

**SECTION 21 00 00  
FIRE SUPPRESSION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Specification requirements defined in Division 21 of this specification apply to and are in addition to the work associated with equipment, systems, materials, and installation requirements specified in Division 21. The [Contractor], [Construction Manager] shall provide the requirements specified in Division 21 to obtain complete systems, tested, adjusted, and ready for operation.

**1.2 RELATED WORK**

- A. Section 01 31 00 Coordination
- B. Section 07 84 00 Firestopping
- C. Section 21 13 13 Automatic Fire Sprinkler System
- D. Division 26 - Electrical
- E. Division 28 - Electronic Safety and Security

**PART 2 - PRODUCTS**

- 2.1 Not Applicable to this Section.

**PART 3 – EXECUTION**

- 3.1 Not Applicable to this Section.

**END OF SECTION**

**SECTION 21 05 19**  
**METERS AND GAGES OF FIRE-SUPPRESSION SYSTEMS**

**Building Metering Guide**

**Website: [Building Metering Guide](#)**

**SECTION 21 11 00  
FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING****PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Water pipe.
- B. Valves.
- C. Fire department connections.
- D. Private fire hydrants.
- E. Bedding and cover materials.
- F. Accessories.

**1.2 RELATED REQUIREMENTS**

- A. Section 21 00 00 – General Fire Suppression Requirements.
- B. Section 21 13 00 - Fire-Suppression Sprinkler Systems.
- C. Section 21 13 13 - Automatic Fire Sprinkler System
- D. Section 31 23 16 - Excavation.
- E. Section 31 23 16.13 - Trenching.
- F. Section 31 23 23 - Fill.
- G. Division 33 – Utilities

**1.3 REFERENCE STANDARDS**

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.
- B. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250 2016.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.
- D. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).
- E. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications 2014.
- F. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals 1998 (Reapproved 2011).
- G. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings 2012.
- H. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.
- I. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast 2017, with Errata (2018).
- J. AWWA C502 - Dry-Barrel Fire Hydrants 2018.
- K. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service 2015.
- L. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution 2016.

**1.4 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data:
  - 1. Include data on pipe materials, pipe fittings, valves, and accessories.
  - 2. Provide the manufacturer's catalog information.
  - 3. Indicate valve data and ratings.
  - 4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

**PART 2 PRODUCTS**

**2.1 WATER PIPE**

- A. Ductile Iron Pipe: Listed, AWWA C151/A21.51.
  - 1. Fittings: AWWA C110/A21.10, ductile iron, standard thickness.
  - 2. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR rubber gasket with 3/4-inch (19 mm) diameter rods.
- B. PVC Pipe: Listed, AWWA C900 Class 100:
  - 1. Fittings: AWWA C111/A21.11, cast iron.
  - 2. Joints: ASTM D3139 compression gasket ring.

**2.2 VALVES**

- A. Valves: Manufacturer's name and pressure rating marked on the valve body.
- B. Water Pressure Reducing Valves:
  - 1. 1-1/2 NPS (40 DN) up to and including 8 NPS (200 DN):
    - a. Function: Reduce higher inlet pressure to an adjustable, constant lower outlet pressure independent of flow rate fluctuations.
    - b. Pilot-Operated Type: External pilot control.
- C. Double Check Detector Valve Assembly, Flanged End:
  - 1. 2-1/2 NPS (65 DN) up to and including 10 NPS (250 DN):
    - a. Construction:
      - 1) Listed.
      - 2) Body: 300 Series stainless steel, ASTM A536 Grade 65-45-12 ductile iron or [\_\_\_\_\_].
      - 3) Two independently operating, spring-loaded, check valves.
      - 4) Two OSY resilient seated gate valves.
      - 5) Bypass Assembly:
        - (a) Bypass Line: Hydraulically sized to accurately measure low flow.
        - (b) Double check including shut-off valves, and required cocks.
        - (c) Meter with [\_\_\_\_\_] gallon ([\_\_\_\_\_] cu ft) readout.
      - 6) Cam-Check:
        - (a) Internally loaded providing positive, drip-tight closure against reverse flow.
        - (b) Stainless steel cam arm and spring, rubber-faced disc, and replaceable, thermoplastic seat.
      - 7) Valve Cover:
        - (a) Provides access to all internal parts.
        - (b) Held in place through the use of a single grooved style two-bolt coupling.

**2.3 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 (65 DN) female inlets, thread size compatible with fire department hardware.
    - d. Rated Working Pressure: 175 psi (1200 kPa). See 211313 3.6, D, for Test Pressure Rating Requirements.
    - 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.

**2.4 PRIVATE FIRE HYDRANTS**

- A. Dry-Barrel:
1. Construction:
    - a. Listed, AWWA C502 and [\_\_\_\_\_].
    - b. Rated Working Pressure: 250 psi (1725 kPa).
    - c. Compression type, opening against system pressure and closing with system pressure.
    - d. Traffic breakaway type.
  2. Hydrant Cap and Stuffing Box: One-piece design with a water-tight cavity, sealed from contact with water.
  3. Operating Nut: One-Piece, bronze construction with protective weather seal, shield, or [\_\_\_\_\_].
  4. Nozzles: Tamper-resistant, 1/4 turn type with O-ring seals including retaining/locking screws, other suitable nozzle locks, or [\_\_\_\_\_] to prevent inadvertent removal.
  5. Main Valve: Provide reinforced, synthetic rubber, completely encapsulated with EPDM or [\_\_\_\_\_].
  6. Seat: Provide O-rings to seal the drain-way and barrel from water leakage into the shoe.
  7. Drains to momentarily flush outward when opened to remove debris and complete draining upon closing of the main valve.

**2.5 ACCESSORIES**

- A. Concrete for Thrust Restraints: Concrete type specified in Section 211313, 3.2,12, a.
- B. Tracer Wire:
1. Provide a magnetic, detectable conductor with a clear plastic covering imprinted with "Water Service" in large letters.
  2. Conductor to be of sufficient length to be continuous over each separate run of nonmetallic pipe.

**END OF SECTION 21 11 00**

**SECTION 21 12 00  
FIRE-SUPPRESSION STANDPIPES****PART 1 GENERAL****1.1 RELATED REQUIREMENTS**

- A. Section 21 05 00 - Common Work Results for Fire Suppression: Fire protection piping.
- B. Section 21 05 23 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- C. Section 21 13 13 - Automatic Fire Sprinkler System

**1.2 REFERENCE STANDARDS**

- A. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems 2019.
- B. UL 405 - Fire Department Connection Devices Current Edition; Including All Revisions.

**PART 2 PRODUCTS****2.1 FIRE DEPARTMENT CONNECTIONS**

- A. Type: Free standing made of corrosion-resistant metal complying with UL 405.
  - 1. Sleeve: Brass, 18 inches in height.

**PART 3 EXECUTION****3.1 INSTALLATION**

- A. Install in accordance with the manufacturer's instructions.
- B. Install in accordance with the current edition of NFPA 14.
- C. Connect standpipe system to water source ahead of domestic water connection.
- D. Flush the entire system of foreign matter.
- E. Buried piping and fittings:
  - 1. Cement-mortar lined, ductile iron pipe conforming to AWWA C-151, Class 200, 21/45 with Tyton or as approved, mechanical joints and fittings conforming to the current edition of NFPA-24.
  - 2. Install pipe joints anchored with tie rods and restraints. Provide concrete thrust blocks at elbows and offsets conforming to the current edition of NFPA-13 and NFPA-24.
  - 3. Other types of UL/FM reviewed piping including PVC C900 Class 200 may be used as approved by University's Representative and the State Fire Marshal.
  - 4. Thrust block installation shall be inspected by State Fire Marshal. See Section 211313, 3.2 for inspection requirements.
- F. Above-ground piping and fittings:
  - 1. Standard weight, Schedule 40, welded and seamless black steel, ASTM A-135 or A-53 pipe conforming to NFPA-13.
  - 2. Fittings for pipe sizes 2-1/2 inch and smaller shall be malleable iron, black, 150 lb. standard or cast iron, 175 lb. WP, screwed ends.
  - 3. Fittings for pipe sizes 3 inches and larger may be as above or weld fittings, ANSI 16.9, Schedule 40, flanged or welded fittings, cast iron, 175 lb. WP.
  - 4. Clamp-type UL/FM approved fittings may be used on concealed piping where listed by the State Fire Marshal.
  - 5. Piping installed outdoors shall be galvanized.
- G. Alternate piping system to be Victaulic, Grinnel, or equal grooved piping systems.

END OF SECTION 21 12 00

**SECTION 21 13 00  
FIRE-SUPPRESSION SPRINKLER SYSTEMS****PART 1 GENERAL****1.1 SUMMARY****A. Work Included:**

1. Fabricate, install, and secure necessary approvals for an Automatic Fire Sprinkler System.
2. Provide all materials and equipment, and perform all labor required to install a completely new fire protection systems from the new fire sprinkler riser locations indicated on the construction documents and continuing throughout the building in accordance with this specification, the current adopted edition of NFPA 24 & [NFPA 13, Standard for the Installation of Sprinkler Systems, Current OSFM adopted Edition], [NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes, Current OSFM adopted Edition], [NFPA 13R, Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies, Current OSFM adopted Edition].
3. Provide personnel, equipment (i.e. ladders, and lifts), and materials to perform all acceptance tests, and to assist in inspections.  
Tests are to be witnessed by the Authority Having Jurisdiction.
4. Provide all fire-stopping material and installation labor, using UL Listed fire blocking systems, at all fire sprinkler system penetrations of fire-rated assemblies.

**1.2 QUALITY ASSURANCE****A. Contractors and Manufacturers:**

1. The performance of the work described in this Section is restricted to established Contractors and Manufacturers specializing in automatic fire sprinkler systems that have satisfactorily completed jobs of this size and type, who are acceptable to the Authority Having Jurisdiction. The Contractor shall hold a valid California C-16 contractor's license. The Contractor shall demonstrate satisfactory installations of comparable systems within the proceeding ten years, and shall supply references for review and approval.

**B. Installation Responsibility:**

1. The Contractor is hereby advised that the responsibility for the installation of the fire protection systems is that of the Contractor and that all designs and resolutions proposed in the Shop Drawings, calculations, and related documentation must be demonstrated not only in the test procedure but also throughout the guarantee period.
2. The Systems specified herein are for defining installation intent and minimum performance requirements and may not be downgraded without the written consent of the Architect, University and Authority Having Jurisdiction.
3. See Architect's Construction Documents for location requirements of fire sprinkler systems.

