

SECTION 15305

SPRINKLER AND DRY STANDPIPE SYSTEMS

PART 1 - GENERAL

1.1 PRINCIPAL WORK IN THIS SECTION

- A. Design and installation of complete wet automatic fire sprinkler system including all interior areas, all exterior soffits, and all concealed spaces and shafts as required by local fire authorities and Owner's insurance rating service.
- B. Following is provided by Division 2, civil drawings:
 - 1. Connection of fire sprinkler system to water main or lateral including reduced pressure backflow preventer, post indicator valve, check valve, and fire department pumper valve.
- C. Inspection test valves, drain lines, and other inspection components.
- D. All boring, notching, and chasing required for pipe installation and as approved by University Representative.
- E. Alarm bell.
- F. Connection to fire alarm and supervising systems, including valve electronic supervisors complete with electrical connections.

1.2 QUALITY ASSURANCE

- A. Qualifications of Fabricators and Installers:
 - 1. For actual fabrication and installation of sprinkler systems, use only personnel who are thoroughly trained and experienced in the products involved and in the recommended methods of their fabrication and installation.
 - 2. In the acceptance or rejection of the sprinkler system, no allowance will be made for lack of skill on the part of workmen.
 - 3. Contractor shall have a California C-16 license.
- B. Qualifications of Design Engineer:
 - 1. Design and all calculations shall be approved by a registered fire protection engineer, experienced in preparation of designs for similar systems.
- C. In addition to complying with all pertinent codes and regulations, comply with all requirements of:
 - 1. University Fire and Building Department requirements.
 - 2. NFPA 13 and 24.

3. UL and/or FM rating requirements for products.
- D. Refer to Section 15400: General Provisions.
- E. Reference Standards:
 1. Type and size of materials and equipment, installation and operation shall be in accordance with:
 - a. Local Fire Department or Authority Having Jurisdiction (AHJ).
 - b. National Fire Protection Association:
 - 1) NFPA 13: Installation of sprinkler systems.
 - 2) NFPA 101: Life Safety Code.
 - 3) ANSI B-16.4 - Cast Iron Threaded Fittings.
 - 4) ANSI B-16.1 - Cast Iron Flanges and Flanged Fittings.
 - 5) ANSI B-16.3 - Malleable Iron Threaded and Banded Fittings.
 - 6) ANSI B-16.26 - Copper Flared Fittings.
 - 7) ASTM A-120 and ASTM-53 - Steel Pipe.
 - 8) AWWA C-506 - Backflow Double Check Assembly.
 - 9) AWWA C-506 - Double Check Detector Assembly.
 - 10) Associated Factory Mutual Fire Insurance Companies.
 - 11) Industrial Risk Insurers.

1.3 SUBMITTALS

- A. Shop Drawings/Calculations:
 1. Within 21 days and prior to submittal of complete piping layout and hydraulic design, the contractor shall submit the following:
 - a. A reflected ceiling plan of the complete project showing all sprinkler head locations, lights, diffusers, grilles, access panels, etc.
 - b. Provide equipment list describing all piping materials, valves, fittings, supports, hangers, and appliances. The list shall be approved by the University Representative prior to construction.
 2. Within 45 days after award of Contract, submit complete shop drawings to the University's Representative and the Insurance Services offices for review. Shop drawings and calculations

shall include the following:

- a. Principle dimensions, including tie-in to water main point-of-connection, and details of construction.
- b. Sizes and locations of piping, valves, fittings, braces and hangers.
- c. Hydraulic calculations: Contractor is responsible for sizing all supply and distribution piping.
- d. Fire alarm and supervising system diagram.
- e. Approval stamp of the local Fire Department and all other authorities having jurisdiction on drawings, calculations, data sheets, etc., requiring such approval.
- f. Certified performance requirements.
- g. All welded sections shall be identified on drawings. All welded fittings or formation shall be identified.
- h. Components of hanger assemblies not listed by UL, and installation methods thereof, shall be certified by a registered professional engineer. Provide construction details, as necessary, to achieve this approval.

