SECTION 21 05 23
VALVES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.02 SUBMITTALS

A. Submit manufacturer's data in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.01 VALVES

A. General: Valves shall have the following requirements:

1. Working pressure stamped or cast on bodies.
2. Stem packing serviceable without removing valve from line.
3. UL listed and FM approved and labeled for intended fire protection service. Sprinkler systems 175 WWP; stamped/cast on body.

B. Acceptable Manufacturers:

1. Gate Valves: Kennedy, Mueller, Nibco, Stockham, Victaulic.
2. Butterfly/Ball Valves, Indicating Type: Grinnell, Kennedy, Milwaukee, Stockham, Victaulic.
3. Check Valves: Grinnell, Kennedy, Nibco, Stockham, Victaulic.
4. Wall and Post Indicator Valves: Grinnell, Kennedy, Mueller, Nibco, Stockham, Victaulic.

2.02 GATE VALVES

A. 2-1/2 in. and Larger: IBBM, resilient wedge disc, OS&Y, flanged ends, stems grooved for tamper switch, 200 WWP; Stockham Fig. G-610.

B. 2-1/2 in. and Larger: IBBM, solid wedge disc, OS&Y, flanged ends, stems grooved for tamper switch, 300 WWP; Stockham Fig. F-670.

C. 2-1/2 in and Larger: IBBM, solid wedge disc, OS&Y, grooved ends, stems grooved for tamper switch, 250 WWP; Victaulic Series 771.

D. 2 in. and Smaller: Bronze body and bonnet, OS&Y, threaded ends, solid wedge, 175 WWP; Stockham Fig. B-133.

2.03 BUTTERFLY/BALL VALVE

A. 2-1/2 in. and Larger: Butterfly style, ductile iron body, lug type, aluminum bronze disc, stainless steel trim, EPDM seat, bubbletight shutoff, suitable for dead end service, gear operator, provision for tamper switch, 200 WWP; Stockham #LD-72UF.

B. 2-1/2 in. and Larger: Butterfly style, ductile iron body, ductile iron disc coated with EPDM, bubbletight shutoff, suitable for dead end service, gear operator, provision for tamper switch, grooved ends, 300 WWP; Victaulic Series 705W.

C. 2 in. and Smaller: Bronze body, threaded ends; indicating gear operator, provision for tamper switch; Milwaukee "Butterball".

2.04 CHECK VALVES

A. 2-1/2 in. and Larger: IBBM, swing type, rubber faced disc, bolted flange cap, flanged ends; Stockham #G-940.

B. 2-1/2 in. and Larger: Ductile iron body, aluminum bronze or ductile iron disc coated with EPDM, stainless steel shaft and spring, grooved ends, 250 WWP; Victaulic Series 717.

C. Wafer Type, 2-1/2 in. and Larger: Cast iron body, aluminum-bronze disc plates, stainless steel hinge pin and spring, stainless steel bolts and fasteners, Buna-N seat for water temperatures up to 150°F at 200 psi; Stockham #WG-950.

D. 2 in. and Smaller: Bronze body, swing type, rubber faced, threaded ends; Grinnell #3315.

2.05 BACKFLOW PREVENTERS

A. Backflow preventer provided by Plumbing Contractor. Coordinate hydraulically calculated size and requirements with the Plumbing Contractor.

2.06 PRESSURE REDUCING VALVES

A. Ductile iron body construction, nylon reinforced diaphragm, nylon reinforced brass and stainless steel pilot valve, integral strainer, pressure relief valve, adjustable pressure range.

B. Valve shall be UL listed and FM approved.

C. Design Equipment: Tyco Model PRV-1.

D. Acceptable Manufacturers: Cla-Val, Tyco, Viking.

2.07 MISCELLANEOUS

A. Trim and Test Valves: Ball, plug, angle or globe type; bronze body; threaded ends; UL listed.

1. Ball Valves: Bronze two-piece body, full port, threaded ends, chrome plated ball, blowout proof stem, reinforced TFE seats, 300 psi working pressure, UL listed, FM approved; Nibco Model KT-585-70-UL.

B. Hose Thread Drain Valves:

1. Ball Valve: Bronze body, hardened chrome ball with hose thread end, cap and chain; Watts #B6001CC (sweat connection), Watts #B6000CC (threaded connection).

C. Wall Post Indicator Valves: Straight or angled two-way adjustable; surface or recessed post with hardware, stem, operating wheel; IBBM, flanged end, 200 WWP, resilient wedge disc, square operating nut non-rising stem gate valve; Stockham #G-950 post and #G-605 valve.

2.08 UNDERGROUND VALVES AND ACCESSORIES

A. Combined water service provided by Plumbing Contractor. Coordinate hydraulically calculated size and requirements with the Plumbing Contractor.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide all shutoff, check, drain and other type valves as required by Code as indicated and as required for proper system maintenance, isolation and safety.

B. Locate valves for easy access and provide separate support where necessary. Install valves with stems at or above the horizontal position. Install swing check valves in horizontal position with hinge pin level.

C. Provide hose thread drain valves at all low points to enable complete drainage of all portions of the system.

D. For underground valves: Valve boxes shall be placed vertically over each valve, and the top of the box adjusted to proper grade, and the valve and box immediately backfilled with crushed stone carefully tamped into place. Valves shall be checked for proper operation before installation and, unless otherwise instructed are to be left in the open position.

E. Install valves per respective listing/approval.

F. Use 250 WWP, FM approved anti-water hammer check valves at discharge and bypass of fire pumps, otherwise use swing type.

G. Use ball valves for auxiliary drains and inspector test valves on dry pipe and pre-action systems.

END OF SECTION

SECTION 21 05 33
HEAT TRACING FOR FIRE PROTECTION PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 00 and Division 01 Specification Sections, apply to this Section.

B. Comply with all requirements of IEEE 515.1 "Standard for the Testing, Design, Installation and Maintenance of Electrical Resistance Trace Heating for Commercial Applications".

1.02 WORK INCLUDED

A. Section includes plumbing trace heating for gutter and downspout deicing and flow maintenance in grease waste piping with the following trace heaters:

1. Self-regulating, parallel resistance.

1.03 SUBMITTAL

A. Product Data: For each type of product.

B. Operation and Maintenance Data: Specific for each system type.

PART 2 - PRODUCTS

2.01 SELF-REGULATING, PARALLEL-RESISTANCE TRACE HEATERS

A. Manufacturers: Chromalox, Raychem, Thermon.

B. Trace Heaters: Pair of parallel stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

C. Electrical Insulating Jacket: Flame-retardant polyolefin.

D. Capacities and Characteristics:

1. Freeze protection for fire protection systems:
   a. Setpoint: Below 45 deg. F.
2. Electrical Characteristics for Single-Circuit Connection:
   a. Volts: 120 or 277
   b. Phase: Single
   c. Hertz: 60.

3. Temperature of heating cable in direct contact with pipe shall not exceed 200 deg. F.

2.02 CONTROLS

A. Controls:

1. Ambient temperature sensing.
2. Minimum 24-hour battery carryover.
3. On-off-auto switch with indicating light.
4. Relays with contacts to indicate operational status, on or off.
5. NEMA 4X enclosure

2.03 ACCESSORIES

A. Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Section 210553 "Identification for Fire Protection Piping and Equipment."

C. Warning Tape: Continuously printed "Electric Traced"; vinyl, at least 3 mils (0.08 mm) thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, and Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces and substrates to receive trace heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with trace heaters are free of burrs and sharp protrusions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Install the following types of electric heating cable for the applications described:

1. Freeze Protection for Fire Suppression Piping: Self-regulating, parallel-resistance trace heater; pipe-mounted temperature sensor control.

3.03 INSTALLATION

A. Install trace heaters across expansion, construction, and control joints according to manufacturer's written instructions; use conduit and slack cable to allow movement without damage to cable.

B. Trace Heater Installation for Freeze Protection for Fire Suppression Piping:

1. Install trace heaters after piping has been tested and before insulation is installed.
2. Install insulation over piping with trace heaters according to Section 210700 "Insulation."
3. Install warning tape on piping insulation where piping is equipped with trace heaters.

C. Set field-adjustable switches and circuit-breaker trip ranges.

3.04 FIELD QUALITY CONTROL

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

1. Perform tests after trace heater installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
2. Test trace heaters for electrical continuity and insulation integrity before energizing.
3. Test trace heaters to verify rating and power input. Energize and measure voltage and current simultaneously.

B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted trace heaters.

C. Trace heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.05 PROTECTION

A. Protect installed trace heaters, including nonheating leads, from damage during construction.

B. Remove and replace damaged trace heaters.

END OF SECTION

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SECTION 210554
PAINTING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.02 SUBMITTALS

A. Product Data: Manufacturer's technical data sheets for each coating.
   1. Material analysis including vehicle type and percentage by weight and by volume of vehicle, resin, and pigment.
   2. Application instructions including mixing, surface preparation, compatible primers and topcoats, recommended wet and dry film thickness, recommended application methods.