**C. Testing Laboratories:** All materials and equipment used in the installation of the fire protection Systems shall be listed as approved by the Underwriters Laboratories, Inc., List of Fire Protection Equipment and Materials, or approved by other appropriate, nationally recognized testing laboratories for use in sprinkler systems, and shall be the latest design of the manufacturer.**D. Requirements of Regulatory Agencies:** Obtain necessary approvals from, have all materials approved by, and comply with the requirements of all Authorities Having Jurisdiction.**E. Coordinate and secure installation of fire service lines and connect to fire service laterals as required.****F. Comply with the requirements of the current OSFM adopted Edition NFPA pamphlets 13 and 24.****1.3 PRODUCTS AND SUBMITTALS****A. Product Data:** Complete materials list of items with available finishes proposed to be provided under this Section. The quality of materials required for this installation shall be that which comply with the requirements of the Authority Having Jurisdiction and the Current OSFM adopted Edition of NFPA**13. All materials must be UL Listed for fire protection. All piping shall be free from rust.****B. Shop Drawings:**

1. Prior to submitting product submittals to the Architect, indicate any changes to the locations of the following items on plans and submit to Architect and the University for review:
  - a. Sprinkler heads in finished rooms:
  - b. Grills and registers:

- c. Light fixtures, speakers, and smoke detectors:
    - d. All underground fire service piping, risers, backflow assemblies, thrust blocks and related appurtenances.
  2. Required fire sprinkler locations:
    - a. Corridors and halls: Align heads symmetrically so as not to conflict with other ceiling items.
    - b. Rooms: Center sprinkler heads in-line with other ceiling devices.
    - c. Acoustical tile or panel ceilings: Locate heads in the center of the tile or panel.
  3. Architect will review the layout and may relocate or add sprinkler heads to achieve an orderly pattern of ceiling elements, at the Contractor's sole expense.
  4. If required by Architect, meetings will be held at their office to coordinate the locations of sprinklers with other ceiling elements.
  5. After obtaining Architect approval of any proposed fire sprinkler system changes from the approved Construction Documents, and prepare product submittals for review by the Architect. Indicate all elements indicated in paragraphs 1.3, B, above, 21 13 13, 15. and as required by Division 1.
  6. Submit proposed changes or revisions of shop drawings to the Architect for review and approval prior to work. Include details and sections as required to clearly define and clarify the design.
  7. If changes to the approved Construction Documents are required and approved by the Architect and Engineer, the Contractor is to provide drawings, calculations, and submittals to the California State Fire Marshal for approval.
- C. Project Record Documents:
  1. Submit three (3) copies of Project Record Documents in accordance with the requirements of Division 1 Specifications and Section 21 13 13, 1.5, H, for required documents.
  2. Contractor to provide a completed and signed NFPA 13 Contractors Material and Test Certificate upon acceptance of the system by the Authority Having Jurisdiction.
- D. Operation/Maintenance Data and Warranty:
  1. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the University and the Architect (3) copies of an Operation and Maintenance Manual. Include in each copy of the Manual a copy of the Project Record Documents in accordance with the requirements of Division 1 Specifications and Section 21 13 13, 1.5, H, for required documents.
  2. The Contractor shall provide a minimum warranty of one year after final inspection and sign-off of the fire sprinkler system, including all parts, materials of construction, and labor for the installation.
- E. General Piping Requirements
  1. Underground Piping: Provide an installation that is complete in all regards including, but not necessarily limited to:
    - a. Provide fire service supply piping per the civil engineer's site water utility plan, fire sprinkler system Construction Documents, and site water line specification.
    - b. Connections from the main to the base of the riser shall be as shown on the project drawings. Piping shall terminate in a flanged fitting 1'-0" inches above the finished floor.
    - c. When using approved PVC piping for underground supply piping, a transition shall be made to ferrous pipe shall be accomplished at the following locations:
      - 1) A minimum distance of five feet from a 90-degree elbow designed to supply a sprinkler riser.
      - 2) A minimum distance of five feet from the underground elbows on the supply and the service side of an above-ground exterior check valve and other above grade exposed piping, fittings, connections, or valves.
      - 3) A minimum distance of five feet prior to entering a building.
      - 4) A minimum distance of five feet prior to passing under or through a footing or retaining wall.
  2. Above Grade Piping – All pipe shall be made in the USA domestically manufactured, and shall be UL Listed for Fire Protection System installation.
    - a. Flanged fittings shall be used at above-grade exterior locations.
    - b. Connections and fittings shall be threaded, flanged, grooved, or welded.
    - c. Grooveless clamp or saddle fittings are not acceptable. Fittings and couplings shall be



Class 125 (standard) weight minimum.

- F. Fire Sprinklers:
1. In soffits and interior ceilings: Reliable Semi-Recessed Quick Response Pendent (finish selected by the architect) or approved equal.
  2. In hard ceilings: Reliable Semi-Recessed Quick Response Pendent (to be selected by the architect) or approved equal. Finishes to be selected by Architect.
  3. Sidewall interior sprinkler to be Reliable Quick Response HSW (finish to be selected by Architect) or approved equal.
  4. Concealed spaces: Reliable Quick Response upright or pendants, brass finish, as approved for use.
- G. Fire Sprinkler System Piping:
1. Pipe sized 1" thru 1-1/2": Use domestically manufactured Schedule 40 black steel pipe with threaded, banded cast or malleable iron fittings, or equivalent, UL Listed for fire protection.
  2. Pipe sized 2" thru 8": Use domestically manufactured Schedule 10 black steel pipe with welded and/or grooved cast iron fittings of required pressure rating, UL Listed for fire protection.
  3. Piping sized 8" and larger to be Schedule 10, UL Listed steel piping.
- H. Fire Department Connection (FDC)
1. Provide appropriately sized (four-inch or larger, depending on system design) freestanding pipe mount, cast brass FDC with 2-1/2-inch individually clappered fire department inlet connections with breakable cast iron domed caps, and one-inch cast lettering. The Fire Department Connection shall be Potter Roemer Standard No. 5500 series or approved equal, UL listed with a finish as selected by the Architect.
  2. Fire department connection shall be located where indicated on the Construction Documents. Note: Where conditions do not permit, the fire department connections shall be placed where readily accessible in case of fire and not liable to injury or fire exposure. All fire department connection locations shall be approved by the Authority Having Jurisdiction.
  3. Where subject to mechanical injury, protection shall be provided. The means of protection shall be approved and shall be arranged in a manner, which will not interfere with the connection to inlets.
  4. Maintain a 36-inch clear radius around the fire department connection. Grade variation within this radius shall not exceed 1:12. The fire department connection shall be arranged so that hose lines can be readily and conveniently attached to inlets without interference from any nearby objects including buildings, fences, posts, or other fire department connections.
  5. The fire department connection shall be visible from the street and provided with an identification sign as approved by the University Representative and the AHJ. See Section 21 13 13, 2.3, K, for requirements.
- I. Supervisory switch: Designed so that it will operate between the first and second revolution of the valve control wheel or when the stem moves no more than one-fifth of the distance from its normal position or if the unit is removed from its mounting.
- J. Flow switch: All wetted parts of brass or stainless steel. Flow switch to be complete with retard setting providing a 30-second delay before actuating.
- K. Valves: U.L. listed Kennedy, Nibco, or Stockham or approved alternate. Valves shall be rated for minimum 175 psi working pressure zones.
- L. Pressure gauge: Bourdon spring pressure type with non-corrodible movements, set in cast iron case with black flange and with rings of pressed brass, flared type construction. Cases and rings black enamel finish. Gauges shall have 4-1/2" dials with white background, black lines, and figures, calibrated for 2 times working pressure. Installation: Each gauge connected to its respective pipe line located where shown and at the inlet and outlet of each pump, by means of suitable brass pipe, pigtails, and fittings containing a brass cock, Ashcroft, U.S. Gauge Company, or Crosby.
- M. Piping Seismic Separation Joints, where required, shall be Metraloop-Fireloop UL Listed Flexible Expansion Loops, as manufactured by the Metraflex Company Chicago, Illinois.
- N. Sprinkler Cabinet
1. Provide a cabinet containing spare sprinkler heads and equipment of the following type and number installed at an interior location nearest the wall at the system riser, in an accessible location as directed by the Architect, and as approved by the California State Fire Marshal. Provide sprinklers of each type used in the installation, with sprinkler wrenches per Section 21 13 13, 2.3, K, for requirements. 2.8, I, shall be complete with the required number of spare

- sprinkler heads of each type and temperature rating per [NFPA 13], [NFPA 13R], [NFPA 13D]
2. The cabinet shall be distinctly labeled, designating the type and quantity of equipment it contains.

#### 1.4 INSTALLATION AND EXECUTION

- A. Installation shall not be started until the submittal is approved by the California State Fire Marshal, the Architect of Record, and the Engineer of Record. The component submittals shall be stamped and signed by the qualified engineer registered in the State of California prior to submitting to the Authorities Having Jurisdiction.
- B. Install the work of this Section in strict accordance with the reviewed Shop Drawings and the requirements of the Authorities Having Jurisdiction. Relocate any heads not aligned with other ceiling fixtures or outlets at the Contractors' sole expense.
- C. Coordinate routing of sprinkler piping with all other trades that will be affected by the installation of the fire sprinkler system to avoid interferences. The cost of any field to work in place due to incomplete or inaccurate coordination revisions with other trades will be the responsibility of the Contractor.
- D. Maintain maximum clearances above ceilings. All piping is to be concealed unless specifically noted otherwise on the plans.
- E. Install drains on main risers and auxiliary drains in accordance with standard practices and local ordinances. Install one Inspector's Test drain on each system and discharge to an approved exterior location where indicated on the project drawings and approved by the Architect.
- F. Access: Do not locate any device requiring access in walls or above ceilings of public areas without Architect's prior approval. Provide access doors complying with specifications and signs for all concealed devices.
- G. Piping, Hangers, Supports, Anchors, and Sleeves: Install in complete accordance with NFPA 13 requirements, using UL Listed components by Tolco.
- H. Install all horizontal piping to run parallel to or perpendicular to the building walls, unless otherwise shown on the Drawings or approved by the Architect. Do not install sprinkler piping that obstructs any door openings.
- I. Guide and support all vertical risers or piping in accordance with standard practice. Fabricate and construct pipe joints so that they produce a true alignment of the pipe. Ream all pipe ends. Construct welded pipe joints in accordance with applicable codes.
- J. Run all piping in such a manner as to provide appropriate flexibility with respect to expansion and contraction. In general, accomplish this with flexible couplings, expansion loops, and/or leads from mains with proper lengths and appropriate fittings. Anchor piping is required.
- K. Where exposed piping penetrates the floors, walls, or ceiling of finished areas, provide chromium plated pipe escutcheons at the penetrations.
- L. Provide pipe sleeves through partitions, walls, slabs, and outside walls for piping furnished and installed under this Section. Extend all vertical pipe sleeves on the floor 6" above the finish. Provide Drawings showing openings for proper installation of the work specified.
- M. Provide all UL Listed hangers and supports required for the installation. Bracing the pipes to the bottom flanges of steel beams are not permitted.
- N. Use hot dipped galvanized materials in any exterior or open spaces such as canopies or covered walkways.
- O. Clean pipe and fittings and keep interiors clean throughout the installation. Provide caps on the ends of cleaned piping.
- P. Use full pipe lengths; random lengths joined by couplings will not be accepted.
- Q. Provide for expansion and contraction of all pipes and seismic movement. Provide reducing fittings for all changes in pipe size; provide fittings for all changes in pipe direction. Riser piping shall be installed plumb with offset fittings used where alignment adjustment is necessary.
- R. Provide unions for pipe sizes below two-inch and flanged or grooved fittings for sizes two-inch and above to permit disconnection of equipment and fixtures.
- S. Prepare all piping having welds for Authority Having Jurisdiction inspection prior to installation.
- T. On-site fire code welding permits shall be obtained from the Authority Having Jurisdiction.
- U. Piping arrangement shall avoid beams, columns, ducts, lighting fixtures, doors, windows, and similar obstructions for openings.
- V. All piping that penetrates fire-rated construction shall be fire-stopped in accordance with these

specifications and project drawings.