B. Maintenance and Operation Manual

1. Two copies of the maintenance and operation manual fully describing maintenance schedules, replacement parts, and other operation requirements shall be submitted at the end of the project.

C. Submit product data for the following items per the provisions of Division 1 and this division's General Provisions:

1. Pipe and fittings.
2. Pipe Sleeves.
3. Valves.
4. Backflow preventers.
5. Alarm actuating devices.
6. Pressure gauges.
7. Sprinkler heads.
8. Sprinkler cabinet.
9. Floor plans, details, pipe sizes, elevations, and hydraulic calculations, performed in compliance with the Design Criteria indicated on the Contract Drawings. All floor plans shall be a

minimum scale of 1/8" = 1'-0".

10. All submittals shall indicate M.E.A. approval with a Calendar Number.

1.4 COORDINATION

- A. Coordination work with the work of other trades before any installation takes place.
- B. Installed fire sprinkler piping runs found to be in conflict with work of other trades as a result of neglected coordination shall be removed and reinstalled in new locations as designated by the University Representative at no expense to the Owner. Gravity sewer and storm drainage systems take precedence.
- C. To achieve coordination, the Contractor shall contact the University's Representative and obtain necessary information to design his system to fit into allotted spaces without interfering with work by other trades following in a later construction sequence.

1.5 GUARANTEE

- A. Contractor shall guarantee fire protection system from leaks for a period of two years after final acceptance. Guarantee shall include repair of damage to Owner and tenant improvements.

1.6 GENERAL DESIGN CRITERIA

- A. Materials and Products
 - 1. All material, equipment, valves and devices installed shall be approved for use in the fire protection installation by the referenced authorities, codes and standards, new and without field modifications.
- B. Coverage and Scope
 - 1. System shall be designed to provide coverage and density for occupancy type within building as required by local Fire Marshal requirements and NFPA hazard classifications.
 - 2. Design the system based on the University's Representative reflected ceiling plans.
 - 3. Provide heads for all concealed spaces, attic, and soffit spaces at coverage and density requirements per (1.) above.
 - 4. Provide heads for all exposed structure areas as required by (1.) above.
- C. Water supply data for this system shall be determined using current (within one year of bid date) flow test information. Contractor shall obtain and verify flows, pressures, and related hydraulic data.

PART 2 - PRODUCTS

2.1 THE MANUFACTURERS LISTED SET A STANDARD FOR REVIEWED EQUIVALENTS.

2.2 MANUFACTURERS

- A. Flashing sleeves:
 - 1. Josam Mfg. Co.
 - 2. Jay R. Smith Mfg. Co.
 - 3. Zurn Industries, Inc.
 - 4. Wade Div. Tyler Pipe and Foundry Co.
 - 5. Or equal.
- B. Piping:
 - 1. Allied.
 - 2. Berger.
 - 3. Northwest Pipe and Casing Co.
 - 4. LTV Steel Tubular Products.
 - 5. Or equal.
- C. Fittings:
 - 1. Ward Fittings.
 - 2. Victaulic Co. of America.
 - 3. Grinnell Corp.
 - 4. Star Pipe Products, Inc.
 - 5. Or equal.
- D. Gate and Check Valves (Inside):
 - 1. Stockham Co.
 - 2. Milwaukee.
 - 3. Crane Co.
 - 4. Nibco Inc.
 - 5. Victaulic Co. of America.
 - 6. Or equal.
- E. Ball valves:

1. Milwaukee Valve Co.
 2. Nibco.
 3. Victaulic Co. of America.
 4. Grinnell Corp.
 5. Or equal.
- F. Butterfly Valves:
1. Henry Pratt Co.
 2. Kennedy Valve Co.
 3. Nibco.
 4. Grinnell Corp.
 5. Victaulic Co. of America.
 6. Or equal.
- G. Noiseless check valves:
1. Williams Gauge Co. (Clow)
 2. Kennedy Valve Co.
 3. Mueller Steam Specialties Co.
 4. Miller Valve Co.
 5. Milwaukee Valve.
 6. Or equal.
- H. Pressure regulating valves:
1. Cla-Val Co.
 2. Potter-Roemer.
 3. Croker Corp.
 4. Wilkins-A Zurn Co.
 5. Or equal.
- I. Backflow preventers:

