

SECTION 15300

STANDPIPE AND FIRE SPRINKLER STANDARDS

PART I - GENERAL

NOTES:

1. UCCS Standards are not intended and shall not be used as guide specifications. While it is expected that this information will be of assistance to architect and engineer, in developing plans, specifications, and contract documents on particular projects, no portion of this standard may be produced by photographic or other means in any specification intended to become a part of contract documents without explicit written prior approval of the University of Colorado. Architects and engineers shall refer to Page 1 of Notice to UCCS Standards for additional information.
2. The design professional is responsible for complying with all of the requirements of applicable codes unless specifically waived, in writing, by the Authority Having Jurisdiction (AHJ).
3. The design professional shall review shop drawings for compliance with Contract Documents and conduct necessary inspections including rough-in inspections and punch list preparation. The design professional shall provide written Field Report of all inspections and punch lists to the AHJ and the project manager.
4. For projects that do not retain the services of a consultant, the design may be completed by the standing-order contractor. In such cases, contractor shall implement UCCS Standards in place of specifications. For such projects, the term "engineer" in this section of UCCS Standards shall also mean "contractor".

1.1 SUMMARY

- A. Section includes provision of materials and installation of water based fire extinguishing systems:
 1. Materials and the installation of the above-ground portion of the fire protection systems.

NOTE: Engineer to determine the need and provide specifications for underground piping, under the appropriate Division of specifications, where applicable for the project. Engineer shall identify and specify design requirements.
 2. Furnishing equipment.
 3. Designing/installing piping and appurtenances.
 4. System testing and documentation.
 5. System calculations.
 6. Installation of valves and switches.
 7. Pipe joining techniques.
 8. System tests and certifications.

B. Related Sections

1. **Division-1.**
2. Section 02200, "Earthwork"
3. Section 07270, "Firestopping"
4. Section 10520, "Fire Protection Specialties"
5. Section 16720, "Fire Detection and Alarm Systems"

NOTE: Engineer to refer to section specifying underground piping, e.g., Division 2, for underground FP piping including FDC piping.

1.2 REFERENCES

The installation, certification and documentation shall conform to applicable portions of the following codes, standards, and regulations:

1. IBC, International Building Code
2. IFC, International Fire Code
3. UMC, Uniform Mechanical Code
4. IPC, International Plumbing Code
5. UL (Underwriters Laboratories) Fire Resistance Directory
6. UL Fire Protection Equipment Directory
7. Colorado Primary Drinking water Regulations
8. National Fire Protection Association (NFPA) Pamphlet No. 13
9. **NFPA-14**
10. **NFPA-20**
11. **NFPA-25**
12. **NFPA-72**
13. **NFPA-214**
14. **NFPA-231**
15. **NFPA-231C**
16. Other NFPA Standards as applicable.
17. ANSI A-17.1, Safety Code for Elevators and Escalators.
18. Colorado Dept. of Public Safety, Division of Fire Safety 8CCR 1507-11
19. Colorado Revised Statutes Section 24-33.5-1202 through 1208 (Senate Bill 90-4)
20. Colorado Cross-Connection Control Manual

NOTE: Engineer to add and delete as required for the specific project.

The effective date of the codes shall be that of the execution of the contract between the University and architects/engineers, unless the project is postponed, in which case the codes at the time of reactivation of the project shall be complied with. All appendices of referenced NFPA Standards shall be considered part of the applicable standards for design and interpretation purposes under this standard.

Nothing in this standard shall be construed to relieve the Engineer of record or the Contractor of their responsibility with respect to applicable codes, laws or ordinances.

If there is overlap in or conflicts between the requirements of the codes, laws and ordinances and this standard then that requirement, which provides the highest level of safety, as determined by the Engineer, shall take precedence unless directed in writing to the contrary by AHJ.

1.3 DEFINITIONS

- A. AHJ: Authority Having Jurisdiction (AHJ). Colorado Springs Fire Department
- B. CDH - Colorado Department of Health.
- C. Engineer - The Engineer of record who represents the Design or Architect/Engineer firm. Engineer shall stamp record set of drawings and specifications.
- D. Contractor - When used in terms of Fire Protection system installations, Section 15300, "contractor" shall mean the firm responsible for preparation of shop drawings and installation of the fire protection system.
- E. FACP- Fire Alarm Control Panel
- F. FM: Factory Mutual
- G. F.M.: Department of Facilities Management
- H. Owner - University of Colorado at Colorado Springs.
- I. NICET - National Institute for Certification in Engineering Technologies.
- J. UL: Underwriters Laboratories

1.4 SYSTEM DESCRIPTION

A. GENERAL DESIGN REQUIREMENTS

- 1. All areas of each facility shall be protected by the automatic sprinkler system, unless specifically waived by NFPA-13 or otherwise approved, in writing, by the AHJ.
- 2. All sprinkler and standpipe systems shall be hydraulically calculated to verify proper pipe sizes in strict accordance with NFPA #13.
NOTE: Where deemed appropriate by the Engineer and approved, in writing, by the AHJ, pipe schedule system may be specified.
- 3. Each fire protection system shall be monitored by the building fire alarm system and the University Public Safety Dispatch. All buildings equipped with fire sprinkler systems shall be equipped with an exterior local alarm (bell and strobe) initiated by the flow detection device. Coordinate with Division 16.
- 4. The 100% design drawings prepared by the Engineer shall indicate principal pipe layouts, including risers and cross-mains. They need not show every required offset, dimension, fitting, or similar details unless so recognized by the Engineer.

Contract Document drawings may not be used as shop drawings.

5. Existing system equipment and components which may be reused shall be within the scope of each project and shall comply with current codes and these standards. See section 1.04-B.2.
6. A safety factor of 10 psi shall be included in hydraulic calculations; see 3.01-B.3.

NOTE: The Engineer shall determine available water supply from the University and include in specifications. The specifications shall require a water flow test by Contractor for installations that incorporate more than 15 sprinklers. The Contractor shall use the more conservative water supply test results in hydraulic calculations.

B. MISCELLANEOUS REQUIREMENTS

1. System Sub-section Zoning
 - a. Sub-section zoning shall be accomplished by providing individual zone water flow detection, zone control valve, zone drain, gauge, and inspectors test connection.
 - b. Sub-section zoning shall be provided for the following areas:
 - Elevator Machine Rooms and Shafts. Flow switches may be specified only where deemed appropriate by the engineer.
 - Transformer rooms (double interlock preaction system)
 - c. When a building exceeds three (3) floor levels (including basement) the sprinkler system on each floor shall be a separate zone; see 16720-2.02-5.
 - d. When a floor area exceeds 10,000 square feet, it shall be on a separate zone.
 - e. As required by NFPA-13 under protection area limitations.
 - f. Other areas as determined by the Architect/Engineer depending on specific project requirements.

NOTE: Engineer to minimize the number of sprinkler zones while meeting the above requirements and providing adequate zones to facilitate identification of the zone/area of the fire origin.

2. Existing Equipment (Also see section 3.01-D)
 - a. The use of existing features and equipment may be considered.

NOTE: A building survey shall be conducted by the Engineer to determine the continued use, or the removal of, existing systems. These measures shall be clearly indicated in contract documents.

- b. Before considering existing equipment or piping systems, for use in a

new project, all such equipment or systems shall be tested/inspected to assure their operational integrity and compliance with current codes.

C. SYSTEM DESIGN CONSIDERATIONS

1. Wet Pipe Systems

- a. Wet pipe systems shall be used in the majority of system applications.
- b. Flow detection for wet pipe systems shall be by electronic vane type water flow detectors, with the following exception:
 - Alarm check valve assemblies may be used for systems installed in buildings if there is no approved fire alarm control panel installed and the system protects only one zone.

2. Antifreeze Systems

- a. Antifreeze systems shall not be installed unless specifically approved, in writing, by the AHJ.
- b. If these systems are proposed, they shall only be used for incidental areas susceptible to freezing.

NOTE: Engineer to determine the feasibility and advantages of using other approved methods for protection of piping against freezing, e.g., listed heat tapes for sprinkler systems.

3. Dry Pipe Systems

- a. System shall be monitored for low gas pressure.
- b. System air pressure shall be maintained by a nitrogen system determined by the Engineer.

4. Preaction Systems

NOTE: Engineer to determine the appropriate type of preaction system, e.g., single- or double-interlock, and specify accordingly. Double-interlock shall be specified where accidental water damage is hazardous or highly undesirable.