- W. Underground Piping Installation – See 21 13 13, 3.2, B for installation and inspection requirements.
- X. Fire-Stopping: Fire stop all holes or voids created by penetrations of the Fire Sprinkler System piping through fire-rated construction, with UL Listed Fire Stop / Block Systems appropriate for the rated construction penetration.

### 1.5 TESTING

- A. All tests described and referenced in these specifications shall be performed by the Contractor in the presence of the Authority Having Jurisdiction and the University Representative. Tests and inspections shall apply to all water-sourced fire protection systems, including fire hydrants, sprinklers, standpipes, and all underground piping that is installed to supply these systems and devices.
- B. Hydrostatic Test Preparation:
  - 1. Interior piping shall be filled with water for two (2) hours preceding hydrostatic testing.
  - 2. Piping shall be purged of all air and other gasses prior to hydrostatic testing.
  - 3. Underground piping shall be center loaded and all fittings, joints, strapping, and thrust blocking shall be exposed for hydrostatic pressure testing and inspection.
  - 4. All above-grade and interior piping, fittings, sprinkler heads, and supports shall be exposed for inspections and hydrostatic testing.
  - 5. A hydrostatic pre-test shall be conducted for both aboveground and underground piping prior to calling for Authority Having Jurisdiction final acceptance test. Written confirmation of passed 100% pre-test shall be given to the inspector of record prior to calling for the final inspection. All costs associated with delays caused by failure to complete 100% operational pre-test shall be borne by the contractor. A Contractors Material and Test Certificate shall be filled out upon completion of testing.
- C. Fire department connections and piping shall be included in hydrostatic testing and shall be back flushed until clear water is observed.
- D. Underground mains and supply connections to sprinkler risers shall be flushed thoroughly before connections to sprinkler systems.
- E. Tests of drainage facilities shall be conducted by opening each drain valve while the system control valves are open to the supply.
- F. All water level sensors, alarm and supervisory signals, tanks, and automatic valves shall be performance tested.
- G. Water remaining in normally dry piping shall be evacuated at the completion of testing.
- H. Contractor to provide to the University completed copies of the forms depicted in Figure 25.1 “Contractor’s Material and Test Certificate for Above Ground Piping” and Figure 10.10.1 “Contractor’s Material and Test Certificate for Underground Piping” of the Current OSFM adopted Edition of NFPA 13, upon completion of the system installation and approval by the California State Fire Marshal.

**END OF SECTION 21 13 00**

**SECTION 21 13 13**  
**AUTOMATIC WET-PIPE FIRE SPRINKLER SYSTEM****PART 1- GENERAL****1.1 SUMMARY DESCRIPTION**

- A. This Section specifies materials, methods, and equipment to be used for automatic wet pipe sprinkler system standpipe system, fire pump system (when applicable for the project), and related fire protection piping to 5 ft outside the building.
1. Work Included:
    - a. Provide all materials and equipment, and perform all labor required to install a complete new fire protection systems from the new fire sprinkler riser locations indicated on the construction documents and continuing throughout the building in accordance with this specification, the current adopted editions of the Codes and Standards as noted in 211313, 1.3, A.
    - b. Provide personnel and materials to perform all acceptance tests, and to assist in inspections. Tests are to be witnessed by the Authority Having Jurisdiction.
    - c. Provide all fire-stopping material and installation labor, using UL Listed fire-blocking systems, at all fire sprinkler system penetrations of fire-rated assemblies.
- B. [NFPA 13], [NFPA 13R], and [NFPA 13D]'s seismic requirements are part of this project.
- C. This is not a Factory Mutual Global (FMG) protected property.
- D. System(s) shall consist of:
1. Automatic fire sprinkler zone(s) which consist of:
    - a. Wet sprinkler zones
    - b. Preaction sprinkler zone
- E. Each wet pipe zone shall begin with:
1. Indicating-type floor control valve with tamper switch
  2. Check valve (required on combined standpipes)
  3. Pressure gauge
  4. Waterflow switch
  5. Inspector's test and drain assembly
  6. Hydraulic calculation plate
- F. Engineer of Record:  
The contractor shall retain the Engineer of Record. The contractor shall produce stamped and sealed installation drawings, which are also referred to as shop drawings in this Section, based on the design criteria listed in this Section.
- G. All work shall be installed in conformance with the governing codes, regulations, local ordinances, Cal Poly Construction Standard Specifications and Campus Standard Detail, and requirements of Authorities Having Jurisdiction. It shall be the responsibility of the Fire Protection Contractor to familiarize themselves with all governing codes and requirements and report any noncompliance of the plans or specifications to the Cal Poly Representative, prior to entering into the contract. These requirements are minimum criteria and no reductions permitted by Code shall be allowed without written permission of the Cal Poly Representative.
- H. No additional compensation shall be granted for work which must be changed as a result of the work not originally complying with codes and the campus standard specifications or not in accordance with the multiple trade coordination design criteria set forth in the contract documents. As the AHJ and Campus review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arises during installation.
- I. If code or other requirements exceed provisions indicated in the Contract Documents, the Owner's Representative shall be notified in writing. Where the work indicated on the Contract Documents

exceeds code requirements, the installation shall be done in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the expense of the responsible Contractor.

- J. Fire Protection Contractor shall become familiar with all details of the work, verify dimensions in the field, and advise the Cal Poly Representative of any discrepancy prior to entering into the contract.
- K. Authorities Having Jurisdiction (AHJ) will be conducting inspections. Cal Poly Construction Inspector of Record (I.O.R.) will conduct rough pre-inspection prior to AHJ inspections. The fire protection Contractor shall arrange an inspection with the Cal Poly Representative proper and include all costs associated with attending said inspections in their bid.
- L. Cal-GREEN requirements, Title 24, Part 11, California Green Building Standards (CAL Green Code)

## 1.2 RELATED WORK

- A. Section 21 00 00 – General Fire Suppression Requirements
- B. Section 07 84 00 – Firestopping
- C. Division 26 – Electrical
- D. Division 27 - Communications
- E. Section 28 31 13 – Fire Detection and Alarm Systems

## 1.3 REFERENCES & QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. This installation shall conform to the following:
    - a. [NFPA 13, Standard for the Installation of Sprinkler Systems, Current OSFM adopted Edition], [NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes, Current OSFM adopted Edition], [NFPA 13R, Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies, Current OSFM adopted Edition]
    - b. NFPA 14, Installation of Standpipe and Hose Systems, Current OSFM adopted Edition.
    - c. NFPA 20, Installation of Stationary Pumps for Fire Protection, Current OSFM adopted Edition
    - d. NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances, Current OSFM adopted Edition.
    - e. NFPA 25, Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, Current California OSFM adopted Edition
    - f. NFPA 30, Flammable and Combustible Liquids Code, Current OSFM adopted Edition
    - g. NFPA 45, Fire Protection for Laboratories Using Chemicals, Current OSFM adopted Edition
    - h. NFPA 55, Compressed Gases and Cryogenic Fluids Code, Current OSFM adopted Edition
    - i. NFPA 70 National Electrical Code, Current Edition
    - j. NFPA 72, National Fire Alarm and Signaling Code, Current OSFM adopted Edition
    - k. NFPA 101, Life Safety Code, Current OSFM adopted Edition
    - l. California Code of Regulations Title 19, Section 939
    - m. Underwriters Laboratories (UL) Fire Protection Equipment Directory
    - n. Factory Mutual Engineering Corporation (FM): Approval Guide
    - o. ANSI/ASME A13.1
    - p. ISO 6789-2 Requirements for Calibration and Determination of Measurement Uncertainty in Hand Torque Tools
    - q. AWWA Standard for Disinfecting Water Mains, Current Edition
    - r. Cal Poly Construction Campus Standard Specifications and Campus Standard Details: <https://afd.calpoly.edu/facilities/planning-capital-projects/construction-standard/>

## B. Contractor Installation Program:

1. Provide licensed design professionals employed by the sprinkler contractor to perform planning, calculations, layout, installation, engineering, and testing of fire protection systems. The following are acceptable:
  - a. Licensed Professional Engineer
  - b. National Institute for Certification of Engineering Technologies (NICET) Level IV
  - c. Certified sprinkler designer
  - d. Fire Protection Engineer
2. Provide journeyman sprinkler fitter(s) for installation and supervision.
3. The contractor shall be licensed in the State of California for the installation of fire protection systems.
4. Work shall be done by a Certified Sprinkler Fitter working for a C16 contractor.
5. Automatic Fire Extinguishing Systems (AES) Sprinkler Pipe fitters are to be certified by the CAL FIRE - Office of the State Fire Marshal (CAL FIRE – OSFM).
6. The contractor performing the installation shall have been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years. The contractor shall submit pre-qualification evidence of at least 3 projects of comparable size completed with their Bid.
7. Distortion or misrepresentation of qualification evidence may result in contract cessation.
8. Contractors and Manufacturers:
  - a. The performance of the work described in this Section is restricted to established Contractors and Manufacturers specializing in automatic fire sprinkler systems that have satisfactorily completed jobs of this size and type, who are acceptable to the Authority Having Jurisdiction. The Contractor shall hold a valid California C-16 contractor's license. The Contractor shall demonstrate satisfactory installations of comparable systems within the proceeding ten years and shall supply references.
9. Installation Responsibility:
  - a. The Contractor is hereby advised that the responsibility for the installation of the fire protection systems are that of the Contractor, and all designs and resolutions proposed in the Shop Drawings, calculations, and related documentation must be demonstrated not only in the test procedure but also throughout the guarantee period.
  - b. The Systems specified herein are for defining installation intent and minimum performance requirements and may not be downgraded without the written consent of the Architect, University, and the Authority Having Jurisdiction.
  - c. Contractor shall coordinate with the Architect's Construction Documents for location requirements of fire sprinkler systems.
10. Testing Laboratories: All materials and equipment used in the installation of the fire protection systems shall be listed as approved by the Underwriters Laboratories, Inc., List of Fire Protection Equipment and Materials, or approved by other appropriate, nationally recognized testing laboratories for use in sprinkler systems, and shall be the the latest design of the manufacturer.
11. Requirements of Regulatory Agencies: Obtain necessary approvals from, have all materials approved by, and comply with requirements of all Authorities Having Jurisdiction prior to installation.
12. Interruption of Service: There shall be no interruption of the existing sprinkler protection, water, electric, or fire alarm services without prior permission of the Cal Poly representative and the AHJ. The contractor shall develop an interim fire protection program where interruptions involve occupied spaces. Request in writing at least 14 business days week prior to the planned interruption.

**C. Electrical Coordination**

1. All relays, wire, conduit, pushbuttons, pilot lights, and other devices required for the power side of the control of electrical equipment shall be furnished by Division 26 and Division 28 contractors, except as specifically noted elsewhere in this specification.
2. Should any change in electrical equipment size, horsepower rating, or means of control be made to any motor or other electrical equipment after contracts are awarded, the sprinkler contractor is to immediately notify Division 26 and Division 28 contractors of this change and pay any costs due to this change, at no charge to the Owner.
3. Division 26 contractors shall provide all power wiring and the sprinkler contractor shall be responsible for providing all control wiring and its conduit. Control wiring shall conform to Division 26 and 28 requirements for control wiring. Conduit:  $\frac{3}{4}$ -inch, minimum.
4. The sprinkler contractor shall provide exterior water flow alarms and coordinate installation with Division 26 and Division 28 contractors.
5. Furnish wiring diagrams to Division 26 and Division 28 contractors for equipment and devices furnished by sprinkler contractors which have been indicated to be wired by Division 26 and Division 28 contractors.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to the site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. All materials shall be stored in a clean, dry space.
- D. Promptly inspect shipments to ensure material is undamaged and complies with Specifications. Storage and protection methods must allow inspection by the AHJ to verify products prior to installation.
- E. Furnish the pipe with plastic end-caps/plugs on each end of the pipe. Maintain end-caps/plugs through shipping, storage, handling, and installation to prevent pipe-end damage and to eliminate dirt and construction debris from accumulating inside of the pipe. Protect fittings and unions by storage inside or by durable, waterproof, aboveground packaging.
- F. Cover the pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade.
- G. Offsite storage agreements will not relieve the Contractor from using proper storage techniques.

