SECTION 13910
BASIC FIRE PROTECTION MATERIALS AND METHODS

PART 1 - GENERAL

1.01 PROVISIONS INCLUDED

A. The Drawings and general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 General Requirements, apply to work specified in this Section.

1.02 SUMMARY

A. Work Included: This Section specifies the following basic fire protection materials and methods, including the following:
   1. Specific requirements for submittals for approval, and for closeout submittals.
   2. Piping materials, piping specialties, and installation instructions common to most piping systems.
   3. Installation requirements common to equipment specification Sections.
   4. Grouting for support of equipment bases.
   5. Pipe, valve, and equipment identification.
   6. Hangers and supports.
   7. Seismic bracing.

B. Give necessary notices, obtain permits, pay governmental taxes, fees and other costs as required for the fire protection work, and to file for necessary approvals with the jurisdiction under which the work is to be performed. Obtain Certificate of Inspection for the fire protection work; this certificate is a prerequisite to final acceptance of and final payment for the fire protection work.

C. Related Work Specified in Other Sections:
   1. Cutting new openings larger than 12-inches to accommodate penetrating work and patching unused openings left behind by the removal of penetrating work: Section 01731, "Cutting and Patching."
   2. Wood blocking and nailers: Section 06100, "Rough Carpentry."
   3. Firestopping of penetrations: Section 07840, "Fire Stopping."
   4. Alarm Devices: Section 13850, "Fire Alarm Systems."

1.03 REFERENCED CODES AND INDUSTRY STANDARDS

A. Provide materials, equipment and execute the work, including test and inspections, per applicable provisions of Federal, State and Local government laws and ordinances, Utility Company Regulations, latest editions and referenced codes and standards. Governing laws, ordinances, codes and standards constitute minimum requirements.

B. In case of conflict between the Contract Documents and the requirements of any Code or Authorities having jurisdiction, the most stringent requirements shall govern.

C. Comply with the requirements of the National Fire Protection Association publication NFPA 13, 2003, "Standard for the Installation of Sprinkler Systems."

1.04 DEFINITIONS

A. "NFPA" is the abbreviation for the National Fire Protection Association.

B. Definitions specific to fire protection systems are as provided in those NFPA standards referenced by subsequent 13900 series Sections.

1.05 LIST OF SUBMITTALS; SUBSTITUTIONS

A. Concurrent with the submittal schedule, required by Section 01330 "Submittal Procedures" submit a list identifying the manufacturers from which the Contractor intends to procure all equipment under 13900 series work.

B. If the Contractor intends to furnish a product from a manufacturer other than the ones specifically named in 13900 series Sections, then the Contractor shall submit a request for substitution, in accordance with provisions of Section 01620, and this request shall be submitted concurrent with submittal of the list of proposed manufacturers.

C. The Architect will review proposed substitutions and either accept or reject the proposed manufacturer. If the Architect rejects the proposed substitution, resubmit conforming product within 15 days.

D. No shop drawings will be reviewed until the list of proposed manufacturers has been approved in its entirety, including substitutions, by the Architect.

1.06 SUBMITTALS

A. Items to be Submitted: Specific items to be submitted are specified in other 13900 series Sections. Definitions and type of information required for each type of submittal are specified below. When required, include the following information, as a minimum, with each submittal:

1. Make and Model Number: Submit the manufacturer's name, the trade name and the complete model number for the listed product or device. Also, indicate the applicable catalog number and date of publication wherein the product or device is fully described.

2. Shop drawings: Prepare shop drawings in accordance with individual 13900 series specification requirements.
   a. Shop drawings for all systems shall indicate the locations where seismic bracing will be installed. Drawings shall also include proposed seismic bracing details.

3. Product Data: Submit samples specified in the individual Division 15 sections. In addition, where operating ranges are shown, mark data to show portion of range required for project application. Expansion or elaboration of standard data to describe non-standard product must be processed as a shop drawing submittal. For each product, include manufacturer's production specifications, installation instructions, nearest source of supply

(including telephone number), piping connection sizes and locations, evidence of compliance with required standards and governing regulations (include manufacturer's signed statements if not covered in printed data), and similar information needed to represent compliance with requirements. Submitted data shall be original printed material, not photocopies or facsimile (Fax) copies.

