SECTION 21 0500
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, fittings, sleeves, escutcheons, seals, and connections for sprinkler systems.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 09 9123 - Interior Painting: Preparation and painting of interior fire protection piping systems.

1.03 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2011.

F. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).

G. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

H. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.

I. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

J. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

K. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2013.

L. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.

M. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2012.

N. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.

O. AWWA C606 - Grooved and Shouldered Joints; 2011.

P. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Project Record Documents: Record actual locations of components and tag numbering.

D. Operation and Maintenance Data: Include installation instructions and spare parts lists.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified this section.
   1. Minimum three years experience.

B. Conform to UL, FM, and Warnock Hersey requirements.

PART 2 PRODUCTS

2.01 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Comply with NFPA 13.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 BURIED PIPING

A. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: AWWA C110/A21.10, standard thickness.
   2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket.
   3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

2.03 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A795 Schedule 10 or ASTM A795 Schedule 40, black.
   1. Schedule 10 for pipes over 3" in diameter.
   2. Schedule 40 for pipes up to 3" in diameter.
   3. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
   4. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
   5. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), H58 drawn.
   1. Mechanical Grooved Couplings: Ductile iron housing with alkyd enamel paint coating clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers.
   2. Pro Press:

2.04 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.

B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Quarry Tile, Terrazzo, or Ceramic Tile Floors:
   1. Brass pipe.
   2. Connect sleeve with floor plate.

E. Pipe Passing Through Mechanical and Laundry Floors above Basement:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

F. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
   3. Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.05 ESCUTCHEONS

A. Manufacturers:
   1. Fire Protection Products, Inc: www.fppi.com.com.
   2. Tyco Fire Protection Products: www.tyco-fire.com.
   3. Viking Group Inc: www.vikinggroupinc.com.

B. Material:
   1. Chrome-plated.
   2. Metals and Finish: Comply with ASME A112.18.1.

C. Construction:
   1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
   2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.06 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.07 MECHANICAL COUPLINGS

A. Manufacturers:
   1. Victaulic Company: www.victaulic.com.

B. Rigid Mechanical Couplings for Grooved Joints:
   1. Dimensions and Testing: Comply with AWWA C606.
   2. Minimum Working Pressure: 300 psig.
   3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
   4. Housing Coating: Factory applied orange enamel or _____.
   5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   6. Bolts and Nuts: Hot dipped galvanized or zinc electroplated steel.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

G. Pipe Hangers and Supports:
   1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   6. Provide copper plated hangers and supports for copper piping.

H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Structural Considerations:
   1. Do not penetrate building structural members unless indicated.

K. Provide sleeves when penetrating footings, floors, walls, and partitions and seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
   2. Aboveground Piping:
      a. Pack solid using mineral fiber complying with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.
   4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

L. Escutcheons:
   1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
   2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
   3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

M. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 21 0500

SECTION 21 0513
COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

1.02 REFERENCE STANDARDS

A. NEMA MG 00001 - Motors and Generators; 2024.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

D. Operation Data: Include instructions for safe operating procedures.

E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of electric motors for Fire Protection use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.

B. Comply with NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for motors larger than 20 horsepower.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Baldor Electric Company/ABB Group: www.baldor.com.

B. US Motor.

C. Lincoln.

D. Marathon.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
   1. Motors Larger than 3/4 Horsepower: 460 volts, three phase, 60 Hz.
      a. TEFC Type unless notes otherwise.

B. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 104 degrees F environment.
   3. Design for temperature rise in accordance with NEMA MG 00001 limits for insulation class, service factor, and motor enclosure type.

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

D. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

2.04 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION 21 0513

SECTION 21 0523
GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Two-piece ball valves with indicators.

B. Bronze butterfly valves with indicators.

C. Iron butterfly valves with indicators.

D. Check valves.

E. Bronze OS&Y gate valves.

F. Iron OS&Y gate valves.

G. NRS gate valves.

H. Indicator posts.

I. Trim and drain valves.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

1.03 ABBREVIATIONS AND ACRONYMS

A. EPDM: Ethylene-propylene diene monomer.

B. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

C. NRS: Non-rising stem.

D. OS&Y: Outside screw and yoke.

E. PTFE: Polytetrafluoroethylene.

F. SBR: Styrene-butadiene rubber.

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch); 2013.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.

C. ASME B31.9 - Building Services Piping; 2014.

D. AWWA C606 - Grooved and Shouldered Joints; 2011.

E. FM (AG) - FM Approval Guide; current edition.

F. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

G. NFPA 13R - Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies; 2025.

H. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

I. UL 262 - Gate Valves for Fire-Protection Service; Current Edition, Including All Revisions.

J. UL 789 - Indicator Posts for Fire-Protection Service; Current Edition, Including All Revisions.

K. UL 1091 - Standard for Butterfly Valves for Fire-Protection Service; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Obtain valves for each valve type from single manufacturer.
   2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B. Where listed products are specified, provide products listed, classified, and labeled by FM (AG), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.

C. Installer and Maintenance Contractor Qualifications:
   1. Company specializing in performing the work of this section with minimum five years documented experience.
   2. Trained and approved by manufacturer to design, install, test and maintain the equipment specified herein.
   3. Complies with manufacturer's certification requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors and maintain at higher than ambient dew point temperature.
      b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.

C. Use the following precautions for handling:
   1. Do not use operating handles or stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. UL Listed: Provide valves listed in UL (DIR) under following headings and bearing UL mark:
   1. Main Level: HAMV - Fire Main Equipment.
      a. Level 1: HCBZ - Indicator Posts, Gate Valve.
      b. Level 1: HLOT - Valves.
      c. Level 3: HLUG - Ball Valves, System Control.
      d. Level 3: HLXS - Butterfly Valves.
      e. Level 3: HMER - Check Valves.
      f. Level 3: HMRZ - Gate Valves.
   2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.
      a. Level 1: VQGU - Valves, Trim, and Drain.

B. FM Global Approved: Provide valves listed in FM (AG) Approval Guide under the following headings:
   1. Automated Sprinkler Systems:
      a. Indicator posts.
      b. Valves:
         1) Gate valves.
         2) Single check valves.

3) Miscellaneous valves.

C. ASME Compliance:
   1. ASME B16.1 for flanges on iron valves.
   2. ASME B1.20.1 for threads on threaded-end valves.
   3. ASME B31.9 for building services piping valves.

D. Comply with AWWA C606 for grooved-end connections.

E. Comply with NFPA 13 and NFPA 13R for valves.

F. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

2.02 TWO-PIECE BALL VALVES WITH INDICATORS

A. Manufacturers:
   1. Nibco
   2. Victaulic
   3. Viking
   4. Watts

B. Description:
   1. Minimum Pressure Rating: 175 psig.
   2. Body Design: Two piece.
   3. Body Material: Forged brass or bronze.
   4. Port Size: Full or standard.
   5. Seat: PTFE.
   6. Stem: Bronze or stainless steel.
   7. Ball: Chrome-plated brass.
   8. Actuator: Worm gear or traveling nut.

2.03 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers:
   1. See 2.02.A for manufacturers.

B. UL 1091 and FM (AG) standard listing for indicating valves, (butterfly or ball type), Class Number 1112.

C. Minimum Pressure Rating: 175 psig.

D. Body Material: Bronze.

E. Seat: EPDM.

F. Stem: Bronze or stainless steel.

G. Disc: Bronze with EPDM coating.

H. Actuator: Worm gear or traveling nut.

I. Supervisory Switch: Internal or external.

2.04 IRON BUTTERFLY VALVES WITH INDICATORS

A. UL 1091 and FM (AG) standard listing for indicating valves (butterfly or ball type), Class Number 112.

B. Minimum Pressure Rating: 175 psig.

C. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.

D. Seat: EPDM.

E. Stem: Stainless steel.

F. Disc: Ductile iron, nickel plated.

G. Actuator: Worm gear or traveling nut.

H. Supervisory Switch: Internal or external.

I. Body Design: Grooved-end connections.

2.05 CHECK VALVES

A. Minimum Pressure Rating: 175 psig.

B. Type: Center guided check valve.

C. Body Material: Cast iron, ductile iron.

D. Center guided check with elastomeric seal.

E. Hinge Spring: Stainless steel.

F. End Connections: Flanged, grooved, or threaded.

2.06 BRONZE OS&Y GATE VALVES

A. UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).

B. Minimum Pressure Rating: 175 psig.

C. Body and Bonnet Material: Bronze or brass.

D. Wedge: One-piece bronze or brass.

E. Wedge Seat: Bronze.

F. Stem: Bronze or brass.

G. Packing: Non-asbestos PTFE.

H. Supervisory Switch: External.

I. End Connections: Threaded.

2.07 IRON OS&Y GATE VALVES

A. UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).

B. Minimum Pressure Rating: 175 psig.

C. Body and Bonnet Material: Cast or ductile iron.

D. Wedge: Cast or ductile iron, or bronze with elastomeric coating.

E. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.

F. Stem: Brass or bronze.

G. Packing: Non-asbestos PTFE.

H. Supervisory Switch: External.

I. End Connections: Flanged.

2.08 NRS GATE VALVES

A. UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).

B. Minimum Pressure Rating: 175 psig.

C. Body and Bonnet Material: Cast or ductile iron.

D. Wedge: Cast or ductile iron with elastomeric coating.

E. Stem: Brass or bronze.

F. Packing: Non-asbestos PTFE.

G. Supervisory Switch: External.

H. End Connections: Flanged.

2.09 INDICATOR POSTS

A. UL 789 and FM (AG) standard listing for indicator posts.

B. Type: Underground.

C. Base Barrel Material: Cast or ductile iron.

D. Extension Barrel for Adjustable Length Indicator Posts: Cast or ductile iron.

E. Cap: Cast or ductile iron.

F. Operation: Wrench.

2.10 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Description:
    a. Pressure Rating: 175 psig.
    b. Body Design: Two piece.
    c. Body Material: Forged brass or bronze.
    d. Port Size: Full or standard.
    e. Seat: PTFE.
    f. Stem: Bronze or stainless steel.
    g. Ball: Chrome-plated brass.
    h. Actuator: Hand-lever.