**1.5 SUBMITTALS**

- A. Shop Drawings Submittals and Product Data Submittals on Items Specified:
  1. Pipe, Fittings, and Joints
  2. Valves
  3. Tamper Switches
  4. Flow Switches
  5. Pressure Switches
  6. Exterior Weatherproof Waterflow Alarm
  7. Sprinkler Heads
  8. Sprinkler Head Cabinet
  9. Preaction Valve and Accessories
  10. Hanger Assemblies
  11. Pressure Gauges
  12. Fire Department Connection (FDC)
  13. Fire Valve Cabinets (FVC)
  14. Fire Department Valves (FDV)

15. Fire Pump and Accessories (When Applicable for the Project)
  16. Fire Pump Test Connection (When Applicable for Project)
  17. Fire Pump Controller with Automatic Transfer Switch (When Applicable for the Project)
  18. Jockey Pump and Accessories (When Applicable for Project)
  19. Jockey Pump Controller (When Applicable for Project)
  20. Drawings
  21. Hydraulic Calculations
  22. Seismic Restraint Detailing
  23. Pipe Identification ANSI/ASME A13.1
- B. Submit fire pump-certified shop test curves showing pressure rating and rated horsepower to University Representative (when applicable for the project).
- C. Submit Safety Data Sheet (SDS) for corrosion inhibitive paint.
- D. Product Data: Complete materials list of items with available finishes proposed to be provided under this Section. The quality of materials required for this installation shall be that which comply with the requirements of the Authority Having Jurisdiction and in accordance with the current adopted editions of the Codes and Standards as noted in 211313, 1.3, A. All materials must be UL Listed for fire protection or approved by other appropriate, nationally recognized testing laboratories for use in sprinkler systems. All piping shall be free from rust. Include items listed in the product section and additional items required to provide complete installation. Indicate by red marking or arrow, items that are to be provided, where more than 1 item appears on the manufacturer's catalog sheet. Include listing information and installation instructions in data sheets. Where data sheets describe items in addition to those proposed to be used for the system, clearly identify the proposed items on the sheet.
- E. Submit stamped and sealed drawings, product datasheets, calculations of loads for sizing of sway bracing, and hydraulic calculations, to the AHJ for approval via Cal Poly Representative, prior to installation or fabrication of system components.
- F. Prior to installation or fabrication of system components, submit layout drawings and equipment submittals to Cal Poly Representative.
- G. OFS and Cal Poly Representative review of submittals does not relieve the Contractor from coordinating the installation of work with other trades or from compliance with Codes and Standards.
- H. After acceptance tests:
1. Send a copy of the test log to the Cal Poly Representative
  2. Send a copy of the NFPA Contractor's Material and Test Certificates and fire pump test results to:
    - a. Cal Poly Representative
    - b. Authority Having Jurisdiction (i.e. State Fire Marshall) via the Cal Poly I.O.R
  3. Provide the Cal Poly Representative with the following:
    - a. Manufacturer's literature and instructions describing the operation and maintenance of equipment and devices installed.
    - b. Typewritten chart with identification and location of all access panels serving equipment and valves. Incorporate into Operation & Maintenance (O&M) manual.
    - c. Typewritten valve schedule indicating valve number, fixture/equipment, or areas served by each numbered valve. Incorporate into the O&M manual.
    - d. Detailed Site and System Specific Monthly Fire Pump Testing Procedure with pictures and floor plans indicating the location of the equipment. Include the testing requirements noted in the current edition of NFPA 72, NFPA 20, and NFPA 25
    - e. Final Document Submittals: Provide as-built drawings, testing, and maintenance instructions in accordance with the requirements of Division 1 Specifications. In addition,



submittals shall include, but not be limited to, the following:

- 1) A complete set of as-built drawings showing the installed system with the specific interconnections between the system switches and the fire alarm equipment. Provide a complete set in the formats as follows. Submit items 2 and 3 below on a compact disc or as directed by the Cal Poly representative.
  - 2) One complete set in electronic pdf format.
  - 3) One complete set in AutoCAD format or a format as directed by the Cal Poly representative.
- f. Operations and Maintenance Manuals that include step-by-step procedures required for system startup, operation, shutdown, and routine maintenance and testing. The manuals shall include the manufacturer's name, model number, parts list, and tools that should be kept in stock by the owner for routine maintenance, including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization, including the address and telephone number, for each item of equipment.
- g. Provide one additional copy of the Operations and Maintenance Manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser or as directed by the Cal Poly representative.
- h. A current copy of NFPA 25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

## 1.5 PRE-INSTALLATION CONFERENCE

- A. Conduct a pre-installation conference in accordance with Section 013119.
- B. Agenda: Include discussion and agreement upon acceptance.

## 1.8 SEQUENCING

- A. Sequence Work properly with adjacent work to allow unobstructed access to all areas.
- B. Inspection Request: inspection by the authority having jurisdiction and testing before concealment.
  1. The [Contractor], [Construction Manager] shall sequence work to permit installation to be inspected by the AHJ and approved prior to being concealed.
  2. Ensure that subsequent installations are reported, properly installed, and inspected by the AHJ.

## PART 2- PRODUCTS

### 2.1 MATERIALS

- A. Materials and Equipment
  1. Materials and equipment in the system shall be new and current products of the manufacturer regularly engaged in the production of such materials and equipment.
  2. Where 2 or more pieces of equipment are required to perform interrelated functions, they shall be products of the same manufacturer.
  3. Clean and cap the pipe after fabrication and prior to placing the pipe in the building.
  4. Mark pipe with tags that can be removed during installation so no permanent markings remain on unpainted pipe located in exposed areas.
- B. Approval Guides:
  1. Materials Unless otherwise shown, products shall be UL Listed in the latest publication of the UL Fire Protection Equipment Directory for service intended.

### 2.2 PIPE

- A. Below Ground:

1. Pipe: Ductile iron, Class 52, American Water Works Association (AWWA) C151, 150 psi working pressure, with standard cement mortar lining, AWWA C104, American National Standards Institute (ANSI) A21.4
  2. Fittings: Ductile iron or grey iron, mechanical joint, cement mortar lined, Class 250, AWWA C110
  3. Encasement: Polyethylene encasement, 8 mil thick, AWWA C105  
Stainless steel bolt kits.
- B. Above Ground:
1. Carbon Steel, 2" and smaller:
    - a. Pipe: Carbon steel pipe, Schedule 40, American Society for Testing of Materials (ASTM) A795, A53, or A135
    - b. Fittings:
      - 1) Malleable iron, threaded, Class 125, 175 psi Cold Water Pressure (CWP) rating, ANSI B16.3
      - 2) Cast iron, threaded, Class 125, 175 psi CWP rating, ANSI B16.4
    - c. Joints:
      - 1) Threaded, tapered pipe threads, ANSI B1.20.1
  2. Carbon Steel, larger than 2":
    - a. Pipe: Carbon steel pipe, Schedule 10, ASTM A795, ASTM A53, or A135
    - b. Fittings:
      - 1) Ductile iron or malleable iron, roll grooved for mechanical coupling, 175i CWP rating, malleable iron conforming to ASTM A47.
        - a) Acceptable manufacturers: Anvil Gruvlok, Tyco Grinnell, Victaulic, Viking, or approved equal
        - b) Fitting, gasket, and coupling shall be furnished by the same manufacturer.
    - c. Joints:
      - 1) Welded, welding electrodes shall be Lincoln or approved equal with coating and diameter as recommended by the manufacturer for the type and the thickness of the work being done.
      - 2) Mechanical:
        - a) Flexible mechanical, malleable iron, ASTM A47, approved equal to Victaulic Style 75
        - b) Rigid mechanical, ductile iron, ASTM A-536, approved equal to Victaulic Style 009N
        - c) Wet systems gasket: Grade E EPDM gasket per UL 157 and UL 213
        - d) Dry systems gasket: Victaulic "FlushSeal" or approved equal
        - e) Rigid or zero flex type couplings shall be provided when operating pressures cause piping to move out of place or sway on hangers. Flexible couplings may be used where the pipe is braced or clamped into a rigid position
  3. Galvanized Steel, 2" and smaller
    - a. Pipe: Galvanized steel pipe, Schedule 40, ASTM A795, ASTM A53, or A135
    - b. Fittings:
      - 1) Malleable iron, threaded, galvanized coating, Class 150, ANSI B16.3
      - 2) Forged steel, threaded, galvanized coating, ANSI 16.11
        - a) Ductile iron or malleable iron, cut grooved for mechanical coupling, 175 psi CWP rating, malleable iron conforming to ASTM A47, hot dipped galvanized to ASTM A153 or zinc electroplating to ASTM B633

- Acceptable manufacturers: Anvil Gruvlok, Tyco Grinnell, Victaulic, Viking, or approved equal.
- b) Fitting, gasket, and coupling shall be furnished by the same manufacturer.
- c. Joints:
- 1) Tapered pipe threads, ANSI B1.20.1
  - 2) Mechanical:
    - a) Flexible mechanical, malleable iron, ASTM A47, approved equal to Victaulic Style 75
    - b) Rigid mechanical, ductile iron, ASTM A-536, approved equal to Victaulic Style 009N
    - c) Wet systems gasket: Grade E EPDM gasket per UL 157 and UL 213
    - d) Dry systems gasket: Victaulic "FlushSeal" or approved equal
    - e) Rigid or zero flex type couplings shall be provided when operating pressures cause piping to move out of place or sway on hangers. Flexible couplings may be used where a pipe is braced or clamped into rigid position
4. Galvanized Steel, larger than 2":
- a. Pipe: Galvanized steel pipe, Schedule 40, ASTM A795, ASTM A53, or A135
  - b. Fittings:
    - 1) Cast iron, threaded, galvanized coating, Class 125, ANSI B16.4
    - 2) Forged steel, threaded, galvanized coating, ANSI 16.11
    - 3) Ductile iron or malleable iron, cut grooved for mechanical coupling, 175 psi CWP rating, malleable iron conforming to ASTM A47, hot dipped galvanized to ASTM A153 or zinc electroplating to ASTM B633.
      - a) Acceptable manufacturers: Viking, Tyco Grinnell, Victaulic, or approved equal
      - b) Fitting, gasket, and coupling shall be furnished by the same manufacturer.
  - c. Joints:
    - 1) Tapered pipe threads, ANSI B1.20.1
    - 2) Mechanical:
      - a) Flexible mechanical, malleable iron, ASTM A47, equal to Victaulic Style 75
      - b) Rigid mechanical, ductile iron, ASTM A-536, equal to Victaulic Style 009N
      - c) Wet systems gasket: Grade E EPDM gasket per UL 157 and UL 213
      - d) Dry systems gasket: Victaulic "FlushSeal" or equal
      - e) Rigid or zero flex type couplings shall be provided when operating pressures cause piping to move out of place or sway on hangers. Flexible couplings may be used where the pipe is braced or clamped into a rigid position.
5. Flexible sprinkler hose fittings for fire protection service shall be manufactured by FlexHead Industries, Inc., 56 Lowland Street, Holliston, MA 01746; Telephone: (800) 829-6975 or approved equal. The product shall be FMRC Approved for its intended use pursuant to FM 1637 – Approval Standard for Flexible Sprinkler Hose with Threaded End Fittings. The product shall be UL Listed for its intended use pursuant to UL 2443 – Standard for Flexible