- a. Coordinate work with Division 16.
- b. All preaction system piping shall be supervised by an approved method.
- c. For combined dry and preaction systems, the nitrogen supply shall meet the requirements for dry pipe systems.
- d. Preaction valve assemblies shall be electronically released through an approved releasing panel. This shall be coordinated with the Division 16 work.
- e. Activation shall be by means of automatic fire detection with manual release capability. These devices shall be coordinated with Division 16

work.

- f. Automatic fire detection devices shall be spaced according to NFPA #72. Engineer shall determine whether additional devices are necessary in order to meet the client's objective.

NOTE: Engineer to determine the division under which automatic detection system for the preaction system shall be provided, i.e., Division 15 or 16. The responsibilities of Contractors of Divisions 15 and 16 shall be clearly identified and included in the specifications. See section 2.02-B.5 for types.

- g. System activation method/sequencing, coordinate with Division - 16
- Detection method shall be by one or more of the following, as determined by the Engineer based on specific project requirements:
 - Smoke Detectors
 - Heat Detectors
 - Loss of Air Pressure
 - Manual pull stations
 - Means of manual release at the PA valve

Sequence of operation for valve actuation shall follow one or a combination of the following, as determined by the Engineer:

- Automatic Detector Signal
- Cross-zoned or verified Automatic Detector Signals
- Automatic Detector Signal(s) and Loss of Air
- Manual

- h. Type(s)
- Single interlocked preaction systems that admit water to sprinkler piping upon operation of detection devices.
 - Non-interlock preaction systems that admit water to sprinkler piping upon operation of detection devices or automatic sprinklers if approved by the AHJ.
 - Double interlocked preaction systems that admit water to sprinkler piping upon operation of both detection devices and automatic sprinklers.

Specific to systems protecting elevator mechanical rooms and shafts:
See 1.04-C-8.

5. Requirements for Mitigation of Microbiologically Induced Corrosion (MIC)

The following requirements, intended for MIC mitigation, shall supercede all similar requirements in the UCCS Standards section 15300.

- a. Pipes and Tubes

- i. All piping shall be USII manufactured steel Schedule 10 or 40 and piping used in dry and preaction systems shall have an Antibacterial Formula (ABII) coating or approved equal.
 - ii. For wet pipe systems, all piping shall be steel Schedule 10 or 40 for 2 ½” and larger and schedule 40 for all pipe 2” and smaller. For 2” and smaller pipe, threadable thinwall pipe may be used only if the threaded Corrosion Resistance Ratio is greater than or equal to 1.0
 - iii. For dry and preaction systems, all piping shall be steel Schedule 40. For 2 ½” and larger, cut-groove the pipe for grooved fittings. Roll grooved pipe shall not be accepted. For all pipe sizes, threadable thinwall pipe may be used only if the Corrosion Resistance Ratio is greater than or equal to 1.0 as installed within the system, i.e., threaded or cut-grooved as applicable.
 - iv. For drain pipes, all piping shall be galvanized steel Schedule 10 or 40 for 2 ½” and larger and schedule 40 for all pipe 2” and smaller. For 2” and smaller pipe, threadable thinwall pipe may be used only if the threaded Corrosion Resistance Ratio is greater than or equal to 1.0.
- b. Pipe and Tube Fittings
- i. All pipe 2” and smaller shall have threaded fittings. The only exception to this requirement is at locations where unions would be required, grooved fittings may be used in place of unions. The number of grooved fittings for 2” and smaller pipe shall not exceed 1% of the total number of fittings installed on the system. Threaded fitting shall be either malleable or cast iron.
 - ii. For 2 ½” and larger pipe, all fittings shall be ductile iron grooved fittings. For the preaction systems, provide grooved fittings and gaskets that are listed for dry-pipe systems. Grooved fittings shall be of a type that does not require field lubrication; Victaulic Vic-Plus or approved equal.
- c. Nitrogen Pressure System
- i. In order to reduce the likelihood of microbiologically induced corrosion (MIC), nitrogen is to be used in place of air for all preaction and dry systems.
 - ii. Provide two (size 300 manufactured by AirGas) nitrogen tanks of adequate size, e.g., size “Q” or larger, to supply supervisory pressure to preaction systems.
 - iii. Nitrogen tanks shall be positioned to discourage accidental damage to the tanks, valves, and regulators. Secure tanks to walls or provide freestanding rakes to securely restrain tanks. Coordinate tank location with Engineer and Owner.

- iv. Provide Nitrogen Regulating Device (Reliable or approved equal) to reduce the pressure from 2200 psi to approximately 50 psi. Nitrogen Regulating Device shall be located as close to tanks as possible to minimize high-pressure piping. Provide rigid pipe from the Nitrogen Regulating Device to each preaction system.
 - v. Provide a low pressure supervisory switch to monitor the pressure within the pipe between the Nitrogen Regulating Device and each Pressure Maintenance Device for each preaction system. This low pressure supervisory switch shall be set to provide a supervisory signal if the pipe pressure is less than 20 psi below the normal operating pressure.
 - vi. For each preaction system, provide an approved pressure maintenance device, e.g., Reliable Model C Pressure Maintenance Device, or approved equal, to reduce the pressure from 50 psi to approximately 30 oz/in². Pressure Maintenance Devices shall be adequately supported. Contractor is to construct rack or similar system to support these and other devices as necessary. Configure Pressure Maintenance Device as required by manufacturer's data sheets.
 - vii. Provide a low-pressure switch, Reliable or approved equal, which is factory set to 11 oz/in² to supervise pressure within the preaction system.
 - viii. Provide gauge on each preaction system that is listed to monitor oz/in². Provide second gauge on each preaction system for water pressure.
- d. Installation
- i. In the preaction systems, all piping shall be sloped to facilitate drainage toward the point of the supply. Slope shall be provided as required for dry systems per NFPA 13. All trapped sections of piping shall be provided with auxiliary drains as required by NFPA 13. Drum drips shall not be required. However, all drains shall be a minimum of 1" valves with plug at all low points. **This requirement exceeds the provisions of NFPA 13.**
- e. Sprinklers
- i. For the preaction system, use upright sprinklers. Pendent sprinklers shall not be used with the preaction system. Where pendent sprinklers are required due to suspended ceilings, Contractor shall provide dry pendent sprinklers installed in manner that no trapped water will result. Sidewall sprinklers may be used on the preaction system as long as they are installed so that no trapped water will occur.

6. Deluge Systems

- a. The deluge valve assembly, including the valve, trim packages and actuation system, shall be UL listed or approved by Factory Mutual, as a complete assembly.
- b. Fire detection devices or systems shall be automatically supervised in all areas.
- c. Detection systems can be pilot line or electronic as determined by the Engineer for the specific project.
- d. If pneumatic detection is incorporated into the design, a dedicated air supply system meeting the requirements for dry pipe systems shall be provided.
- e. Hydraulic or pneumatic heat detectors shall be spaced according to NFPA #13 and manufacturers requirements.
- f. Fire detection spacing shall be in accordance with NFPA #72 including its Appendix-C. These items shall be coordinated with the fire alarm Contractor.

NOTE: Engineer to specify the responsibilities of sub-Contractors under each Division of specifications.

- g. Deluge valve actuation by electronic means shall be through an approved agent releasing panel. This shall be coordinated with the Division 16 work.

NOTE: Engineer to determine the division under which automatic detection system for the deluge system shall be provided, i.e., Division 15 or 16. The responsibilities of Contractors of Divisions 15 and 16 shall be identified and clearly included in the specifications.

7. Exposure Protection Systems

- a. The exposure sprinkler system shall have an independent supply from the vertical or main riser, prior to any other sectional controls, with a supervised control valve and distinctive flow detection.

- b. Where needed, systems incorporating open sprinklers shall be controlled by the operation of detection devices designed for the specific application.
- c. If the systems incorporate dry pipe, deluge or preaction valves, the requirements for each type of system in applicable codes and these standards shall apply.

8. Standpipe Systems

- a. The system shall be designed as required by NFPA #14 and IBC.
- b. Hose valves shall be located within the building stairway enclosures, with additional corridor locations as required, unless alternative locations are approved by the AHJ in writing.
- c. Approved roof manifolds shall be provided where required by the IBC or by the AHJ. Roof manifolds shall be minimum 4" with two (2) 2-1/2" gated outlets with the interior control valve operable from the roof location. Suitable and accessible manual drains and automatic drip drains shall be provided per NFPA-14.
- d. Standpipe systems shall be hydraulically calculated for the project specific requirements.