1.03 GENERAL

A. All primers and paint used in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green building Council LEED Credits EQ 4.1 and EQ 4.2.

1.04 QUALITY ASSURANCE

A. Materials:
   1. All coating materials required by this section shall be provided by a single manufacturer, unless otherwise required or approved.
      a. Contractor: Firm with successful experience in painting work similar in scope of work of this project.
      b. Maintain throughout duration of the work a crew of painters who are fully qualified to satisfy requirements of the specifications.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Design Make:
   1. Sherwin Williams Company.

B. Acceptable Makes:
   1. Devoe & Raynolds Company
   2. The Glidden Company
   3. Benjamin Moore & Company
   4. PPG Industries, Inc./Pittsburgh Paints

5. Pratt & Lambert, Inc.
6. Sherwin Williams Company

2.02 PRODUCTS

A. Colors:
1. As selected by Owner.

B. Lead Content:
1. Not more than 0.06 percent lead by weight (calculated as lead metal) in the total nonvolatile content of the paint or the equivalent measure of the lead in the dried film.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that surfaces and conditions are ready for work in accordance with coating manufacturer's recommendations.

B. Prior to commencement of work, examine surfaces scheduled to be finished.

C. Report any unsatisfactory conditions in writing.

D. Do not apply coatings to unsatisfactory substrates.

E. Beginning painting work on an area will be deemed construed acceptance of surfaces in that area.

3.02 SCOPE

A. Fire protection components shall be painted by the Fire Protection Contractor.

B. All painting shall consist of one (1) prime coat and two (2) finish coats of non-lead oil base paint, unless otherwise indicated herein. Provide galvanized iron primer for all galvanized surfaces. All surfaces must be thoroughly cleaned before painting. See schedule for color code.

C. Paint all hangers, rods and any other bare iron work in all exposed areas.

D. Paint all exterior metal or iron including all piping, supporting metals, etc., unless furnished with a factory finish. This shall include galvanized steel. Paint with galvanized primer and finish with epoxy of color selected by Architect. Exterior metal painting shall include all exposed plumbing piping, fittings, valves, etc.

E. Paint bare metal and touch up damaged finish on all fire protection equipment. Use heat resistant paint on all hot surfaces.

F. Paint all insulated and bare piping exposed to view in all areas.

G. Paint all uninsulated water pump casings and piping connections.

H. All items installed after finished painting is completed and any damaged factory finish paint on equipment furnished under this contact must be touched up by Contractor responsible for same.

3.03 SURFACE PREPARATION

A. Apply coatings to surfaces that are clean and properly prepared in accordance with manufacturer's instructions and as herein specified. Remove dirt, dust, grease, oils and foreign matter. Prepare surface for proper texture necessary to optimum coating adhesion and intended finished appearance. Plan cleaning, preparation, and coating operations to avoid contamination of freshly coated surfaces.

B. Provide protection for non-removable items not called for coating. After application of coatings, install removed items. Use only skilled workmen for removal and replacement of such items.

C. Protect surfaces not called for coating. Clean, repair, or replace to the satisfaction of the Engineer/Owner's Representative any surfaces inadvertently spattered or coated.

D. Metal Work:

1. Remove all oil and grease with non-flammable solvent. Remove all rust with steel wool.
2. Patched Areas, Touch-up Areas. Clean and prepare all surfaces as required to provide a smooth, even substrate for proper application of finish.
3. Contractor must examine areas and conditions under which paint is to be applied and notify Engineer in writing of conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.

3.04 APPLICATION

A. General:

1. Apply coatings in accordance with coating manufacturer's instructions and using application method best suited for obtaining full, uniform coverage of surfaces to be coated.
2. Apply successive coats after adequate cure of the preceding coat and within the recommended recoating time.
3. Complete coatings shall be free of defects such as runs, sags, variations in color, lap or brush marks, holidays, and skips.

B. Remove coatings not in compliance with this specification, reclean and re-prepare surfaces as specified, and apply coatings to comply with the contract documents.

3.05 SCHEDULE OF COATINGS FOR METAL SURFACES

A. Porous Surface:

1. The coating shall be Tough-Coat as manufactured by VAC Systems Industries, Foster 40-10, 40-20, or 40-23 as manufactured by Foster Products Corporation, or approved equal. Coating shall meet NFPA Standard 90A and 90B and contain an anti-microbial agent.

B. Non-Porous Surface:

1. The paint shall be Porta-Sept as manufactured by Porter Paints, Inc., Foster 40-26 as manufactured by Foster Products Corporation or approved equal. Paint shall contain an EPA registered anti-microbial, Intercept, which inhibits the growth of bacteria, mold, mildew and fungi.

3.06 COLOR CODING

A. Pipe coloring shall conform to the following schedule:

Piping System	**Safety Color**
Air, Compressed	YELLOW
Fire Protection	RED

END OF SECTION

SECTION 21 08 00
COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Commissioning is a systematic process of verifying that all building systems perform interactively according to the Owner's operational needs, the design documents, manufacturer's recommendations, good engineering and workmanship practices. This is achieved by beginning in the design phase and documenting the Owner's requirements and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

B. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

1. Verify that applicable equipment and systems are installed according to the contract documents, manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
2. Verify and document proper performance of equipment and systems.
3. Verify that O&M documentation provided for the project is complete, accurate and represents the actual installed equipment.
4. Verify that the Owner's operating personnel are adequately trained.

C. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

D. Abbreviations: The following are common abbreviations used in the Specifications. Definitions are found in Article 1.2.

A/E - Architects and Design Engineers
CxA - Commissioning Authority
CC - Controls Representative
CTR - Contractors Technical Representative
Cx - Commissioning
Cx Plan - Commissioning Plan Document
FPC - Fire Protection Representative
FT - Functional Performance Test
GC - General Contractor
MC - Mechanical Representative
PFI - Pre-Functional Inspection
PM - Project Manager (of the Owner)

PC - Plumbing Representative

EC - Electrical Representative

TAB - Test and Balance Contractor

1.02 STANDARD AND CORE COMPLIANCE

A. Commissioning will be accomplished to comply with, and in accordance with the requirements of the following:

1. 2020 Energy Conservation Construction Code of New York State, Section C408 System Commissioning.

1.03 RESPONSIBILITIES

A. The responsibilities of various parties in the commissioning process are provided in this section. Additional specific responsibilities, when required, of the fire protection representative, mechanical representative, TAB, controls representative, plumbing representative and those of the electrical representative are described in their particular contract specifications and documents. It is noted that the commissioning responsibilities of the Owner's Project Manager, Architect, HVAC Mechanical and Electrical Designers/Engineers and Commissioning Authority are not provided for in this contract. That is, the Contractor is not responsible for providing their services, and those responsibilities are listed here only for clarification of the commissioning process.

B. All Parties:

1. Follow the Commissioning Plan.

2. Attend the commissioning scoping meeting and additional meetings as necessary.

C. Commissioning Authority (CxA):

1. The CxA is not responsible for design concept, design criteria, compliance with codes, design or construction scheduling, cost estimating, or construction management. The CxA may assist with problem solving non-conformance or deficiencies, but ultimately that responsibility resides with the GC and A/E. The primary role of the CxA is to develop and coordinate the execution of the Commissioning Plan, observe and document system performance. Specifically, that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractor will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied by the CxA.

2. Construction and Acceptance Phase:

a. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular

communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

b. Coordinate the commissioning work and, with the GC and CTRs, verify that commissioning activities are being scheduled into the master schedule.

c. Revise the Commissioning Plan as necessary.

d. Plan and conduct a commissioning scoping meeting.

e. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.

f. Before startup, gather and review the current control sequences and interlocks and work with installers and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.

g. Review equipment submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.

h. Write and distribute prefunctional inspections. The CxA will provide the GC and installers a list of the required submittals. The Contractor bears all costs associated with providing the requested submittals to the CxA without any additional cost to the Owner, CxA or others.

i. Develop prefunctional checklists for completion by Contractor.

j. Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.

k. Witness all or part of the fire protection piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify Owner's Project Manager of any deficiencies in results or procedures.

l. With necessary assistance and review from the Contractor and installers, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.

m. Confirm completion of prefunctional checklists by site observation and spot-checking.

n. Evaluate systems startup procedures by reviewing start-up reports and by selected site observation.

o. Analyze any functional performance trend logs and monitoring data to verify performance.

p. Maintain a master deficiency and resolution log and a separate testing record. Provide the GC, PM and installers with written progress reports and test results with recommended actions.

q. Review equipment warranties to verify that the Owner's responsibilities are clearly defined.

r. Oversee and approve the training of the Owner's operating personnel.

s. Compile and maintain a commissioning record and Systems Energy Manual.

t. Review the preparation of O&M manuals.

u. Provide a final commissioning report.

v. Return to the site at ten (10) months into the twelve (12) month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

w. Identify any warranty phase deficiencies and provide detailed documentation to the Contractor.