Sprinkler Hose with Fittings for Fire Protection Service. For seismic projects, the product shall be seismically qualified for use pursuant to ICC–ES AC-156 – Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems. Provide high-pressure fittings where pressures exceed 175 psi water working pressure. Model numbers on high-pressure fittings must include the “H” suffix.

a. FlexHead Flexible Hose Assemblies and End Fittings:

- 1) Composition: 100% Type 304 Stainless Steel
- 2) Shall be fully welded non-mechanical fittings, braided, leak-tested with minimum 1” true-bore internal corrugated hose diameter
- 3) Straight Hose Assembly Lengths: 2 ft length, Model #2024; 3 ft length, Model #2036; 4 ft length, Model #2048; 5 ft length, Model #2060; 6 ft length, Model #2072
- 4) Elbow Hose Assembly lengths: 2 ft length, Model 2024E; 3 ft length,

Model #2036E; 4 ft length, Model #2048E; 5 ft length, Model #2060E; 6 ft length, Model #2072E

b. FlexHead Ceiling Bracket:

- 1) Composition: Type G90 Galvanized Steel
- 2) Type: Direct attachment type, having integrated snap-on clip ends positively attached to the ceiling using tamper-resistant screws
- 3) Flexible hose attachment: Removable hub type with set screw

6. Provide metal pipe’s exposed threads with corrosion-inhibitive paint, approved equal to Rust-Oleum.
7. Provide pipe identification system with flow directional arrows on fire protection pipe. For additional information about pipe identification, refer to Section 20 0553 – Mechanical Systems Identification
8. Plain-end couplings (Roust-A-Bouts, Plainloks, or similar couplings) are not allowed on either new or existing sprinkler systems.
9. Adjustable drop nipples are not allowed on either new or existing sprinkler systems.
10. Shop welded joints:
  - a. Welding electrodes shall be Lincoln or approved equal with coating and diameter as recommended by the manufacturer for the type and thickness of work being done.

## 2.3 VALVES

### A. Gate Valve:

1. Acceptable manufacturers: Kennedy, Milwaukee Valve Co., Mueller, Nibco, Stockham, Victaulic, or approved equal
2. Outside screw and yoke (OS&Y) gate valve, bronze body, and trim or cast-iron body bronze mounted and rated for 175 psi, non-shock water working pressure, Nibco F-607-OTS or approved equal.
3. Provide high-pressure valves and fittings when pressures exceed 175 psi water working pressure.

### B. Check Valve:

1. Acceptable manufacturers: Reliable, Tyco Fire Products, Victaulic, Viking, or approved equal.
2. Iron body, bronze seat, stainless steel clapper with a replaceable rubber seal, Tyco Fire Products CV-1F, Viking Model G-1, or approved equal.
3. Provide high-pressure valves and fittings when pressures exceed 175 psi water working pressure.

- C. Check Valve: (Anti-Water-Hammer type)
1. Acceptable manufacturers: Anvil Gruvlok, Reliable, Tyco Fire Products, Victaulic, Viking, or equal
  2. Ductile iron conforming to ASTM A536, Grade 65-45-12, rust inhibiting coating, sizes 2" to 5" consisting of stainless-steel clapper conforming to ASTM A-167 and for sizes 6" to 8" consisting of ductile iron clapper conforming to ASTM A-536, Anvil Gruvlok Series 78FP or equal.
  3. Provide high-pressure valves and fittings where pressures exceed 175 psi water working pressure.
- D. Ball Valve:
1. Acceptable manufacturers: Milwaukee Valve Co., Mueller, Nibco, Stockham, Victaulic, or equal
  2. Provide high-pressure valves and fittings when pressures exceed 175 psi water working pressure.
  3. All ball valves to be stainless steel ball and stem.
- E. Test and Drain Valves:
1. Acceptable manufacturers: AGF, Victaulic, or equal
  2. AGF TESTanDRAIN, Victaulic Style 720 TestMaster II, or equal
  3. Test and drain valve shall include an integral pressure relief valve. The pressure relief valve shall be set to operate at 175 psi or 10 psi in excess of the maximum system pressure, whichever is greater.
  4. Provide high-pressure valves and fittings where pressures exceed 175 psi water working pressure.
- F. Drain Valves:
1. Acceptable manufacturers: Kennedy, Nibco, or equal
  2. Thread-in bonnet bronze globe valves, rated to 175 psi non-shock water working pressure, Nibco KT-65 Series for valve sizes 1/2" to 1", KT-211 Series 1-1/4" to 2", or equal.
  3. Provide high-pressure valves and fittings when pressures exceed 175 psi water working pressure.
- G. Pressure Regulating Valves:
1. Acceptable manufacturers: Croker, Elkhart Brass, Potter-Roemer, or equal
  2. Valve shall be able to regulate inlet pressure up to 400 psi, brass body with brass and stainless-steel internal parts, field adjustable indicating scale, non-rising stem, red handwheel, tamper-proof monitor switch adapter, Potter-Roemer Model 4036-MSA, or equal for in-line applications and Model 4021-MSA or equal for end-of-line applications.
- H. Fire Department Valve (FDV):
1. Acceptable manufacturers: Croker, Elkhart Brass, Potter-Roemer, or equal
  2. Fire Department valve shall be a 2-1/2" angle valve, cast brass body, polished brass finish, equal to Potter-Roemer Model 4065. Valve cap for 2-1/2" valve shall be 2-1/2" x 1-1/2" hose adapter reducer, Potter-Roemer Model 2810 or equal, with 1-1/2" cap with chain, Potter-Roemer Model 4615 or equal. The cap and chain finish shall match the finish of the valve body. Threads shall match Fire Department Standards.
- I. Riser Manifold:
1. Acceptable manufacturers: Viking, Victaulic, Tyco Fire Products, or equal
  2. Ductile iron or fabricated steel pipe body; threaded or grooved connections; rated to 175 psi non-shock water working pressure; includes test and drain valve, flow switch with optional cover tamper kit and pressure gauge; Viking Products Model EasyPac or equal.
  3. Provide high-pressure valves and fittings when pressures exceed 175 psi water working pressure.
- J. Air Release Valve:

1. Acceptable manufacturers: Engineered Corrosion Solutions, Potter Electric Signal Co., or equal
  2. Automatic float-type air vent, ball valve with tamper switch, Y-type strainer, and a single set of normally closed dry contacts rated 24VAC/DC at 2 Amps, UL 2573 Listed, FM Approved "Automatic Air Release Valve for Sprinkler Systems", rated to 175 psi non-shock water Working pressure, Potter Electric Signal Co. Model PAAR-B or equal.
  3. Air release valve shall be installed in an accessible location to permit operation, maintenance, and visual inspection of the status of the valve.
  4. Provide high-pressure valves and fittings when pressures exceed 175 psi water working pressure.
- K. Provide identification sign (enamel on metal) for valves per NFPA requirements and per ANSI/ASME A13.1
1. Signs must be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate and as required by NFPA 13. Main drain test results must be etched into the main drain identification sign. Hydraulic design data must be etched into the nameplates and permanently affixed to each sprinkler riser as specified in NFPA 13. Provide labeling on the surfaces of all feed and cross mains to show the pipe function (e.g., "Sprinkler System", "Fire Department Connection", "Standpipe") and normal valve position (e.g. "Normally Open", "Normally Closed"). For pipe sizes 4-inch and larger provide white painted stenciled letters and arrows, a minimum of 2 inches in height and visible from at least two sides when viewed from the floor. For pipe sizes less than 4-inch, provide white painted stenciled letters and arrows, a minimum of 0.75-inch in height and visible from the floor.
- L. Valve Charts: Provide a valve chart that identifies the location of each control valve. Coordinate nomenclature and identification of control valves with COR. Where existing nomenclature does not exist, the chart shall include no less than the following: Tag ID No., Valve Size, Service (control valve, main drain, aux. drain, inspectors test valve, etc.), and Location.
- M. Valves in galvanized piping shall be bronze
- N. All Valves accessible to the public shall have a factory-installed locking device.

#### **2.4. PREACTION VALVE AND ACCESSORIES**

- A. Acceptable manufacturers: Reliable, Tyco Fire Products, Victaulic, Viking, or equal.
- B. Each preaction sprinkler system shall be independent of each other and shall contain separate valves and accessories.
- C. Preaction system shall be a single interlocked, supervised system.
- D. Piping system shall be pneumatically pressurized for supervisory purposes.
- E. Valve shall be self-closing design and will not require disassembly for resetting.
- F. Each system shall include:
  1. Preaction valve trim
  2. Pressure-operated relief valve
  3. Alarm pressure switch
  4. Supply control valve
  5. Soft seat check valve
  6. Air supervisory pressure switch
  7. Air supply control valve
  8. Release solenoid valve
  9. Maintenance air compressor
  10. Emergency release
  11. Microprocessor-Controlled Release Control panel with compatible Fire Detection System
- G. Preaction Control Panel:

1. Control panel shall communicate and be coordinated with the main Fire Alarm System.
  2. Contacts shall be available so that the main Fire Alarm Control Panel can monitor the preaction system releasing panel for alarm, trouble, and supervisory signals.
  3. Provide additional contacts as needed for additional auxiliary functions. Verify the type of secondary power supply to be provided for this project with the Electrical Engineer and then refer to NFPA 72 for standby battery requirements.
  4. Standby power battery: Minimum battery capacity shall be for 4h standby mode plus 5 minutes alarm mode. Battery derating factor shall be 1.2.
  5. Shall include an automatic battery charger
- H. Provide a detection system to operate the preaction sprinkler system. A detection system shall be installed per Division 28 - Fire Detection and Alarm Systems and indicated on fire protection drawings.
- I. Provide maintenance air compressor.
1. UL 1450 Listed maintenance air compressor shall have the capacity to refill the system within 30 minutes.
  2. Compressor shall be floor mounted.

## **2.5 TAMPER SWITCH**

- A. Acceptable manufacturers: Potter Electric Signal Co., System Sensor, or equal
- B. Outside screw and yoke (OS&Y) supervisory switch, NEMA 4 enclosure, provided with 2 sets of SPDT (Form C) contacts rated at 2.5 Amps at 30 VDC and 15 Amps at 125/250 VAC. Provide with optional cover tamper kit. For areas identified as hazardous locations, provide EX Model. Potter Electric Signal Co. OSY series or equal.
- C. Control valve supervisory switch, NEMA 4 enclosure, provided with 2 sets of contacts rated at 2.5 Amps at 30 VDC and 15 Amps at 125/250 VAC. Provide with optional cover tamper kit. For areas identified as hazardous locations, provide EX Model. Potter Electric Signal Co. PIBV series or equal.
- D. Tamper switch shall be capable of transmitting signal during first 2 revolutions of handwheel or during 1/5 of travel distance of valve control apparatus from its normal position.
- E. Unit shall be compatible with the building's fire alarm system.