1. Viking Corp.
2. Watts Regulator Co.
3. Wilkens-A Zurn Co.
4. Cla-Val Co.
5. Hersey Products, Inc.
6. Or equal.

J. Sprinklers, alarm and alarm actuating devices:

1. Automatic Sprinkler Co. of America
2. Grinnell Fire Protection Systems Co.
3. Star Sprinkler Co.
4. Central Sprinkler Corp.
5. Reliable Co.
6. Viking Co.
7. Or equal.

K. Grooved fittings and couplings for grooved pipe:

1. Victaulic Co.
2. Gruvlok.
3. Grinnell Corp.
4. Or equal.

2.3 PIPING

A. Underground: Provide thickness Class 54 cement lined ductile iron bell and spigot water pipe with 350 psig ductile iron fittings, mechanical joint banded and roded except as noted.

1. Provide flanged connection on service inside building.
2. Provide standpipe piping with malleable iron or cast steel fittings with the pressure rating as indicated on the riser diagram.
3. Provide sprinkler piping with malleable iron or standard weight cast iron fittings, 175 psi wwp.
4. All fittings shall have minimum 175 psi wwp pressure rating.

- B. Above Ground: Schedule 10 or lightwall pipe may be used in lieu of Schedule 40 pipe for diameters 2 inches through 5 inches with wall thickness in accordance with Schedule 10; 6 inches and 8 inches with minimum wall thickness .134 inches and .188 inches respectively.
 - 1. Threaded or cut grooved connections are not permitted.
 - 2. Lightwall pipe shall not be used for the standpipe system, sprinkler system risers, supply cross-connecting header and fire department siamese connection..
- C. Welded joints using factory fabricated steel welding fittings may be used. Connections to existing piping inside the building may be malleable iron or ductile iron threaded clamp connectors, similar to Victaulic Style 920 or 921.
- D. Grooved end malleable iron fittings and bolted clamp type malleable iron couplings with rubber sealing gaskets for grooved end pipe with appropriate pressure rating, similar to Victaulic Style 75 may be used.
- E. Unions: Provide ground joint type unions for 2 inch and smaller pipe, of galvanized malleable iron with brass seats.
- F. Provide galvanized pipe for following:
 - 1. Between siamese and check valve, ball drip drains, drain and test piping subject to alternate wetting and drying, test and relief piping and water motor gong piping.
 - 2. Fittings and couplings for galvanized pipe shall be galvanized.

2.4 SHUT-OFF VALVES

- A. Valves controlling water flow in the fire protection piping shall be of OS&Y type, except as noted.
- B. 2 inches and smaller:
 - 1. Provide threaded bronze, 175 psi wwp, similar to Milwaukee No. 118, or Butterball series BBSC with or without built-in tamper switch.
 - 2. Auxiliary valves (drain valves, test valves, trim valves) may be of a globe or angle type, similar to Milwaukee No. 502 and 504.
- C. 2-1/2 inch and larger, except as noted:
 - 1. Provide flanged IBBM, OS&Y gate type, 175 psig wwp, similar to Milwaukee No. F-2885-FP.
 - 2. Provide tight closing, rubber seated cast iron wafer type butterfly valves, 175 psig wwp, with stainless steel shaft, lifetime bearings, Ni-Resist disc, and crank actuated operator with position indicator, similar to Mueller Fig. B-3220.
- D. 2-1/2 inch and larger, shall be flanged IBBM, OS&Y gate type.
 - 1. Provide 175 psig wwp, similar to Milwaukee F2885-FP.

- E. Valves 6 inch and larger, shall be provided with a valved bypass.
- F. Seal valves in proper position and provide approved type metal signs indicating purpose of valve. Fasten sign to yoke with brass chain.
- G. Provide all valves controlling water flow in the fire protection piping (including valves on the fire services) with supervisory tamper switches, similar to Potter Electric Signal Co., Model OSYS-U, mounted in accordance with requirements of the equipment manufacturer and all authorities having jurisdiction.
 - 1. Electrical connection shall be of the rigid conduit type. No plug-in connections will be permitted.