D. General Contractor (GC):

1. Construction and Acceptance Phase:

a. Include the cost of supporting commissioning in the contract price.

b. Attend a commissioning scoping meeting and other commissioning team meetings.

c. Furnish a copy of all construction documents, addenda, change orders and submittals and shop drawings related to commissioned equipment to the CxA. The CxA will forward a request to the GC for copies of the submittals that the CxA is required to review concurrently with the Engineer as required by the LEED guidelines. The Contractor bears all costs associated with providing the requested submittals to the CxA without any additional cost to the Owner, CxA or others.

d. Provide the requisite readiness notification to the CxA for equipment prefunctional inspections and functional testing utilizing forms provided by the CxA.

e. Participate in pre-functional inspections, startup and functional testing of all equipment, as directed by the CxA.

f. Review the functional performance test procedures submitted by the CxA, prior to testing, and provide comments.

g. Review commissioning progress and deficiency reports.

h. Coordinate the resolution of deficiencies identified by the CxA.

i. Document the completion and/or action taken for the resolution of deficiencies as directed by the CxA and described in the Cx Plan utilizing forms provided by the CxA.

j. Coordinate and perform the training of Owner personnel. Notify the CxA when training will be taking place.

k. Ensure that all installers execute their commissioning responsibilities according to the Contract Documents and schedule.

l. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

m. Ensure that installers correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

E. Installers (CTRs):

1. Construction and Acceptance Phase:

a. Attend all commissioning scoping meetings and other commissioning team meetings.

b. Provide the requisite readiness notification to the GC for equipment prefunctional inspections and functional testing.

c. Complete prefunctional checklists developed by the CxA.

d. Review the functional performance test procedures submitted by the CxA, prior to testing.

e. Review commissioning progress and deficiency reports.

f. Coordinate the resolution of deficiencies identified by the CxA.

g. Document the completion and/or action taken for the resolution of deficiencies as directed by the CxA and described in the Cx Plan.

h. Coordinate and perform the training of Owner personnel.

i. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

j. Ensure deficiencies are corrected and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

F. Equipment Suppliers:

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment commissioning with CTRs as per the Contract Documents.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor.
4. Provide the information requested by the CxA regarding equipment sequences of operation and testing procedures.
5. Review test procedures for equipment installed by factory representatives.

1.04 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning record:

1. Plan for delivery and review of submittals, systems manuals and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for fire protection systems, assemblies, equipment and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks and startup procedures have been completed.
5. Certificate of readiness certifying that fire protection systems, subsystems, equipment and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.

1.05 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning record:

1. Plan for delivery and review of submittals, systems manuals and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for fire protection systems, assemblies, equipment and components to be verified and tested.

4. Certificate of completion certifying that installation, prestart checks and startup procedures have been completed.
5. Certificate of readiness certifying that fire protection systems, subsystems, equipment and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.

1.06 SYSTEMS TO BE COMMISSIONED

A. The following systems will be commissioned in this project. The Owner and the CxA reserves the right to amend this list at anytime during the construction and acceptance process.

B. Fire Protection:
1. Dry Pipe system
2. Wet sprinkler system

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division Contractor for the equipment being tested.

B. Special equipment, tools, instruments, (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents, shall be included in the base bid price to the Contractor and left on site, except for stand-alone datalogging equipment that may be used by the CxA.

C. Datalogging equipment and software required to test equipment will be provided by the CxA, but shall not become the property of the Owner.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications.

PART 3 - EXECUTION

3.01 MEETINGS

A. Scoping Meeting: The CxA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CxA. Information gathered from this meeting will allow the CxA to revise the Commissioning Plan to its final version, which will also be distributed to all parties.

B. Prefunctional Inspection (PFI) Meeting: The CxA will schedule, plan and conduct a PFI meeting with the entire commissioning team in attendance to kickoff the PFI phase.

C. Functional Performance Testing Meeting: The CxA will schedule, plan and conduct a functional performance test meeting with the entire commissioning team in attendance to kickoff the FT phase. The Controls Representative (CC) will play a critical role in the Functional Performance Testing. The CC's Project Manager will be required to attend this meeting.

D. Miscellaneous Meetings: Progress meetings will be scheduled and conducted by the CxA, as necessary. Other meetings will be planned and conducted by the CxA as the construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular CTRs. The CxA will plan these meetings and will minimize unnecessary time being spent by CTRs.

3.02 REPORTING

A. The CxA will provide regular reports to the Owner, PM, GC and A/E depending on the management structure, with increasing frequency as construction and commissioning progresses.

B. The CxA will regularly communicate with all members of the commissioning team, keeping them apprised for commissioning progress, and scheduling changes through memos, progress reports, etc.

C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

D. A final summary report by the CxA will be provided to the Owner. The report will include:

1. A brief summary report that includes a list of participants and roles, brief building description, overview of commissioning and testing scope, and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the CxA regarding the adequacy of the equipment, documentation, and training as it relates to the Contract Documents in the following areas:
    a. Equipment meeting the equipment specifications.
    b. Equipment installation.
    c. Functional performance and efficiency.
    d. Equipment documentation.
    e. Operator training.
2. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment and operations, future actions, recommended commissioning process changes, etc. shall also be listed.

3. Also included in the Commissioning Record shall be the issues log, commissioning plan, progress reports, submittal and O&M manual reviews, training record, test schedules, construction checklists, start-up reports, functional tests and trend log analysis.

E. The CxA will compile a Systems Manual that consists of the following:

1. Space and use descriptions.
2. Single line drawings and schematics for major systems (to be provided by the Design Engineer).
3. Control drawings and sequences of control (to be provided by the Controls Contractor).
4. Schedules.
5. Instructions for operation of each piece of equipment for emergencies and shutdown.
6. Recommendation for recommissioning the facility.

3.03 SUBMITTALS

A. The CxA will provide the Contractor with a specific request for the type of submittal documentation the CxA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At a minimum the request will include the manufacturer and model number, the manufacturer's printed installation and detailed startup procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of Owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CxA. All documentation requested by the CxA will be included by the CTRs in their O&M manual contributions.

B. The CxA will review submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The CxA will notify the Owner, PM, GC or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission. The CxA does not have approval responsibility, but is required to review the submittals concurrently with the Engineer as required by LEED guidelines.

C. The CxA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

D. These submittals to the CxA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CxA will review them.

3.04 SYSTEM START-UP AND TESTING

A. General Requirement:

1. All systems and system components shall be tested by the CTRs and in the presence of the Owner and Design Consultants if desired by the Owner and Design Consultants to demonstrate compliance with specified requirements. To minimize the time of commissioning, contracting, and Design Consultant team members, testing shall be done in seasonal single blocks of time insofar as possible.
2. The Contractor shall notify the CxA fourteen (14) days prior to scheduled functional performance tests, of the scheduled completion date of the installation verification and prefunctional inspections.
3. All testing shall be conducted under specified design operating conditions as approved by the CxA and Design Consultants.
4. All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on a hierarchical basis. Each piece of equipment shall be tested for proper operation, and functionality of safety devices, followed by each system's subsystem, followed by the entire system, followed by any interlocks to other major systems.
5. All special testing materials and equipment shall be provided by the CTR. This includes, but is not limited to, proprietary equipment, hand-held control parameter/setpoint adjustment tools, water flow balancing readout and adjustment tools.
6. One (1) copy of all factory test reports and records as well as all start-up documentation shall be provided to the CxA.

B. Test Procedure Development and Test Documentation:

1. At least fourteen (14) days prior to startup of the fire protection system, the CTR shall inform the CxA, the Owner's Representative and Design Consultants of the intention to start up the system.

C. Installation Verification Requirements:

1. All systems and system components shall be checked and verified by the CTR that they have been installed according to the drawings, specifications, and manufacturer's written instructions, and that all connections have been made correctly. Discrepancies shall be corrected and resolved to the satisfaction of the Engineer and CxA prior to proceeding any further with prefunctional inspections.
2. Each system of interlocked system components shall be observed and verified by the CTR that it is ready to function as specified.

3. Verification of complete and proper installation shall be completed prior to the CxA authorizing functional performance testing.
4. The installation verification shall be documented by the CTR in a written format for each system/piece of equipment as designated by the CxA. Each certificate of readiness shall be dated and initialed by the Contractor and clearly stating any items that are deficient or have not been completed. The protocols for this will be further clarified in the Commissioning Plan.
5. Certify that fire protection systems, subsystems and equipment have been installed and started and are operating according to the Contract Documents.
6. Inspect and verify the position of each device and interlock identified on checklists.
7. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
8. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

D. Prefunctional Inspection Requirements:
1. The CxA will provide the inspection forms for each system and equipment.
2. Verification of completion of the prefunctional checklists is the responsibility of the CxA.
3. Prior to the CxA performing the prefunctional inspection, the CTRs shall check the equipment for proper installation, adjustments, and shall calibrate the equipment to verify that it is ready to perform as specified.
4. Verification of complete and proper installation shall be completed prior to performing functional performance tests.