9. Elevator and Electrical Equipment

- a. The installation of sprinkler systems in elevator machine rooms and shafts shall be in compliance with the requirements of ANSI A-17.1.
- b. In existing buildings where the elevator equipment is not provided with shunt trip, sprinkler protection shall not be provided in the elevator shaft or machine room. A dedicated feed main shall be provided to facilitate a future sprinkler system, terminating at a location outside elevator machine room and hoistway and acceptable to the AHJ. An isolation control valve sized for the maximum number of sprinkler heads shall be provided.
- c. On existing and new buildings where the elevator equipment is provided with Phase I emergency service, sprinkler protection shall be provided in the elevator shaft and elevator machine room. Sprinkler protection serving these areas shall be a preaction system or the system described below. In either case, the system shall actuate the shunt trip prior to application of water:
 - Provide 286⁰ F sprinklers, with head guards, in elevator machine rooms and hoistways. Sprinklers are not required at top of hoistways for new elevators. Sprinklers are not required at the bottom of non-combustible hoistways for elevators that do not use hydraulic fluid.
 - Provide a control valve with tamper switch outside elevator machine rooms and shafts.

- Provide smoke detectors for elevator recall. This work, and the elevator recall functions are normally under Division - 16. Coordinate between Divisions 15 and 16 for proper detector and sprinkler locations.
- Provide one 190°F fixed temperature non-resetting heat detector adjacent to each sprinkler. After the elevator is recalled and prior to application of water, heat detectors shall automatically disconnect power to the elevator machinery and the elevator controller. Provision of detectors and power disconnect is normally under Division - 16. Coordinate between Divisions 15 and 16 for proper detector and sprinkler locations.
- Supervision and zoning of detectors shall be under Division - 16.
- d. Each bank of elevators and associated equipment rooms shall be protected by an independent system unless determined otherwise by the Engineer and approved by AHJ.
- e. Transformer rooms shall be protected by a preaction sprinkler system. Other systems may be approved on a case by case basis as determined by the Engineer and approved by the AHJ.

10. Protection for Mechanical Shafts

- a. Sprinklers shall be required in all shafts where the shaft construction or contents are combustible or where the shaft is accessible by personnel.

EXCEPTION: For shafts housing a single duct which occupies the entire area of the shaft, sprinklers are not required.
- b. Where sprinklers are provided in shafts, they shall be accessible for inspection, maintenance or repair and replacement.
- c. Sprinkler heads shall be placed at the top of all shafts requiring protection. If the shafts have offsets, additional protection may be required as determined by the Engineer based on project and code requirements.
- d. The coverage and spacing limitations from NFPA #13 shall be complied with.

11. Protection for shafts housing a hazardous exhaust system.

- a. Sprinklers shall be provided for protection of all shafts serving a special hazard exhaust system.

EXCEPTION: Coverage is not required if the shaft is dedicated to special hazard exhaust system(s), the shaft is not accessible by personnel, is of fire resistive non-combustible construction, and duct work is

completely non-combustible.

- b. The AHJ shall be consulted in all situations.
- c. For special hazard exhaust systems, such as paint spray operations or cooking exhaust, refer to the appropriate NFPA Standards for the design of sprinkler protection.
- d. Also refer to Section 1.04-C.9.

1.5 SUBMITTALS (Supplemental to Section 01300)

A. GENERAL REQUIREMENTS

- 1. The Owner reserves the right to charge the Fire Protection Contractor for multiple reviews by the AHJ or engineer if more than two (2) submittals (either for shop drawings or as-built drawings) are made by the Fire Protection Contractor.
- 2. Partial submittals shall not be acceptable.
- 3. Equipment submittals shall contain annotated descriptive data to show the specific model, type and size of each item the Contractor proposes to furnish. Catalog cut sheets shall be submitted in a suitable folder or binder and indexed referencing the applicable specification sections. Unclear or partial reproductions of manufacturer's original catalog cuts or descriptive data shall not be accepted. Each item supplied shall be clearly identified on each sheet. Where the submittal material describes items, in addition to the items being submitted, the additional items shall be crossed out and the submittal item shall be identified.

Submit proof of compatibility for equipment components required to be approved as a system.
- 4. The Contractor shall be responsible for acquiring any general arrangement drawings depicting the building layouts, overall site plan and the detailed building drawings, as necessary to develop complete submittals. Reference drawings may be obtained from the owner if available; Contractor to verify such availability prior to bidding.
- 5. Submittals processed by the Engineer shall not be considered Change Orders. The purpose of submittals shall demonstrate to the Engineer that the Contractor understands the design concept, and that such understanding is demonstrated by indicating and detailing the fabrication and installation methods intended to be used.
- 6. Review by the Engineer shall not relieve the Contractor from full compliance with requirements of the contract documents, codes, and standards.

B. SHOP DRAWINGS

- 1. Refer to Division-1 for general submittal requirements.
- 2. Submit detailed shop drawings including a riser diagram, hydraulic calculations,

equipment data sheet submittals and employee certification in accordance with NFPA #13. Shop drawings shall be first reviewed by the Engineer for conformance with contract documents and, subsequently reviewed and accepted by the AHJ.

3. Submit anchoring details and calculations.
4. When a fire protection system employs electronic fire detection devices to activate a system, e.g., in preaction and deluge systems, detailed fire detection and alarm shop drawings, shall accompany the fire protection shop drawing submittal under appropriate division, Division-15 or 16, as determined by the Engineer.
5. Drawings shall be minimum size of 24"x 36", with a minimum scale of 1/8" = 1'-0". Shop drawings, hydraulic calculations and equipment data sheets shall be submitted for review within a maximum of thirty (30) working days after award of contract. Written approval of the Engineer and the AHJ shall be obtained prior to starting the installation
6. Drawings shall include a site plan, floor plan/layout drawings, riser diagram(s) and hydraulic calculations based upon the general arrangement drawings provided and other drawings that may be available from the Owner. Drawings shall include column line designations where provided on the contract documents. The site plan drawing shall clearly indicate the required water supply information from NFPA #13.
7. Include details and sections as required to clearly define and clarify the design.
8. Drawings shall be in strict compliance with NFPA #13 and drawn on computer to a commercial or architectural/engineering drawing standard and the University CAD standards unless waived in writing by the AHJ. Computer drawings shall be full scale and be plotted to a noted scale. For additional details see UCCS CAD Standards.
9. An up-dated set of shop drawings approved by the AHJ that incorporates all field changes shall be maintained at the job site, in good condition from the start of construction until all inspections are completed.
10. The drawings shall show the location and ratings of all fire rated floors and walls. Each pipe penetration of these rated assemblies shall be detailed on the drawings showing pipe sleeve and a fire rated penetration seal.
11. The Contractor shall not proceed with purchase, fabrication, or installation of submittal related work until notified in writing. Re-submit as required until so marked by the Engineer. Work which is executed without required prior acceptance by the Engineer/AHJ shall be subject to rejection. Removal and reconstruction of rejected work shall be at the Contractor's expense.
12. Completed State of Colorado Plan Registration Form shall accompany the shop drawing submittal.

C. AS-BUILT DRAWINGS

1. Submit as-built drawings (one set of blue prints and one set of reproducible) to

the Engineer and AHJ for review and approval. After review and approval, submit the final drawings on computer disk to the University, in University standard CAD format. The as-built drawings shall include all of the information required under shop drawings and the following:

- a. The drawings shall show the system as installed, including all deviations from the approved shop drawings.
- b. When a fire protection system employs electronic fire detection and alarm devices to activate a system, detailed fire protection and alarm as-built drawings, complying with Standard 16720 shall accompany the fire protection as-built drawing submittal by the appropriate contractor.
- c. Dependent upon the extent of field changes required to the original approved shop drawings submitted to the AHJ, the AHJ reserves the right to require a supplemental set of hydraulic calculations, at no additional cost to the Owner to verify the adequacy of the system in the as-built condition.
- d. Submittal of as-built drawings shall follow the job schedule and shall be submitted within thirty (30) days upon completion of the sprinkler work in the respective building.

D. TEST CERTIFICATES

1. Test certificate(s) showing that pneumatic, hydrostatic and final tests were conducted in accordance with the applicable NFPA standards, shall be submitted to the AHJ.

E. OPERATING AND MAINTENANCE MANUAL

1. Manual shall be approved by the Engineer prior to conducting training session.
2. Manual shall contain a complete training session outline (agenda).
3. Manual shall include all system test certificates.