4. Certifications: When indicated, submit warranty which, in addition to execution by authorized officer of each guarantor, is attested to by Secretary of each guarantor and bears corporate seal. Submit draft of each warranty (for Owner's acceptance of text) prior to execution.

5. Test Reports: Submit test reports of the product or device which have been dated and signed by representatives of the testing agency performing test. Prepare test reports in manner consistent with standard or regulation governing test procedure (if any) as indicated. Test reports shall be clear, concise, complete and in typed tabular form.
   a. Provide notarized executions on test reports. Include name of testing agency and name of individual performing or responsible for the testing.

6. Product Warranties: Submit only specified warranties. Where special project warranty is specified, submit warranty prepared specifically for this project and executed by an authorized officer of the warrantying firm.

7. Operating Instructions: Submit type written operating instructions for each product or device and supplement with additional project application instructions where necessary. Prepare and submit specific operating instructions for each system which involves multiple items of equipment, including instructions for charging, start-up, control or sequence of operation, shut-down, safety and similar operational instructions.

8. Operation and Maintenance, (O&M) Manual: Prepare manuals in accordance with the requirements of Section 01770 "Closeout Procedures And Submittals." In addition to the requirements specified in Division 1, include the following information for equipment items:
   a. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
   b. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions.
   c. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   d. Servicing instructions and lubrication charts and schedules.

9. Maintenance Materials: Deliver required quantity of product or device to Owner's representative at location as directed, in containers or packages suitable for storage and fully identified.

10. Record Drawings: Prepare record documents in accordance with the requirements of Section 01770 “Closeout Procedures And Submittals.” In addition to the requirements specified in Division 1:
    a. The drawings shall be a revised edition of the previously submitted shop drawings, indicating all contract modifications.
    b. The drawings shall have valve numbers clearly indicated. These numbers shall correspond to the valves schedules.
    c. Drawings shall be accompanied by system design, (hydraulic) calculations.
    d. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
    e. Contract Modifications, actual equipment and materials installed.

B. Valve Schedules: Submit valve schedules for each piping system. Reproduce on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification. Mark valves intended for emergency shutoff and similar special uses. Furnish extra copies (in addition to mounted copies) for Maintenance Manuals as specified in Section 01770 “Closeout Procedures And Submittals.”

1.07 QUALITY ASSURANCE

A. Manufacturers: Companies specializing in manufacturing the products specified; demonstrate a minimum three years documented experience but in no case less than specified in other sections.

B. Installers: Companies which have been specializing in performing work of the type specified for at least three years but in no case less than specified in other sections. Foreman shall have at least five years experience.

C. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

D. Identification Systems: ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

E. Hangers and Supports: Manufacturer's Standardization Society Standard Practices, (MSS SP):
    1. MSS SP-58, "Pipe Hanger and Supports – Materials, Design and Manufacture."
    2. MSS SP-69, " Pipe Hanger and Supports – Selection and Application."
    3. MSS SP-89, " Pipe Hanger and Supports – Fabrication and Installation Practices."

F. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements. The Contractor is responsible for installation and service area requirements for substituted equipment. Areas of rooms or depths of ceiling plenums will not be increased to accommodate larger equipment.

G. Components and Installation: Capable of producing piping systems with a minimum working pressure rating of 175 psig, except where indicated otherwise.

H. Approvals and Listings: All fire protection components shall either be listed by Underwriter's Laboratories, (UL Listed) or approved by Factory Mutual, (FM approved).

1.08 WARRANTY

A. Provide guarantees for work under this Contract as required by the Conditions of the Contract.

B. Guarantee that all elements of the systems which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth in these specifications or as indicated on drawings.

C. Upon receipt of notice from the Owner of failure of any part of the systems or equipment during the guarantee period, the affected part or parts shall be replaced by the fire protection subcontractor for his work.

D. Furnish a written guarantee covering the above requirements before submitting the application for final payment.

1.09 DELIVERY, STORAGE AND HANDLING

A. Acceptance at the Site: Upon receipt, inspect fire protection equipment (including Owner furnished equipment) in accordance with manufacturers instructions.
   1. Do not install equipment until all defects detected during inspection have been corrected.

B. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

C. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

D. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.10 SEQUENCE AND SCHEDULING

A. Coordinate fire protection work with work of other trades, so that all work will be completed without interruption. Make adjustments necessary to conform to structural and architectural conditions.

B. Changes in construction required for coordination, which deviate from the intent or requirements of the specifications and/or drawings, must be described and detailed in writing and submitted to the Architect for approval.

C. Require trades providing equipment bases and pads, curbs, chases, pockets and openings to coordinate dimensions with actual dimensions of equipment furnished under this section. Furnish

dimensions, templates, bolts, and anchors for support or attachment of fire protection work to other trades requiring them.

D. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed. Arrange for chases, slots, and openings in building structure during progress of construction to allow for fire protection installations.

E. Coordinate connection of electrical services.

F. Coordinate connection of fire protection systems with other overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and authorities having jurisdiction

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Nameplates: Subject to compliance with requirements, provide products by one of the following:
1. Viking Corp.
2. Reliable Automatic Sprinkler Co., Inc.
3. Central Sprinkler Co.

B. Pipe and Valve Identification Systems: Subject to compliance with requirements, provide products by one of the following:
1. Brady: Signmark Div.; W.H. Brady Co.
2. Seaton Name Plate Co.
3. Kolbi Industries, Inc.

C. Hangers and Supports: Subject to compliance with requirements, provide products by one of the following:
1. Carpenter & Patterson, Inc.
2. Fee & Mason Mfg. Co.
3. B-Line Systems, Inc.

D. Seismic Bracing Systems: Subject to compliance with requirements, provide products by one of the following:
1. Loos & Co., Inc.
2. Amber / Booth Co.
3. B-Line Systems, Inc.

E. Threadolets and Weldolets: Subject to compliance with requirements, provide products by one of the following:
1. Bonney-Forge
2. Allied Products Co.
3. Grinnell Supply Sales Co., Grinnell Corp.

F. Mechanical Sleeve Seals: Subject to compliance with requirements, provide products by Thunderline Corporation / Link Seal.

2.02 PIPE AND PIPE FITTINGS

A. Refer to individual piping system specifications in other 13900 series Sections for pipe and fitting materials.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

A. Refer to individual piping system specifications in other 13900 series Sections for special joining materials not listed below.

B. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3mm) maximum thickness, except where thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125 cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250 cast-iron and steel flanges.
   2. ASME B16.20 for grooved, ring-joint, steel flanges.
   3. AWWA C110, rubber, flat face, 1/8 inch (3 mm) thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.

D. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon steel bolts and nuts.

E. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end pressure pipes.
   1. Sleeve: ASTM A 126, Class B, gray iron.
   2. Followers: ASTM A 47 (ASTM A 47M), Grade 32510 or ASTM A 536 ductile iron.
   3. Gaskets: Rubber.
   4. Bolts and Nuts: AWWA C111.
   5. Finish: Enamel paint.

2.04 PIPING SPECIALTIES

A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type where required to conceal protruding fittings and sleeves.
   1. Inside Diameter: Closely fit around pipe, tube, and insulation.
   2. Outside Diameter: Completely cover opening.
   3. Cast Brass: One piece with set-screw; polished chrome plate finish.
   4. Stamped Steel: One piece with set screw.
      a. Finish for Interior applications: Chrome-plated finish.
      b. Finish for Exterior applications: Galvanized finish.

5. Cast-Iron Floor Plate: One-piece casting.

B. Mechanical Sleeve Seals: Modular, watertight mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened.

C. Sleeves: The following materials are for wall, floor, and slab penetrations:
1. Steel Sheet-Metal: 24-gage (0.70mm) or heavier galvanized sheet metal, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast-Iron: Cast or fabricated wall pipe equivalent to ductile-iron pressure pipe, having plain ends and integral water stop, except where other features are specified.
4. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with 1 mechanical-joint end conforming to AWWA C110 and 1 plain pipe-sleeve end.
   a. Penetrating Pipe Deflection: 5 percent without leakage.
   b. Housing: Ductile-iron casting having waterstop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
   c. Pipe Sleeve: AWWA C151, ductile-iron pipe.
   d. Housing-to-Sleeve Gasket: Rubber or neoprene push-on type of manufacturer's design.
5. Cast-Iron Sleeve Fittings: Commercially made sleeve having an integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.
   a. Underdeck Clamp: Clamping ring with set-screws.