E. Functional Performance Testing Requirements:
1. A functional performance test shall be performed on each complete system. Each function shall be demonstrated to the satisfaction of the CxA based on the written test procedure developed by the CxA to demonstrate conformance to the requirements of the Contract Documents.
2. Each functional performance test shall be performed, witnessed and signed off by the CxA. The CxA and the CTRs will perform the functional testing together. Any exceptions to this will be made clear to the Owner as to the reason and justification.
3. The functional performance testing shall be conducted in accordance with prior approved procedures and documented as required.
4. The Contractor shall notify the contracting team, the CxA, and Design Consultants, at least two weeks prior to the date of schedule functional performance tests. The schedule of functional performance tests shall be based on the construction completion schedule.

3.05 FUNCTIONAL TESTING SUPPORT REQUIREMENTS

A. General Requirements:

1. This section provides brief descriptions of the testing and support the Contractor and installers will be required to provide to perform the functional testing of the equipment for the project.

B. Fire Protection Systems:

1. The installer(s) will be required to demonstrate all safeties, local device operation, any local controls and any integrated 3rd party Building Management System controls INCLUDING ALL RELATED DEVICES AND SEQUENCE OF OPERATIONS.
2. The installer(s) will be required to manually operate all hand valves and automatic valves.

C. Pumping Systems:

1. The installer(s) will be required to demonstrate in writing that the pumps are balanced to achieve the specified design flows, including motor performance data as specified in the specifications. The Controls Contractor will be required to demonstrate that the pumps can start, stop, modulate speed (if required) and the lead/lag sequence performs as per the sequence of operations. In addition, a representative will be required to manually operate all hand valves.

D. Pipe system cleaning, flushing, hydrostatic tests and chemical treatment requirements are specified in fire protection piping sections. Fire Protection Contractor shall prepare a pipe system cleaning, flushing and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested and chemically treated.

3.06 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation - The CxA shall witness and document the results of all functional performance tests using the specific forms developed by the CxA for that purpose.

B. Non-Conformance:

1. The CxA will record the results of the PFIs and functional tests utilizing the appropriate documentation. All deficiencies or non-conformance issues shall be noted and reported to the Owner, PM, GC and CTRs.
2. Reports of the deficiencies identified will be provided to the project team by the CxA. Individual forms identifying the deficiencies for each trade will also be provided. These forms are utilized for the contractor to inform the CxA of the action taken to address the deficiency items and these forms must be returned in a timely manner to the CxA.
3. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases, the deficiency and resolution will be documented by the CxA.
4. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or compromising acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner.
5. Cost of Retesting:
    a. The cost for the Installer to repeat a prefunctional inspection or functional test, if they are responsible for the deficiency, shall be theirs.
    b. The time for the CxA to direct any retesting required because a specific prefunctional inspection of start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the appropriate CTR.
6. The Contractor shall respond in writing to the CxA at least as often as commissioning meetings are scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

C. Failure Due to Manufacturer Defect or Improper Installation - If 10%, or three (3), whichever is greater, of identical pieces of equipment (size alone does not constitute a difference) fail to perform to the Contract Documents (either mechanically or substantively) due to manufacturing defect or improper installation, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CxA, PM, A/E or Owner. In such case, the Contractor shall provide the Owner with the following:

1. Within one (1) week of notification from the A/E (via the CxA), the installer or Manufacturer's Representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CxA or PM within two (2) weeks of the original notice.

2. Within two (2) weeks of the original notification, the installer or manufacturer shall provide a signed and dated written explanation of the problem, cause of failures, etc., and all proposed solutions, which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.

3. The CxA, G/C and PM will determine whether a replacement of all identical units or a repair is acceptable.

4. Two (2) examples of the proposed solution will be installed by the Contractor and the CxA will be allowed to test the installations for up to one (1) week, upon which the CxA or PM will decide whether to accept the solution.

5. Upon acceptance, the installer and/or manufacturer shall replace or repair all identical items, at their expense, and extend warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one (1) week from when parts can be obtained.

D. Approval: The CxA documents each satisfactorily demonstrated functional test.

3.07 OPERATION AND MAINTENANCE MANUALS

A. Standard O&M Manuals:

1. The specific content and format requirements for the standard O&M manuals are detailed in the contract documents. Special requirements for the controls representative and TAB are detailed in the contract documents.

2. Prior to substantial completion, the CxA shall review the O&M manuals, documentation and redline as-builts for systems that were commissioned to verify compliance with the specifications. The CxA will communicate deficiencies in the manuals to the CTRs, PM, FPC, GC, A/E or Owner as requested. Upon successful review of the corrections, the CxA recommends approval and acceptance of these sections of the O&M manuals to the PM, FPC, GC, A/E and Owner. The CxA also reviews each commissioned equipment's warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E contract.

3.08 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and for ultimately ensuring that training is completed. The GC shall inform the CxA when training will be scheduled.

B. The CxA shall be responsible for overseeing and approving the content and adequacy of the training of the Owner personnel for commissioned equipment.

C. The CxA shall interview the facility manager and lead engineer to determine the special needs and areas where training would be most valuable. The Owner and CxA shall decide how rigorous the training should be for each piece of commissioned equipment.

D. In addition to these general requirements, the specific training requirements of Owner's personnel by CTRs, as detailed in the specifications, shall be provided.

E. Each CTR and vendor responsible for training will submit a written training plan to the CxA, for review and approval prior to training. The plan will cover the following elements:

1. Equipment (included in training).
2. Intended audience.
3. Location of training.
4. Objectives.
5. Subjects covered (description, duration of discussion, special methods, etc.).
6. Duration of training on each subject.
7. Instructor for each subject and qualifications.
8. Methods (classroom lecture, video, site walk thru, actual demonstrations, etc.).

F. The CxA develops criteria for determining that the training was satisfactorily completed, including attending some of the training.

3.09 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in various parts of the specifications. The Commissioning Plan lists all the formal written work products, describes briefly their contents, who is responsible to create them, and, who receives and approves them and the location of the specification to create them. In summary the written products are:

	Product	**Developed By**
1.	Final Commissioning Plan	CxA
2.	Commissioning Schedules	CxA, GC and CTRs
3.	Equipment Documentation Submittals	CTRs
4.	Sequence Clarifications	A/E and CTRs as needed

	Product	Developed By
5.	Pre-Functional Inspection Forms	CxA
6.	Pre-Functional Inspections	CxA
7.	Startup and Initial Checkout Plans	CTRs
8.	Commissioning Progress Record	CxA
9.	Issue and Resolution Log	CxA
10.	Functional Test Procedures	CxA
11.	O&M Manuals	CTRs
12.	Commissioning Record	CxA
13.	Overall Training Plans	GC and CTRs
14.	Specific Training Syllabus	CxA
15.	Final Commissioning Report	CxA

END OF SECTION

SECTION 21 10 10
PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 SUBMITTALS

A. Provide a schedule of pipe materials, fittings and connections.

B. Provide a detailed matrix listing the specific UL approved firestop system assembly to be used for each type of piping provided and each type of construction to be penetrated along with all associated UL assembly details.

PART 2 - PRODUCTS

2.01 GENERAL

A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

2.02 STEEL PIPING AND FITTINGS

A. Pipe: ASTM A53, or ASTM A106 seamless, Schedule 40 or Schedule 80 weight; black or galvanized finish as called for; ends chamfered for welding or grooved for grooved mechanical connections.

B. Fittings: Same material and pressure class as adjoining pipe.

1. Welded Fittings: Factory forged, seamless construction, butt weld type chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets" or "Sockolets" acceptable. Mitered elbows, "shaped" nipples, and job fabricated reductions not acceptable unless specifically called for. Socket weld type, 2000 psi wp, where called for.

2. Threaded Fittings: Class 125, cast or malleable iron, black or galvanized, as called for; UL listed and FM approved for fire protection systems. Street type 45° and 90° elbows are not acceptable.

C. Flanges, Unions, and Couplings:

1. Threaded Connections:

a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.

b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.

c. Couplings: Malleable iron. Steel thread protectors are not acceptable as couplings.

2. Welded Connections:

a. Flanges: Welding neck type. Slip-on type not allowed unless noted and shall not be installed in conjunction with butterfly valves.

3. Grooved Mechanical Connections:

a. Couplings: Ductile iron, ASTM A395 and ASTM A536, with painted coating, designed for rolled grooved piping, hot dipped galvanized finish complying with ASTM A153 where called for.

b. Gaskets: Grade "E" EPDM synthetic rubber, -30°F to 230°F temperature range, suitable for water service.

c. Bolts and Nuts: Heat treated, hex head carbon steel, ASTM A183, cadmium plated or zinc electroplated.

d. Fittings: Elbows, tees, laterals, reducers, adapters as required shall be ductile iron conforming to ASTM A395 and A536, forged steel conforming to ASTM A234, or fabricated from carbon steel pipe conforming to ASTM A53. Fittings shall have grooves designed to accept grooved end couplings of the same manufacturer.

e. Victaulic, rigid system, Style 005 couplings cast with offsetting angle pattern bolt pads to provide system rigidity and support in accordance with ANSI B31.1 and B 31.9. UL listed and FM approved; 300 psi wwp; use a gasket and coupling system similar to Victaulic Flush-Seal for all dry type systems; follow all terms of listings/approvals.

f. Acceptable Manufacturers: Grinnell, Gruvlok by Anvil, Victaulic or approved equal.