1.6 QUALITY ASSURANCE

A. GENERAL REQUIREMENTS

1. All necessary system acceptance and variances shall be granted by the AHJ after review and approval by the Engineer. This includes shop drawings, as-built drawings and inspections. All variance requests and AHJ responses shall be in writing.
2. The system design and installation shall conform to these standards. When variances are granted by the AHJ, they will be documented in writing by the AHJ and a copy shall be maintained in all project files and at the job site.
3. If a condition arises that is not clearly identified in the Contract Documents, design direction shall be provided in writing by the Engineer. This includes, but is not limited to, walls relocated or not shown on the plans, potential freezing

points, ducts and other obstructions, or interferences as they relate to system coverage or hydraulic performance parameters.

4. The Contractor shall be ultimately responsible to guarantee the system against freezing for reasons other than that of the building Owner's negligence.
5. Systems shall be designed in strict accordance with applicable codes and standards, the manufacturer's recommended practice and the requirements from the AHJ.

B. CONTRACTOR'S DESIGNER QUALIFICATIONS

1. The design of the fire protection systems shall be performed by or under the direction and control of a Colorado registered P.E. or a NICET level IV, unless otherwise advised by the AHJ during the Design Document phase in which case, an individual with NICET, level III or higher may be accepted. Said professionals shall be experienced in fire protection, thoroughly familiar with and experienced in this type of installation. Colorado registered professional engineers or the NICET level III (or higher) professionals who are "Members" in the national organization of the Society of Fire Protection Engineers (SFPE) or meet the qualifications for the grade of "Member" in the national organization of the SFPE are preferred.
2. The owner's representative, Engineer, and AHJ reserve the right to request proof of qualifications.
3. No design related work shall be subcontracted or performed by persons other than bona fide employees working solely for the contractor. Any exception shall be pre-approved by the owner, in writing.

C. INSTALLER/CONTRACTOR QUALIFICATIONS

1. Shall be pre-qualified by the University to work on any major projects. Major projects shall be identified by Facilities Management project manager and AHJ on a case by case basis. As a rule of thumb, projects involving more than 50,000 square feet of sprinkler protection should be considered major.
2. The entire fire protection system project including design, calculation, installation and testing, excluding prefabrication, shall be bid by a single firm which has the capabilities to perform all of the work required under this standard. No installation work shall be sub-contracted without prior permission in writing from the AHJ.
3. Fire Protection Contractor, individually shall be able to prove bonding capacity equal to the total amount of the fire protection portion of the contract, for the specific project.
NOTE: Engineer to make reference to front portion of contract documents for general bonding requirements.
4. Shall be registered for the design and installation for fire protection systems in the State of Colorado.
5. Shall have a minimum of five (5) years of experience in the design and installation of similar projects of comparable size and value.

- . Shall have the capability of providing a full service maintenance, testing and inspection program in accordance with NFPA standards and where applicable, be certified to perform these services .
- 7. Shall have an emergency service capability for response to emergency conditions.
- 8. Shall have an established office within one hundred (100) miles of the campus, which maintains a full complement of spare parts, tools and equipment for the specific project and type of system.

D. INSTALLATION QUALIFICATIONS

- 1. Welders shall comply with the requirements of AWS D10.9, "Specifications of Qualifications of Welding Procedures and Welders for Piping and Tubing, Level AR-3."
- 2. Job foremen shall be trained for the installation and operation of each type of system and possess documentation of qualifications and training. Foremen shall have a minimum of three (3) years of successful installation experience on projects with fire protection systems similar in scope and nature to that required for the project. Job foreman shall have Colorado Springs Fire Protection Systems Installers License.

1.7 WARRANTY

- A. All material and workmanship shall be warranted for a minimum period of one (1) year beginning with the date of final acceptance by the University.
- B. The Contractor shall be responsible during the design, installation, testing and guarantee periods for any damage caused by contractors or by defective work, materials or equipment.

1.8.1 EMERGENCY SERVICES

- A. During the installation and warranty period, the Contractor shall provide emergency repair service for the sprinkler system within four (4) hours of a request by the University.
- B. Service shall be available twenty-four (24) hours per day, seven (7) days per week.

PART II - PRODUCTS

2.1 MANUFACTURERS

- A. Equipment used shall bear the UL listing or FM approval for the use intended and be permitted by applicable referenced standards. See the following list of preferred manufacturers from Facilities Management maintenance personnel.
- B. Equipment used shall be new and compatible.

1. Gate Valves:
 - a. Nibco Inc.
 - b. Kennedy Valve
 - c. Mueller
 - d. Stockham
 - e. Milwaukee

2. Butterfly and Ball Valves:
 - a. Victaulic
 - b. Milwaukee
 - c. Nibco Inc.
 - d. Kennedy Valve

3. Grooved Mechanical Couplings shall be greaseless type:
 - a. Victaulic Company of America
 - b. Grinnell
 - c. Tyco

4. Sprinklers:
 - a. Viking Corp.
 - b. Globe
 - c. Reliable
 - d. Other manufacturers, if approved by the University as equal.

Note: Sprinklers that contain a synthetic, non-metallic o-ring are not acceptable.

5. Fire Protection Specialities (such as hose valves and fire hose cabinets):
 - a. Croker
 - b. Potter Roemer, Inc.
 - c. Guardian Fire Equipment, Inc.

6. Backflow Preventers:
 - a. Febco (see other parts of Division 15 for Model#)

7. Check Valves:
 - a. Central Sprinkler Corp.
 - b. Mueller
 - c. Kennedy Valve
 - d. Viking Corp.
 - e. Victaulic Company of America
 - f. Globe Firm Sprinkler Corp.

8. Fire Protection Speciality Valves (Dry and Preaction):

- a. Viking Corp.
- b. Central Sprinkler Corp.
- c. Globe Fire Sprinkler Corp.
- d. Victaulic

9. Air Compressors:

- a. Gast
- b. Viking Corp.
- c. General Blower Company, Inc.
- d. Emglo Products Corp.

10. Alarm, Flow and Tamper Switches:

- a. Potter Electric Signal Corp.
- b. System Sensor
- c. Victaulic

11. Fire Department Connection:

- a. Croker
- b. Potter Roemer
- c. Elkhart

C. Incidental items, which are essential, but which may not be described by this specification, shall also be provided and installed in the commercial/industry standard or better method and quality.

2.2 MATERIALS

A. PIPING

NOTE: Engineer shall determine and specify the material, products, and manufacturer(s) that the Contractor is authorized to use.

1. All piping shall be USA manufactured Schedule 10 or 40 piping for 2-1/2" and larger and Schedule 40 steel for all piping 2" and smaller as required by NFPA-13. Thinwall piping may be used only if the threaded Corrosion Resistance Ratio is greater than or equal to 1.0. Note that Schedule 40 black steel has a CRR of 1.0.
2. Copper tubing may be used if identified desirable by the engineer. Full compliance with NFPA#13 requirements and recommendations is required.
3. UL listed CPVC piping such as Blaze Master may be used if the Architect & Engineer firm obtains the approval of the University prior to bidding.

4. Pipe joining: Fittings shall comply with NFPA #13 requirements. Grooved couplings, fittings and gaskets used throughout a system, shall be supplied from the same manufacturer and be designed for the specific installation.
5. Threaded fittings are preferred in architecturally exposed or sensitive areas.
6. Design, hydraulic data and fabrication documentation shall be submitted on the use of segmentally welded fittings.
7. Threaded and cut-grooved pipes are subject to the limitations of NFPA#13.
8. Face bushings and hexagonal bushings shall not be permitted.

B. VALVES (Refer also to Section 15050)

1. General Requirements

- a. Suitable for a minimum of one-hundred seventy five (175) psi working pressure unless the project requirements demand higher pressures, i.e., 50 psi above the anticipated system pressure.
- b. Riser and sectional control valves: Indicating types, sized to match the supply pipe and approved for use in automatic sprinkler and standpipe systems.
- c. Control valves: Provide with adequate means for mounting an electrical supervisory contact switch, which shall be specified in this section.

2. Check Valves

- a. 1-1/2" and smaller: All bronze with screwed ends.
- b. 2" and larger: Iron or brass body.

3. Miscellaneous Valves

- a. Ball drip valves: Brass with 1/2" NPT rated for one-hundred seventy-five (175) psi or higher where necessary.
- b. Inspector's test valves: 1" brass ball valves.
- c. Main and sectional drain valves: All bronze gate valves.
- d. Approved combination test/drain valves may be installed.
- e. The valves used for the gauge assemblies shall be 1/4" globe or angle 3-way valves, with a working pressure of not less than one hundred seventy-five (175) psi. They shall have a screwed bonnet and renewable composition disc.