2.5 CHECK VALVES

- A. Provide swing type check valves, except as noted. Two inch and smaller valves, except as noted, shall be threaded bronze, 175 psig wwp, similar to Milwaukee Fig. 509. 2-1/2 inch and larger, except as noted, shall be flanged IBBM, 175 psig wwp and similar to Milwaukee Fig. F2974-FP.
 - 1. 2 inches and smaller valves on un-reduced pressure piping shall be 400 psig wwp, similar to Stockham Fig. B-345, 2 1/2 inch and larger valves shall be 500 psig wwp, similar to Stockham Fig. F-947.
- B. Wafer type check valves similar to Grinnell Model F512 or grooved end check valves similar to Grinnell No. F5201 may be used.
- C. Provide hub end IBBM, swing type check valves, 175 psig wwp for underground installation, similar to Clow No. F-5348-R.

2.6 SLEEVES

- A. Extend sleeves through construction. For insulated piping, size to allow insulation to pass through sleeve.
- B. Except where framed openings are provided in General Construction Work, Provide No. 22 USSG galvanized iron sleeves through interior floors, ceilings, walls and partitions.
- C. Provide sleeves of cast iron or steel pipe through exterior walls, beams, interior machine room floors and interior sprinklered area floors, except as noted. Extend sleeves 3 inches to 6 inches above finished floor. Provide continuously welded center flange for sleeves through exterior walls, floors of machine rooms and sprinklered areas.
- D. Provide projecting flashing type sleeves through interior membrane waterproofed floors, except as noted. Sleeves shall be cast iron with integral flashing flange for built up membrane, with clamping ring, similar to Josam Series No. 26420 or to Smith No. 1760. For liquid membrane provide sleeves with integral or brazed 4 inch wide flange, similar to Josam Series No. 26420-47 and to Smith No. 1755. Adjust sleeves to floor construction with galvanized steel pipe nipples top and bottom, extending 2 inches above finished floor. Seal pipe watertight in sleeve with approved packing and hot poured mastic.
- E. Provide flush flashing type sleeves through membrane waterproofed walls, slabs with earth fill above

and slabs on ground. Sleeves shall be cast iron with integral flashing flange and clamping ring for built up membrane, similar to Josam Series No. 26400 or/and Smith No. 1721. For liquid membrane sleeves shall be with integral or brazed 4 inch wide flange, similar to Josam Series No. 26400-47 or Smith No. 1721. Sleeves shall be modified for wall or slab thickness. Seal pipe watertight in sleeve with oakum packing and caulked lead joint.

- F. Through elastomeric type waterproofing, provide galvanized cast iron sleeves with integral bottom flange, similar to Smith No. DX-9325. Seal joint between pipe and sleeve with approved packing and hot poured mastic for interior sleeves or caulked lead for exterior sleeves.
- G. Provide sleeves through fire walls and slabs. Pack with approved fire resistive material in accordance with local code and Underwriters' requirements.
 - 1. Exposed sleeves after packing shall be covered by close-fitting metal escutcheons on both sides of construction.
- H. Generally, sleeves through foundations are by others. Provide additional sleeves required and cutting and patching to install same or to relocate existing sleeves.

2.7 ESCUTCHEONS

- A. Provide cast iron, cast brass, or stamped steel escutcheons for exposed piping through floors, ceilings, walls and partitions.
- B. Escutcheons shall have a set screw or a retaining spring.
- C. Finish at tile walls shall be chrome plated. Provide deep type escutcheons to cover sleeve hubs or fitting projections.
- D. For sprinkler heads through hung ceilings, provide special stamped brass escutcheons securely held in place.
 - 1. Finish shall be satin chrome plated.
 - 2. For chrome plated heads, finish shall be satin chrome plated.