D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.

E. Base Elbows:

1. Cast iron or steel type, flange connections; Crane 500 or equivalent made from welding elbows, with welded pipe support and steel base. Reducing elbows where necessary.

ELBOW SIZE	SUPPORT SIZE	BASE PLATE
Up to 3 in.	1-1/4 in.	6 in. x 6 in. x 1/4 in.
4 in. to 6 in.	2-1/2 in.	8 in. x 8 in. x 1/4 in.

ELBOW SIZE	SUPPORT SIZE	BASE PLATE
8 in. and larger	6 in.	14 in. x 14 in. x 5/16 in.

2. Anchor bolt holes in each corner of base for securely bolting to floor or concrete base; minimum 3/4 in. bolts.

2.03 THINWALL STEEL PIPE

A. Pipe: ASTM A53, or A135, with Schedule 10 wall thickness for 2-1/2 in. through 5 in.; 0.134 in. for 6 in. and 0.188 in. for 8 in. and 10 in.; black or galvanized finish as called for; roll grooved ends.

B. Fittings: Same construction as noted for steel pipe, ends roll grooved for grooved mechanical connections.

2.04 COPPER TUBE AND FITTINGS

A. Pipe: ASTM B88; Type L, hard temper. Plans show copper tube sizes.

B. Tees, Elbows, and Reducers: Wrought copper, ASME B16.22 or cast bronze, ASME B16.18; solder end connections.

C. Unions and Flanges: 2 in. and smaller use unions, solder type, cast bronze, ground joint, 150 lb. swp: 2-1/2 in. and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 lb. swp.

D. Solder Materials: No-lead solder, using alloys made from tin, copper, silver and nickel. Harris, Inc., "Stay-Safe 50" and "Bright", Engelhard "Silvabright 100", Canfield "Watersafe" or approved equal.

E. Brazing Materials: Class BcuP-5 for brazing copper to brass, bronze to copper. Harris, Inc. "Stay-Silv 15" or approved equal.

2.05 SPECIAL FITTINGS

A. Copper to Cast Iron: Cast bronze, cast iron to sweat adapter.

B. Copper to Steel Piping:

1. Cast bronze copper to iron male or female adapter with shoulder for drainage piping only.
2. Dielectric pipe fittings.

C. Steel to Cast Iron: Cast iron soil pipe connector with spigot and IPS male thread end (Manhoff fittings).

2.06 DIELECTRIC PIPE FITTINGS

A. Description: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

B. Unions: Factory fabricated, for 250 psi minimum working pressure at 180°F, threaded or solder ends, insulating material suitable for system fluid, pressure and temperature.

C. Flanges: Factory fabricated, companion flange assembly, for 150 or 300 psig minimum pressure to suit system fluid pressures and temperatures with flange insulation kits and bolt sleeves.

D. Acceptable Manufacturers: EPCO, Capitol Manufacturing, Victaulic, Watts or approved equal.

2.07 HANGERS, INSERTS AND SUPPORTS

A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing.

B. Hangers:

1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. Copper plated or PVC coated where in contact with copper piping. Hot-dipped galvanized finish for exterior locations.
2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.
3. Adjustable steel clevis type for piping 4 in. and larger.
4. Nuts, washers and rods with electroplated zinc or cadmium finish. Hot-dipped galvanized finish for exterior locations.

C. Spacing Schedule (Maximum Distance between Hangers (ft.-in.):

NOMINAL PIPE SIZE (IN.)	**3/4**	**1**	**1-1/4**	**1-1/2**	**2**	**2-1/2**	**3**	**3-1/2**	**4**	**5**	**6**	**8**
Steel Pipe except Threaded Lightwall	N/A	12-0	12-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0
Copper Tube	8-0	8-0	10-0	10-0	12-0	12-0	12-0	12-0	15-0	15-0	15-0	15-0
Rod Size (in.)	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	1/2	1/2	1/2

D. Beam Attachments:

1. C-Clamp style, locknut, restraining strap, electroplated finish, UL listed, FM approved for pipe sizes 2 in. and smaller, complying with NFPA 13.

2. Center loaded style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements, complying with NFPA 13.

E. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1300 lbs., for 3/8 in. to 3/4 in. rod sizes, reinforcing rods on both sides, MSS-SP-69 Type 19 or approved equal, complying with NFPA 13.

F. Supports:

1. For all piping larger than 2 in., provide intermediate structural steel members for hanger attachment. Members shall span across the bar joists at panel points of joists. Secure member to structure. Select size of members based on a minimum factor of safety of four.
2. For weights under 1,000 lbs.: "Drill-In" inserts, "U" shaped Channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.
3. For Metal Decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use devices designed for this application, with a safety factor of four.
4. Acceptable Manufacturers: Hilti, ITW Ramset, Phillips "Red Head" or approved equal.

G. Hangers for fire protection piping as specified and in accordance with NFPA 13 and NFPA 14. Hangers and building attachments shall be UL listed and FM approved for fire protection service. Adjustable swivel ring type hangers are permitted for 3 in. and smaller piping.

2.08 PIPING ACCESSORIES

A. Escutcheon Plates: Steel or cast brass, split hinge type with setscrew, high plates where required for extended sleeves. Chrome plated in finished areas.

B. All bushings and nipples required for instruments and gauges shall be brass.

2.09 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves for structural surfaces, two (2) pipe sizes larger than the pipe, and as recommended by the sealing element manufacturer. Provide full circle water stop collar for sleeves located within below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.
2. Schedule 40 PVC sleeves or sheet metal sleeves for nonstructural surfaces and existing construction. Sheet metal sleeves shall be 18 gauge minimum and braced to prevent collapsing.

2.10 SEALING ELEMENTS

A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.

1. Acceptable Manufacturers: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

2.11 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL AND FLOOR ASSEMBLIES

A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform to the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.12 PIPING MATERIALS AND SCHEDULE

A. See Exhibit "A" - Piping Materials at end of this Section for Fire Protection piping.

B. See Exhibit "B" - Testing at end of this Section for Fire Protection piping.

PART 3 - EXECUTION

3.01 EQUIPMENT AND SYSTEMS

A. Install equipment and systems in accordance with provisions of each applicable section of these Specifications, and Local/State Codes/Regulations having jurisdiction. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing, except where specifically called for, making proper allowance for expansion and anchoring. Changes in size shall be made with reducing fittings. Reducing couplings are not acceptable. Arrange piping at equipment with necessary offsets, unions, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required, to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting systems. Conceal piping unless otherwise called for.

B. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing.

C. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation.

Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Materials within a system and between systems shall be consistent. If this is not possible, install dielectric fittings.

3.02 PIPING OVER ELECTRICAL EQUIPMENT

A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.

B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3ft. to 9 ft. depending on the voltage.

3.03 HANGERS, INSERTS AND SUPPORTS

A. Piping shall not be supported by wires, band iron, chains, from other piping, or by vertical expansion bolts. Support piping with individual hangers from concrete inserts, wood construction, welded supports, or beam clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size called for, using four (4) nuts per rod. Provide additional structural steel members, having one coat rustproof paint, where required for proper support. Provide oversized hangers on diesel engine exhaust piping where insulation/supports must pass between pipe and hanger. Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point. Only concentric type hangers are permissible on piping larger than 2-1/2 in.; "C" types are permitted for piping 2 in. and smaller on joists. Provide riser clamps for each riser at each floor.

3.04 PIPE CONNECTIONS

A. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specifically selected for each application.

B. Grooved Mechanical Joints: Pipes joined with grooved fittings shall be joined by a listed combination of fittings, couplings, gaskets and grooves of a single manufacturer. Lubricate and install gasket and couplings. Follow manufacturer's recommendations. Grooved ends shall be clean and free of indentations, projections and roll marks in the area from pipe end to groove.

C. Brazed Connections: Make joints with silver brazing alloy in accordance with manufacturer's instructions. Remove working parts of valves before applying heat.

D. Dielectric Pipe Fittings: Protect fittings from excessive heat.

3.05 WELDING

A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded piping fabricated by qualified welder. Use certified welder where specifically required by code or insurance company. If indicated and permitted for fire protection systems, all provisions for welded pipe shall additionally be in accordance with NFPA Standard 13. Use full length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe with inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe.

B. When welding galvanized pipe, apply cold galvanizing on joint following welding.

3.06 SLEEVES

A. Provide for pipes passing through floors, walls or ceilings. Not required for floors that are core-drilled, except where floor is waterproofed. Extend 1/8 in. above finished floor in finished areas. In above grade Mechanical Rooms and other areas with floor drains use steel pipe sleeves 2 in. above floor. Use steel pipe sleeves in bearing wall, structural slabs, beams and other structural surfaces, and where called for. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating. Fill abandoned sleeves with concrete. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.07 SLEEVE PACKING

A. Seal void space at sleeves as follows:

1. Interior locations: Firmly pack with fiberglass and caulk.
2. Exterior walls above grade: Use sealing element.
3. Exterior walls below grade and above floors: Use sealing element.
4. Cored holes: Use sealing element.
5. Fire rated, partitions and floor slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.
6. Waterproofed walls/floors: Use waterproof sealing element, device or compound.