PART 3 EXECUTION

3.01 EXAMINATION

A. Confirm valve interior to be free of foreign matter and corrosion.

B. Remove packing materials.

C. Examine guides and seats by operating valves from the fully open position to the fully closed position.

D. Examine valve threads and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage.

1. Check bolting for proper size, length, and material.
2. Verify gasket for size, defects, damage, and suitable material composition for service.
3. Replace all defective valves with new valves.

3.02 INSTALLATION

A. Comply with specific valve installation requirements and application in the following Sections:

B. Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.

1. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in water supply connections and backflow preventer at potable water supply connections.

D. Valves with threaded connections to have unions at equipment arranged for easy access, service, maintenance, and equipment removal without system shutdown.

E. Valves in horizontal piping installed with stem at or above the pipe center.

F. Position valves to allow full stem movement.

G. Install valve tags. Comply with Section 21 0553 requirements for valve tags, schedules, and signs on surfaces concealing valves; and the appropriate NFPA standard applying to the piping system in which valves are installed.

END OF SECTION 21 0523

SECTION 21 0533
HEAT TRACING FOR FIRE SUPPRESSION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Self-regulating parallel resistance electric heating cable.

1.02 REFERENCE STANDARDS

A. IEEE 515.1 - IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications; 2012.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Coordinate the work with other trades to provide ground fault protection for electric heat tracing circuits as required by NFPA 70.

C. Coordinate the work with other trades to provide circuit breaker ratings suitable for installed circuit lengths.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate electric heat tracing layout, electrical terminations, thermostats, controls, branch circuit connections, and _____.

C. Field Quality Control Submittals: Indicate test reports and inspection reports.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 SELF-REGULATING PARALLEL RESISTANCE ELECTRIC HEATING CABLE

A. Manufacturers:
   1. Chromalox, Inc: www.chromalox.com.
   2. Raychem.

B. Provide products listed, classified, and labeled by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction (AHJ) specifically for use on branch sprinkler lines in accordance with NFPA 13.

C. Factory Rating and Testing: Comply with IEEE 515.1.

D. Heating Element:
   1. Provide pair of parallel No. 16 tinned, nickel coated, or _____ stranded copper bus wires embedded in cross linked conductive polymer core with varying heat output in response to temperature along its length.
   2. Terminations: Waterproof, factory assembled, non-heating leads with connector at one end and water-tight seal at opposite end.
   3. Capable of crossing over itself without overheating.

E. Insulated Jacket: Flame retardant polyolefin.

F. Cable Cover: Provide tinned copper and polyolefin outer jacket with UV inhibitor.

G. Maximum Power-On Operating Temperature: 150 degrees F.

H. Maximum Power-Off Exposure Temperature: 185 degrees F.

2.02 CABLE OUTER JACKET MARKINGS

A. Name of manufacturer, trademark, or other recognized symbol of identification.

B. Catalog number, reference number, or model.

C. Month and year of manufacture, date coding, applicable serial number, or equivalent.

D. Agency listing or approval.

E. Applicable environmental or area use requirements, such as NEMA 4, Type 4, IP ratings, and hazardous (classified) location markings including temperature rating.

F. Any applicable warning/caution statements such as "WARNING: De-energize circuit before removing cover.

2.03 CONNECTION KITS

A. Provide power connection, splice/tee, and end seal kits compatible with the heating cable and without requiring cutting of the cable core to expose bus wires.

B. Furnish with NEMA 4X rating for prevention of corrosion and water ingress.

C. Provide UV stabilized components.

2.04 ACCESSORIES

A. Provide Accessories As Indicated or As Required for Complete Installation, Including but Not Limited To:
   1. High temperature, glass filament tape for attachment of heating cable to metal piping.
   2. Aluminum self-adhesive tape for attachment of heating cable to plastic piping.
   3. Heat-conductive putty.
   4. Cable ties.
   5. Silicone end seals and splice kits.
   6. Installation clips.
   7. Warning labels for attachment to exterior of piping insulation. Refer to Section 22 0553.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping and equipment are ready to receive work.

B. Verify field measurements are as indicated on shop drawings.

C. Verify required power is available, in proper location, and ready for use.

3.02 PREPARATION

A. Clean all surfaces prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer.

3.03 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Comply with installation requirements of IEEE 515.1, NFPA 70, Article 427, and applicable requirements of NFPA 13.

C. Apply heating cable linearly on pipe with fiberglass tape only after piping has successfully completed any required pressure testing.

D. Comply with applicable local code requirements.

E. Identification:
   1. After thermal insulation installation, apply external pipeline decals to indicate presence of the thermal insulation cladding at intervals not to exceed 20 ft including cladding over each valve or other equipment that may require maintenance.

F. Electronic Supervision:

1. Provide positive confirmation that circuit is energized in accordance with the requirements of NFPA 13.

3.04 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 21 0533

SECTION 21 0548
VIBRATION AND SEISMIC CONTROLS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration-isolated equipment support bases.

B. Vibration isolators.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

PART 2 PRODUCTS

2.01 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION 21 0548

SECTION 21 0553
IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Stencils.

C. Pipe markers.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Stencil paint.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C.

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Red.

2.02 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
   2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
   3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.

2.03 PIPE MARKERS

PART 3 EXECUTION

3.01 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Apply stencil painting in accordance with Section 09 9123.

C. Use tags on piping 3/4 inch diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 21 0553

SECTION 21 0719
FIRE SUPPRESSION PIPING INSULATION

PART 2 PRODUCTS

1.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

END OF SECTION 21 0719

SECTION 21 1100
FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water pipe.

B. Valves.

C. Fire department connections.

D. Accessories.

1.02 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

B. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2011.

C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

E. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications; 2014 (Reapproved 2022).

F. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.

G. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape-Hot-Applied; 2008.

H. AWWA C206 - Field Welding of Steel Water Pipe; 2011.

I. AWWA M11 - Steel Water Pipe - A Guide For Design and Installation; 2004 w/Errata.

J. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.

C. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.
   2. Provide manufacturer's catalog information.
   3. Indicate valve data and ratings.

D. Project Record Documents:
   1. Record actual locations of piping mains, valves, connections, fire hydrants, free-standing fire department connections, underground manholes and vaults, valve boxes, thrust restraints, and invert elevations.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.

B. Welder Qualifications:
   1. Provide certificate of compliance from local Authority Having Jurisdiction, indicating approval of welders.

C. Perform Work in accordance with local authorities having jurisdiction, municipality, and water utility requirements.

PART 2 PRODUCTS

2.01 WATER PIPE

A. Steel Pipe and Fittings:
   1. Pipe: Standard weight, zinc-coated, listed, ASTM A53/A53M.
   2. Fittings: Comply with ASME B16.3, Class 150, zinc coated, threaded or ASME B16.4, Class 125, zinc-coated
   3. Mechanically Factory Applied Protective Materials:
      a. Clean by wire brushing and solvent cleaning.
      b. Apply one coat of coal-tar primer and two coats of coal-tar enamel complying with AWWA C203.
      c. Protect threaded pipe ends and fittings prior to coating.

2.02 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

2.03 FIRE DEPARTMENT CONNECTIONS:

A. Free-Standing Inlet:
   1. Construction:
      a. Listed .
      b. Type: Free standing type ASTM B584 poured brass alloy.
      c. Inlets: Two way, 2-1/2 inch female inlets, thread size compatible with fire department hardware.
      d. Rated Working Pressure: 175 psi.
      e. Double clapper-valves, rocker-lug caps and chain, and cast-in function-identifying lettering.
      f. Finish: Polished brass.
      g. Label: Sprinkler - Fire Department Connection.

2.04 ACCESSORIES

A. Outdoor Backflow Enclosures:

B. Tracer Wire:
   1. Provide magnetic, detectable conductor with clear plastic covering and imprinted with "Water Service" in large letters.
   2. Conductor to be of sufficient length to be continuous over each separate run of nonmetallic pipe.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 INSTALLATION

A. General Requirements:
   1. Location of Water Lines:
   2. Sleeving:
      a. Sleeve water piping where piping is required to be installed within 3 feet of existing structures.
      b. Provide ductile iron, Schedule 40 steel, or _____ sleeves.
      c. Fill annular space between pipe and sleeves with mastic.

d. Install water pipe and sleeve without damaging structures or causing settlement or movement of foundations or footings.

3. Pipe Laying and Jointing:
   a. Remove fins and burrs from pipe and fittings.
   b. Prior to placing in position, clean pipe, fittings, valves, and accessories, and maintain in clean condition.
   c. Provide proper facilities for lowering pipe sections into trenches.
   d. Dropping or dumping of piping, fittings, valves, or any other water line material into trenches is not permitted.
   e. Cut pipe in a neat workmanlike manner accurately to length established at the site and work into place without forcing or springing.
   f. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
   g. Wedging or blocking between bells and spigots will not be permitted.
   h. Install bell-and-spigot pipe with the bell end pointing in the direction of laying.
   i. Grade the pipeline in straight lines avoiding the formation of dips and low points.
   j. Support piping at proper elevation and grade.
   k. Secure firm, uniform support.
   l. Wood support blocking will not be permitted.
   m. Install pipe so that the full length of each pipe section and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
   n. Provide anchors and supports where indicated, necessary, and _____ for fastening work into place.
   o. Provide proper provisions for expansion and contraction of pipelines.
   p. Keep trenches free of water until joints have been properly made.
   q. Close open ends of piping temporarily with wood blocks or bulkheads at the end of each work day.
   r. Do not install pipe during unacceptable trench conditions or inclement weather.
   s. Minimum Depth of Pipe Cover: Not less than 2-1/2 feet.
4. Connections to Existing Water Lines:
   a. Ensure minimal interruption of service on the existing line.
   b. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped.
5. Penetrations:
   a. Provide ductile-iron, Schedule 40 steel, or _____ for pipes passing through walls of valve pits and structures.
   b. Fill annular space between sleeves and walls with rich cement mortar.
   c. Fill annular space between pipe and sleeves with mastic.