2.8 AUTO BALL DRIPS

- A. Provide 3/4 inch bronze auto ball drips with threaded ends, similar to Potter-Roemer No. 5982 (Straight).

2.9 DRAINS AND TEST PIPES

- A. Drains: For siamese in areas subject to freezing, provide auto ball drip. For others, provide valves and/or plugs as required.
 - 1. Provide:
 - a. At siamese.
 - b. At base of risers.

- c. On valved sections.
 - d. At alarm valves.
 - e. At other required locations for complete drainage of systems.
 - B. Test pipes: Provide valved test connections at the following locations and pipe them to discharge through proper orifice.
 - 1. At each waterflow alarm device. (Floor control assembly with PRV, test line shall be 2 inch minimum and drain riser shall be 3 inch minimum.)
 - 2. At the end of the most remote sprinkler branch pipe in the uppermost story.
 - 3. At other required locations.
 - C. Drain pipes or test pipes shall spill:
 - 1. Through building wall.
 - D. Where required, provide test pipe with sight glass, and calibrated orifice.
- 2.10 ALARM BELLS:
- A. 10" diameter, polished chrome plated, electronic, 110 volt.
- 2.11 WATER FLOW ALARM SWITCHES
- A. Provide closed circuit water flow indicators with two sets of S.P.D.T. contacts, similar to Potter Electric Signal Co. Model PS10 for water piping.
 - 1. Electrical connections shall be of rigid conduit type. No plug-in connectors will be permitted.
- 2.12 PRESSURE GAUGES
- A. Provide 3-1/2 inch diameter single spring bronze Bourdon tube type gauges with brass case and chrome plated brass ring with heavy glass.
 - B. Provide gauges at the top of each standpipe riser, at each sprinkler connection to riser, at inlet and outlet of pressure reducing valves and at other required locations.
 - C. Gauges shall be controlled by shut-off valves and shall be provided with a drain outlet.
- 2.13 SPRINKLER HEADS
- A. Provide cast brass, closed, fusible link or frangible bulb, spray type heads with 1/2 inch discharge orifice and of ordinary degree temperature rating, except as noted.
 - B. Provide higher temperature rating as required due to abnormal heating conditions.
 - C. On exposed piping, provide standard upright heads wherever possible. On wet pipe systems, provide

standard pendent heads where necessary.

1. Heads shall have satin chrome finish.
 2. Standard upright and pendent heads shall be similar to Reliable Model G.
- D. Sidewall heads shall be provided where noted and installed in accordance with their listings.
1. Provide sidewall heads with 1/2 inch orifice, except as noted, similar to Reliable Model G.
 - a. Finish shall be satin chrome.
 2. Provide where noted, extended coverage sidewall heads with 17/32 inch orifice, similar to Reliable Model G with EC2 deflector.
 - a. Finish shall be satin chrome.
- E. In hung ceiling areas, run piping concealed with pendent heads. For dry systems, provide dry pendent type. Where indicated, provide standard pendent heads, similar to Reliable Model G, chrome plated.
- F. Sprinkler heads in ceilings shall be of the following types.
1. In all spaces except mechanical rooms, provide concealed heads.
 2. For storage areas and all other back of the house areas that are Ordinary Hazard Occupancy and are provided with hung ceilings similar to Reliable Model G4FR concealed type.
 - a. Concealed heads shall be similar to Reliable Model G1.
 - 1) Ceiling plates shall be factory painted white.
- G. Provide heavy wire guards for heads placed where liable to be accidentally hit or where directed.

2.14 SPRINKLER CABINET

- A. Provide enameled steel cabinet with 2 extra sprinkler heads including each temperature rating and type used. Provide sprinkler head wrenches for each type of sprinkler head used.

2.15 SIGNS, TAGGING AND IDENTIFICATION

- A. Provide metal or plastic signs, permanently marked to show function, for all valves, controls, and related assemblies. Locate as directed by University Representative.
- B. Brass identification tags shall be provided for all valves, equipment and controls provided under this Section. The tags shall have a minimum 1/2" high lettering and sufficient length for the required lettering on 1/32" minimum thickness brass sheet and shall conform to NFPA Standard No. 13.
- C. Signs shall be attached to conceal valve locations using 1-1/2 inch high white laminated plastic with red letters.
1. Letter shall be 1/2" high.