3.08 ESCUTCHEON PLATES

A. Provide polished chrome setscrew type escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except in Boiler, Fan and Mechanical Rooms.

3.09 TESTS

A. Fire suppression systems shall be hydrostatically tested at 200 psi for two (2) hours in accordance with NFPA 13.

B. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing Codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner. Isolate existing systems.

3.10 PIPE LINE SIZING

A. Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative and shall be justified by hydraulic calculations. Where discrepancy in size occurs, the larger size shall be provided.

EXHIBIT "A" - PIPING MATERIALS
(Notes at end of Exhibit "A")

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
Fire service	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Sprinkler (wet)	Schedule 40, black steel, 2 in. and smaller	Cast or malleable iron	Threaded
	"Thinwall" black steel, 2-1/2 in. and larger	Ductile iron	Roll grooved mechanical type couplings
	Schedule 40, black steel 2-1/2 in. and larger	Ductile iron	Roll grooved mechanical type couplings
Sprinkler dry	Schedule 40, galvanized steel, 2 in. and smaller	Galvanized cast or malleable iron	Threaded
	Schedule 40, galvanized steel, 2-1/2 in. and larger	Galvanized ductile iron	Roll grooved mechanical type couplings
Compressed air piping	Schedule 40, galvanized steel	Galvanized malleable iron	Threaded

NOTES FOR EXHIBIT A:

NOTE 1: Provide schedule 40 galvanized steel pipe and fittings for all aboveground exterior locations passing through exterior walls such as downstream of inspector's test and auxiliary drain valves, between fire department connection and associated check valve, and where called for.

NOTE 2: Provide Class 250 fittings for threaded systems operating at working pressures above 175 psi.

NOTE 3: Dry piping systems shall be pitched as described in NFPA 13 to facilitate the removal of moisture from the system to minimize internal corrosion. Provide auxiliary drains as required to assure entire system is drainable.

EXHIBIT "B" - TESTING

SERVICE	TEST REQUIREMENTS
Sprinklers	Test hydrostatically at 200 psi for two (2) hours in accordance with NFPA 13.

END OF SECTION

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SECTION 21 13 00
FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.02 QUALITY ASSURANCE

A. Comply with the 2020 Fire Code of New York State referenced edition of the following National Fire Protection Association (NFPA) Standards:

1. NFPA 13: Standard for the Installation of Sprinkler Systems.
2. NFPA 25: Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.
3. NFPA 72: National Fire Alarm Code.
4. NFPA 241: Standard for Safeguarding Construction, Alteration and Demolition Operations.
5. NFPA 291: Recommended Practice for Fire Flow Testing and Marking of Hydrants.

B. Follow all requirements, recommendations and appendices to comply with the latest edition of the following publications, codes, standards, and listings/approvals:

1. Factory Mutual Engineering Corporation (FM) Approval Guide.
2. Underwriters Laboratories, Inc. (UL) Fire Protection Equipment Directory.
3. 2020 Fire Code of New York State.
4. OSHA Rules and Regulations.
5. Requirements of Insurance Underwriter and other Authorities Having Jurisdiction.

C. Equipment, devices, hangers and components shall be UL listed or FM approved and labeled for the intended fire protection service.

D. The fire protection work shall be performed by an experienced firm regularly engaged in the installation of fire protection sprinkler systems.

E. Preparation of working plans, calculations and site observation of systems shall be completed by a NICET Level III technician under the direction of a qualified New York State Registered Professional Engineer.

1.03 SYSTEM DESCRIPTION

A. The fire protection system shall be a wet pipe and dry pipe automatic sprinkler system arranged to properly protect all spaces.

B. Water is supplied from a 12 in. municipal water main located in the town of Greenburgh, NY, through an 8" in. underground water main to the system's main riser. Water supply data at the municipal main indicates the following:

1. 110+ psi static.

2. Residual 54 psi residual with 2270 gpm flowing.

C. The residual hydrant is located at the Greenburgh property north of the site (higher elevation) with the flow hydrant located at the Greenburgh property north of the site (higher elevation). The flow test information above is submitted for information only. This contractor shall arrange for a new flow test on the municipal main prior to performing hydraulic calculations. The more restrictive of these two tests shall be used as the basis of design.

D. Fire department connection(s) shall be provided to allow the servicing fire department to augment the system's normal automatic water supply.

E. The system shall be hydraulically calculated in accordance with all provisions of the Contract Documents and any Authority Having Jurisdiction.

F. Use of room design method will not be permitted. Calculations shall be based upon the specific hazard for the areas being protected. The following minimum requirements shall be provided as actually installed in the protected spaces.

G. Maximum coverage for any sprinkler head shall not exceed NFPA requirements and the listing for the sprinklers provided.

H. A minimum 10% safety factor shall be provided between the available municipal water supply curve and the total system demand point. The total system demand point shall be at the municipal water main and include the calculated sprinkler and interior hose stream demands plus the exterior hose stream demand at the residual pressure required for proper system operation.

I. The maximum flow velocity shall not exceed 20 ft. per second in the piping system and 15 ft. per second in mains with paddle type waterflow indicators.

J. Water supply control valves shall be electrically supervised and mechanically locked for proper position. Waterflow and supervisory circuits shall be in accordance with the requirements of electrical specifications. Electric connections to sprinkler system shall be by Division 26. Furnish wiring diagrams for all equipment.

K. Provide 3/16 in. x 1 in. cadmium plated carbon steel chains and master keyed all brass case hardened padlocks to lock water supply valves in the proper position.

1.04 SUBMITTALS

A. Product Data:

1. Submit manufacturer's catalog cut, specifications and installation instructions for each item or component of fire protection system. Clearly indicate pertinent information such as, but not limited to:

a. Manufacturer's model number.

b. Materials, size, finish and type of connection.

c. Pressure ratings of components.

d. FM approval/UL listing.

B. Certification: Submit Contractor's NICET certification and number.

C. Samples:

1. If requested, submit sample of sprinklers.

D. Drawings and Calculations:

1. All drawings and calculations shall be signed and sealed by a New York State Registered Professional Engineer.

2. Submit complete NFPA 13 drawings and hydraulic calculations with cross reference to applicable drawings, water supply data, and equipment schedule with ratings for the system to the Owner's Representative, Insurance Underwriter, and other Authorities Having Jurisdiction.

3. Submit hydraulic calculations for each design density/remote area with items in NFPA 13 incorporated including sketches to indicate flow quantities, sprinklers operating and direction of flow for pipes in looped and gridded systems.

4. Drawing shall be fabrication drawings provided to indicate actual sprinkler, standpipe and equipment layouts. Drawings shall be 1/4" = 1'-0" scale on reproducible sheets of uniform size. Drawings shall show all data required by NFPA 13.

5. Submit drawings in one (1) complete package.

E. Record Drawings and Documents:

1. Submit Record Drawings, hydraulic calculations, test reports, and NFPA Above and Below Ground Material and Test Certificates to the Owner's Representative, Insurance Underwriter and other Authorities Having Jurisdiction.

PART 2 - PRODUCTS

2.01 GENERAL

A. Mixing of manufacturers or models of the same or similar component will not be acceptable.

2.02 FIRE DEPARTMENT CONNECTION

A. Cast brass; straight or angle body as required; two-way lug swivel inlets with individual drop clappers; cast brass; raised letter escutcheon labeled "AUTOSPKR"; matching brass plugs and chains.

1. 2-1/2 in. x 2-1/2 in. x 4 in.
2. 2-1/2 in. hose threads shall match those in use by the local Fire Department.
3. Polished brass escutcheon, inlets, plugs, and chains.
4. Design Equipment:
    a. Horizontal Flush Wall Type: Potter-Roemer 5020 Series.
    b. Projecting Wall Type: Potter-Roemer Fig. No. 5721.

B. Storz quick connect type with 30-degree elbow, cap, chain and escutcheon labeled "AUTOSPKR".

1. 4 in. Storz x 4 in. NPT.
2. Polished brass escutcheon, inlets, plugs and chains.
3. Design Equipment: Potter-Roemer Fig. No. 5795-01 connection with Fig. No. 5799-01 cap and chain.

C. Acceptable Manufacturers: Badger-Powhatan, Croker, Elkhart, Potter-Roemer or approved equal.

2.03 PRESSURE GAUGES

A. Water Pressure Gauge:

1. Anodized aluminum case, 3-1/2 in. diameter, glass lens, brass movement, 1/4 in. NPT male bottom connection with gauge cock.
2. 0 to 300 psi range, in 5 psi increments with accuracy to meet ANSI B40.1.

