn.

2.24 ROOF MANIFOLD

A. 6" x 2-1/2" x 2-1/2" or 6" x 3" x 3" as required by local fire department, straight pattern cast brass roof manifold. Manufacturer: Croker or equal.

B. 6" x 2-1/2" x 2-1/2" or 6" x 3" x 3" as required by local fire department, 90-degree pattern cast brass roof manifold. Manufacturer: Croker or equal.

2.25 BYPASS METERS EQUIPPED WITH TOUCH READ REGISTER AND TOUCH PADS

A. All Double Check Detector Assemblies (DCDAs) and Reduced Pressure Detector Assemblies (RPDA's) installed on fire services must be equipped with a Water Bureau approved bypass meter and compatible touch-pad. The touch-pad must be accessible from the right-of-way.

B. Only 5/8" x 3/4" Neptune T-10 meters with PRO READ or AUTOREAD registers are to be used. Registers must read in cubic feet. Touch-pads must be compatible with these meters. Compatible touch-pads for the above meter are Neptune model #12081-000

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(wall mount application) and Neptune model 12223-150 (vault door application, requires 1-3/4” hole).

C. All wiring from the touch-pad to the bypass meter shall be insulated 1 pair solid 22 AWG copper wires secured so as not to interfere with the operation and maintenance of the backflow assembly. The wiring shall not encumber the vault opening or ladder. Where the touch-pad wire follows the path of other electrical wiring, shielded wire as described above shall be used. Splices shall be made with 3M Scotchlok moisture resistant connectors part number UR or UY or equivalent. All splices shall be accessible.

D. Touch-pad mounting options:

1. On an outside building wall, at a height between 1’ and 5’ above the floor or finished grade and within 50’ of the backflow assembly.
2. May be mounted on the vault door. The orientation should locate the touch-pad near the hinged portion of the door so as not to stress the wire between the touch-pad and meter when the door is fully opened.
3. May be installed in the concrete portion of the vault top, the touch-pad must be easily accessible for replacement.
4. If touch-pad wire must be run underground, the wire must be routed through PVC conduit from the meter to the touch-pad.
5. Touch-pads not installed in vault doors or on a building face shall be installed using the Brooks #07, 12” X 20” box with T&R lid.
6. The touch-pad must be rigidly mounted.

PART 3 - EXECUTION

3.1 GENERAL

A. This system to be installed by an experienced firm regularly engaged in the installation of automatic sprinkler system as specified by the requirements of the Specifications.

3.2 PERFORMANCE OF WORK

A. Examine areas and conditions under which materials are to be installed. Layout the system to suit the different types of construction and equipment as indicated on the drawings and in accordance with NFPA 13, 14, 20 and 24.

B. Work to start immediately after authorization has been given to proceed so that the overall progress of the construction is not delayed.

C. Coordinate with other trades as necessary to properly interface components of the sprinkler system.

D. Follow manufacturer's directions and recommendations in all cases.

E. The omission from the drawings or Specifications of any details of construction, installation, materials, or essential specialties shall not relieve the Contractor from furnishing the same in place for a complete system.

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3.3 TEMPORARY FIRE PROTECTION

A. Provide all temporary valving, piping, Siamese connections and other components as directed by the fire agency office during all phases of construction.

3.4 INSTALLATION-GENERAL

A. Fire protection system shall be installed in accordance with the approved Drawings. The finished ceiling is not to be erected until all fire protection piping has been installed, tested, and inspected. Sprinkler heads located in the electrical equipment, elevator machine, or similar rooms shall be furnished with deflectors to prevent water spray on equipment.

B. Underground piping shall be permitted to extend into the building through the slab or wall no more than 24 inches (600 mm). In locations where freezing is not a factor, the depth of cover shall not be less than 30 inches (750 mm) below grade to prevent mechanical damage. In addition, in freezing environments shall be buried not less than 12 inches (300 mm) below the frost line for the locality. Pipe joints shall not be located under building foundation. Piping shall be installed a minimum of 12 inches (300 mm) below the bottom of building foundation or footers.

C. Before connection to the overhead piping, all underground piping shall be flushed with water flowing at velocity and quantity required by the installation standards specified above in this Section of the Specifications.

D. The arrangement of all pipes shall conform to all architectural requirements and field conditions, shall be as straight and direct as possible, forming right angles or parallel lines with building walls and other pipes, and shall be neatly spaced. Offsets will be permitted only where required to permit the pipes to follow the walls. Standard fittings shall be used for offsets. All risers shall be erected plumb and true, shall be parallel with the walls and other pipes, and shall be neatly spaced. All work shall be coordinated with HVAC, Plumbing, Electrical and Structural work in order to avoid interference and unnecessary cutting of floors or walls. All underground or concealed work shall be inspected before the construction is closed up.