2. Sigh shall state exactly what is concealed in the access panel preceded by the words "Fire Sprinkler System".

2.16 VALVE CHART

- A. Provide enclosed frame with chart enclosed, indicating all valves, pipe sizes, locations, and system functions.

2.17 GUARDS

- A. Provide UL approved guard for sprinkler heads which are susceptible to mechanical damage.

2.18 ESCUTCHEON PLATES

- A. Provide chrome plated where piping penetrations are made through finished walls and ceilings.

2.19 SEALS AND TAGS

- A. Provide brass cross-link chain, with brass padlock and 2 keys, for each valve required to be sealed in open position. Provide identification tags, 2" diameter, at all control valves.

2.20 PAINTING:

- A. See Painting Section of the specification for field painting.
- B. Painting shall be done in accordance with NFPA Standard No. 13. The Sprinkler Contractor shall supervise the painting of the sprinkler system. The following items shall be painted:
 1. All exposed piping within rooms and exterior areas shall be painted.
 2. Sprinkler heads, nameplates, polished surfaces and trimmings furnished with manufacturer's finish shall be painted.
 3. Post Indicator Valve.
 4. Exposed fire sprinkler riser assembly.

PART 3 - EXECUTION

3.1 INSTALLATION.

- A. Provide the following minimum cover for underground piping:
 1. 4 ft below final grade.
- B. Accurately align sprinkler heads in hung ceiling areas symmetrically with diffusers, grilles, lighting fixtures and ceiling tiles.
 1. Install heads in center of tiles, this may result in additional heads which shall be provided at no additional cost to the University unless indicated otherwise.

- C. Pitch sprinkler piping to main and auxiliary drain outlets to provide for complete drainage. Number of drain outlets shall be kept to a minimum.
 - 1. Slope of horizontal runs of drain piping shall be 1/8 in. per ft for 2 1/2 inch diameter and less and 1/16 inch per foot for larger diameters.
- D. Install piping approximately as indicated and modify to suit building conditions and to avoid interferences with other trades. Maintain access to all parts of piping systems and duct work and maintain required pitch.
- E. Provide additional offsets, fittings, valves, drains, etceteras, where required by construction and work of other trades.
- F. Run in chases, recesses, shafts, hung ceilings and beam cuts where applicable. Do not cover before examination and testing. Run parallel with or at right angles to walls and other piping, neatly spaced and with plumb risers.
- G. Maintain minimum 1 inch clearance between hubs, coverings and adjoining work. Support from overhead construction. Maintain maximum headroom and for concealed piping in ceilings obtain ceiling heights from University Representative's drawings.
- H. Location and elevations of exterior utilities shall be as indicated or required by existing conditions.
- I. Provide control valves where noted or required. Valves shall be accessible, but no gate valve handle shall be pointing down. Butterfly valve shall be installed with operator on side.
- J. Provide tapered reducing fittings for changes in pipe size; no bushings will be permitted, except with prior special approval.
- K. Use extra heavy pipe for nipples where unthreaded portion of pipe is less than 1½ inches long. Use no close nipples. Connect to risers, bypasses and equipment with unions or flanges.
- L. Provide main and auxiliary drain connections throughout as required for complete drainage of piping.
- M. Expansion swings: Provide elbow swings or expansion loops in piping for vertical and horizontal expansion and contraction and building expansion joint crossings.
- N. Joints: Install joints in accordance with manufacturer's instructions. For screwed piping; threads shall be clean-cut of exact length. Ream pipe after cutting and threading. Apply approved compound on male threads only, apply graphite on drain plugs. No lamp-wick will be permitted in joints.
 - 1. Cast iron and/or ductile iron bell and spigot piping: provide clean dry jute packing and caulked molten lead applied in one continuous pour; finish shall be flush with bell face. Provide push-on rubber gasket joints, in accordance with ANSI A21.11, similar to Tyton. Provide mechanical stuffing box type joints: bolted assembly, in accordance with ANSI A21-11, assembled with torque limiting wrench.
 - 2. Underground piping: Reinforce joints at fittings and valves with galvanized steel clamps and ¾ inch galvanized steel rods, approved masonry thrust blocks or combination of both in accordance with manufacturers' recommendations and with NFPA No. 24 Standard. Paint clamps and rods with heavy coat of bitumen solution paint.