B. Special Requirements:
1. Steel Piping:
   a. Jointing:
      1) Welded: Make welded joints in accordance with AWWA C206 and install in accordance with AWWA M11.
   b. Allowable Offsets:
   c. Pipe Anchorage:
      1) Provide concrete thrust blocks (reaction backing) for pipe anchorage, except where metal harness is indicated.
      2) Thrust blocks to be in accordance with the recommendations for thrust restraint in AWWA M11, except that size and positioning of thrust blocks are to be as indicated.

3) Use ASTM C94/C94M concrete having a minimum compressive strength of 2500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
4) Metal Harness:
   (a) Provide in accordance with the recommendations for joint harnesses in AWWA M11, except as otherwise indicated.
   (b) Fabricated by the pipe manufacturer and furnished with the pipe.

C. Valves:
1. Set valves on solid bearing.
2. Center and plumb valve box over valve.
3. Set box cover flush with finished grade.

3.04 SERVICE CONNECTIONS

A. Provide fire water service to Local Authority Having Jurisdiction requirements with reduced pressure backflow preventer and water meter with by-pass valves and sand strainer.

3.05 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
1. See Section 01 4000 - Quality Requirements, for additional requirements.
2. Provide all labor, equipment, and incidentals required for field testing, except that water and electric power needed for field tests will be furnished as set forth in Section 01 5100 - Temporary Utilities.
3. Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently and at least 5 days after placing of concrete after concrete thrust blocks have hardened sufficiently, at least 5 days after placing of concrete, and _____.
4. Fill pipeline 24 hours before testing and apply test pressure to stabilize system, using only potable water.
5. Pressure test piping to ____ psi.
6. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
7. Prepare reports of testing activities.

3.06 CLOSEOUT ACTIVITIES

END OF SECTION 21 1100

SECTION 21 1200
FIRE-SUPPRESSION STANDPIPES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire hose cabinets.

B. Valves.

C. Fire department connections.

D. Fire extinguishers.

1.02 RELATED REQUIREMENTS

A. Section 10 4400 - Fire Protection Specialties.

B. Section 21 0500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION: Fire protection piping.

C. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

D. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

E. Section 21 1300 - Fire-Suppression Sprinkler Systems.

F. Section 21 3000 - Fire Pumps.

G. Section 22 0553 - Identification for Plumbing Piping and Equipment.

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; current edition.

B. ITS (DIR) - Directory of Listed Products; current edition.

C. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

D. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2013.

E. NFPA 1963 - Standard for Fire Hose Connections; 2014.

F. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

G. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's catalog sheet for equipment indicating rough-in size, finish, and accessories.

B. Shop Drawings: Indicate supports, components, accessories, and sizes.
   1. Submit shop drawings and product data to Owner's insurance underwriter for approval.
   2. Submit proof of approval to Architect.

C. Project Record Documents: Record actual locations of components.

D. Operation Data: Include appropriate manufacturer's data.

E. Maintenance Data: Include servicing requirements and test schedule.

F. Certificates: Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 14. Maintain one copy on site.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years documented experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in shipping packaging until installation.

PART 2 PRODUCTS

2.01 FIRE HOSE CABINETS

A. Manufacturers:
   1. Substitutions: See Section 01 6000 - Product Requirements.

B. Cabinet:
   1. Style: Recessed mounted.
   2. Door: 12 gage, 0.1046 inch thick steel, flush, glazed with 1/4 inch (6.35 mm) thick wired glass full panel; hinged, positive latch device.
   3. Finish: Prime coated.

C. Hose Rack: Steel with polished chrome finish; swivel type with pins and water stop.

D. Hose: 1 inch diameter, 50 feet long, of linen hose; mildew and rot-resistant.

E. Nozzle: Chrome plated brass; combination fog, straight stream, and adjustable shut-off.

2.02 VALVES

A. General Duty Valves: Refer to Section 21 0523.

B. Specialty Valves:
   1. Hose Connection Valve:
      a. Angle type; brass finish; 2-1/2 NPS, thread to match fire department hardware, 300 psi working pressure, with threaded cap and chain of same material and finish.

C. Hose Connection Valve Cabinets:
   1. Style: Recessed mounted.
   2. Tub: 16 gage, 0.0598 inch thick steel, prepared for pipe and accessory rough-in.
   3. Door: 12 gage, 0.1046 inch thick steel, flush, glazed with 1/4 inch (6.35 mm) thick wired glass full panel; hinged, positive latch device.
   4. Finish: Prime coated.

2.03 FIRE DEPARTMENT CONNECTIONS

A. Type: Free standing made of corrosion resistant metal complying with UL 405.
   1. Manufacturers:
      a. Elkhart Brass Manufacturing Company, Inc; _____: www.elkhartbrass.com/#sle.
      b. Fire End & Croker Corporation; _____: www.croker.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.
   2. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
   3. Rated Working Pressure: 175 psi.
   4. Finish: Chrome.
   5. Sleeve: Brass, 18 inches height.
   6. Signage: Raised or engraved lettering 1 inch minimum indicating system type.

2.04 FIRE EXTINGUISHERS

A. General: Comply with NFPA 10; FM (AG), ITS (DIR), and UL (DIR) listed product.

B. Multi-Purpose Dry Chemical Type: Cartridge operated with hose and shut-off nozzle or integral shut-off nozzle.
   1. 10 pound capacity with 4A:60BC rating.
   2. 20 pound capacity with 20A:120BC rating.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 14.

C. Locate and secure cabinets plumb and level. Establish top of cabinet (inside horizontal) surface 66 inches above finished floor.

D. Connect standpipe system to water source ahead of domestic water connection.

E. Flush entire system of foreign matter.

END OF SECTION 21 1200

SECTION 21 1300
FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. Dry-pipe sprinkler system.

C. Pre-action sprinkler system.

D. System design, installation, and certification.

E. Fire department connections.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 07 8700 - Smoke Containment Barriers: Smoke and fire curtains to be released by activation of sprinkler system.

C. Section 14 9100 - Facility Chutes: Sprinkler heads inside chutes.

D. Section 21 0500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION: Pipe and fittings.

E. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

F. Section 21 0548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.

G. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

H. Section 21 1200 - Fire-Suppression Standpipes.

I. Section 21 3000 - Fire Pumps.

J. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

K. Section 22 0553 - Identification for Plumbing Piping and Equipment.

L. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

M. Section 28 4600 - Fire Detection and Alarm.

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; current edition.

B. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2012.

C. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2012.

D. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.

E. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2013.

F. ITS (DIR) - Directory of Listed Products; current edition.

G. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

H. NFPA 13R - Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies; 2025.

I. NFPA 1963 - Standard for Fire Hose Connections; 2014.

J. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:
   1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
   2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
   3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect.

D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

E. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
   3. Sprinkler Wrenches: For each sprinkler type.

1.06 QUALITY ASSURANCE

A. Comply with FM (AG) requirements.

B. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Michigan.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience and approved by manufacturer.

E. Equipment and Components: Provide products that bear FM (AG) label or marking.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sprinklers, Valves, and Equipment:
   1. Tyco Fire Protection Products; _____: www.tyco-fire.com/#sle.
   2. Viking Corporation; _____: www.vikinggroupinc.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for entire building.

B. Occupancy: Light hazard; comply with NFPA 13.

C. Water Supply: Determine volume and pressure from water flow test data.

D. Provide fire department connections where indicated.

E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

F. Pipe Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
   2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
   3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
   4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.

2.03 SPRINKLERS

A. Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

B. Exposed Area Type: Pendant type with guard.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Brass.
   4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

C. Dry Sprinklers: _____ pendant type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Finish: Brass.
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

D. Storage Sprinklers: Pendant type with guard.
   1. Response Type: Standard.
   2. Coverage Type: Standard.
   3. Finish: Chrome plated.
   4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

E. Guards: Finish to match sprinkler finish.

F. Flexible Drop System: Stainless steel, multiple use, open gate type.
   1. Application: Use to properly locate sprinkler heads.
   2. Include all supports and bracing.
   3. Provide braided type tube as required for the application.
   4. Manufacturers:
      a. Victaulic Company; Vic-Flex: www.victaulic.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
   1. Activate electric alarm.
   2. Test and drain valve.
   3. Replaceable internal components without removing valve from installed position.
   4. Manufacturers:
      a. Victaulic Company; Series 751 with Series 760 motor alarm: www.victaulic.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

B. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, accelerator, and with the following additional capabilities and features:
   1. Activate electric alarm.
   2. Test and drain valve.
   3. Externally resettable.
   4. Replaceable internal components without removing valve from installed position.

5. Manufacturers:
    a. Victaulic Company; Series 768 - NXT: www.victaulic.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

C. Preaction Valve:
1. Operated by detection system listed for releasing service and independent of building fire alarm system with provisions for local, manual, and indicated remote releases.
2. Incorporate mechanical latching mechanism incorporating valve clappers independent of system water pressure fluctuations.
3. Provide test detection device for each actuation circuit adjacent to each controlled valve in accordance with NFPA 13.

D. Backflow Preventer: Reduced pressure principle valve assembly backflow preventer with drain and OS & Y gate valve on each end.