E. All sprinkler heads to be installed in ceilings throughout the scope of work building as listed in Part 2 sections. All areas without ceilings shall have rough brass upright or pendent heads.

F. Sprinkler heads in all finished areas are to be installed on a true axis line in both directions, with maximum deviation from the axis line of 1/2-inch plus or minus and shall be plus or minus 1" within center of tile. At the completion of the installation, if any heads are found to exceed the above-mentioned tolerance, they shall be removed and reinstalled.

G. No pipes or other apparatus shall be installed so as to interfere in any way with full swing of doors.

H. The arrangement, positions, and connections of pipes, drains, valves, etc., shall be as required by NFPA-13 for all areas requiring sprinklers. At all low points provide drains

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and provide drains or capped tees fittings at isolated low points in the piping system. However, the right is reserved by the Owner's Representative to change the location of any item to accommodate conditions, which may arise during progress of the work, without additional compensation for such changes provided that no additional heads are required prior to the installation of the work.

I. Where required, piping shall be installed concealed in building construction, or though steel beams, to obtain adequate head room.

J. All pipe throughout the job shall be reamed smooth before being installed. Pipe shall not be split, bent, flattened, or otherwise injured either before or during installation.

K. Provide protective pans under pipes passing over high voltage electrical bus duct or switchgear equipment. The pan shall be constructed of 22-gauge black iron with a 6-inch lip, the corners being welded to make the pans watertight. Each pan shall be given two coats of gray primer paint and shall be supported by pipe hangers. The pan shall drain clear of the bus duct or switchgear.

L. All pipe interiors shall be thoroughly cleaned of foreign matter before installation, and shall be kept clean during installation by plugging or other approved means. Piping shall be covered with waterproof plastic sheeting during storage. Piping that shows signs of rusting will be removed from job site and replaced.

M. Field Connections: Any modifications to system required by field conditions, physical equipment changes or compliance with code regulations shall be made promptly without cost to Owner.

N. Interference: No piping or sprinkler devices shall interfere with the operations of any door, window, or mechanical and/or electrical systems. No part of this system shall visibly installed in the physical parameter of any window.

O. Threaded Pipe: Threads shall be clean cut, standard and tapered. Threads shall be made up using flaked graphite and lubricating oil, piping compound or Teflon tape applied to the male threads only.

P. Grooved joint piping systems shall be installed in accordance with the manufacturer's guidelines and recommendations. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by the same manufacturer. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

Q. Keep all pipe and other openings closed to prevent entry of foreign matter. Cover all equipment and apparatus to protect against dirt, water, chemical or mechanical

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damage, before and during construction period. Restore to original condition all apparatus and equipment damaged prior to final acceptance, including restoration of damaged shop coats of paint.

R. Location of sprinkler piping is critical.

1. Where ceiling space is at a minimum under beams location of ductwork takes precedence, coordinate accordingly.
2. Include in base bid, multiple coordination meetings, as required with Owner's Representative for coordination of sprinkler pipe routing, at no additional cost to the Owner.
3. Coordinate beam and shear wall penetrations with Structural Engineer. Obtain written approval for all beam penetrations from Structural Engineer.

S. Elevator Pits and Hoistways: Sidewall spray sprinklers shall be installed at the bottom of each elevator hoistway no more than 2 feet (0.61 m) above the floor of the pit. Sprinkler heads shall be installed at the top of elevator hoistways. Sprinkler heads are not required for enclosed, non-combustible elevator shaft that do not contain combustible hydraulic fluids. Refer the NFPA-13 and Building Code for requirements.

T. Tracer wire shall be wrapped and taped to non-metallic underground piping at maximum 20-foot intervals.

3.5 INSTALLATION-MAIN DRAIN TEST CONNECTIONS

A. Provide and install all drain piping associated with fire protection systems as required by NFPA-13, Chapter 8. Minimum drain riser size shall be 2-1/2" diameter, or larger, as required by quantity of connections to riser.

B. Coordinate location of floor sinks and sizing with plumbing design prior to installation of fire protection or plumbing piping. Fire protection contractor will be responsible for any revisions to other trades due to lack of fire protection coordination.