## **2.6 FLOW SWITCH**

- A. Acceptable manufacturers: Potter Electric Signal Co., System Sensor, or equal
- B. Vane-type waterflow switch for use in wet sprinkler systems, minimum 300 psi service pressure rating, 10 gpm minimal flow rate to activate the alarm, and 2 sets of SPDT (Form C) contacts. Provide without optional cover tamper kit. Potter Electric Signal Co. VS series or equal.
- C. Unit shall be compatible with the building's fire alarm system.

## **2.7 AIR SUPERVISORY PRESSURE SWITCH**

- A. Acceptable manufacturers: Potter Electric Signal Co., System Sensor, or equal
- B. Pressure actuated switch to detect a decrease from normal system pressure in dry sprinkler systems, 300 psi service pressure rating, set to operate at a pressure decrease of 10 psi at 30 psi, 2 sets of SPDT (Form C) contacts rated at 2 Amps at 30 VDC and 10.1 Amps at 125/250 VAC. Provide with optional cover tamper kit. Potter Electric Signal Co. PS series or equal.
- C. Unit shall be compatible with the building's fire alarm system.

## **2.8 SPRINKLER HEAD**

- A. Manufacturers:
  1. Unless otherwise noted below, shall be manufactured by Reliable, Tyco Fire Products, Viking, or approved equal.

- B. Automatic, having temperature and pressure ratings suitable for the location
- C. Light Hazard occupancies shall utilize quick-response type sprinkler heads.
- D. Architect will review deviations from specified styles for approval prior to installation.
- E. Provide the following type of sprinkler head.
  - 1. Unfinished areas such as mechanical spaces.
    - a. Standard Coverage, Brass Upright or Pendent, ordinary temperature class (155°F), Viking Microfast, or approved equal.
  - 2. In areas with ceilings.
    - a. Standard Coverage, Semi-Recessed, ordinary temperature class (155°F), Viking Microfast, or approved equal. The sprinkler and escutcheon finish shall be coordinated with the architect and a Cal Poly Representative for aesthetic purposes.
  - 3. In areas where ceiling conditions do not permit installation of the pendent head or finished areas where the sidewall head provides better coverage of hazard.
    - a. Standard Coverage, standard chrome finish, ordinary temperature class (155°F), Viking Microfast horizontal (HSW) sidewall with Viking Microfast Model F-1 adjustable escutcheon, or approved equal.
  - 4. In walk-in coolers, freezers, and areas subject to temperatures at or below 40°F.
    - a. Standard Coverage, standard brushed chrome finish dry horizontal sidewall, intermediate temperature class (175°F), adjustable recessed chrome escutcheon, Tyco Fire Products Model DS-1 or approved equal.
    - b. Provide compatible wire cage sprinkler head guard where sprinklers are subject to impact damage.
- F. Submit samples for examination and approval by the architect and a Cal Poly Representative when the appearance is different than the sprinkler head specified.
- G. Temperature class of sprinkler heads shall vary if installed close to heat sources, under skylights, or in special hazard areas. Refer to [NFPA 13], [NFPA 13R], and [NFPA 13D] for requirements.
- H. Provide high-pressure sprinklers where pressures exceed 175 psi working water pressure.
- I. Sprinkler Cabinets:
  - 1. Shall be complete with the required number of spare sprinkler heads of each type and temperature rating per [NFPA 13], [NFPA 13R], [NFPA 13D]
  - 2. Shall be provided with at least one sprinkler wrench for each type of sprinkler installed
  - 3. Provide multiple cabinets to meet this requirement.
  - 4. Coordinate cabinet locations with the design team and a Cal Poly Representative.

## 2.9 FIRE VALVE CABINETS (FVC)

- A. Manufacturers:
  - 1. Acceptable Manufacturers: American Fire Hose & Cabinet, Badger-Powhatan, Croker Corp., Elkhart Brass, Fire End, Guardian Fire Equipment, Potter-Roemer, or equal
- B. Fire Valve Cabinets:
  - 1. FVC-1:
    - a. Cabinet: recessed, Potter-Roemer Series 1810 [FRC] or equal.
    - b. Door Style: [Full Glass] [Break Glass] [Solid Metal], white polyester coating with identifying decal.
    - c. Angle Valve: Female x Male, 2-1/2 cast brass body, [polished brass] [rough brass] [polished chrome plated] finish, equal to Potter-Roemer Model 4065. Valve cap for 2-1/2 valve shall be [2-1/2 x 1-1/2 hose adapter reducer, Potter-Roemer Model 2810 or equal, with 1-1/2 cap with chain, Potter-Roemer Model 4615, or equal] [2-1/2 cap with chain, Potter-Roemer Model 4625 or equal]. The cap and chain finish shall match the finish of the valve body. Threads shall match the City of San Luis Obispo Fire Department Standards.



**2.10 FIRE DEPARTMENT CONNECTION (FDC)**

- A. Manufacturers:
  - 1. Acceptable Manufacturers: Croker Corp.; Dixon Fire; Elkhart Brass; Potter-Roemer; Tyco Fire Products; or approved equal
- B. Fire Department Connection:
  - 1. Provide flush type, cast brass body with drop clappers, faceplate shall be brushed chrome finish, with lettering reading AUTOSPKR STANDPIPE.
  - 2. Unit shall include 4 2-1/2 snoots with rigid end threading to match local fire department standards by pin-lug hose thread swivels, pin-lug plugs, and chains. The finish of the snoots shall match the faceplate finish. Provide Elkhart Brass or approved equal.
  - 3. FDC check valve shall be of wafer check type with plated bolts. Acceptable manufacturers Potter-Roemer or approved equal.
  - 4. Provide signage of where the FDC feeds, and the building number. The sign shall be red background with white letters sized per NFPA requirements. The contractor shall submit the signage shop drawings to the Cal Poly Representative for AHJ review and approval per 01 33 00 Submittal Procedures.

**2.11 ROOF MANIFOLD**

- A. Acceptable Manufacturers: Croker Corp., Elkhart Brass, Potter-Roemer, or approved equal
- B. Two-way connection cast brass body with female NPT inlet and 2-1/2 male NPT outlets, Croker Corp. 6860 Series or approved equal.

**2.12 BALL DRIP**

- A. Acceptable manufacturer: Potter-Roemer, Reliable, Tyco Fire Products, or approved equal
- B. Provide bronze ball drip for fire department connection (FDC) inside of the building and pipe to the nearest floor drain or discharge to the exterior.
- C. Exterior discharge location shall be coordinated with the design team and a Cal Poly Representative.

**2.13 FIRE PUMP (When Applicable for Project)**

- A. Acceptable Manufacturers: Peerless Pump, A-C Fire Pump, Patterson Pump, or approved equal
- B. Fire pump if determined to be needed by the engineer of record, shall meet the following criteria:
  - 1. Deliver rated flow at rated pressure
  - 2. Deliver not less than 65% of rated pressure at 150% rated capacity
  - 3. Not exceed 140% of rated pressure at shutoff
- C. Pump Type: Electric Driven
- D. Pump Configuration: Horizontal Split Case Rated Flow: Refer to the schedule as provided by the engineer of record
- E. Rated Pressure: Refer to the schedule as provided by the engineer of record.
- F. Pump casing shall be pressure rated to handle system pressure.
- H. Pump and motor shall be mounted on a common steel baseplate.
- I. Motor:
  - 1. Refer to the schedule
  - 2. Provide open drip proof, high-efficiency, foot-mounted.
  - 3. Locked rotor current shall not exceed values specified in NFPA 20.
- J. Accessories to be provided with each fire pump are as follows:
  - 1. Fire Pump Test Connection:
    - a. Test connection shall be flush type, cast brass body, polished brass plated with lettering reading PUMP TEST CONNECTION.

- b. Unit shall include four 2-1/2, polished brass plated caps with chains.
- c. Potter-Roemer Model 5864 or approved equal
2. Discharge pressure gauge and compound suction gauge shall be liquid-filled type.
3. Circulation Relief Valve: 3/4 Cla-Val Model 55L pressure relief valve or approved equal
4. Automatic Air Release Valve
5. Basis of Design: Refer to the schedule as provided by the engineer of record.

#### **2.14 CONTROL EQUIPMENT FOR ELECTRIC DRIVE**

- A. Acceptable Manufacturers: Eaton, Firetrol, Joslyn Clark, Metron, or approved equal
- B. Fire Pump Controller:
  1. Shall be completely assembled, wired, and tested by the control manufacturer before shipment from the factory
  2. Shall be labeled Fire Pump Controller
  3. Shall be located as close as practical and within sight of motor
  4. Shall be located and protected such that it will not be damaged by water escaping from the pump or connections
  5. Shall be combined manual and automatic
  6. Heavy gauge formed steel, NEMA Type 2 enclosure with top drip hood
  7. Provide complete with the following:
    - a. Starter: [Reduced Voltage wye-delta closed] [Reduced Voltage wye-delta open] [Reduced Voltage Solid State] [Reduced Voltage Auto Transformer] [Reduced Voltage Part Winding] [Reduced Voltage Primary Resistor] [Full Voltage Across-the-Line]
    - b. Isolating Switch: Externally operable, quick-break type
    - c. Circuit breaker: Rated at XXX KAIC at XXX VAC
    - d. Locked rotor protector for the drive motor
    - e. Pilot light to show circuit breaker closed and power available
    - f. Ammeter and voltmeter displays on front of panel
    - g. Alarm relay to energize audible or visible alarm
    - h. Pressure recording device
    - i. With Automatic Transfer Switch
    - j. Voltage surge protection
    - k. Contacts for the remote alarm of:
      - 1) Pump Running
      - 2) Loss of Line Power in any phase
      - 3) Phase Reversal
      - 4) Controller Connected to Alternate Source
    - l. [Provide remote fire pump alarm panel in a location of constant attendance.]
      - 1) [Remote pump alarm panel shall be a key lockable enclosure consisting of audible or visible alarms.]
      - 2) Alarms shall show: Pump Running; Supervisory Power Failure; Phase Reversal and, when required by NFPA 20, Controller Connected to Alternate Source.

#### **2.15 JOCKEY PUMP (When Applicable for Project)**

- A. Acceptable manufacturers: Peerless Pump, A-C Fire Pump, Patterson Pump, or equal
- B. Jockey pump shall be:
  1. Same manufacturer as the main fire pump
  2. Refer to the schedule
- C. Pump casing shall be pressure rated to handle system pressure.
- D. Motor shall be:

1. Refer to Fire Protection Engineer's Schedule
2. 3 Ph, Jockey pump shall be close-coupled.
3. Open Drip Proof (ODP)
4. Pump and motor shall be integrally mounted on a common steel baseplate.

**2.16 JOCKEY PUMP CONTROLLER**

- A. Acceptable manufacturers: Eaton, Firetrol, Joslyn Clark, Metron, or approved equal
- B. Jockey pump controller shall be the same manufacturer as the main fire pump controller.
- C. Jockey pump controller:
  1. Wall-mounted, NEMA Type [2] [3R] control cabinet
  2. Maintain the automatic sprinkler system at 5-10 psi above the fire pump starting pressure.
  3. Mercury-free pressure switch with independent adjustment
  4. Multiple position control switch
  5. 3-pole disconnect switch
  6. Starter
- D. Basis of Design: Eaton Model XXX

**2.17 HANGERS**

- A. Acceptable manufacturers: Afcon, Anvil, Eaton, Pentair, Tolco, or approved equal
- B. Concrete expansion hangers, when provided, are to be Hilti, Illinois Tool Works (ITW), Powers Fasteners, or approved equal
- C. Hanger rods shall comply with Manufacturer Standardization Society (MSS) standards and manufacturers published load rating.
- D. Provide hanger rod, hanger rod attachments, pipe stands, bolts, U-bolts, nuts, studs, and washers with electroplated zinc coating or with a hot-dipped galvanized finish.
- E. Riser clamps shall be electroplated zinc coated or have a hot-dipped galvanized finish and shall not protrude more than 2 beyond the edge of the hole, Anvil Fig. 261, or approved equal.