E. Test Connections:
1. Inspector's Test Connection for Preaction Systems:
    a. Provide test connections approximately 6 ft above floor for each or portion of each sprinkler system equipped with an alarm device, located at the most remote part of each system.
    b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
    c. Supply discharge orifice with same size as corresponding sprinkler orifice.
    d. Limit vertical height of exterior wall penetration to 2 ft above finished grade.
2. Backflow Preventer Test Connection:
    a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch National Standard male hose threads with cap and chain.
    b. Furnish one valve for each 250 gpm of system demand or fraction thereof.
    c. Provide permanent sign reading "Test Valve" in accordance with Section 22 0553.

F. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

G. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

H. Fire Department Connections:
1. Type: Free standing made of corrosion resistant metal complying with UL 405.
    a. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
    b. Rated Working Pressure: 175 psi.
    c. Finish: Chrome.
    d. Sleeve: Brass, 18 inches height.
    e. Signage: Raised or engraved lettering 1 inch minimum indicating system type.
    f. Manufacturers:
        1) Elkhart Brass Manufacturing Company, Inc; _____: www.elkhartbrass.com/#sle.
        2) Fire End & Croker Corporation; _____: www.croker.com/#sle.
        3) Substitutions: See Section 01 6000 - Product Requirements.

2.05 PREACTION VALVE CONTROL PANEL

A. Provide a modular type control panel for electrically operated detection and extinguishing systems for each preaction valve.
1. Factory mount in surface mounted, steel cabinet with hinged doors, and cylinder lock.
2. Provide factory wired assembly containing components and equipment as required to perform specified system operating and supervisory functions.
3. Include isolation switch to allow system testing without activation of the preaction valve.
4. House batteries in separate and lockable, steel cabinet.

5. Finish interior and exterior of cabinet with enamel paint and provide identification plates in accordance with Section 22 0553.
6. Provide 120 volt AC service transformed through a two-winding, isolation type transformer and rectified to low voltage DC for operation of all system actuating, signal sounding, trouble signal, and fire alarm tripping circuits.
7. Provide UL (DIR) listed as an extinguishing system releasing panel and separate from the building's fire alarm control panel.

B. Secondary Power Supply:
1. Provide nickel cadmium rechargeable storage batteries and battery charger.
2. Storage Batteries:
a. Provide with sufficient ampere-hour rating to operate under supervisory and trouble conditions, including audible trouble signal devices under alarm conditions for an additional 10 minutes and as required in accordance with the equipment listing.
b. Prevent contact between terminals of adjacent cells, battery terminals, and other metal parts with separate cell construction.
3. Battery Charger:
a. Provide solid state automatic two rate type, capable of recharging completely discharged batteries to fully charged condition in 24 hours or less.
b. Locate charger within control panel or battery cabinet.

C. Wiring: Refer to Section 26 0583.

D. Supervision: Refer to Section 28 4600.

2.06 PRESSURE MAINTENANCE PUMP

A. Type: Close coupled motor and positive displacement pump unit.

B. Construction: Bronze with stainless steel shafts, carbon bearings.

C. Motor: Open drip proof, permanently lubricated.

D. Electrical Characteristics:
1. 0.33 hp.
2. 115 volts, single phase, 60 Hz.

E. Accessories: Include flexible hose connections.

F. Operation: Manual.

2.07 AIR COMPRESSOR

A. Compressor: Single unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and unloader valve.

B. Electrical Characteristics:
1. 1/3 hp.
2. 125 volts, single phase, 60 Hz.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Provide approved backflow preventer assembly at sprinkler system water source connection.

D. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

E. Locate outside alarm gong on building wall as indicated.

F. Place pipe runs to minimize obstruction to other work.

G. Place piping in concealed spaces above finished ceilings.

H. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

I. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

J. Install air compressor on vibration isolators. Refer to Section 22 0548.

K. Flush entire piping system of foreign matter.

L. Install guards on sprinklers where indicated.

M. Hydrostatically test entire system.

N. Require test be witnessed by Fire Marshal.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

3.03 SCHEDULES

A. System Hazard Areas:
   1. Offices: Light Hazard.
   2. Warehouse: Ordinary Hazard, Group 2.
   3. Computer Room: Light Hazard, Pre-action.

B. Sprinklers:
   1. Drawing Code:
   2. Manufacturer:
   3. Model:
   4. Location:
   5. Temperature Rating:
   6. Finish:
   7. Style:

END OF SECTION 21 1300

SECTION 21 1339
FOAM-WATER SYSTEMS

PART 2 PRODUCTS

1.01 SYSTEM DESIGN

A. Provide foam-water solution protection complying with NFPA 13 and NFPA 16, for the areas indicated.
   1. Provide a complete system with all required valves, controls, wiring, and pressure sources to supply foam concentrate at the required flow and pressure to the proportioners, through the distribution piping, to discharge elements.
   2. Foam Concentrate: Aqueous film-forming type (AFFF).
   3. Tank Capacities: Sufficient to provide sufficient foam flow for the time specified when the system is discharging at design discharge rate.

B. Fire Alarm: Provide a fire alarm system monitoring foam releasing system and covering building and site areas that foam extinguishing system covers.

C. Wiring and Electrical Work: Comply with NFPA 70.

1.02 FOAM PROPORTIONING DEVICES

A. Proportioners: In-line balanced pressure proportioners.

B. Pressure Balancing Valve:
   1. Pressure balancing valve: Modulate to balance the foam concentrate pressure to the water pressure at the proportioner.

C. Duplex Pressure Gauge:
   1. Duplex Pressure Gauge: Sensing the water and foam concentrate pressures at the proportioner.

1.03 DISCHARGE ELEMENTS

A. Oscillating Monitors: Water powered type with chain drive, with mechanical adjustments for arc and speed of oscillation.
   1. UL (DIR) listed.
   2. FM (AG) approved.

1.04 PIPING AND PIPING SPECIALTIES

A. Piping for Water and Foam Solution (Not Concentrate): Steel pipe, ASTM A53/A53M, Schedule 40 unless otherwise indicated.

B. Piping for Foam Concentrate: Schedule 40, 300 series stainless steel pipe with flanged fittings.

1.05 VALVES

A. Valves - General: Pressure rating not less than maximum working pressure available to system.

B. Valves in Contact with Water and Foam Solution: Cast iron body construction.
   1. UL (DIR) listed.
   2. FM (AG) approved.

C. Valves in Contact with Foam Concentrate: Stainless steel, brass, or bronze body construction.

D. Deluge Valves: Non-latching or mechanically latching type.

E. Flow Control Valves: Non-latching type, with a diaphragm operated clapper, externally resettable by operation of the valve trim, without removing the valve's face plate.

F. Alarm Check Valves:

G. Automated Foam Concentrate Valves: Hydraulically controlled ball valves, bronze or stainless steel body, stainless steel ball, and glass reinforced teflon valve seats:

H. Valve Supervisory (Tamper) Switches: Appropriate for type of valve on which it is used; in metal housings.
   1. UL (DIR) listed.
   2. FM (AG) approved.

1.06 FIRE ALARM AND CONTROL SYSTEMS

A. Provide foam releasing and fire alarm systems connected to operate as a single system.
   1. Foam Releasing Controls: Dedicated panel containing releasing circuits for solenoids, hard wired, UL (DIR) listed for releasing service.
   2. Provide control, alarm, detection, releasing, notification, and manual equipment and components are electrically compatible and either are the standard equipment of a single manufacturer or are cross-listed for use with each other; non-listed components will be rejected.

B. Alarm and Control Panels: Modular construction to facilitate system expansion and servicing.

C. Operational Functions:
   1. Annunciate alarm and trouble conditions for each zone.
   2. Backup Power: Design and equip all portions of the fire alarm systems to be capable of operating on standby (rechargeable) battery power.
      a. Ensure that loss of primary power or the sequence of applying primary or emergency power will not affect normal operation or annunciation or the transmission of alarm, supervisory or trouble signals.
      b. Provide a power transfer circuit to switch to backup power automatically and instantaneously upon loss of normal AC power.

1.07 DETECTION DEVICES AND NOTIFICATION APPLIANCES

A. Flame Detectors: Either controller based or unitized type, mounted on swivel bases for proper positioning, capable of passing specified field tests.
   1. UL (DIR) listed.
   2. FM (AG) approved.
   3. Range: Capable of responding to a ____ fuel fire, ___ feet by ___ feet in size at a distance of ___ feet, within ___ seconds.
   4. Thermal Rating: ___ degrees F to ___ degrees F.

B. Heat Detectors: Spot type, rate compensated, automatically self-restoring detectors.

C. Evacuation Notification Appliances: Surface-mounted, suitable for use in an electrically supervised circuit and compatible with the releasing panel.

D. Manual Fire Alarm and Foam Discharge Stations: Double action type listed as a manual fire alarm station.
   1. UL (DIR) listed.
   2. Reset Function: Requiring a key for reset; key to match the key for the fire alarm panel and foam releasing panel.

E. Manual Foam Abort Stations: Momentary contact (dead man) switch, mounted on weatherproof backbox.
   1. Type: 3/4 inch minimum diameter red protected button.

END OF SECTION 21 1339

SECTION 21 2200
CLEAN-AGENT FIRE-EXTINGUISHING SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Total flooding extinguishing system for enclosed spaces.

B. Fire detection system.

C. Control and supervision systems.

D. Extinguishing agent, containers, distribution and discharge system.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 08 7100 - Door Hardware: Release hardware for automatic closing doors.

C. Section 09 9123 - Interior Painting.

D. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

E. Section 21 1300 - Fire-Suppression Sprinkler Systems.

F. Section 22 0553 - Identification for Plumbing Piping and Equipment.

G. Section 23 0913 - Instrumentation and Control Devices for HVAC: Dampers.

H. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

I. Section 28 4600 - Fire Detection and Alarm: Building fire alarm system and devices.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

B. ASME B31.1 - Power Piping; 2014.

C. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.

D. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

F. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2014.

G. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2009 (Reapproved 2014).