C. Drain piping shall be provided and installed by fire protection installer. Drains shall discharge outside or to a drain connection capable of handling the flow of the drain. Where possible, the main sprinkler riser drain should discharge outside the building at a point free from the possibility of causing water damage.

D. Main drain test connections shall be provided at locations that will permit flow test of water supplies and connections.

E. Where drain connections for floor control valves are tied into a common drain riser, the drain riser shall be one pipe size larger downstream of each size drain connection typing into it.

F. Where exposed drain pipes terminate provide turned-down elbow and terminate with a minimum air gap of two times the drain pipe diameter.

G. Drain pipes shall be arranged to avoid exposing any of the water-filled portion of the sprinkler system to freezing conditions.

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H. Provisions should include vents at the top of drain riser including a check valve to allow air into the drain riser.

3.6 INSTALLATION-COMMERCIAL GREASE EXHAUST DUCTS

A. Standard pendant sprinkler heads shall be so located as to provide for the protection inside of exhaust ducts, hood exhaust duct collars, and hood exhaust plenum chambers. Sprinkler protection is not required where all cooking equipment is served by listed grease extractors.

B. Horizontal exhaust ducts shall have sprinkler heads located on 10 feet (3 m) centers beginning no more than 5 feet (1.5 m) from the duct entrance.

C. Where ducts do not exceed 75 feet (23 m) in length and the entire exhaust duct is protected in accordance with NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, sprinkler(s) or automatic spray nozzle(s) shall not be required.

3.7 WELDING

A. Conform to welding procedures per recommendations of American Welding Society.

3.8 EXCAVATION AND BACKFILL

A. Trench and excavation work shall be done in a neat workmanlike manner, of the depth required by the authorities and/or agencies having jurisdiction. Pipe crown shall not be less than 30 inches below the finished ground surface. After the pipe has been properly tested and inspected, trench shall be backfilled with sand, or an approved sandy material, to a depth of 6 inches above the pipe. Backfill material shall be consolidated by tamping or by saturating with water and vibrating. Subsequent backfill shall consist of the original excavated material, free of organic matter, placed in 6-inch layers and compacted layer by layer by means of power driven vibrators.

B. Replace to original condition all turf, plants, concrete, asphalt, or other improvements disturbed by trenching. In graded, unpaved areas, backfill trenches with crown 8 inches above the surrounding surface.

3.9 UNDERGROUND PIPE COATING:

A. All underground ferrous piping shall be covered with:

1. External pipe coating shall be asphaltic coating per ANSI/AWWA C151/A21.51 and ANSI/AWWA C110/A21.10 for fittings. Or, field wrapped with double layers of 2" wide, 20 mil vinyl tape, with 50% overlap. Manufacturer: 3M #Scotchrap Tape 51 or equal.
2. And, piping shall be field wrapped in approved 8-mil polyethylene encasement per AWWA/ANSI C105/A21.5. Method A and B use polyethylene tubes and Method C uses polyethylene sheets.

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3.10 THRUST BLOCKS

A. Provide thrust blocks at changes in pipe direction, changes in pipe sizes, dead-end stops and at valves.

B. Calculate area of undisturbed earth of thrust block based on actual soil conditions and water test pressure of 200 psi.

C. Concrete and reinforcing steel shall be as specified in Division 03 and 05. All concrete shall be Class A, unless specified otherwise.

D. Miscellaneous nuts and bolts shall be stainless steel.

3.11 SLEEVES AND FLASHINGS

A. Wherever pipes are exposed and pass through walls, floors, partitions or ceilings, they shall be fitted with chromium plated steel escutcheons held in place with setscrews. Care shall be taken to protect the escutcheons during the course of construction.

B. Penetrations through fire rated walls and floors shall be sealed with listed mastic of similar fire rating.

3.12 HANGERS, INSERTS, SUPPORTS, AND SWAY BRACING

A. Hangers and supports shall be installed per NFPA-13 sections on Hangers and Protection of Piping Against Damage Where Subject to Earthquake. Provide restraint from movement at end sprinkler on branch line per NFPA-13.

B. Bending of threaded hanger rod is not allowed. Powder driven anchor pins in concrete are not allowed.

C. Upgrade existing end sprinklers on branch line with new restraint from movement device.

3.13 EXPANSION LOOPS AT EXPANSION JOINTS

A. Provide flexible hose expansion loop(s) as indicated on the contract drawings or as required to accommodate any thermal expansion, contraction, building settlement, or seismic movement of the piping system.