2.05 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.50MPa), 28-day compressive strength.
3. Packaging: Premixed and factory-packaged.

2.06 IDENTIFICATION SYSTEMS

A. General: Provide Manufacturer's standard products. Where more than one type is specified for listed application, selection is Installer's option, but provide single selection for each product category.

B. Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid snap-on, color-coded pipe markers, conforming to ASME A13.1; except use permanent black marker to indicate specific zone information on the markers.

C. Nameplates: Provide factory pre-printed porcelain enameled, 20 gauge minimum, steel nameplates.
   1. Exception: Use permanent black marker to indicate application specific information.
   2. Hydraulic Nameplates: 5-inches by 7-inches minimum size. Indicate the following:
      a. Protected area(s).
      b. Design density, design area, and occupancy classification.
      c. Required flow and residual pressure at the base of the riser.
      d. Hose stream demand, (inside and out).
   3. Miscellaneous Nameplates: 2-inches by 6-inches minimum size. Provide for:
      a. Inspector's Test.
      b. Main Drains.
      c. Auxiliary Drains.

D. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Provide a 5/32-inch hole for fastener.
   1. Material: 3/32-inch-thick plastic laminate having two black surfaces and a white inner layer.
   2. Size: 1-1/2-inches diameter, except as otherwise indicated.

E. Valve Tag Fasteners: Brass chain (wire link or beaded type) or brass S-hooks.

F. Valve Schedule Frames: Glazed display frame, with screws for removable mounting on solid walls for each page of valve schedule.
   1. Frame: Rigid plastic.
   2. Glazing: 2.5 mm, single thickness, flat transparent acrylic.

G. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in fire protection identification, with corresponding designations indicated. Use numbers, lettering and wording indicated for proper identification and operation/maintenance of fire protection systems and equipment.

2.07 HANGERS AND SUPPORTS

A. Horizontal Piping Hanger and Supports: Provide factory fabricated horizontal piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected to suit horizontal piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit around pipe size for bare piping, and to exactly fit around piping insulation with saddle and shield for insulated piping. Provide copper plated or non-metallic coated hangers and supports for copper piping systems. Provide non-metallic coated hangers and supports for plastic piping systems.
   1. Adjustable steel clevis hangers: MSS type 1
   2. Adjustable swivel rings, Band type: MSS type 10
   3. U-Bolts: MSS type 24
   4. Stanchion assemblies: MSS type 37

B. Vertical Piping Clamps: Provide factory fabricated vertical piping clamps complying with MSS SP-58, of one of the following types listed, selected to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of vertical piping clamps to exactly fit around pipe size for bare pipe. Provide copper plated or non-metallic coated clamps for copper piping systems. Provide non-metallic coated clamps for plastic piping systems.
   1. Two bolt riser clamp: MSS type 8
   2. Four bolt riser clamp: MSS type 42

C. Hanger Rod Attachments: Provide factory fabricated hanger rod attachments complying with MSS SP-58, of one of the following types listed, selected to suit horizontal piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger rod attachments to suit hanger rods. Provide copper plated or non-metallic coated hanger rod for copper piping systems.
   1. Steel turnbuckles: MSS type 13

D. Building Attachments: Provide factory fabricated building attachments complying with MSS SP-58, of one of the following types listed, selected to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper plated or non-metallic coated building attachments for copper piping systems.
   1. Concrete inserts: MSS type 18
   2. Malleable beam clamps: MSS type 30
   3. C-type beam clamps: MSS type 19 or 23
      a. Include retaining strap per NFPA 13 seismic requirements.
   4. Steel brackets; One of the following for indicated loading:
      a. Light duty, (750 lbs.): MSS type 31
      b. Medium Duty, (1,500 lbs.): MSS type 32
      c. Heavy duty, (3,000 lbs): MSS type 33

E. Miscellaneous Materials:
   1. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
   2. Galvanized steel framing: Provide products complying with NEMA STD ML 1.
   3. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex-head, track bolts and nuts.
   4. Washers: ASTM F 844, steel, plain, flat washers.
   5. Heavy duty steel trapeze: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards. Use galvanized steel in exposed and wet areas.
   6. Pipe guides: Provide factory fabricated guides of cast semi-steel or heavy fabricated steel, consisting of bolted two section outer cylinder and base with two section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.
   7. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.

8. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.

2.08 SEISMIC BRACING

A. General: Provide systems comprised of components specifically listed for seismic bracing applications. Bracing systems shall be in accordance with NFPA 13 requirements.

1. Component Compatibility: Do not "mix and match" individual components. Systems shall consist of components which are listed and detailed for use with each other.

2. Piping Coordination: Piping systems which are joined by grooved couplings shall use flexible style couplings.

3. Hanger Coordination: Furnish C-type beam clamps with retaining straps of the following sizes:
   a. 8-inch and smaller piping: 16 gauge minimum, 1-inch wide steel.
   b. Piping larger than 8-inch: 14 gauge minimum, 1-1/4 inch wide.

B. Tension and Compression Systems: Systems consisting of strut and associated hardware.

C. Tension Only Systems: Cable systems and associated corrosion resistant hardware. Use color coded cable to differentiate between cable size and capacity.

PART 3 - EXECUTION

3.01 EXAMINATION

A. The Contract Drawings are diagrammatic only intending to show general runs and locations of piping, equipment and specialties and not necessarily showing all required offsets, details and accessories and equipment to be connected. Install the work to fulfill the diagrammatic intent expressed on the Fire Protection Drawings, but in conformity with the dimensions indicated on the final working drawings, field layouts, and shop drawings of all trades. Lay out work accurately in coordination with other Trades to avoid conflicts in placement of the piping, pumps, equipment, and similar items, and to obtain a neat installation which will afford maximum accessibility for operation, maintenance and headroom. In case of conflict between sizes shown on plans, details or diagrams, allow for the largest size.

B. Examine existing conditions and prior construction to determine that they are in proper condition to receive fire protection work prior to beginning installation. Do not permit fire protection work to proceed until conditions detrimental to the installation have been corrected.

C. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

3.02 PIPING SYSTEMS

A. Perform fire protection work in conjunction with all other work at the site. Coordinate with the Architect, General Contractor, all other Contractors and equipment suppliers working at the site. Proceed in a manner so as not to delay the progress of the project.

B. Provide materials, equipment and workmanship to provide for adequate protection of fire protection equipment during the course of construction of the project. Include protection from moisture and all foreign matter. Be responsible for damage caused to the work of other Trades, and remedy such injury at no expense to the Owner.

C. Coordinate the exact mounting arrangement and location of equipment indicated on the drawings, prior to Installation, to allow proper space requirements. Particular attention shall be given in the field to group installations. If it is questionable that there is sufficient space to avoid conflict with the work of other Contractors, architectural or structural obstructions and that will result in an arrangement which will prevent proper access, operation or maintenance of the indicated equipment, immediately notify the Architect and do not proceed with this part of the Contract work until definite instructions have been given by the Architect.

D. Do not allow equipment or piping to be installed or pass through elevator equipment rooms or hoist ways, electric rooms, electric closets, telephone or data closets, except where specifically called for on the Fire Protection Drawings, or as required by the authority having jurisdiction.

E. Arrange for chases, slots and openings in other building components during progress of construction, to allow for fire protection installations.

F. Equipment Supports: Provide adequate supports wherever required, whether or not indicated. Fabricate supports from steel channels 1-5/8 inch minimum width, 0.105 inch minimum wall thickness. Use larger size or gauge if required to support weight. All supports shall be clean, rust free and prime painted.

G. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

H. Provide systems and equipment called for in the specification and/or shown on the drawings as if these were required by both the drawings and specifications. However, bring such conflicts to the attention of the architect for direction prior to ordering or installing any portion of the work in question.