4. Dry Pipe Valves

- a. Valves shall be sized per hydraulic calculations and be supplied by pipe of an equal or greater size.

- b. Shall have a positive latching clapper.
 - c. Shall be of the differential or latching differential type.
 - d. For low differential valves, a high water level signaling device or automatic drain shall be provided.
 - e. All trim parts, accelerators and exhausters shall be of the same manufacturer as the dry pipe valve.
5. Preaction and Deluge Valves
- a. The valve assembly including the valve, trim packages, and actuation system shall be FM approved as a complete assembly.
 - b. The preaction valve shall be actuated and sequenced as noted in Section 1.04-C.4.
 - c. The size of the preaction valve shall be established via the hydraulic calculations and be supplied by a pipe of an equal or larger size. The valve shall be rated for a one-hundred seventy-five (175) psi working pressure. The basic valve trim shall include manual control/activation capability, drain and test provision with trim for automatic operation via a 24 volt solenoid (to be provided under this section). Valve shall be wired normally closed or as otherwise specified by the manufacturer. The manual release switches, whether mechanical or electrical, shall be located at the exits from the protected area. Coordinate work with Division 16 when necessary.
6. Solenoid Release Valves
- a. Shall be specifically listed/approved for use in fire protection systems.
 - b. Shall be FM approved as compatible with the preaction valve and fire alarm control panel.

C. GAUGES

1. Water Pressure
- a. Brass bourdon tube with 3-1/2" diameter case rated for three-hundred (300) psi water pressure.
 - b. Gauge dial: From 0-300 psi in 5 # increments.
 - c. Equip gauges with a 1/4" stem with a 1/4" shut-off valve.
2. Air Pressure
- a. Brass bourdon tube with 3-1/2" diameter case rated for two-hundred fifty

(250) psi air pressure.

- b. Gauge dial: From 0-100 psi in 1 psi increments.
- c. Equipped gauges with a 1/4" stem with a 1/4" shut-off valve.

D. FIRE DEPARTMENT CONNECTIONS

- 1. New fire department connections: Double 2-1/2" Siamese connection with (NH) threads, compatible with Colorado Springs Fire Department threads.
- 2. Single 2-1/2", with NH threads, fire department connections may be used or reused if the riser is less than 3".
- 3. Labels and signs shall be provided per NFPA 13 and 14. See section 3.03-H.
- 4. Provide drain facilities, piped to the outside of the building for fire department connection piping.

NOTE: Engineer shall determine and specify if drain shall discharge in an acceptable location inside the building.

- 5. Where more than one fire department connection is used for the sprinkler system in a building, they shall be interconnected so that the entire sprinkler system is fed by each of the fire department connections.
- 6. Where more than one fire department connection is used for the standpipe system or combination standpipe/sprinkler system in a building, they shall be interconnected so that the entire system is fed by each of the fire department connections.

E. BACKFLOW PREVENTERS

NOTE: Engineer shall conduct code review and specify cross-connection devices that meet the requirements of Colorado Cross-Connection Control Manual.

- 1. Reduced Pressure Backflow Preventer

Reduced pressure backflow preventers shall be used for fire suppression systems only when chemical additives such as antifreeze are present or when untreated water may be pumped into the system. Use Febco models acceptable to Facilities Management Department.

- 2. Double Check Valve Assembly

Provide an approved double check valve backflow prevention assembly on each new automatic sprinkler and standpipe system, at the base of the system riser downstream of the domestic water supply tap. Approved manufacturers are Febco and other manufacturers determined by the Engineer and approved by the University. The model required by Facilities Management is Febco 850.

- 3. Assemblies shall be complete including manufacturer's installed control valves.

F. FIRE DEPARTMENT HOSE VALVES FOR STANDPIPES

1. Hose valves for Class I and III service: 2-1/2" size (with a 2-1/2" x 1-1/2" reducing fitting, except for Class I systems), with American National Standard Hose male thread with cap and chain (brass or chrome consistent with building decor).
2. Hose valves for Class II service: shall meet these standards, with the exception of the valves being of 1-1/2" in size, with a cap and chain. Threads shall meet NFPA #1963 (i.e. NH threads).
3. Engineer shall not specify or require fire hoses for standpipe hose valves unless specifically required by the code and approved by AHJ.
4. Locate hose valves per NFPA #14, unless otherwise approved by the AHJ.
5. Concealed hose valves within a building shall be accessible by the use of a single key. This keying shall match keying which is used to access system control valves.

G. HANGERS AND SUPPORTS

1. Provide pipe hangers of the design required for the specific installation and location.
2. Install retaining clips/clamps in locations where vibration may be a concern.

H. AUTOMATIC SPRINKLERS

1. Orifice size: 1/2" diameter. The same model, manufacturer and orifice size shall be used throughout the project. Other orifice sizes are acceptable when so determined and specified by the Engineer.
2. Finished Ceilings
 - a. Temperature rating classification: Ordinary, unless required otherwise based on ambient conditions.

NOTE: Use of quick response sprinklers is strongly encouraged. Engineer to specify quick response sprinklers where allowed by NFPA-13 and suitable for the specific project.

- b. Style and finish shall be specified.

NOTE: The University departments of Facilities Management maintenance personnel discourage the use of concealed sprinklers with certain exceptions such as cleanrooms.

3. Corrosive atmospheres: coated to prevent deterioration.
4. Other areas (non-finished): brass finish Ordinary temperature rating.
5. Mechanical rooms/attics: brass finish, intermediate temperature rating.

6. Localized areas with potential for freezing: dry pendant or dry sidewall sprinklers.
7. Metal Cabinet and spare sprinklers. Spare sprinklers and wrenches located where the temperature will not exceed 100°F. The number of spare sprinklers shall be based on the requirements of NFPA-13, all interpretations will be by the AHJ. Location to be approved by the University. In sprinkler remodeling and additions, when an adequate supply of spare sprinklers exist an the project uses the same model and manufacture sprinklers in the remodel project, spare sprinkler requirements may be waived upon approval by the University prior to bidding.
8. Sprinklers subject to damage and/or located within 7'-0" of the floor and those protecting electrical or mechanical rooms shall be provided with approved guards.

I. DRAIN AND TEST LINES

1. The two (2) inch main drain, sub-system drains and inspector's test connection drains shall be provided with the appropriate size valve per applicable NFPA standards or manufacturer's recommendation.

J. ELECTRICAL EQUIPMENT (MUST BE COMPATIBLE WITH THE FIRE ALARM SYSTEM)

1. Supervisory Switches
 - a. Compatible with the type of valve used, activated by turning the valve actuator.
 - b. Shall have automatic reset capabilities.
 - c. Capable of being wired in normally open/closed position.
 - d. Cover shall have tamper resistant screws.
 - e. Minimum contact ratings:
0.25 A @ 24 VDC
2. Automatic Water Flow Detectors
 - a. Electronic vane type or pressure activated.
 - b. Compatible with the type of pipe and equipment used.
 - c. Built-in retard device, field adjustable from 0-70 seconds. Set for a time delay of thirty (30) seconds. Exception: pressure switches.
 - d. Automatic self reset capabilities.
 - e. Capable of being wired in normally open position.

- f. Tamper proof.
- g. Minimum contact ratings:
0.235 A Q 24 VDC
- h. All parts in contact with water shall be corrosion resistant.
- i. Shall initiate a distinct water flow alarm signal at the Fire Alarm Control Panel (FACP) by zone.

NOTE: Engineer to coordinate with Electrical Engineer and determine the need for addressable modules and specify under appropriate Division of specifications.

3. Low Pressure Supervisory Switches

- a. A low pressure alarm switch shall be provided for dry pipe sprinkler systems and supervised preaction sprinkler systems. The switches shall meet the following requirements:
 - Compatible with the equipment used.
 - 1/2" NPT enclosure.
 - NEMA I enclosure.
 - Capable of detecting a ten (10) psi decrease in normal pressure and be adjustable.
 - **Tamper proof.**
 - Capable of operating at 24 VDC or as specified by the manufacturer.

4. Exterior Alarm Signals

- a. Shall mount above the fire department connection at a height of ten (10) to fifteen (15) feet above adjacent grade.
- b. Where a FACP is available, an exterior electric bell with flashing strobe, **as specified in Section 16720**, powered by the FACP having a minimum audible level of 85 dBA at ten (10) feet. This work shall be coordinated with Division - 16.
- c. When approved by AHJ, a water motor gong with a minimum six (6) inch diameter shall be provided for sprinkler systems which are installed where there are no fire alarm panels capable of monitoring the required signals. The water motor gong shall be used in conjunction with an alarm check valve.