**2.18 EARTHQUAKE BRACING**

- A. Sprinkler and standpipe system shall be protected from earthquake influence in accordance with requirements of [NFPA 13], [NFPA 13R], [NFPA 13D], and as required by the Seismic Anchorage and Restraints design provided by the contractors' engineer of record of the fire protection system drawings.
- B. Provide flexible couplings, bracing, and other components required, compatible with piping material and jointing system used.
- C. Seismic detailing shall be included on contractors' fire protection system installation drawings.

**2.19 PRESSURE GAUGES**

- A. Acceptable manufacturers: Ashcroft, Potter-Roemer, Viking, or equal
- B. Pressure gauges shall be 3-1/2", corrosion-resistant moving parts, polycarbonate window, and provided with a connection not smaller than 1/4" NPT.
- C. Include a ball valve with provisions for draining on each pressure gauge.
- D. Installed with brass 3-way valve and plug. Acceptable manufacturer United Brass or approved equal.

**2.20 DIELECTRIC FITTINGS**

- A. Acceptable manufacturers: Epco Sales, Lochinvar, Watts Regulator Co., Wilkins, or approved equal
- B. Insulating nipple, metal casing, inert thermoplastic lining, Clearflow dielectric fitting by Perfection Corporation or approved equal.

- C. Dielectric unions 2" and smaller; dielectric flanges 2" and larger; with iron female pipe thread to a copper solder joint or brass female pipe thread end connections, non-asbestos gaskets, and pressure rating of not less than 175 psig at 180F. Provide high-pressure type when pressures exceed 175 psi water working pressure.

## **PART 3- EXECUTION**

### **3.1 DESIGN CRITERIA**

- A. The California Polytechnic State University Construction Details and Specifications :
  - 1. Static Pressure: The contractor shall coordinate with a Cal Poly representative to conduct a site-specific hydrant flow test to determine the static pressure for the basis of the design. Testing is to be performed at 7:00 am during the work week and while school is in session to determine pressure during peak campus usage.
  - 2. Residual Pressure: The contractor shall coordinate with a Cal Poly representative to conduct a hydrant flow test a hydrant flow test a site-specific hydrant flow test to determine the residual pressure for the basis of the design. Testing is to be performed at 7:00 am during the work week and while school is in session to determine pressure during peak campus usage.
- B. Sprinkler Contractor, prior to the preparation of installation drawings and hydraulic design calculations shall ensure that a hydrant flow test is conducted within the last 6 months witnessed by the AHJ.
- C. Provide a copy of hydrant flow test data to Cal Poly Representative.
- D. The Engineer of record shall determine if a Fire Pump is needed based on the site-specific hydrant flow test and shall be designed to meet fire protection system demand as determined by the site specific hydrant flow test and the hydraulic design as determined by the engineer of record.
- E. Hydraulically calculated system shall be designed to a minimum of 10% or 10 psi (whichever is more stringent) below the available water flow curve. Hydraulic calculations must be in accordance with the Area/Density Method of NFPA 13.
  - 1. Hydraulic Calculations.
    - a. Water supply curves and system requirements must be plotted on a semi-logarithmic graph ( $N^{1.85}$ ) paper so as to present a summary of the complete hydraulic calculation.
    - b. Provide a summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, minimum discharge pressures, and minimum flows. Elevations of hydraulic reference points (nodes) must be indicated.
    - c. Documentation must identify each pipe individually and the nodes connected thereto. Indicate the diameter, length, flow, velocity, friction loss, number and type of fittings, total friction loss in the pipe, equivalent pipe length, and Hazen-Williams coefficient for each pipe.
    - d. Where the sprinkler system is supplied by interconnected risers, the sprinkler system must be hydraulically calculated using the hydraulically most demanding single riser. The calculations must not assume the simultaneous use of more than one riser.
    - e. All calculations must include the backflow preventer manufacturer's stated friction loss at the design flow or [83 kPa12 psi for reduced pressure][55 kPa8 psi for double check] backflow preventer, whichever is greater.
    - f. All calculations must be performed back to the actual location of the flow test, taking into account the direction of flow in the service main at the test location.
    - g. For gridded systems, calculations must show the peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. A flow diagram indicating the quantity and direction of flows must be included.
- F. Systems that are hydraulically calculated must include 1.2 factor for design area.
- G. Basis of Design:

1. Office areas and general building spaces shall be hydraulically designed to provide The minimum density of 0.1 gpm per sq. ft over most hydraulically remote 1500 sq. ft. Maximum spacing shall not exceed 225 sq. ft per head.
  2. Laboratory areas, including corridors between labs separated from office areas by doors and firewalls, shall be hydraulically designed to provide the minimum density of 0.2 gpm per sq. ft over most hydraulically remote 1500 sq. ft. Maximum spacing shall not exceed 130 sq. ft per head.
  3. Penthouse and other mechanical equipment areas shall be hydraulically designed to provide the minimum density of 0.15 gpm per sq. ft over most hydraulically remote 1500 sq. ft. Maximum spacing shall not exceed 130 sq. ft per head.
  4. General storage areas and machine shop areas shall be hydraulically designed to provide the minimum density of 0.2 gpm per sq. ft over most hydraulically remote 2500 sq. ft. Maximum spacing shall not exceed 130 sq. ft per head.
  5. Hydraulic calculation plate shall be stamped or engraved. NOT written in with permanent marker or other pens.
- H. Hose Streams:
1. Add 250 gpm hose stream to sprinkler zone hydraulic calculations, at the system riser
- I. Fire Protection System Layout and Installation Drawings:
1. Contractor shall review Design Drawings and Specifications and shall provide engineered installation drawings, calculations, and related product datasheets.
  2. Layout of the fire protection system shall be established by the engineer of record as it relates to structure, and mechanical/electrical systems in the building, and shall be produced by the Contractor in coordination with building components.
  3. Conceal sprinkler piping above ceilings where possible.
  4. Submit stamped and sealed installation drawings, calculations, and product data sheets for review and approval to the Cal Poly Representative, and Authorities Having Jurisdiction prior to installation (see submittals).
  5. Contractor shall be responsible to have examined "Reflected Ceiling" drawings as well as Mechanical, Electrical, Piping, Information Technology, Structural, and Architectural building plans prior to system layout.
  6. Contractor shall coordinate the routing of piping with other trades and trades under separate contracts with the Cal Poly Representative.
  7. Contractor shall participate in the coordination process and shall not install piping prior to coordination with other trades per 01 31 00, 1.6.

### 3.2 INSPECTION

- A. Investigate site conditions; verify utility locations and elevations before the start of excavation. Forward discrepancies to Cal Poly University Representative via a formal RFI before proceeding with construction.
- B. Underground Inspection Requirements:
1. Inspections are required: 1) prior to pouring thrust blocks, 2) for hydrostatic testing, and 3) for flush. Schedule all inspection requests a minimum of 72 hours in advance. Coordinate with a Cal Poly representative to schedule the inspection with the local Deputy State Fire Marshal.
  2. Installation, inspection, and testing shall conform to the current edition of [NFPA 13], [NFPA 13R], [NFPA 13D], the current edition of NFPA 24 with California Amendments.
  3. Private fire hydrants shall be of an approved type with a minimum of one 2 ½" and one 4" outlet. The 4" outlet shall face the fire department access road. All outlets shall be provided with National Standard Threads (NST). Threads shall match the City of San Luis Obispo Fire Department Standards.
  4. Fire hydrant supply piping shall be a minimum of 6" in diameter. The lowest operating nut shall

- be a minimum of 18" above grade and the hydrant flange shall be a minimum of 2" above grade.
5. Fire hydrants shall be a minimum of 40 feet from all structures. A keyed gate valve shall be provided for each hydrant in an accessible location within 20 feet of hydrants. Valves shall not be located in parking stalls.
  6. All pipe shall be approved for use in fire service systems, complying with the current edition of NFPA 24 with California Amendments.
  7. All buried fittings shall be of an approved type with joints and pressure class ratings compatible with the pipe used.
  8. All ferrous pipe and fittings shall be protected with a loose 8-mil polyethylene tube. The ends of the tube and any splices made for "T"s or other piping components shall be sealed with 2" tape, rated and approved for underground use. All bolted joints shall be cleaned and thoroughly coated with asphalt or other corrosion retarding material after assembly and prior to poly-tube installation.
  9. A 12" bed of clean fill sand shall be provided below and above the pipe (total 24").
  10. All bolts used for underground connections shall be stainless steel and the tightness of bolted joints shall be verified by a calibrated bolt torque or by the method described in the listing information or the manufacturer's installation instructions. The contractor is to provide a current Traceable Calibration Certificate per ISO 6789-2, upon request by a Cal Poly representative, AHJ, IOR, or Cal Poly Construction Inspector.
  11. A minimum of 30" of cover, from the finish grade to the top of the pipe, shall be provided. When surface loads are expected, a minimum of 36" cover shall be provided.
  12. Thrust blocks, or other approved methods of thrust restraint, shall be provided wherever the pipe changes direction. (All tees, plugs, camps, bends, reducers, valves, and hydrant branches shall be restrained against movement in accordance with the current edition of NFPA 24 with California Amendments.)  
Note: Basis of Design for AHJ Pre-Approved Concrete Mix for Thrust Blocks:
    - a. CalPortland Construction - Concrete Mixture Design Number: 675GM3090 or Engineer of Record and AHJ approved equal.
  13. The trench shall be excavated for thrust blocks and inspected prior to pour. All corrosion Protection shall be in place. Thrust blocks shall be placed between undisturbed earth and the fitting to be restrained. The thrust block shall be capable of resisting the calculated thrust force. Thrust blocks shall be placed so that the joints are accessible for repair.
  14. A hydrostatic test (200 psi for two hours or 50 psi over maximum static pressure, whichever is greater) shall be witnessed by a Deputy State Fire Marshal. The trench shall be back-filled between the joints to prevent movement of the pipe. See 3.6, D. for additional information and requirements.
  15. The system shall be thoroughly flushed before connection is made to overhead piping. Flow shall be through a minimum of a 4" hose or pipe unless otherwise approved by the Deputy State Fire Marshal. A Deputy State Fire Marshal shall witness the flush.
  16. Private hydrants, sprinkler control valves, detector check assemblies, post-indicating valves and fire department connections shall be painted OSHA red.
  17. All control valves shall be locked in the open position. Valves shall be monitored in accordance with the current edition of NFPA 24.
  18. Hydrants shall be protected from mechanical damage. The means of protection shall not interfere with connection to or operation of hydrants.
  19. Subject to additional requirements not reflected in this list, per the current edition of CBC, the current edition of CFC, and the current edition of NFPA 24 with California Amendments.