B. Air Pressure Gauge:

1. Anodized aluminum case, 3-1/2 in. diameter, glass lens, brass movement, 1/4 in. NPT male bottom connection with gauge cock.
2. 0 to 80 psi range, in 1 psi increments with accuracy to meet ANSI B40.1.

2.04 SPRINKLER EQUIPMENT

A. Alarm Check Valve: Vertical style with grooved ends, cast iron body, replaceable clapper facing, right or left hand alarm trim for variable pressure operation.

1. Trim:
    a. Main drain and valve.
    b. Gauges with gauge cocks.
    c. Galvanized pipe and trim fittings.

d. Retard chamber and pressure switch.

e. Water motor gong.

2. Design Equipment: Reliable Model E (175 psi).

3. Acceptable Manufacturers: Reliable, Tyco, Victaulic, Viking or approved equal.

B. Riser Check Valve: Vertical style, grooved end, cast iron body and stainless steel clapper with replaceable facing.

1. Trim:

a. Main drain and valve.

b. Gauges with gauge cocks.

c. Galvanized pipe and trim fittings.

2. Design Equipment: Reliable Model G (250 psi).

3. Acceptable Manufacturers: Reliable, Tyco, Victaulic, Viking or approved equal.

C. Dry Pipe Valve: Vertical style with grooved ends, cast iron body, replaceable clapper facing with right or left hand trim and controls for automatic operation.

1. Trim:

a. Main drain and valve.

b. Gauges with gauge cocks.

c. Galvanized pipe and trim fittings.

d. Low air and waterflow alarm switches.

e. Automatic air pressure maintenance device.

f. Air relief valve set at 5 psi in excess of maximum pressure that should be on system.

g. Water motor gong.

h. Anti-flooding type accelerator with trimmings.

2. Design Equipment: Reliable Model A (2-1/2 in.), or Model D (4 in. and 6 in.).

3. Acceptable Manufacturers: Reliable, Tyco, Victaulic, Viking or approved equal.

2.05 SPRINKLERS AND ACCESSORIES

A. Brass or bronze, 1/2 in. orifice, 1/2 in. NPT. 165°F ordinary temperature classification for light and ordinary hazards. Use 286°F sprinklers in Mechanical, Electrical and Elevator Rooms; in vicinity of heat equipment/sources; and in accordance with NFPA 13.

1. Finished Ceiling Areas: Concealed pendent sprinklers with matching coverplate, color as selected by Architect.

2. Unfinished Ceiling Areas: Natural brass/bronze finish pendent or upright sprinklers as required.

B. Sprinkler Types and Design Equipment:

1. Quick Response Pendent and Upright: Reliable Model F1FR.
2. Quick Response Concealed Pendent: Reliable Model G4A.
3. Quick Response Horizontal Sidewall: Reliable Model F1FR-HSW1.
4. Quick Response Dry Pendent and Horizontal Sidewall: Reliable Model F3QR.
5. SSP and SSU: Reliable Model F1.
6. Concealed Pendent: Reliable Model G4.
7. Horizontal Sidewall: Reliable Model F1-HSW1.
8. Dry Pendent and Horizontal Sidewall: Reliable Model F3.
9. Quick Response Extended Coverage Pendent: Reliable Model F1FR.
10. Quick Response Extended Coverage Concealed Pendent: Reliable Model G4 XLO QREC.
11. Quick Response Extended Coverage Horizontal Sidewall (Type A): Reliable Model F1FR EC-8.
12. Quick Response Extended Coverage Horizontal Sidewall (Type B): Reliable Model DH 56.
13. Intermediate Level Upright and Pendent: Reliable Model F1.
14. Corrosion Resistant: Furnish with factory applied wax or lead plating. Do not disrupt during installation.
15. Early Suppression, Fast Response Upright: Tyco Model ESFR-17/16.8 K-Factor.

C. Flexible Sprinkler Drops:

1. FM Approved braided Type 304 stainless steel tube with union joints, factory tested to 400 psi and listed for up to three (3) 90° bends including bracket for mounting to ceiling or building structure.
    a. Design Equipment: Victaulic "VicFlex".

D. Sprinkler Guards:

1. Steel wire cage with base plate and retaining clamps. Same manufacturer as sprinkler.
2. Design Equipment: Reliable Model C-1.

E. Sprinkler Cabinets and Spare Sprinklers:

1. Steel or aluminum construction with shelves and shell holes to accommodate the number of spare sprinklers required by NFPA 13.
2. Bright red finish with hinged front door and label.

3. Sprinkler wrenches compatible for each type used.

4. Spare sprinklers for each system of the type and proportion of those used in each system.

5. Design Equipment: Reliable Model A-4.

F. Acceptable Manufacturers: Reliable, Tyco, Victaulic, Viking or approved equal.

2.06 ALARM EQUIPMENT

A. Waterflow Pressure Switch:

1. Pressure activated waterflow alarm switch with retard, steel enclosure and cover, adjustable differential type, SPDT contacts, 24 volt DC, 1/2 in. pressure connection, 250 psi rated.

2. Design Equipment: Potter Electric #WFSR-F.

B. Air Pressure Supervisory Switch:

1. For remote low air pressure supervisory alarm and for air compressor operation, steel enclosure and cover, adjustable differential type, SPDT contacts, 24 volt DC, 1/2 in. pressure connection compatible with system devices, 250 psi rated.

2. Design Equipment: Potter Electric #PS40A.

C. Paddle Waterflow Detectors:

1. Adjustable retard feature, SPDT contacts, 24 volt DC, 250 psi rated.

2. Design Equipment: Potter Electric #VSR Series.

D. Tamper Switches:

1. Integral with valve or separate device installed on valve to actuate alarm upon valve movement, steel enclosure, SPDT contacts, 24 volt DC, mounting brackets and hardware.

2. Design Equipment: Potter Electric #OSYSU (for OS&Y valves) and #PIVSU-A (for post indicator and butterfly valves).

E. Acceptable Manufacturers: Autocall, Potter Electric, System Sensor or approved equal.

2.07 INSPECTOR'S TEST EQUIPMENT

A. Test and Drain Valve:

1. Combined test and drain valves, sight glass and interchangeable restricting orifice, sized for smallest orifice in sprinkler zone.

2. Design Equipment: AGF Manufacturing "Test and Drain".

3. Acceptable Manufacturers: AGF Manufacturing, Viking, Victaulic or approved equal.

B. Remote Flow Detection and Test Assembly:

1. Bronze body sized as required by NFPA 13 with threaded connections, brass stem, impregnated Teflon seat, chrome coated brass ball, steel handle with positive stops at the test and drain positions, tamper resistant test orifice, integral tamper resistant sight glasses, tapped and plugged port for system access and steel identification plate. Assembly shall be rated for 300 psi working pressure.
2. Test orifice size shall match the smallest orifice installed on the system.
3. Solenoid Valve:
   a. 24V DC, or 120V AC.
   b. Pressure Rating: 300 psig.
4. Bypass Drain Loop Kit connecting the solenoid valve outlet to the bypass drain port.
5. Locking Plate Kit to provide vandal resistance and prevent accidental alarm activation by locking the valve handle in the "OFF" position with carbon steel locking plate, 1-1/2 in. wide solid brass lock with 3/8 in. chrome plated hardened steel shackle.
6. Assembly shall comply with UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide" as well as the requirements of NFPA 13, NFPA 70 and NFPA 72.
7. Design Equipment: AGF Manufacturing, Inc. Model 1200 Remote Test and Drain.
8. Acceptable Manufacturers: AGF Manufacturing, Inc. or approved equal.

2.08 MANUAL AIR VENTS

A. Manual air vent shall include 1 in. isolation valve with forged brass body, stainless steel 20 mesh strainer, ball float, hose connection, threaded cap and lanyard.

1. Design Equipment: AGF Manufacturing, Inc. Model 7910MAV.
2. Acceptable Manufacturers: AGF Manufacturing, Inc. or approved equal.

2.09 AUTOMATIC AIR VENTS

A. Automatic air vent shall include 1 in. NPT isolation valve with forged brass body and stainless steel 20 mesh strainer, adjustable purge valve with hose connection, threaded cap and lanyard and automatic air release valve with conical body, recessed venting valve, single float on rigid shaft and bubble breaker.

B. Provide with end cap and close nipple (AGF Model 7930ECA).

1. Design Equipment: AGF Manufacturing, Inc. Model 7900AAV.
2. Acceptable Manufacturers: AGF Manufacturing, Inc. or approved equal.

2.10 SYSTEM COMPONENT IDENTIFICATION

A. At control, test and drain valves, provide permanently marked identification signs constructed of 18 gauge steel with baked enameled finish. The signs shall be permanently mounted on the piping or wall at the valve, or on the valve, but shall not be hung on the valve with wires or chains which permits easy removal of the sign. The sign shall clearly indicate the valve's purpose and what portion of the structure it serves. Additional signs, shall be provided at each alarm check and dry pipe valve to clearly indicate hydraulic calculation data.