K. AIR COMPRESSOR

- 1. The air compressor shall be UL listed and sized to be capable of replenishing the system within thirty (30) minutes.

2. Air line piping shall be galvanized or copper.
3. System piping components such as check and shut-off valves shall be brass.
4. Power shall be obtained from a dedicated circuit wired to the building's emergency power system.
5. Air Maintenance Device shall be:
 - a. Listed/approved for fire protection service. If used with tankless compressors, shall be specifically listed for such use.
 - b. Automatic and field adjustable with an integral unloading valve.
 - c. For shop air or cylinders with single stage pressure regulators, the device shall also be of the pressure reducing type.
6. Nitrogen Maintenance Device
 - a. Listed/approved for the service intended.
 - b. Automatic and field adjustable.
 - ...
 - c. Shall be of the high pressure reducing type.

PART III - EXECUTION

3.1 SPECIFIC DESIGN PARAMETERS

A. GENERAL

1. The "Room Design Method" and "Small Room Rule" shall not be used in the design of systems unless otherwise deemed necessary by engineer and accepted by AHJ.
2. Architect/Engineer shall determine which hydrants to test in consultation with the AHJ.
3. Water supply flow test(s) shall be conducted by the contractor and witnessed by the AHJ. Test(s) shall be conducted in strict accordance with NFPA #13 and NFPA #291. The City of Colorado Springs Fire Department shall be invited to witness the test(s). Notify the City of Colorado Springs Water Department of the time and location of the test(s) prior to operating hydrants. Procedures specific to each project including location, date and time shall be submitted to the AHJ for approval two weeks prior to conducting tests. Such tests may discolor water supply to

buildings during the test. As such, if the test date or time coincides with uninterrupted Campus functions, such as research, the owner reserves the right to delay or otherwise reschedule the test.

4. Sprinkler systems protecting buildings classified as Ordinary Hazard shall not be connected to a 6" dead-end type supply main if the main also supplies a fire hydrant. The minimum size supply main shall be 8" for this situation (from the looped main to the hydrant.)

B. HYDRAULIC CALCULATIONS

1. Flow velocity in underground water mains shall not exceed sixteen (16) feet per second. Velocity in above ground sprinkler system piping shall not exceed twenty (20) feet per second.
2. When the domestic and fire protection system water supplies are interconnected, the domestic demand (gpm) shall be added to the fire protection system demand at the point of connection. The domestic demand shall be calculated by the engineer in accordance with the Uniform Plumbing Code based on fixture units and specified accordingly.
3. Pipe sizes shall be calculated so that the combined sprinkler and standpipe system (plus domestic demand) leave a safety factor of 10 psi; see 1.04-A.6.
4. The hydraulic calculations shall be calculated back to a looped water main and be based on the available water supply flow test results. In the case of dead-end type mains, calculations shall include piping to the point where the flow test is effective.
5. The hydraulic calculations shall prove the hydraulically most remote and demanding areas of not less than 1,500 sq. ft., to allow for flexibility in building use, i.e., Room Design Method of NFPA 13 may not be used. Velocity pressure may be neglected in the hydraulic calculations. This may involve submitting auxiliary hydraulic calculations to prove that the most remote and demanding area was calculated. See item 3.01-A.1, above.

NOTE: Allowable reductions of the system's area of operation for the Area/Design Method from NFPA 13 are acceptable and encouraged.

6. Hydraulic calculation submittals shall clearly define and annotate all devices which will cause friction loss with equivalent lengths of pipe. This includes vane type electric water flow switches (assume 10 feet of equivalent length of pipe).
7. For hydraulic calculation purposes, the friction loss coefficient for existing piping over ten (10) years in age, the Hazen-Williams design C values given in NFPA-13 shall be reduced by a factor of 10 for pipes 10 years or more in service, e.g. "C" reduced from 120 to 110. More restrictive requirements of NFPA-13 shall be implemented as applicable. This includes non-circulating water mains and above ground piping.

8. Open sprinkler type exposure protection system demand shall be added to the automatic sprinkler demand.

For systems (closed or open head type), incorporated as part of a rated construction or glazing assembly, the specific design criteria shall be proven through hydraulic calculations.

9. Inside Hose Streams

NOTE: Engineer to update the hose demands, given below, based on the most recent versions of NFPA-13, NFPA-14, and IBC.

- a. For Class II standpipe systems supplied from a sprinkler system, provide 50 gpm at the two most remote outlets or 100 gpm if one hose outlet exists. Flows shall be added at the point of connection to the sprinkler system for hydraulic calculation purposes.
- b. For combined standpipe/sprinkler systems, standpipe demands are added to the sprinkler system demand at the point(s) of connection.
- c. For Class I, II or III standpipe systems not supplied through a sprinkler system, the minimum demand shall comply with NFPA #14.

C. FIRE PROTECTION SYSTEM(S) DESIGN REQUIREMENTS

This section includes specific requirements for the system(s) as they pertain to an individual project. Engineer shall complete the density and area data for each system or each hazard classification within the project. Contract documents shall identify the hazard classification of each area within project boundary. In addition, minimum density (gpm/ft²), minimum operation area (ft²), inside hose stream (gpm), outside hose stream (gpm) shall be included per NFPA-13. Domestic demand (gpm) shall be per actual site conditions.

1. Exposure protection system as calculated.
2. Piping C-factors for new, existing, above ground, and underground shall be included in contract documents.

NOTE: For existing piping older than 5 years, the C factor is not to exceed 100. The C factor for shall be 120 for new steel piping.

3. Maximum Sprinkler Head Spacing for Light Hazard, Ordinary Hazard, and Extra Hazard occupancies shall be per NFPA-13.
4. Special System Considerations
 - a. System Zoning: zoning and subzoning shall be identified and indicated in contract documents.
 - b. Existing Equipment: When an existing system is being expanded, enough of the existing system shall be indicated on plans to make all conditions clear.

- Sprinklers (make/model/etc.)

- Piping
 - Valves (make/model/etc.)
 - Mechanical Fittings (make/model/etc.)
 - Electrical Devices (make/model/etc.)
- c. Antifreeze solution and ratio:
5. Municipal fire apparatus pumping capacity.
6. Standpipe demands.

D. EXISTING EQUIPMENT

- a. The use of existing features and equipment may be considered. Engineer shall conduct survey, prior to 95% documents, and determine and specify the extent to which the existing systems and devices shall be used. Clear directions shall be given to the Contractor in the contract documents.
- b. Before considering existing equipment or piping systems for use in a new project, all such equipment or system shall be tested/inspected to assure their operational integrity and current code compliance.
- c. New equipment shall be of the same manufacturer, make and model, as the existing, where specified in this section.

This shall include, as a minimum:

- Sprinkler Heads
 - Pipe Schedules
 - Electrical Devices
 - Specialty Valves
- d. If the existing equipment is not compatible with the new equipment, the existing equipment shall be replaced.
- e. If existing equipment or piping is deemed unusable, same shall be removed, i.e., abandoned pipe shall not be left in the building without written approval by the AHJ.

3.2 PREPARATION

- A. Any system piping or components which are installed, purchased or fabricated prior to the Contractor receiving a set of approved shop drawings, shall be the responsibility of the Contractor.
- B. System installation shall not commence until the Contractor has obtained required

approval of shop drawings.

- C. Contract drawings are diagrammatic in character and do not necessarily indicate every required offset, valve, fitting, etc.
- D. Contract drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both. The most restrictive requirements shall be applied.
- E. Contract drawings shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or have to be made from field measurements, contractor shall take necessary measurements and prepare the drawings.
- F. Before any work is installed, determine that equipment will properly fit the space; that required piping grades can be maintained without interferences between systems, with structural elements or with the work of other trades.
- G. Coordinate the installation of fire protection materials and equipment above and below ceilings with suspension system, light fixtures, and other building components.
 - 1. Coordinate ceiling space carefully with all trades. In the event of conflict, install fire protection and electric systems within the cavity space allocation in the following order:
 - a. Fire sprinkler mains and cross mains.
 - b. Electrical conduit.
 - c. Fire sprinkler branch line piping.
- H. Verify all dimensions by field measurements.
- I. Arrange for chases, slots, and openings in other building components to allow for fire protection installations.
- J. Sequence, coordinate, and integrate installations of fire protection materials and equipment for efficient flow of the work.
- K. Coordinate the cutting and patching of building components to accommodate the installation of fire protection equipment and materials.
- L. Where mounting heights are not detailed or dimensioned, install overhead fire protection services and equipment to provide the maximum headroom possible. Notify Engineer and Owner of any conditions where headroom of less than 7'-4" will result.
- M. Install fire protection equipment to facilitate maintenance and repair or replacement of equipment components. Connect equipment for ease of disconnecting and to allow minimum interference with other installations.
- N. Coordinate connection of fire protection systems with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

3.3 INSTALLATION OF COMPONENTS

A. GENERAL

1. Any damages resulting from the failure of any new system components shall be repaired at no cost to the Owner.
2. System shall be installed in a workmanlike manner.