I. Install piping in strict accordance with NFPA requirements, and as described below.

1. Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on shop drawings.
2. Install piping at indicated slope.
3. Install components having pressure rating equal to or greater than system operating pressure.

4. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
5. Install piping free of sags and bends.
6. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
7. Install couplings according to manufacturer's printed instructions.

J. Install pipe escutcheons for exposed pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
1. Interior Walls: Cast-brass or stamped-steel.
2. Floor Plates in Utility Areas: Cast-iron floor plates.
3. Exterior Walls: Stamped-steel, galvanized.

K. Install dielectric unions to join dissimilar metals.

L. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor and roof slabs, and where indicated.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab to secure clamping ring where specified.

2. Build sleeves into new walls and slabs as work progresses.

3. Interior, Above Grade: Install large enough sleeves to provide 1/4-inch (6mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than 6 inches (150 mm).
   b. Steel Sheet-Metal Sleeves: For pipes 6 inches (150 mm) and larger that penetrate gypsum-board partitions.
   c. Cast-Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Flashing is specified in Division 7 Section "Flashing and Sheet Metal." Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.
   d. Seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealant; use one of the products specified in Section 07920, "Joint Sealants."

4. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25mm) annular clear space between pipe and sleeve for installation of mechanical seals.
   a. Install steel pipe for sleeves smaller than 6 inches (150 mm).
   b. Install cast-iron wall pipes for sleeves 6 inches (150 mm) and larger.
   c. Assemble and install mechanical seals according to manufacturer's printed instructions.

d. Seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealant; use one of the products specified in Section 07920, "Joint Sealants."

5. Below Grade, Exterior Wall, Pipe Penetrations: Install cast-iron wall pipes for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for one inch annular clear space between pipe and sleeve for installation of mechanical seals.

M. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Sealing of pipe penetrations with firestopping sealant material in accordance with U.L. design is provided by Section 07840, "Firestopping."

N. Verify final equipment locations for roughing in.

O. Refer to equipment specifications in other Sections for roughing-in requirements.

P. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.

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

2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

3. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
   a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
   c. Align threads at point of assembly.
   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
   e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

4. Welded Joints: All welding of piping is to be performed in the fabrication shop in accordance with NFPA requirements.

5. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

6. Grooved Joints: Assemble joints in accordance with fitting manufacturers written instructions.

3.03 EQUIPMENT INSTALLATION

A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Install fire protection equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.04 GROUTING

A. Install nonmetallic nonshrink grout for fire protection equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
   1. Clean surfaces that will come into contact with grout.
   2. Provide forms for placement of grout, as required.
   3. Avoid air entrapment when placing grout.
   4. Place grout to completely fill equipment bases.
   5. Place grout on concrete bases to provide a smooth bearing surface for equipment.
   6. Place grout around anchors.
   7. Cure placed grout according to manufacturer's printed instructions.

3.05 IDENTIFICATION SYSTEMS INSTALLATION

A. Piping Systems: Install pipe markers on the mains of each system. Pipe markers are not required on system branch lines. Locate pipe markers wherever piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces as follows:
   1. Near each valve and control device.
   2. Near locations where pipes pass through walls, floors, ceilings, or enter inaccessible enclosures.
   3. At access doors, manholes, and similar access points that permit view of concealed piping.
   4. Spaced at a maximum of 50-foot (15m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment.
   5. On piping above removable acoustical ceilings.

B. Nameplates: Install nameplates using corrosion resistant wire or chain.
   1. Install hydraulic nameplates at each respective riser, (alarm valve or other). Secure the nameplates directly to the piping.
   2. Install miscellaneous nameplates directly on, or adjacent to the device being identified.

C. Valve Tags: Install valve tags on valves, (alarm check, shut-off, drain and test) in piping systems.
   1. Exception: Tags are not required on the following valves:
      a. Fire department pumper connection line check valves.
      b. Miscellaneous trim valves at alarm check valve assemblies, (water motor gong valves, pressure gauge valves).
   2. List tagged valves in valve schedule.

3.06 HANGER AND SUPPORT INSTALLATION

A. General: Comply with NFPA 13, MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure

B. Install hanger and support spacing and locations for steel piping joined with grooved mechanical couplings according to manufacturer's written instructions for rigid systems.

C. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.

Install concrete inserts before concrete is placed; fasten insert to forms. Install reinforcing bars through openings at top of inserts.

D. Install concrete inserts in new construction prior to placing concrete.

E. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install according to fastener manufacturer's written instructions. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches (100 mm) thick.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and to not exceed maximum pipe deflections allowed by ASME B31.9 "Building Services Piping."

I. Install hangers with the following minimum rod sizes and maximum spacing:

Nom. Pipe Size	Max. Span-Ft. (sch 10, 30 and 40 steel)	Max. Span-Ft. (lightwall steel)	Min. Rod Size-Inches
1	12	12	3/8
1-1/4	12	12	3/8
1-1/2	15	12	3/8
2	15	12	3/8
2-1/2	15	N/A	3/8

Nom. Pipe Size	Max. Span-Ft. (sch 10, 30 and 40 steel)	Max. Span-Ft. (lightwall steel)	Min. Rod Size-Inches
3	15	N/A	3/8
4	15	N/A	3/8
6	15	N/A	1/2
8	15	N/A	1/2

1. Provide additional hangers as required to distribute load to supporting structure. Do not hang from the roof deck. Hang from bar joists. Refer to the Fire Protection and Structural Drawings for loading criteria.

J. Erection of Metal Supports and Anchorage:
1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
2. Field Welding: Comply with AWS D1.1 "Structural Welding Code--Steel."

3.07 SEISMIC BRACING INSTALLATION

A. General: Install bracing per NFPA requirements. Bracing shall be installed on systems to resist lateral and longitudinal horizontal forces, as well as vertical motion.

B. Piping Installation: Sway bracing shall be installed on all supply mains, (regardless of size) and on branch piping 2-1/2 inches in diameter and larger.
1. Exception: Where piping is supported on an individual hanger and the hanger rod is less than 6-inches long, (as described in NFPA 13) bracing is not required.
2. Exception: The end sprinkler on each branch line shall be restrained.
3. Flexible couplings: Insure that piping systems which are joined by grooved couplings utilize flexible style couplings, not rigid style.
4. Seismic separations: Provide seismic separation assemblies, (as detailed in NFPA 13) on piping which crosses building seismic separation, (expansion) joints.

C. Hanger Installation: Install retaining straps on c-type beam clamps.

D. Bracing Installation: Install bracing systems in accordance with manufacturer's writtem instructions and details.

3.08 CLEANING AND TOUCH-UP

A. Remove waste materials from the premises promptly as the work progresses.

B. At the completion of the work, thoroughly clean and polish equipment and installed materials. Turn the fire protection work over to the Owner in a condition satisfactory to the Architect.

C. Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

D. Damage and Touch Up: Touch-up damaged finishes on equipment; use same paint as applied in the shop and prepare surfaces and apply paint in accordance with paint manufacturers instructions. Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.09 CORING AND DRILLING

A. Cut, core, and drill floors, roof/ceiling assemblies, and walls necessary for fire protection installations. Take care to make holes as small as possible to accommodate the penetrating work and its associated firestopping or sealants.

B. If adjacent surfaces are damaged by such cutting, coring, or drilling, or if openings are excessively large, Contractor shall have the damage repaired in accordance with provisions for Cutting and Patching in Section 01731, and the Subcontractor responsible for the damage shall reimburse the Contractor.

3.10 DEMONSTRATION

A. Provide on-site services of a competent factory trained Engineer of particular manufacturer of equipment described in the respective sections, to inspect, adjust and place in proper operating condition.

B. No later than 7 days prior to issuance of the Certificate of Substantial Completion by the Architect, provide an experienced and competent Engineer to instruct the Owner's representative in the proper operation of all systems and equipment provided, prior to the final acceptance of his work. Make arrangements with the Owner, who will designate the person or persons who will be instructed in the operation of the basic and auxiliary mechanical systems. The Owner shall be satisfied that instruction has been thorough and complete and the Fire Protection Subcontractor shall provide additional instruction before final payment is made.

C. Install mounted valve schedule in each major equipment room.

END OF SECTION 13910