B. Flexible hose expansion loops shall be manufactured complete with two parallel sections of corrugated metal house, compatible braid, 180 deg return bend, with inlet and outlet connections. Field fabricated loops shall not be acceptable.

C. Flexible loops shall be capable of movement in the ±X, ±Y, and ±Z planes to meet or exceed the limits identified in the structural design.

D. Flexible hose expansion loops shall impart no thrust loads to system support, anchors or building structure.

E. Provide pipe anchors and pipe alignment guides as indicated, and elsewhere as determined by installer to properly anchor piping in relationship to expansion loops.

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3.14 MANUAL AND AUTOMATIC AIR VENTING

A. Install manual and automatic air venting to remove trapped air every time system is filled and as required by NFPA-13 and local AHJ and as recommended by Factory Mutual guidelines. Air vents shall be installed at the high points in the piping system. The objective of venting is to reduce the amount of oxygen trapped in the system that will support corrosion and microbial activity.

B. Install an automatic in-line air vent at each high point in the system to allow air to be removed automatically from the metallic pipe system. Provide copper drainage tubing, minimum 1/2" diameter, on the discharge of the automatic air vent valve and route to approved plumbing receptacle or to the exterior landscaping.

C. Install manual in-line air vents at the end of each branch line, at the most remote point from the riser, and at the top of the supply risers to eliminate as much air as possible to minimize internal pipe corrosion.

3.15 SAFETY TESTING & VERIFICATION

A. Flush, test, and inspect sprinkler piping systems according to NFPA-13 Chapter "System Acceptance" and refer to Factory Mutual FMDS0201 for guidelines on corrosion in sprinkler systems.

1. Chemical cleaning or water treatment shall not be provided. The introduction of a treatment solution into the sprinkler piping network with dead-end pipe runs and pendent drops can result in a large variation of chemical concentrations which can accelerate corrosion and growth of microorganisms. Flushing of the system until water is clear and venting all air is the recommended method for maintaining sprinkler piping.

B. Provide NFPA-13 Contractor's Material & Test Certificate Form 85A for above ground piping and Form 85B for underground piping.

C. Provide manpower to test the function and performance of all Life Safety System components and devices per floor and per zone basis in accordance with the local requirements.

3.16 IDENTIFICATION

A. In addition to the requirements of Section 210500, provide engraved pipe markers every 20 feet, once in every room, and at each building level traversed, minimum. Text shall include riser and/or zone numbers to align with drawings and fire alarm panel.

B. Provide hydraulic design data nameplates (engraved text) on the riser of each sprinkler system in accordance with NFPA-13

C. Equipment such as valves, drains, etc., shall be provided with signs that identify type of equipment and service. The tag shall be securely fastened to the handle or spindle of the valve by a brass chain. Furnish four schedules of valves so tagged. There shall also be furnished four diagrammatic charts showing schematically the complete

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sprinkler system with major control valves and numbers thereof. One set of Schedules and charts shall be mounted in glazed frames located where directed.

3.17 AS-BUILT RECORD DRAWINGS AND CERTIFICATION

A. As-built Record Drawings are to be kept up-to-date and the Master Copy kept at the job site. Prior to final acceptance of work being approved, these drawings are to be turned over to the Owner's Representative for approval.

B. Written certification from the insuring agents, and authorities having jurisdiction that the tests were satisfactory.

C. After installation is complete and tests satisfactorily approved, deliver test certificates and approval by the local Fire Authorities and the insurance company to the Owner’s Representative. Final acceptance of sprinkler/standpipe system by Owner's Representative shall be contingent upon receipt of certificate and approval from authorities having jurisdiction and for the delivery of final Record Drawings.

3.18 INSPECTION, TESTING, AND MAINTENANCE

A. Where steel pipe is used in dry pipe and preaction systems, it shall be assumed that the water supplies and environmental conditions contribute to unusual corrosive properties.

B. A corrosion protection plan shall be developed to address steel piping corrosion in accordance with NFPA-13 and NFPA-25.

C. Sprinkler piping and fittings shall be inspected annually by the Owner’s Representative for signs of corrosion, leakage, and physical damage, in accordance with NFPA-25.

D. Inspection, testing, and maintenance activities shall be followed to determine that components are free of corrosion, foreign material, physical damage, tampering, or other conditions that adversely affect system operation.

E. An internal corrosion evaluation of system piping shall be conducted at intervals not to exceed five (5) years.

F. The evaluation shall include an internal inspection of the piping condition near the sprinkler riser and the opening of the flushing connection on a system main.

END OF SECTION 211000

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