B. PIPING REQUIREMENTS

1. In dry pipe systems and preaction systems, all piping shall be sloped to facilitate drainage toward the point of the supply. All trapped sections of piping in both dry and wet systems shall be equipped with auxiliary drains per NFPA-13.
2. Piping shall be cleaned and kept clean and free of foreign matter before and during erection, including careful removal of dirt, scale, welding icicle or beads, cutting, burrs and similar items.
3. Install unions in pipe two (2) inch or smaller, adjacent to each valve.
 - a. Unions are not necessary on flanged devices or in piping installations using grooved mechanical couplings.
4. Pipelines with screwed fittings shall be made up with as few joints as possible.
 - a. Screwed joints shall have clean machine-cut threads and shall be made up with a piping compound or Teflon pipe thread tape. The threads for opened joints shall be cleaned and new piping compound or Teflon pipe thread tape applied before remaking the joint.
5. Flange bolts shall be evenly tightened with wrenches only.
 - a. Flanged joints that have been made up and broken shall be made with new, unused gaskets supplied with no cost added to the contract amount.
6. The end of each cross main shall be equipped with a minimum of 1-1/4" threaded/capped connections in order to facilitate flushing. See NFPA-13 for complete requirements.
7. In cases where pipe sections are cut and removed on the job site for the installation of sprinklers, branch lines, cross mains, etc., the circular pipe sections shall be removed from the pipe, and available for inspection at the time of hydrostatic testing.
8. Pipe outlets shall be reamed to remove burrs and sharp edges as required in NFPA#13 and UPC, i.e., remove burrs to the full interior diameter of the pipe.
9. The system riser shall not be attached to the supply connection until the underground piping is flushed, tested and accepted by the AHJ. The two week

notice requirements and rescheduling conditions, as stated under section 3.01-A.3 is applicable.

10. Attachment of hangers and supports:
 - a. Hangers shall be attached to the supporting structure by means of approved beam clamps, mounting plates, brackets, clips, bolts or concrete anchors.
 - b. Drilling, cutting or burning of, or welding to, structural members for attachment of hangers and supports shall be subject to prior approval by the AHJ.
 - c. Powder driven hangers shall not be used unless prior approval by the AHJ is received.
 - d. Hanger components shall be installed straight and true.
 - e. Wall assemblies shall not be considered as an acceptable replacement for hangers.
11. Piping shall be concealed to the maximum extent practical .

NOTE: Engineer to discuss with the Owner's representative and determine the locations where the piping may be exposed. Contract documents shall give clear directions to the Contractor.

12. Field changes in the piping layout or pipe sizes shall not be made without the prior approval of the Engineer and the AHJ.

C. VALVE REQUIREMENTS

1. Riser Control Valve
 - a. Rooms or enclosures housing sprinkler system control valves shall be equipped with adequate heating, lighting and adequate clearance.
 - b. System control valves shall be made accessible and operable from the floor, unless otherwise determined by the Engineer and agreed upon by the AHJ in writing.
2. Fire Hose Valves
 - a. Fire department hose valves shall be installed no lower than 3'-6" above the finished floor or no higher than 5'-0" above the finished floor level.
 - b. Fire hose valves located in cabinets shall be arranged so that the outlet points outward perpendicular (90 degrees) from the wall, the outlet projecting from the midpoint of the total height of the cabinet and a minimum of six (6) inches shall be maintained between the cabinet walls and the outlets. Hose valves shall be installed so that the handle is no closer than 1-1/2" to a wall or cabinet wall.
 - c. The location of standpipe hose valve and fire extinguisher cabinets shall be identified as follows:

- The inner panel of the cabinet shall be painted with red reflective paint.
 - Red and white reflective tape shall be installed on the exterior of the cabinets on the sides or side molding.
- d. Concealed locations of all hose valves shall be identified by signs on all doors which shall be passed through to gain access to valve locations from the nearest common area corridor. For signs see section 3.03-H.4.

NOTE: Engineer to determine the need for hose cabinets, based on building aesthetics and Owner's and Architect's requirements, and specify accordingly.

3. Drain And Test Valves

NOTE: All main drains shall discharge to the building exterior through a properly sized drain riser. Engineer to determine and specify means and routing of drain discharge. If the drain discharge shall be in a proper location inside the building, Engineer will identify the location of drain discharge and indicate on drawings.

- a. If the fire protection piping is located at a lower elevation than the adjoining building grade, an outside drain installed to conduct main drain tests and a system auxiliary drain piped to a floor drain is desirable. An extra valve installed on the system drain piping maybe necessary in order to isolate the system drain during tests of the two (2) inch main drain.

NOTE: Engineer to determine.

- b. Auxiliary drains and valves shall be provided as required by NFPA-13.
- c. Sight glasses shall be provided on all inspector's test connections where discharge cannot be seen while valves are operated.
- d. The inspector's test connection, where required, shall terminate at a forty-five (45) degree elbow with a sprinkler which has the frame and strut assembly removed; other restricted orifices listed for the same purpose are acceptable. These shall be piped to the building exterior at grade level. If installed on the building interior, it shall include a restricting orifice and discharge to an acceptable drain with adequate capacity. The orifice size shall be the same as the smallest sprinkler installed on the system.
- e. All drains located inside the building, shall be piped to the outside of the building at a point free from causing water damage, terminating with a forty-five (45) degree elbow. This includes the drain for the fire department connection piping. (Exception: Auxiliary drains).
- f. Contractor shall supply and install a concrete splash block with a

minimum length of four (4) feet to direct the drain or test discharge water so as not to disturb adjacent landscape.

- g. All shut-off, drain, and test valves which are placed in concealed spaces shall have the standard sign affixed in a visible location; see section 3.03-H. For example, if a valve is located above a ceiling, a sign indicating the location and type of valve shall be located on the wall, immediately below the ceiling.
- h. Drain valves shall be made accessible and operable from floor unless otherwise proposed by the engineer and accepted by AHJ in writing.

4. Dry Pipe Valves

- a. Adequate clearance shall be provided to facilitate maintenance.
- b. Valve shall be adequately supported.
- c. Engineer shall indicate valve location on drawings to allow for adequate draining of the system.
- d. Valve shall be located within an artificially lighted and heated enclosure.
- e. Valve shall be installed in the vertical position at twenty-four (24) inches to forty eight (48) inches above the finished floor.
- f. If required by NFPA-13 or otherwise determined by the engineer, a means to accelerate air depletion shall be provided. This includes supplying accelerators and/or exhausters.

NOTE: Where feasible, it is desirable to provide a small hose valve, e.g. from the domestic line, in the vicinity of each dry valve in order to facilitate valve reset during maintenance.

5. Preaction Valves

- a. Adequate clearance shall be provided to facilitate maintenance.
- b. Valve shall be adequately supported.
- c. Engineer shall indicate valve location on drawings to allow for adequate draining of the system.
- d. Valve shall be located within an artificially lighted and heated enclosure.
- e. Valve shall be installed in the vertical position at twenty-four (24) to forty-eight (48) inches above the finished floor.

NOTE: Efforts shall be made to provide floor drains near dry and preaction valves.

D. GAUGES

1. Minimum of two (2) water pressure gauges shall be installed on the system riser; one (1) on the supply side and one (1) on the system side of the main control and backflow check valves.

E. SPRINKLERS

1. Installations shall be in accordance with sprinkler listing and manufacturers recommended practices.
2. Coordinate sprinkler piping and head installations with mechanical, electrical fixtures, other components, and building structural elements.
3. Maintain the maximum height possible.
4. Replace sprinklers that are damaged or coated during the construction process by paint, sprayed fire proofing, or similar material.

F. FIRE DEPARTMENT CONNECTIONS

1. Siamese connections serving the same building shall be interconnected so that each one charges all systems.
2. Fire department connections shall be located as required per NFPA-13 and IFC.

G. ELECTRICAL EQUIPMENT

NOTE: Engineer to coordinate with work in Division-16.