H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

J. FM (AG) - FM Approval Guide; current edition.

K. ISO 9000 - ISO Standards Compendium: ISO 9000 - Quality management; 2005.

L. ITS (DIR) - Directory of Listed Products; current edition.

M. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.

N. NFPA 72 - National Fire Alarm and Signaling Code; 2016.

O. NFPA 2001 - Standard on Clean Agent Fire Extinguishing Systems; 2015.

P. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

Q. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

R. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.

S. UL 1076 - Proprietary Burglar Alarm Units and Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: To bear stamp of approval of Authority Having Jurisdiction. Provide for each piece of equipment comprising the system including detectors, release devices, discharge nozzles, manual controls, alarm devices, annunciators, extinguishing agent containers, manifolds, and control panel.

C. Shop Drawings: To bear stamp of approval of Authority Having Jurisdiction. Indicate detailed layout of system, including piping and location of each component. Include control diagrams, wiring diagrams, and written sequence of operation.
   1. Drawing Scale: 1/8 inch to 1 foot, minimum; use larger scale for details.

D. Design Data: Submit design calculations bearing stamp of approval of Authority Having Jurisdiction. Include calculations that verify system pressures, nozzle flow rate, orifice code numbers, piping pressure losses, component flow data, and pipe sizes.

E. Installer's Qualification Statement.

F. Certificates: Certify that products meet or exceed specified requirements.
   1. Manufacturer: Certify that system meets or exceeds specified requirements.
   2. Welders: Submit certificate indicating compliance with ASME BPVC-IX and AWS D1.1/D1.1M.

G. Manufacturer's Instructions: Include recommended equipment installation and system components.

H. Test Reports: Indicate successful completion of tests; include certification of extinguishing agent container pressure and extinguishing agent quantity.

I. Code Authority Approval: Submit copy of inspection approval of fire protection system by Authority Having Jurisdiction.

J. Project Record Documents: Record actual locations of components and equipment, equipment identification markings, conduit and piping routing details, and agent container positions.

K. Operation and Maintenance Data:
   1. Include electrical schematic written description of system design, drawings illustrating control logic and equipment locations, and technical brochures describing equipment.
   2. Include list of recommended spare parts.
   3. Include checklists and procedures for emergency situations, trouble shooting techniques, abort functions, system control panel operation, trouble procedures, and safety requirements.

L. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Michigan.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
   1. ISO 9000 registered.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX.

D. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store equipment in shipping containers with labeling in place. Deliver fire extinguishing agent in approved containers.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 FIRE SUPPRESSION SYSTEM MANUFACTURERS

A. System Components Other Than Pipe, Piping Specialties, Conduit, Wiring, and Wiring Devices:
   1. ANSUL, a Tyco Business; using INERGEN extinguishing agent: www.ansul.com/#sle.
   2. Chemetron Fire Systems, a UTC Company; FM-200: www.chemetron.com.
   3. Pyro-Chem, a Tyco Fire Business; using FM 200 as extinguishing agent: www.pyrochem.com/#sle.

B. Controls and Control Panels:

C. Alarm and Detection Systems:

2.02 APPLICATIONS

A. Computer Room: Location of devices:
   1. Smoke Detector: One at ceiling, and two below floor.
   2. Heat Detector: Two at ceiling.
   3. Abort Switch: Next to main entrance, left side.
   4. Manual Release: Next to main entrance, right side.
   5. Alarm Bell: Any suitable location.
   6. Alarm Horn: Not required.

2.03 FIRE SUPPRESSION SYSTEM

A. Fire Suppression System: Complete fire detection and suppression system that totally floods protected area with fire extinguishing agent to extinguish fire.
   1. Comply with NFPA 2001 and NFPA 72.
   2. Fire Extinguishing Agent: Any allowed by NFPA 2001.
   3. Locate extinguishing agent supply and backup supply in each protected area.
   4. Locate manual release stations at each exit from protected area.
   5. Locate abort stations at each exit from protected area.
   6. Provide all manufactured system components from a single source and by a single manufacturer.
   7. Provide components listed and labeled by ITS (DIR) or UL (DIR) for the type of system required and for use with the other components of the system.

B. Design Criteria: Provide total flooding of fire extinguishing agent at manufacturer's recommended concentration by volume, in maximum discharge time of 10 seconds, for period of 10 minutes and with 10 percent allowance for room leakage.
   1. Direct discharge parallel to ceiling; use 360 degree pattern nozzles except where obstructions would make 360 distribution inefficient.
   2. Provide sufficient amount of fire extinguishing agent. Consider the following when computing volume:
      a. Volume of protected area.
      b. Specific volume of fire extinguishing agent.
      c. Additional quantities of fire extinguishing agent required to compensate for openings, pipe losses.
      d. Other special conditions affecting extinguishing agent concentration.

2.04 PIPE AND PIPING SPECIALTIES

A. Steel Pipe: ASTM A53/A53M or ASTM A106/A106M Schedule 40, or ASTM A135/A135M Schedule 10, galvanized as specified in ASTM A53/A53M.
   1. Fittings: ASME B16.3 malleable iron class 300 for sizes 2 inch and smaller, or ASTM A234/A234M, wrought steel welding type fittings.
   2. Joints: Threaded, AWS D1.1/D1.1M welded, or grooved and shouldered pipe end couplings.

B. Pipe Hangers: ASME B31.1, FM (AG) or UL (DIR) approved listing for sprinkler systems, split clamp up to 2-1/2 inch size, riser clamps over 2-1/2 inch size, adequate to offset discharge thrust.

C. Escutcheons: Chrome plated pressed or stamped brass, one-piece or split pattern, minimum 2 inches larger than opening.

D. Gauges:
   1. ASME B40.100, UL 393, or UL 404 3-1/2 inch diameter cast aluminum case, phosphor bronze bourdon tube, rotary brass movement, brass socket, front re-calibration adjustment, black figures on white background, 1 percent mid-scale accuracy, scale calibrated in psi.

2.05 EXTINGUISHING AGENT CONTAINERS

A. Containers:
   1. Where multiple, replaceable containers are used, provide only containers of the same size and holding the same amount of extinguishing agent.

B. Contents: Fill with required fire extinguishing agent.

C. Identification: Permanent plate or marking, specifying agent, tare and gross weight, pounds of fire extinguishing agent, and pressurization level; installed so plate or marking is visible and readable.

D. Safety Release: Equip with frangible disc safety device that operates when internal pressure exceeds 730 pounds per square inch.

E. Safety Release: Equip with frangible disc safety device.

F. Valves: Heavy duty forged brass, with safety pressure relief device, manual control, discharge valve, and pressure gauge.
   1. Pressure relief device activated at between 3000 to 3360 pounds per square inch.
   2. Provide a solenoid pilot valve for each container or each bank of containers.

G. Actuator: Resettable electric or pneumatic with pressurized nitrogen cartridge. Explosive devices are NOT permitted.

H. Pressure Gauge: Visual indicator of internal pressure.

I. Low Pressure Switch: Electronic sensor; reports to control panel and provides audible and visual alarms when container pressure drops below 230 pounds per square inch.

J. Manifold: Provide for systems with more than one container, with rack to secure each and check valves between each discharge and manifold.

K. Wall Bracket: Manufacturer's standard; UL (DIR) listed, welded steel construction, modular design with saddle bottom and front bracket.

2.06 MANUAL STATIONS

A. Manual Release Station: Semi-flush housing fitted with double action control fitted with "push in" tab and "pull down" lever that locks in position after releasing spring-loaded contact switch, for mounting on electrical outlet box; addressable using manufacturer's standard monitor module.
   1. Activate all audible and visual alarms.
   2. Override any abort station or time delay function.

3. Activate all release and shutdown functions normally triggered by detectors or alarm system.
4. Locate engraved label adjacent to each manual release station indicating area protected and that actuation will cause discharge of fire extinguishing agent.

B. Manual System Abort Switch: Stainless steel plate with momentary contact push button, countdown timer, magnetic door holders manual release, for mounting on electrical outlet box; addressable using manufacturer's standard monitor module.
1. Locate engraved label adjacent to each manual abort station, indicating area protected and that actuation will prevent discharge of fire extinguishing agent after automatic system is activated.

2.07 DETECTORS

A. Ionization Smoke Detectors: UL (DIR) listed, NFPA 72, adjustable sensitivity, operating on ionization principle, activated by combustion products, plug-in, twist-lock unit easily removed from base.
1. Ionization chambers: Dual, one for fire detection and second for reference, stabilizing detector for changes in temperature, humidity, and pressure.
2. Amplifier-Switching Circuit and Indicator Lamp: Solid state, two-wire, 24 volts. On alarm, unit shall lock and be reset at control panel.
3. Adjustment: Manual for normal or high sensitivity, with sensitivity setting visible and requiring no special tools.
4. Base Assembly: Twist-lock type with screw terminals, lamp to indicate alarm, security base lock, and relay contactor.

B. Photoelectric Smoke Detectors: UL (DIR) listed, NFPA 72, adjustable sensitivity, with LED light source including photocell, activated by smoke, plug-in, twist-lock unit easily removed from base.
1. Amplifier-Switching Circuit and Indicator Lamp: Solid state, two-wire operating on detector line voltage. On alarm, unit shall lock and be reset at control panel.
2. Adjustment: Manual for normal or high sensitivity, with sensitivity setting visible and requiring no special tools.
3. Base Assembly: Twist-lock type with screw terminals, lamp to indicate alarm, security base lock, and relay contactor.

2.08 DISCHARGE NOZZLES

A. Nozzles: UL (DIR) listed; orifice size providing required rates of discharge and coverage and to distribute extinguishing agent uniformly throughout protected area.

B. Construction: Two-piece chrome plated brass or aluminum nozzle with textured finish with female pipe thread integral on body; one-piece deflector plate.

C. Orifice Union Nipple Assemblies:
1. Construction: Manufacturer's standard, UL (DIR) listed.
2. Identification: Permanently marked with manufacturer's part number and UL (DIR) listing or FM (AG) approval.
3. Rating: 2000 pounds.