3. On flanged piping, provide full faced rubber gaskets.
4. Welded piping: Before proceeding with work, submit for review proposed procedures conforming to the latest revision of Code for Pressure Piping Chapter V, ANSI 249.1 Safety in Welding and Cutting and API code for fuel and other API governed piping in accordance with Underwriters' requirements.
 - a. Welders shall be qualified per Section IX of ASME Boiler and Pressure Vessel Code, and licensed to perform work.
 - b. Remove foreign matter from ends of pipe before tacking and welding. Align piping ends concentric, then tack weld to prevent misalignment during welding. Weld and reinforce. Provide welding rods similar to Oxwall No. 1-HT. Hammer, clean and flush out piping after welding to remove scale, slag, welding beads, etceteras.
 - c. Welding fittings: Provide factory made, forged steel welding fittings. Fabricated welded fittings will not be permitted.
 - d. Connections: For one half size of main or smaller, Weldolets or Thredolets may be used. Provide regular welding tees for larger connections.

3.2 TESTS

- A. Test piping with water at 200 psig or at 50 psig above maximum static pressure, whichever is the greater for two hours.
- B. The system shall be flow tested to determine that water is available at the top outlet of each riser, the lowest outlet in each riser, and through each siamese connection. The system shall be flushed to remove all foreign matter from the system. Flow shall be through at least a two and on-half inch hose without nozzle at each one of the above mentioned locations at separate times.
- C. A performance or operation test shall be made on each completed system to determine that all alarms, valves, indicators and all appurtenances are in good working order.

3.3 COMPLETION:

- A. Sprinkler System shall be complete, tested and ready for operation and shall include all necessary and required connections and shall be accomplished prior to carpet installation. Testing shall be as required to conform to current applicable requirements of NFPA and local code authority, as well as the Insurance Services organization. The serving Fire Prevention Bureau, and the Owner's Insurance Underwriter shall be allowed to conduct such tests as may be required. Any cost in connection with these tests is to borne by the Contractor.
- B. Upon completion of the sprinkler system installation, the Contractor shall notify the University Representative.
- C. Upon approval of the sprinkler system, the Contractor shall obtain two copies of letters of approval which are to be forwarded to the University Representative.

3.4 ACCEPTANCE AND INSTRUCTION

- A. After completion of all installation, tests, etc., and prior to the remodel area opening date, the Contractor shall instruct the University Representative in the operation of the Sprinkler System modification.
- B. Final payment will not be made until the letters of approval from all authorities are issued and have been delivered to the University Representative and all tests are completed.
- C. All painting of the sprinkler system shall be complete and as specified under the Painting Section.

3.5 FIELD QUALITY CONTROL

- A. Testing:
 - 1. Test as required to conform to current applicable requirements of NFPA and approval agency, as well as Insurance Services organization.
 - 2. Tests to be conducted after systems are flushed out, accepted by County Health, and in the presence of representative of the Contractor and authorities having jurisdiction.
 - 3. Provide 3 copies of final report and certification as prescribed by Insurance Services organization and inspection bureau having jurisdiction.
 - 4. Upon completion and approval of system, and prior to occupancy, provide instruction to the Owner, or his representative, in all details of system operation and maintenance, including preparation of maintenance and operations manual per Section 01300.

3.6 CLEANUP

- A. Upon completion of work, remove all surplus material, debris, and equipment associated with or used in the execution of this work.
- B. Equipment, apparatus, fixtures and exposed piping shall be thoroughly cleaned. Sprinkler heads shall be thoroughly cleaned without the use of any solvents.

END OF SECTION