1. Tamper switch signals shall initiate a unique supervisory alarm signal at the building FACP.
2. Other system supervisory signals shall provide unique indications of system supervisory status.
3. An exterior electric bell with flashing strobe assembly shall be installed for each system at a minimum height of ten (10) feet or maximum fifteen (15) feet above adjacent grade, above the fire department connection serving the sprinkler system; coordinate with Division 16.
4. If an existing exterior warning signal exists, re-use of the device will depend on the Owners approval as to its condition and location. If reused, contractor shall be responsible for its proper operation.

NOTE: Electrical engineer shall conduct building survey and specify what portion of the existing devices may be used.

H. IDENTIFICATION SIGNS (SUPPLEMENTAL TO SECTION 15190)

1. Signs shall be permanently marked and constructed of weather-proof metal or rigid plastic.
2. Signs shall be secured to a device or the building wall with substantial and corrosion-resistant chains or fasteners.

3. Where sprinkler or standpipe control valves, test locations, or dry-pipe auxiliary drains are located in a room, above the ceiling, or in a concealed space, the location of the valve shall be indicated by a 2"x6" sign. Signs shall be located as follows:
 - a. If a valve is located inside a room, a sign shall be placed above the door tight to the door jam directly above the door handle. Similar signs are required on all intermediate doors within rooms.
 - b. If a valve is located above the ceiling, a sign shall be placed directly under the access panel or proper ceiling tile to access valve. Sign shall be tight to ceiling.
 - c. In other locations, AHJ shall be contacted for specific direction of sign placement.
4. Signs used to identify the location of fire hose valves, in a closet, shall be a minimum of 1'x 2' and have letters with a two (2) inch height and 1/4" stroke.
5. Where a water supply fire pump is provided, a sign shall be located near the pump indicating the minimum pressure and flow required at the pump discharge flange to meet the system demands.
6. Valves
 - a. All control, drain, and test connection valves shall be identified in accordance with NFPA 13.
 - b. All main and sectional system control valves, including water supply control valves, shall have a sign indicating the portion of the system controlled by the valve.
7. Where sprinkler piping is supplied by a system with more than one system riser, a sign shall be located at each dual or multiple feed connection to the combination system riser to identify that to isolate the sprinkler system served by the control valve, an additional control valve or valves at other locations shall be shut off. The sign shall identify the location of the additional control valves.
8. Fire Department Connections
 - a. Each fire department connection shall be designated by a sign having raised letters at least 1 inch in height cast on a plate or fitting indicating service design, e.g., "AUTOSPKR.", "AUTO SPKR. AND STANDPIPE".
 - b. **For manual/dry standpipe a sign shall be provided stating "MANUAL/DRY STANDPIPE FOR FIRE DEPARTMENT USE ONLY".** A sign is also to indicate the pressure required at the inlets to deliver the system demand.
 - c. Where a fire department connection services only a portion of a system

or building, a sign shall be attached indicating portions of the building served.

9. The installing contractor shall provide a sign identifying the design basis of a system as hydraulic calculations or pipe schedule. The sign shall be located at the water supply control valve for sprinkler or standpipe systems.
10. For buildings without central station reporting, an approved identification sign should be provided for outside alarm devices in accordance with NFPA 13: A-4-6.1.1, which will state:

"SPRINKLER FIRE ALARM - WHEN BELL RINGS CALL 911."

I. PROJECT COORDINATION

1. Core Drilling

Provide necessary equipment for core drilling or other equipment to penetrate walls, floors, ceilings and roofs. Provide pipe sleeves and patching to maintain the structural assemblies fire resistant rating where required. All cutting, notching, etc., of structural elements shall be approved in writing by the Architect/Engineer.

2. Interferences

Layout the system to minimize interferences between the fire protection piping and equipment designed and installed by others. Fire protection system zoning shall be consistent with the fire alarm layout.

3. Welding, Cutting, and other Hot Work

Cutting or of pipes using heat/ignition generating devices shall not be conducted inside any portion of existing buildings without written approval from the University. Follow the University Central Station and Hot Work Permit Procedures. Welding of pipes on-site is prohibited by NFPA-13 and only shop welding shall be allowed. Brazing and soldering of copper tubes shall not be conducted within the buildings prior to application and acceptance of hot work permits.

3.4 TESTING REQUIREMENTS

A. GENERAL REQUIREMENTS

1. Engineer and the AHJ shall witness all acceptance tests and inspections.
 - a. A minimum of three (3) working days notice is required.

- b. For cancellation of a test, at least 48 hours notice is required, or it shall be considered as a re-inspection. The Contractor shall be responsible for costs of re-inspections incurred by the AHJ.
 - c. Prior to the time of inspection, the Contractor shall verify that all equipment involved in the test are functioning and are placed as required by contract documents and shop drawings.
 - d. Perform final system testing in conjunction with the fire alarm and detection system specified in Section 16720.
2. Re-inspections
- a. If a system fails any of the above tests, the same scheduling procedure shall be followed.
 - b. If more than two tests are necessary, contractor shall be responsible for any added costs incurred by the Owner.
3. The Contractor shall supply all necessary equipment, such as ladders and special tools.

B. ACCEPTANCE TESTS

1. The Contractor shall conduct the following tests for acceptance of the system installation. This includes all existing equipment which was reused in the system. Record the inspections on a copy of Material and Test Certificate shown in NFPA #13 or similar approved forms. Test report information shall be completed, by the Contractor, prior to each inspection.
- a. The Contractor shall perform all tests and inspections with the AHJ present. A fire alarm representative shall be present when necessary to test fire alarm devices connected to the sprinkler system.
 - b. Prior to any tests on sprinkler/standpipe systems, the piping shall be flushed, as required by NFPA-13, to remove any foreign matter which could have entered the system during installation.
 - c. Functional tests shall be performed on all valves and manual operating devices.

C. SPECIFIC SYSTEM TESTS (WET PIPE)

NOTE: For hydrant flow, water supply tests, see section 3.1-A.3. Note that two weeks of notification is required for such tests.

- 1. Only DowFrost (Propylene Glycol with inhibitor) antifreeze agent shall be used in antifreeze sprinkler systems.
- 2. Antifreeze systems shall be hydrostatically tested prior to introducing antifreeze solution into the system.
- 3. For retrofit installations, a pneumatic test with a maximum pressure of forty (40)

psi shall be conducted prior to a hydrostatic test to avoid any water damage due to leaks. This test does not replace the hydrostatic test.

4. Hydrostatic Test

- a. All piping, including all supply pipe to the fire department connection, shall be hydrostatically tested at fifty (50) psi in excess of the maximum pressure, or 200 psi, whichever is greater. The minimum test duration shall be two (2) hours with no visible leaks or drop in pressure. This test shall be conducted prior to concealing any piping. A complete installation inspection shall be conducted in conjunction with the hydrostatic test while all piping is exposed.
- b. If visible signs of leakage occur or the system loses pressure within the 2-hour test period, the test shall be considered as failed and shall require re-testing after correction of the cause of leakage.

5. Final System Inspection

- a. A final inspection shall be performed when the system installation is complete, which includes: a complete functional test of all system components and of all alarms via the inspectors test correction (manual tripping of alarm devices is not acceptable.)
- b. A complete installation inspection shall be conducted by the Engineer and the AHJ at the time of the final inspection which will be coordinated with the work under Section 16720.
- c. A main drain test shall be conducted with the control valve wide open. The main drain valve shall be opened and remain open until the system pressure stabilizes.

6. For antifreeze systems, test results shall be recorded for the solution ratio.

D. SPECIFIC SYSTEM TESTS (DRY AND PREACTION)

1. All testing requirements for wet pipe systems in this section shall be conducted.
2. An air test shall be performed as follows:
 - a. Air pressure of forty (40) psi shall be maintained for twenty-four (24) hours without losing more than 1-1/2 psi during the test period when the system is required to maintain air pressure.
3. A functional test shall be conducted on all detection devices, valves and drainage facilities for preaction and dry systems.
 - a. Maximum dry valve trip time shall be fifteen (15) seconds from the time the inspectors test valve is completely open.
 - b. Maximum water delivery time to the inspectors test for dry systems shall be sixty (60) seconds from when the inspectors test valve is completely

open.

4. Dry standpipe system piping shall be hydrostatically tested at fifty (50) psi above the maximum street pressure.
5. After a functional test of a dry or preaction valve, if required by valve type, the valve assembly cover plate shall be removed to verify proper valve operation.

END OF SECTION 15300