2.11 ADDITIONAL SPRINKLERS AND SPRINKLER GUARDS

A. Include allowance for providing 10 additional sprinklers with related piping, fittings, hangers and 10 additional sprinkler guards installed at locations where job conditions or equipment selections may be required. Provide a credit for sprinklers and guards not installed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The nature of the work requires coordination with other trades. Shop fabrication shall be done at the Contractor's risk. Relocation of piping and components to avoid obstructions may be necessary. Relocation, if required, shall be done at the Contractor's expense. The installation shall be performed in a workmanlike manner as determined by the Owner's Representative and in accordance with the Contract Documents, manufacturer's printed installation instructions, and submitted and Owner's Representative reviewed drawings.

B. Piping shall not pass directly over electric panelboards, switchboards, motor control centers, and similar electric and telephone equipment. However, protection for these spaces shall be provided.

C. Piping shall be installed concealed above finish ceiling area with sprinklers located in the center of ceiling tiles where ceiling tiles are used.

D. Provide a readily removable flushing connection consisting of a cap at each end of cross mains.

E. Each sprinkler system shall be provided with an automatic vent valve located near the high point of the system in accordance with NFPA requirements.

F. Provide sprinkler guards for sprinklers in mechanical and storage spaces, less than 8 ft. above finished floor subject to mechanical damage.

G. Pipe ball drip valves at a floor drain or to the exterior. Pipe 2 in. main drains and water motor gong drains to discharge to the exterior at approximately 2 ft. above finished grade.

H. Securely install the spare sprinkler cabinets to the building wall at the main riser.

I. Inspector's test valves and dry system auxiliary drains shall be installed 7 ft. or less above the finished floor.

J. Fire department connections shall be installed 3 ft. above finished grade and water motor gongs approximately 10 ft. above finished grade.

K. Upright sprinklers directly on branch lines shall be installed with their frame parallel to the piping.

L. Provide sprinkler protection under ductwork, groups of ductwork and other obstructions to water spray and distribution. Use intermediate level sprinklers if subject to waterspray from above.

M. Exposed pipe shall be left clean for painting.

N. Coordinate and activate the systems or portions of the system to operational status as soon as possible.

3.02 PIPING, VALVES AND HANGERS

A. Refer to other applicable sections.

B. All piping shall be installed to permit drainage of the system through a main drain valve. Where a change in piping direction prevents drainage of the system, auxiliary drains shall be provided. The auxiliary drain assembly shall consist of a lockable ball valve, nipple and cap or plug and shall be located 7 ft. or less above the finished floor. Pipe drain to an accessible location.

3.03 TESTS

A. General:

1. Pipe installation shall be inspected by Owner's Representative prior to being covered by building construction or backfill.
2. Give the Owner's Representative advance notice of final tests. Perform tests in a safe manner. Provide written certification that tests have been successfully completed. Use NFPA Above and Below Ground Material and Test Certificate Forms.
3. Correct system leaks prior to final test. Do not utilize water additives, caulking, etc. to correct leaks. Provide appliances, equipment, instruments, devices and personnel.
4. Flushing: Follow Contract Documents and utilize open end pipe sections if possible.

B. Pressure Tests:

1. Hydrostatic Tests: Minimum 200 psi and in accordance with NFPA 13 for two (2) hours.
   a. Air test not accepted as final test.

2. Air Test: Minimum 40 psi for 24 hours with loss not to exceed 1.5 psi within 24 hour duration.

3. Do not subject existing systems to excess pressures.

C. Alarm Tests:

1. Demonstrate activation of alarms and operational trip test and water delivery time for dry systems by use of Inspector's test valve.

3.04 SYSTEM TURNOVER

A. Prior to final acceptance, instruct the Owner's Representative in the proper operation, maintenance, testing, inspection and emergency procedures for all systems furnished, for a period of time as needed. Provide one (1) new original pamphlet of NFPA 25. Indicate in writing to the Owner's Representative the provisions for proper maintenance, testing, and inspection of the systems as required by local fire codes.

END OF SECTION

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SECTION 21 24 00

FUEL ISLAND FIRE SUPPRESSION SYSTEM

(ADD ALTERNATE 2)

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section covers design, furnishing and installation of a dry chemical fire suppression system at a gasoline and diesel dispensing island, plus all associated piping, fittings, electrical connections, switches, appurtenances, permitting, and testing required to provide a complete and operable system.

1.02 RELATED WORK:

A. Section 33 56 13, Aboveground Fuel Storage Tanks

C. Section 28 09 50, Fuel Dispenser and Management System

D. Division 26, Electrical

1.03 REFERENCES:

A. The following standards form a part of this specification and indicate the minimum standards required:

National Fire Protection Association (NFPA)

NFPA 17	Standard for Dry Chemical Extinguishing Systems
NFPA 30	Flammable and Combustible Liquids Code
NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages

New York Building Code and Fire Prevention Regulations

1.04 SUBMITTALS: IN ACCORDANCE WITH THE REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Shop drawings, details, data sheets, and other descriptive drawings and materials as may be required to fully describe the equipment proposed and to verify conformance with the Contract Documents. Also submit copies of Operation & Maintenance Manuals, train the Owner how to use and operate the system, and advise on periodic testing requirements.

B. Contractor shall provide detailed fire suppression system engineering drawings stamped by a New York Professional Engineer. Contractor is responsible for paying for and obtaining all permits.

C. Two copies of permits and the written results of all tests conducted in the presence of the local Fire Department, allowing operation of the system.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. The system shall be a Pre-Engineered Type and shall be designed to meet UL1254 and NFPA 17 requirements for a Dry Chemical Extinguisher System. The system shall be UL 1254 listed.

B. The system shall be designed to provide required fire suppression for the pump island shown on the Drawings. The system shall provide protection for the complete hazard protection area, as defined by the area within reach of the fuel dispenser hoses.

C. The fire suppression system shall be a manufactured by PEM-ALL, Pyrochem, Kidde, or approved equal.

D. Dry chemical cylinders shall be securely mounted to the fire suppression support frame as shown on the drawings. Actual cylinder size and number shall be determined by the manufacturer to meet UL1254 and code requirements.

E. Operating parts shall include nitrogen bottle switch system, main nozzles and high flow nozzles, 190º F thermostats to automatically activate the fire suppression system, and three manual pull stations as shown on the Drawings. Actual nozzle and thermostat locations and quantities shall be determined by the manufacturer. Nozzles shall not extend below 11-feet above finished grade to allow for sufficient truck clearance and shall not be activated by truck exhaust heat. The thermostats shall be installed generally as shown on the Drawings and in accordance with manufacturer recommendations. The nitrogen bottle and system control panel shall be located within the Directors office shown on the Drawings, and the conduit carrying the nitrogen shall be in accordance with the manufacturer recommendations and shall be placed in a galvanized rigid steel conduit suitable for direct bury with 12-inches of compacted gravel all around meeting the subgrade piping requirements on the fuel equipment drawings and at sufficient depth to protect it from H-20 wheel loads. The nitrogen line shall be installed so that it can be replaced in the future if needed without having to dig up the line.

F. System shall be automatically activated using the 190º F thermostats and shall be manually activated using the remote electrical pull stations, as shown on the Drawings. A mechanical override shall be part of the system in event of a power outage. The system activation switch shall be connected to the fuel pump emergency shut-off

switches so fuel pumps and all power to the fuel island are deactivated automatically when the fire suppression system is activated either manually or automatically. The manual pull stations shall be marked with a sign indicated "EMERGENCY PUMP SHUTOFF - FIRE SYSTEM RELEASE" consisting of block letters not less than 2-inches in height in red letters on a white background. The fire release system switch shall be weatherproof and placed within a weatherproof enclosure (NEMA 4X) in accordance with the manufacturer's recommendations. In addition, all components of the fire suppression system shall be weather and corrosion proof as appropriate. The system shall be tied into the building fire alarm system to notify the fire department in the event the system has been activated. The fuel system Contractor shall perform all work necessary to provide a complete and operable system.

G. System shall include thermal detection, pneumatic release, pressure switches, fire alarm panel, control panel, and all other components necessary to provide a complete working system.

H. Contractor shall provide electrical service and connections, as required by the manufacturer. Heat sensors, strobe horn, pull station, and control panels shall require single phase, 120 volt power supply.

I. All agent piping shall be threaded Schedule 40 hot-dipped galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractor shall apply for, pay for, and secure all permits required by the work of this section.

B. The system shall be installed on the fire suppression support system in accordance with instructions provided by the manufacturer.

C. System shall be installed by a contractor certified by the manufacturer.

D. The general scope of the fire suppression system is shown on the Drawings and described herein and not all components are specified. The Contractor shall provide all equipment, materials, and equipment necessary for a complete, operable, code compliant, and permitted system, and meeting the manufacturer's recommendations.

3.02 TESTING:

A. The Contractor shall notify the Engineer when the installation has been completed and shall perform all required testing in the presence of and to the satisfaction of the local Fire Department.

B. Following completion of all required testing, the system shall be left fully charged and ready for operation.

END OF SECTION

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