**3.3 INSTALLATION**

- A. Install hydraulically designed sprinkler system and associated accessories according to requirements of [NFPA 13], [NFPA 13R], [NFPA 13D], and as shown on drawings.
- B. Install hydraulically designed standpipe system and associated accessories according to requirements of NFPA 14 and as shown on drawings.
- C. Install pipe, fittings, couplings, and valves according to the requirements of the manufacturer.
- D. Keep materials within the listed temperature range to assure jointing in accordance with the manufacturer's requirements.
- E. Pipe and fittings shall be of corresponding materials when assembled. Below Ground Pipe:
  - 1. Anchors and tie rods can be provided in lieu of thrust blocks. Tie rods shall be  $\frac{3}{4}$ " diameter steel rod. Clamps shall be  $\frac{3}{8}$ " thick by 2" wide steel. Each clamp shall be secured with four  $\frac{5}{8}$ " diameter bolts.
  - 2. Apply asphaltum or approved corrosion-inhibitive paint or material, to tie rods, clamps, and bolts of underground pipe and wrapped with loose 8-mil polyethylene tube.
  - 3. Provide metallic bond at each joint of ductile iron and cast-iron pipe. Bond wire shall be the type RHW-USE size 1/0 neoprene-jacketed copper conductor shaped to stand clear of the joint.
- G. Above Ground Pipe:
  - 1. Provide a pipe identification system with flow directional arrows on fire protection pipe per ANSI/ASME A13.1 and in accordance with the manufacturer's installation instructions.
  - 2. Coat exposed threads with corrosion-inhibitive paint, equal to Rust-Oleum. Apply paint per the manufacturer's instructions.
- H. Provide readily removable fittings at the end of cross-mains. The minimum size of the flushing connection shall be 2".
- I. Provide a test connection for each flow switch.
- J. Discharge test connections inside the building to receptacles provided as part of the plumbing system or to standpipes drain riser. An outside discharge shall not be allowed.
- K. Drain line detailed adjacent to standpipe/sprinkler risers shall be considered as part of the Sprinkler System from combination test/auxiliary drain valve for each zone or sub-zone is shown on plans to plumbing receptacle.
- L. Provide auxiliary drains at low points of systems per requirements of the current edition of [NFPA 13], [NFPA 13R], [NFPA 13D].
- M. Identify the valve with a brass tag denoting which flow switch is being tested, when test valves are located remotely from the flow switch.
- N. Clamp-on or saddle-type fittings (i.e. mechanical tees) are not allowed. Outlet fittings inserted into holes drilled into piping or pipe-o-lets are not allowed.
- O. Provide reducing fittings or provide shop-fabricated weld-o-lets to change pipe sizes in sprinkler/standpipe systems. No bushings or grooved reducing couplings, such as Victaulic Style 750, are allowed.
- P. Piping and fittings between the preaction valve and sprinkler heads and test/auxiliary drain piping of dry sprinkler systems shall be galvanized steel to retard or eliminate corrosion due to oxidation in these sub-systems. Provide dielectric fittings between dissimilar pipe materials.
- Q. Feed sprinkler heads, installed in finished ceilings, with FlexHead, swing joint, or return bend

- arrangement for final positioning in ceiling grid pattern during construction phases.
- R. Sprinklers are required to be installed in the center of ceiling tiles.
  - S. Install a tamper switch on each shutoff valve.
  - T. Install a locking device with each shutoff valve to prevent inadvertent closing of the valve. Keys shall be indexed to identify valve location. Install a locking device on all drain and test valves that are publicly accessible. The Campus preference is that locking devices would be factory installed/supplied for all valves that are required to have them.
  - U. Install sprinkler heads as recommended by the manufacturer. Sprinklers shall be set level and at locations to avoid interference with the spray pattern of the sprinkler. When ducts and lights are obstructions to sprinkler distribution, provide additional heads beneath the obstruction.
  - V. Make joints of threaded pipe by cutting the pipe square and reaming inside.
  - W. Use joint compound sparingly.
  - X. Install joints for mechanical coupled pipe according to the manufacturer's recommendations. Use manufacturer's gasket lubricant sparingly.
  - Y. Pipe grooving shall be per the coupling manufacturer's instructions.
  - Z. Welded joints shall be made in a fabrication shop. No welding is allowed at the project site.
  - AA. Hangers, Bracing, and Restraint of System Piping:
    - 1. Provide hangers and associated parts to support piping in perfect alignment without sagging or interference, to permit free expansion and contraction, and meet the requirements of the current edition of [NFPA 13], [NFPA 13R], [NFPA 13D] and manufacturer's installation instructions.
    - 2. Select and size building attachments per Manufacturer Standardization Society (MSS) standards and manufacturers published load rating.
    - 3. Coordinate hanger support installation to group piping of all trades.
    - 4. Hang pipe from building members using either concrete inserts for concrete construction or beam clamps for steel construction. Installation shall comply with the manufacturer's installation instructions. Expansion-type inserts may be used for branch piping.
    - 5. Restraining clips/clamps are required in locations where vibration may be a concern. Refer to Section 23 0550 ' Vibration Isolation, for additional information regarding restraining clips/clamps.
    - 6. Suspend hangers by means of electroplated zinc or hot-dipped galvanized finish hanger rods. Perforated band iron and flat wire straps (strap iron) are not allowed.
    - 7. Mains parallel to joists shall not be supported from a single joist. Mains parallel to joists shall be supported by a trapeze hanger and be positioned equally between two joists. Trapeze hangers shall be positioned to load joists at panel points only.
    - 8. Support pipe from a top flange of beams.
    - 9. Where joists are used, locations of pipe supports shall be approved by the structural engineer prior to installation.
    - 10. Do not support equipment or piping from a metal roof deck.
  - BB. Support piping in accordance with the current edition of [NFPA 13], [NFPA 13R], [NFPA 13D] and Section 20 0549 ' Seismic Anchorage and Restraints, and in accordance with State and Local seismic restraint requirements.



- CC. Include seismic restraint details with sprinkler installation drawings.
- DD. Install flexible fitting at buildings expansion joints per manufacturer's instructions.
- EE. Install pressure gauges as shown on engineering drawings, as required in the manufacturer's installation instructions, and as required per NFPA standards.

### 3.4 FIELD QUALITY CONTROL

- A. Install the fire pump, jockey pump, and controllers per the manufacturer's installation instructions, as shown on drawings and as required in NFPA 20.
- B. Sprinkler piping shall not be subjected to external loads by materials either resting on the pipe or hung from the pipe per NFPA 25.
- C. Sprinkler piping or hangers shall not be used to support non-system components per NFPA 13.
- D. The installed horizontal and upward vertical clearance between horizontal sprinkler piping and structural members not penetrated or used, collectively or independently, to support the piping shall be at least 2 in per NFPA 13.
- C. Grout base-mounted pumps after securely anchoring to the structure.
- D. Coordinate installation with Division 26 and Division 28 contractors.

### 3.5 CLEANING

- A. Flush sprinkler system to purge cutting oil, debris, and metal fines.
- B. Ensure the underground feed pipe has been flushed per NFPA 24 to clear out construction debris and schedule an inspection with the AHJ to witness, prior to connecting the above-ground fire protection system to it.
- C. Clean systems after installation is complete.
- D. Clean piping both internally and externally to remove dirt, plaster dust, or other foreign materials. When external surfaces of piping are rusted, clean and restore the surface to its original condition. Replacement of heavily soiled and deteriorated materials shall be done at the Contractor's expense.
- E. Clean equipment as recommended by manufacturers. Thoroughly clean equipment of stains, paint spots, dirt, dust, and any other foreign materials. Remove temporary labels not used for instruction or operation.

### 3.6 TESTING

- A. Refer to testing requirements per the current edition of [NFPA 13],[NFPA 13R], [NFPA 13D].
- B. Coordinate fire pump tests with Division 26 and Division 28 contractors.
- C. Perform all NFPA-required acceptance tests.
- D. Test the sprinkler system as an entire system. Partial system testing can be requested, but the entire system shall be tested prior to final acceptance by AHJ. The system shall be hydrostatically tested at not less than 200 psi or 50 psi above static pressure in excess of 150 psi for 2 hours. The contractor is to verify that the manufacturer's test rating of the materials is rated for the required test pressure. No leakage allowed. Replace defective joints with new materials. No caulking of defective joints allowed. Re-test the system after defective joints are replaced until satisfactory results are obtained. Note, the hydrostatic test pressures given herein are inspection test pressures, are not intended as a basis for design, and do not have any direct relationship to working pressures.
- E. Hydrostatically test piping between the exterior fire department connection (FDC) and the check valve in the fire department inlet pipe in the same manner as the balance of the system.

- F. Pipe shall not be concealed until satisfactory pressure is tested.
- G. In addition to the hydrostatic test, the preaction system shall be air pressure tested at 40 psi for 24 hours. Leakage in excess of 1-1/2 psi during 24 h will not be permitted.
- H. Conduct drain test. Record static pressure and residual pressure per the current edition of [NFPA 13], [NFPA 13R], [NFPA 13D].
- I. Cal Poly Representative may witness tests. The contractor shall notify Cal Poly Representative a minimum of 5 business days in advance to allow for participation.
- J. Log of tests shall be kept at the job site and shall identify:
  - 1. Who performed the test
  - 2. Time of test
  - 3. Date of test
  - 4. Section of the system tested
  - 5. Results of the test
  - 6. Completed Contractor's Material and Test Certification form(s) from the current edition of [NFPA 13],[NFPA 13R], [NFPA 13D], and the current edition of NFPA 14.
- K. Operate flow and pressure switches to test that signals are transmitted to Fire Alarm Control Panel.
- L. Include a test for tamper switches.

### **3.7 FIRE PUMP TESTING**

- A. Test fire pump, jockey pump, and their controllers per manufacturer's installation instructions and as required in NFPA 20.
- B. Furnish test certificate indicating suction pipe has been flushed and suction and discharge pipe has been hydrostatically tested in accordance with NFPA 20, prior to fire pump acceptance test.
- C. Coordinate fire pump acceptance test so Local Authorities, Cal Poly Representatives, and Insurance Company representatives can witness the test.
- D. Cal Poly Representative may witness tests. The contractor shall notify Cal Poly Representative a minimum of 5 days in advance to allow for participation.
- E. Representatives from the following shall be present for the fire pump field acceptance test:
  - 1. Pump manufacturer
  - 2. Controller manufacturer
  - 3. Transfer switch manufacturer
- F. Coordinate fire pump tests with Cal Poly Representative to verify acceptable methods for disposal of water.
- G. Provide equipment to perform fire pump test, including:
  - 1. Calibrated test gauges
  - 2. Calibrated tachometer
  - 3. Hoses
  - 4. Nozzles
  - 5. Valves

### **3.8 FIELD QUALITY CONTROL**

- A. Site Inspections: Comply with Division 01 requirements.

- B. Inspection: The Cal Poly Representative may engage and pay for the services of an independent testing consultant to perform an independent quality control inspection.
- C. Do not conceal work prior to the required inspections.
- D. Notify the Cal Poly representative to request the authority having jurisdiction and designated inspectors of work released for inspection.
- E. Correct unacceptable installation, and request additional inspection, to verify compliance with this Section, at no additional cost to the Owner.
- F. The building official and the AHJ are authorized to make or require other inspections of any construction work to ascertain compliance with the provisions of this code and other laws that are enforced by the Department of Building Safety (CBC110.3.9) and compliance with the provisions of the Cal Poly Construction Campus Standard Specifications and Campus Standard Details.

END OF SECTION