D. Identification: Permanently mark nozzles with manufacturer's part number, UL listing and equivalent single orifice diameter.

2.09 CONTROLS AND CONTROL PANEL

A. Controls: Combination type approved as both alarm and releasing device, with solid state internal circuitry enclosed in NEMA IA 10030, Type 1 cabinet.

B. Provide supervision to NFPA 72, Class A of following circuits for wire break or ground faults:
1. Zone detection loops.
2. Suppression system solenoid valves.
3. Power supply and circuit wiring and fuse.

4. Battery interconnecting wires and fuse.
5. Alarm in abort mode.

C. Conceal control switches and indicators, with exception of Power On, Master Trouble, Supervisory Trouble, Circuit 1 Alarm, Circuit 2 Alarm and Release Indicators.

D. Equip panel with following standard features:
1. Visual and audible annunciation of trouble or alarm signals.
2. Panel reset switch.
3. Trouble alarm silence switch with ring back feature.
4. Battery test meter and switch.
5. Manual discharge switch.
6. Deadman abort switch.
7. Programmable timers for pre-discharge and discharge, 0 to 60 second cycle.
8. Isolated relay contactors for external alarm or equipment and ventilation shutdown.
9. Relay contactors for general trouble signal.
10. Relay contactor activated by detector zone board in alarm or trouble mode.
11. Drift compensation.
12. Sensitivity test complying with NFPA 72, Chapter 5.
13. Maintenance alert feature.
14. System status report to display or printer.
15. Alarm verification with verification counter.
16. Presignal complying with NFPA 72 3-8.3.
17. Rapid (less than 2 seconds) manual station reporting.
18. Non-alarm points for general control.
19. Periodic, programmed detector self-test program software.
20. Pre-alarm advanced fire warning feature.
21. Detection: Capability of counting two detectors in alarm, two software zones in alarm or one smoke and one thermal detector in alarm.
22. March time and temporal coding.
23. Walk test with check for two detectors set to same address.
24. UL 1076 Security Monitor Points.
25. Control-by-time feature for non-fire operations with holiday schedule.
26. Automatic day or night adjustment of detector sensitivity.
27. Detector blink control for sleeping areas.

E. Annunciation: Provide the following annunciation:
1. Power On: Green.
2. System Trouble: Amber.
3. Battery Trouble: Amber.
4. Ground Fault: Amber.
5. Release trouble: Amber.
6. Agent Release: Red.
7. Alarm Output Trouble: Amber.
8. Supervisory Trouble: Amber.

F. Batteries: Provide nickel cadmium batteries and charger for continuous operation of detection, alarm, actuation and supervision functions for 24 hours. Provide automatic battery switch-over upon failure of primary power supply.

2.10 MISCELLANEOUS EQUIPMENT

A. Mounting Height: Mount miscellaneous equipment listed above 80 inches above floor or 72 inches, whichever is lower.

B. Alarm Bells: 24 volts, with supervision of circuit wiring, of modular design, red baked enamel finish, with minimum sound level of 84 dba at 10 feet, for mounting on 4 inch electrical outlet box.

C. Alarm Horns: 24 volts, with supervision of circuit wiring, with minimum sound level of 90 dba at 10 feet, for mounting on 4 inch electrical outlet box.

D. Strobe Beacon: Manufacturer's standard design, 24 volts, with system identification on strobe lens.

2.11 OPERATING SEQUENCE

A. Actuation of one detector in either zone circuit:
   1. Illuminate zone indicator.
   2. Energize alarm bell.
   3. Shut down air-conditioning system and close dampers.
   4. Close doors to area.
   5. Signal building fire alarm system.

B. Actuation of second detector on second zone circuit:
   1. Illuminate zone indicator.
   2. Energize alarm horn.
   3. Shut down power to protected equipment.
   4. Actuate time delay for up to 30 seconds.
   5. Release extinguishing agent into protected area.
   6. If abort switch is engaged, delay release.
   7. Upon abort switch disengagement release extinguishing agent unless system cleared and reset.

C. Discharge of Extinguishing Agent:
   1. Sounds alarm bells and horns.
   2. Operates strobes.

D. Temperature Detection:
   1. Lower Temperature: Illuminate indicator and energize bell.
   2. Higher Temperature: Shut down power to protected equipment.

E. High Temperature Detection: Close circuit to sprinkler pre-action valve.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that enclosing walls are continuous above ceilings and below raised floors to enable required concentration to be built up and maintained for required time to ensure fire is extinguished.

3.02 INSTALLATION

A. Install in accordance with referenced standards in PART 2 of this section and NFPA 2001.

B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe. Remove scale and dirt on inside and outside before assembly. Blow out pipe before nozzles or discharge devices are installed.

C. Route piping in orderly manner, concealed, plumb and parallel to building structure, and maintain gradient. Install piping to conserve building space, and not interfere with use of space and other work.

D. Securely support piping in accordance with ASME B31.1 with allowance for fire extinguishing agent thrust forces, and thermal expansion and contraction.

E. Use grooved mechanical couplings and fasteners only in accessible locations. Roll groove piping only.

F. Install unions downstream of valves and at equipment or apparatus connections.

G. Prepare pipe, fittings, supports, and accessories for finish painting, in accordance with Section 09 9123.

H. Identify in accordance with requirements of referenced standard.

1. Place directional arrows and system labels wherever piping changes direction and minimum 20 feet on straight runs.
2. Refer to Section 21 0553.

I. Containers: Mount and anchor as indicated on drawings.

J. In rooms with suspended ceiling tiles, clip or retain tiles within 4 foot radius of the nozzles to prevent lifting during discharge.

K. Install wiring in accordance with Section 26 0583 requirements.

L. Make final connections between equipment and system wiring under direct supervision of factory trained representative of manufacturer.

M. Install engraved plastic instruction plate, detailing emergency procedures, at control panel and at each manual discharge and abort switch location. At control panel identify control logic units, contacts, and major circuits with permanent nameplates.

N. At hazard area walls pack space between pipe, pipe sleeve or surface penetration with mineral fiber with elastomer calk to depth of 1/2 inch. Provide escutcheons where exposed piping passes through walls, floors, and ceilings. Seal pipe penetrations of fire separations. Refer to Section 07 8400.

O. Locate discharge nozzle approximately 6 inches above or below ceiling and 6 inches below raised floors. Avoid interference with other piping and equipment.

P. Locate remote manual releases at one or more doors to protect area where indicated. Locate deadman abort switch adjacent.

Q. Locate strobe units at all points of entrance to protected area.

R. Locate abort station at all points of exit from protected area.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Provide interlock with automatic closing door releases. Refer to Section 08 7100.

B. Integrate system with pre-action sprinkler system. Refer to Section 21 1300.

C. Provide signal to building fire alarm system. Refer to Section 28 4600.

3.04 FIELD QUALITY CONTROL

A. Manufacturer Services: Provide experienced manufacturer's field engineer to supervise installation and performance testing of the system.

B. Perform field inspection and testing in accordance with Section 01 4000 - Quality Requirements.

C. Test distribution piping and valving, prior to nozzle installation, to 50 psi air pressure test. Inspect joints using soap water solution or halide torch or lamp. Repair leaks and retest. Maintain test pressure for four hours.

D. Upon completion of installation provide final checkout inspection by factory trained representative of manufacturer to ascertain proper system operation. Leave system in a fully commissioned and automatic readiness state with circuitry energized and supervised.

E. Test circuits including automatic discharge, manual discharge, equipment shut-down, alarm devices, and storage container pressure. Test supervision of each circuit.

F. Check each ionization detector with a sensitivity meter, adjust. Record sensitivity, and include record in test report.

G. Submit original copies of tests, indicating that factory trained technical representatives of the manufacturer have inspected and tested systems and are satisfied with methods of installation, connections and operation.

H. Pressure test entire enclosure with test fan, pressurizing protected area both under positive and negative conditions. Confirm that leakage is within system design allowance.

3.05 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate that components, except discharge assemblies, are functioning properly and in conjunction with controls system.

B. Submit integrated step-by-step test procedure for approval 30 days prior to start of demonstration.
   1. Arrange meeting prior to demonstration with representatives of Owner, Owner's underwriter, and the installer.
   2. Perform visual inspection and overall review of system installed.
   3. Place minimum of three UL-listed recording analyzers in space. Provide certification that testing devices have been checked by recognized testing authority within two weeks of date of demonstration.
   4. Certify that replacement charge can be provided within 24 hours of demonstration.

C. Discharge system using manual-release switch mounted on control panel. Run discharge test with compressed nitrogen at 360 psi. After discharge, check for complete pressure release.

D. After satisfactory completion of discharge test, fill agent containers with amount of fire extinguishing agent specified in design calculations.

END OF SECTION 21 2200

SECTION 21 2400
DRY-CHEMICAL FIRE-EXTINGUISHING SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire suppression system.
B. Cylinder and valve assembly.
C. Manual release station.
D. Control equipment.
E. Distribution system.
F. Pipe and piping specialties.
G. Miscellaneous equipment.
H. System maintenance after closeout.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 08 7100 - Door Hardware.
C. Section 09 9123 - Interior Painting.
D. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.
E. Section 21 1300 - Fire Suppression Sprinkler Systems.
F. Section 22 0553 - Identification for Plumbing Piping and Equipment.
G. Section 23 0913 - Instrumentation and Control Devices for HVAC.
H. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.
I. Section 28 4600 - Fire Detection and Alarm.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.
B. ASME B31.1 - Power Piping; 2014.
C. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.
D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
E. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2014.
F. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2009 (Reapproved 2014).
G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.
H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
I. ITS (DIR) - Directory of Listed Products; current edition.
J. NFPA 17 - Standard for Dry Chemical Extinguishing Systems; 2013.
K. NFPA 33 - Standard for Spray Application Using Flammable or Combustible Materials; 2011.
L. NFPA 34 - Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids; 2024.
M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. NFPA 72 - National Fire Alarm and Signaling Code; 2016.

O. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

P. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

Q. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: To bear stamp of approval of Authority Having Jurisdiction. Provide for each piece of equipment comprising the system including valves, pressure gages, detectors, release devices, actuators, thermostats, discharge nozzles, manual controls, alarm devices, annunciators, extinguishing agent containers, manifolds, and control panel.

C. Shop Drawings: To bear stamp of approval of Authority Having Jurisdiction. Indicate detailed layout of system, including piping and location of each component. Include control diagrams, wiring diagrams, and written sequence of operation.
   1. Drawing Scale: 1/8 inch to 1 foot, minimum; use larger scale for details.

D. Design Data: Submit design calculations bearing stamp of approval of Authority Having Jurisdiction, Fire Marshal, Owner's fire insurance underwriter, and ____. Include calculations that verify system pressures, nozzle flow rate, orifice code numbers, piping pressure losses, component flow data, and pipe sizes. Base design approach on NFPA 17.

E. Certificates: Certify that products meet or exceed specified requirements.
   1. Manufacturer: Certify that system meets or exceeds specified requirements.

F. Manufacturer's Instructions: Include recommended equipment installation and system components.

G. Test Reports: Indicate successful completion of tests; include certification of extinguishing agent container pressure and extinguishing agent quantity.

H. Code Authority Approval: Submit copy of inspection approval of fire protection system by Authority Having Jurisdiction.

I. Project Record Documents: Record actual locations of components and equipment, equipment identification markings, conduit and piping routing details, and agent container positions.

J. Operation and Maintenance Data:
   1. Include electrical schematic written description of system design, drawings illustrating control logic and equipment locations, and technical brochures describing equipment.
   2. Include list of recommended spare parts.
   3. Include checklists and procedures for emergency situations, trouble shooting techniques, abort functions, system control panel operation, trouble procedures, and safety requirements.

K. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed at Michigan.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Provide products listed, classified, and labeled by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store equipment in shipping containers with labeling in place. Deliver fire extinguishing agent in approved containers.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a six year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. System Components Other Than Pipe, Piping Specialties, Conduit, Wiring, and Wiring Devices:
   1. Tyco Fire Protection Products; ____: www.tyco-fire.com/#sle.

B. Controls and Control Panels:
   1. Tyco Fire Protection Products; ____: www.tyco-fire.com/#sle.

C. Alarm and Detection Systems:
   1. Tyco Fire Protection Products; ____: www.tyco-fire.com/#sle.

2.02 FIRE SUPPRESSION SYSTEM

A. Provide a pre-engineered modular type, fixed pipe, automatic dry chemical fire suppression system for the hazard including work area, plenums, all exhaust ventilation pits, all associated ductwork, and _____ requiring protection.

B. System to consist of manufacturer's dry chemical storage cylinders, actuation hardware, distribution nozzles attached to the pipe network, and _____.

C. System to comply with NFPA 17, NFPA 33, NFPA 34, and _____ including extinguishing agent.

2.03 CYLINDER AND VALVE ASSEMBLY

A. Provide steel cylinder and valve assemblies of the type and size required by the manufacturer for dry chemical storage.

B. Specialties to consist of valves and pressure gages, including reliable and safe means of minimizing accidental discharge.

C. Furnish pressurized assembly with the capability of being stored and operated at the following temperature ranges:

D. Provide listed bracketing for the mounting of the cylinder securely to the intended mounting surface.

E. Furnish manufacturer's high-pressure nitrogen tubing when control system is mounted to a dry cylinder and in all cases where actuation delay is employed.

2.04 MANUAL RELEASE STATION

A. Provide as a means of manually actuating the system from a remote location.

B. Surface housing fitted with un-tensioned pull-to-trip that locks in position after allowing the control system to activate the cylinder and valve assembly, for mounting on electrical outlet box; addressable using manufacturer's standard monitor module.

C. Functions:
   1. Activate all audible and visual alarms.
   2. Override any abort station or time delay function.
   3. Activate all release and shutdown functions normally triggered by detectors or alarm system.

D. Identification:

1. Provide engraved label for each manual release station indicating area protected and that actuation will cause discharge of fire extinguishing agent.
2. Provide manufacturer's label directly on faceplate.

2.05 CONTROL EQUIPMENT

A. Provide control equipment capable of automatic and manual discharge of the dry chemical agent from all extinguishing valve assemblies, including automatic shutdown of the heat source or fuel and electrical power to all protected areas upon system activation.

B. Furnish fully enclosed, integral control head and actuator for each cylinder valve assembly without exposed means for actuation.
   1. Control Head: Equip with micro-switch contacts for audible alarm and equipment shutdown.

C. All cylinders protecting one hazard area must be connected for simultaneous discharge by all methods of alarm actuation.

D. Activate control head automatically by electrical and mechanical means.
   1. Provide listed, rate-compensated thermostat fire detectors complying with NFPA 17, with rating suitable to their expected exposure temperature, capable of detecting and indicating heat, flame, smoke, combustible vapors, or an abnormal condition in the hazard that is likely to produce a fire.
   2. Electrical Activation:
      a. Activate electric solenoid by tested and listed system control panel.
      b. Provide supervision for all detection and releasing circuits.
      c. Furnish listed, rate-compensated thermostat fire detectors complying with NFPA 17, with rating suitable to their expected exposure temperature, capable of detecting and indicating heat, flame, smoke, combustible vapors, or an abnormal condition in the hazard that is likely to produce a fire.
      d. Provide secondary, reserve power supply in accordance with NFPA 17, Chapter 9.6.1
   3. Mechanical Activation:
      a. Activate system control head by manufacturer supplied fire detectors incorporating mechanical thermo-bulb link systems requiring no outside power source for operation.
      b. Provide thermo-bulb links with rating suitable to their expected exposure temperature.

2.06 DISTRIBUTION SYSTEM

A. Discharge Nozzles:
   1. Total-flooding type for enclosed spaces.
   2. Duct/plenum type for exhaust ducts or plenums.
   3. Identification: Permanently marked with manufacturer's identification system identifying nozzle type and listing.

B. Discharge Nozzles for Local Application:
   1. High overhead type for discharge of solid cone of dry chemical on to protected area from above.
   2. Identification: Permanently marked with manufacturer's identification system identifying nozzle type and listing.

C. Flow Restrictors: Designed and supplied by the extinguishing system manufacturer to restrict flow of dry chemical through the in-line distribution piping to ensure the appropriate quantity of agent is delivered to each nozzle in the distribution system.

2.07 PIPE AND PIPING SPECIALTIES

A. Steel Pipe: ASTM A53/A53M or ASTM A106/A106M Schedule 40, or ASTM A135/A135M Schedule 10, hot dipped galvanized.
   1. Fittings: ASME B16.3 malleable iron class 300 for sizes 2 inch and smaller, or ASTM A234/A234M, wrought steel welding type fittings.

2. Joints: Threaded, AWS D1.1/D1.1M welded, or grooved and shouldered pipe end couplings.

B. Pipe Hangers: ASME B31.1, listed, split clamp up to 2-1/2 inch size, riser clamps over 2-1/2 inch size, adequate to offset discharge thrust.

C. Escutcheons: Chrome plated pressed or stamped brass, one-piece or split pattern, minimum 2 inches larger than opening.

D. Gages:
1. ASME B40.100, UL 393, UL 404, or _____ 3-1/2 inch diameter cast aluminum case, phosphor bronze bourdon tube, rotary brass movement, brass socket, front re-calibration adjustment, black figures on white background, 1 percent mid-scale accuracy, scale calibrated in psi.

2.08 MISCELLANEOUS EQUIPMENT

A. Alarm Bells: 24 volts, with supervision of circuit wiring, of modular design, red baked enamel finish, with minimum sound level of 84 dba at 10 feet, for mounting on 4 inch electrical outlet box.

B. Alarm Horns: 24 volts, with supervision of circuit wiring, with minimum sound level of 90 dba at ____ feet, for mounting on 4 inch electrical outlet box.

C. Strobe Beacon: Manufacturer's standard design, 24 volts, with system identification on strobe lens.

D. Signage:
1. Entrance Sign: One warning sign at each entrance to protected area.
2. Exit Warning Signs: One lighted, flashing warning sign at each exit from protected area.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that open, enclosed, and protected areas requiring total dry chemical flooding enable required application and concentration to be built up and maintained for the required time to ensure fire is extinguished.

3.02 INSTALLATION

A. Install in accordance with the Authority Having Jurisdiction, Fire Marshal, Owner's fire insurance underwriter, manufacturer's instructions, and _____ including the following NFPA Standards:
1. NFPA 17 and NFPA 33 for the extinguishing system.
2. NFPA 72 for the detection and alarm control units (other than links).
3. NFPA 70 for electrical connections.

B. Agent Distribution Piping:
1. Ream pipe and tube ends, remove burrs and bevel plain end ferrous pipe.
2. Remove scale and dirt on inside and outside before assembly.
3. Blow out pipe before nozzles or discharge devices are installed.
4. Route piping in orderly manner, concealed, plumb and parallel to building structure, and maintain gradient.
5. Install piping to conserve building space and not interfere with use of space and other work.
6. Securely support piping in accordance with ASME B31.1 with allowance for fire extinguishing agent thrust forces, and thermal expansion and contraction.
7. Use grooved mechanical couplings and fasteners only in accessible locations with roll grooved piping only.
8. Install unions downstream of valves and at equipment or apparatus connections.
9. Prepare pipe, fittings, supports, and accessories for finish painting, in accordance with Section 09 9123.
10. Identify in accordance with requirements of referenced standard.

a. Place directional arrows and system labels wherever piping changes direction and minimum every 20 feet on straight runs.
b. Install engraved plastic instruction plate, detailing emergency procedures, at control panel and at each manual discharge and abort switch location.
c. At control panel identify control logic units, contacts, and major circuits with permanent nameplates.
d. Refer to Section 22 0553 for identification.

C. Manufactured Equipment for Field Installation:
1. Cylinder and valve assembly with listed mounting bracket.
2. Discharge adapter kit.
3. Pressure switches where applicable.
4. Discharge nozzles.
5. Actuation System Installation:
a. Mount the housed control system where indicated on drawings.
b. Install the system valve actuators, cylinders, and nitrogen actuation tubing.
c. Mechanical/Electrical Actuation:
1) Install fusible links, cabling, heat detectors, and UL (DIR) listed fire control panel.
2) Locate thermo-bulb links in accordance with manufacturer's instructions and as acceptable to the authority having jurisdiction.
d. Install remote manual release pull station.
e. Mount electrical actuator within control system housing.
f. Attach, mount, and wire all micro-switches.

D. Install wiring in accordance with Section 26 0583 requirements.

E. Make final connections between equipment and system wiring under direct supervision of factory trained representative of manufacturer.

F. Penetrations:
1. At hazard area walls pack space between pipe, pipe sleeve or surface penetration with mineral fiber with elastomer calk to depth of 1/2 inch.
2. Provide escutcheons where exposed piping passes through walls, floors, and ceilings.
3. Seal pipe penetrations of fire separations.
4. Refer to Section 07 8400.

G. Locate remote manual releases and abort switches at one or more doors to protected area.

H. Locate strobe units at all points of entrance to protected area.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Provide interlock with automatic closing door releases. Refer to Section 08 7100.

B. Integrate system with pre-action sprinkler system. Refer to Section 21 1300.

C. Provide signal to building fire alarm system. Refer to Section 28 4600.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Perform field inspection and testing in accordance with Section 01 4000 - Quality Requirements.

C. Pressure Testing:
1. Test distribution piping and valving, prior to nozzle installation, with air pressure test at levels recommended by the manufacturer.
2. Inspect joints using soap water solution or halide torch or lamp.
3. Repair leaks and retest.
4. Maintain test pressure for four hours.

D. Upon completion of installation provide final checkout inspection by factory trained representative of manufacturer to ascertain proper system operation.

E. Leave system in a fully commissioned and automatic readiness state with circuitry energized and supervised.

F. Test circuits including automatic discharge, manual discharge, equipment shut-down, alarm devices, storage container pressure, and supervision of each circuit.

G. Check each detector in accordance with manufacturer's instructions, perform any required adjustments, and include record of work in test report.

H. Submit original copies of tests, indicating that factory trained technical representatives of the manufacturer have inspected and tested systems and are satisfied with methods of installation, connections and operation.

I. Where applicable, pressure test enclosed, protected space with test fan, pressurizing protected area both under positive and negative conditions. Confirm that leakage is within system design allowance.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration and Instructions:
   1. Demonstrate that components, except discharge assemblies, are functioning properly and in conjunction with controls system.
   2. Submit integrated step-by-step test procedure for approval 30 days prior to start of demonstration.
      a. Arrange meeting prior to demonstration with representatives of Owner, Owner's underwriter, and the installer.
      b. Perform visual inspection and overall review of system installed.
      c. Place minimum of three UL-listed recording analyzers in space.
      d. Provide certification that testing devices have been checked by a recognized testing authority within two weeks of date of demonstration.
      e. When applicable, certify that replacement charge can be provided within 24 hours of demonstration.

D. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.

3.06 MAINTENANCE

A. Conduct inspections at six months and 12 months from Date of Substantial Completion to verify proper operation of system, check agent container weight and pressure, and a thorough check of controls, detection and alarm systems.

B. Remedy of all deficiencies shall be included at no extra cost to Owner except for replacement of agent due to discharge under normal use or damage due to abuse.

C. Submit documents certifying satisfactory system conditions and include manufacturer's certificate of acceptance of inspector's qualifications.

END OF SECTION 21 2400

SECTION 21 3000
FIRE PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire pump package, including fire pump, electric motor drive, controller, and accessories.

B. Electric jockey pump.

1.02 RELATED REQUIREMENTS

A. Section 21 0500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION: Fire protection piping.

B. Section 21 0513 - Common Motor Requirements for Fire Suppression Equipment.

C. Section 21 0548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.

D. Section 21 0716 - Fire Suppression Equipment Insulation.

E. Section 21 0719 - Fire Suppression Piping Insulation.

F. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; current edition.

B. ITS (DIR) - Directory of Listed Products; current edition.

C. NEMA MG 00001 - Motors and Generators; 2024.

D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

E. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

F. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection; 2016.

G. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

H. UL 448 - Centrifugal Stationary Pumps for Fire-Protection Service; Current Edition, Including All Revisions.

I. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

J. UL 1478 - Fire Pump Relief Valves; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers literature including general assembly, pump curves showing performance characteristics with pump and system, operating point indicated, NPSH curve, controls, wiring diagrams, and service connections.

C. Shop Drawings: Indicate layout, general assembly, components, dimensions, weights, clearances, and methods of assembly.

D. Certificates: Certify that fire pumps meet or exceed specified requirements at specified operating conditions and that the installation complies with regulatory requirements. Submit summary and results of shop tests performed in accordance with NFPA 20

E. Test Reports: Indicate results of hydrostatic test and field acceptance tests.

F. Manufacturer's Instructions: Indicate support details, connection requirements, for fire pump system.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 13 and NFPA 20; where requirements differ comply with the most stringent.

B. Maintain on site at all times one copy of each design and installation standard referenced.

C. Design fire pump system under direct supervision of a Professional Engineer experienced in design of this work and licensed at Michigan.

D. Equipment and Components: Bearing FM (AG) label or marking.

E. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

F. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

G. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience.

H. Provide certificate of compliance from authority have jurisdiction indicating approval of field acceptance tests.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire pumps and components in factory packing. Comply with manufacturer's rigging and installation instructions.

B. Protect fire pumps and components from physical damage including effects of weather, water, and construction debris.

C. Provide temporary inlet and outlet caps, and maintain in place until installation.

PART 2 PRODUCTS

2.01 FIRE PUMPS

A. Manufacturers:
   1. AC Fire Pump, a xylem brand; _____: www.acfirepump.com/#sle.
   2. Patterson Pump Company, a Gorman-Rupp Company; _____: www.pattersonpumps.com/#sle.
   3. Peerless Pump Company; _____: www.peerlesspump.com/#sle.

B. Horizontal base-mounted type; UL 448; and UL 778 horizontal shaft, single-stage, double suction, direct connected, horizontally split casing, for 250 psi maximum working pressure.
   1. Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
   2. Impeller: Bronze double suction fully enclosed, balanced and keyed to shaft.
   3. Bearings: Grease lubricated ball bearings, replaceable without opening casing.
   4. Shaft: Alloy steel with replaceable bronze shaft sleeve.
   5. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230 degrees F maximum continuous operating temperature.
   6. Drive: Flexible coupling with coupling guard.
   7. Baseplate: Cast iron or fabricated steel with integral drain rim.
   8. Performance:
      a. Flow: _____ gpm, at _____ feet head.
      b. Motor: ____ hp, ____ volt, single phase, 60 Hz.

C. Accessories:

2.02 ELECTRIC MOTOR DRIVE:

A. Motor: Squirrel cage induction type, NEMA MG 00001; in open drip proof NEMA EN 10250 enclosure, 3500 rpm. Refer to Section 21 0513.

B. Controller: Limited service type with auto-transformer starter, in NEMA EN 10250 enclosure, including the following:
   1. Disconnect Switch: Externally operable, quick break type.
   2. Circuit Breaker: Comply with NFPA 20; minimum 65,000 amperes interrupting capacity.

3. Motor Starter: Energized automatically through pressure switch or manually by externally operable handle.
4. Pressure Switch: Set to cut in at _____ psi.
5. Running Period Timer: Keeps motor in operation when started automatically, for a minimum of seven minutes.
6. Pilot Lamp: Indicates circuit breaker closed and power available.
7. Alarm Relay: Energizes alarm to indicate circuit breaker open or power failure.
8. Switch Relay: For remote start.
9. Manual Selector Station: On enclosure marked "Automatic" and "Non-Automatic".

C. Electrical Characteristics:
1. ____ hp.
2. ____ volts, single phase, 60 Hz.

2.03 PRESSURE BOOSTER (JOCKEY) PUMP

A. Manufacturers:
1. Armstrong Pumps Inc; _____: www.armstrongpumps.com/#sle.
2. Grundfos; _____: www.us.grundfos.com/#sle.

B. Electrically operated, horizontal turbine type with standard open drip-proof horizontal motor.

C. Control by automatic jockey pump controller with full voltage starter and minimum run timer to start pump on pressure drop in system and stay in operation for minimum period of time. Fire pump shall start automatically on further pressure drop or on jockey pump failure.

D. Electrical Characteristics:
1. ____ hp.
2. ____ volts, single phase, 60 Hz.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NFPA 20.

B. Provide access space around pumps for service; no less than minimum as recommended by manufacturer.

C. Install piping in accordance with Section 21 0500. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge.

D. Provide drains for bases and seals, piped to and discharging into floor drains.

E. Provide for connection to electrical service. Refer to Section 26 0583.

F. Lubricate pumps before start-up.

G. Check, align, and certify pumps by qualified installer prior to start-up.

3.02 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000 - Quality Requirements.

B. Perform hydrostatic tests, flushing, and field acceptance tests as specified in NFPA 20.

C. Perform field acceptance tests in the presence of Fire Marshal.

3.03 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration:

D. Demonstrate automatic operation of system including verification of pressure switch set points to Owner.

E. Use operation and maintenance data as reference during demonstration.

F. Briefly describe function, operation, and maintenance of each component.

G. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.

END OF SECTION 21 3000