FIRE PROTECTION SYSTEM GUIDELINES

PREFACE:

This guide and the attached exhibits are to be used as a tool to assist in the design and construction of a fire protection system. It is not intended to include all code, design or performance requirements and SHALL NOT be directly copied. This design guide is intended to identify Campus Standards and unique requirements for UCSB fire protection system installations which complements building codes. Some of the provisions of this guide may exceed minimum code requirements and such should be brought to the University Representative’s attention during design for review and approval. Should there be a variance between these guidelines and any codes, such variances should also be brought to the University Representative’s attention.

IT IS DESIRED THAT ALL NEW BUILDINGS CONSTRUCTED AT UCSB INSTALL AN APPROVED FIRE SPRINKLER SYSTEM IN ACCORDANCE WITH THE PROVISIONS OF THE NATIONAL FIRE PROTECTION ASSOCIATION, VOLUME 13 AND ALL OTHER APPLICABLE CODES, UNLESS OTHERWISE APPROVED BY THE CAMPUS FIRE MARSHAL AND THE CAMPUS BUILDING OFFICIAL.

Description of Work:

Design a complete fire protection system from the water main connection to and throughout the building, in accordance with these standards, NFPA 13 as adopted by the California State Fire Marshal at the time of design, applicable codes, FM Global and DCFM (Designated Campus Fire Marshal) requirements.

Provide a flow test plan for each project for the University to confirm available fire flow and pressure to be used for design. Test plan must be reviewed and approved by the University Representative and the DCFM.

Qualifications:

Design Consultant Qualifications – Certified Fire Protection Design Engineer to either fully design or review and approve work by others.

Contractor Qualifications: Contractor shall hold a valid California C-16 contractor's license and shall demonstrate satisfactory installations of comparable systems within the preceding five (5) years, including references.

Reference Standards:

At the start of design, propose and confirm with University Representative and DCFM the edition of standards/codes to be used for the project. Designer shall also verify building type and occupancy with the University Representative and the DCFM.
Standards include but are not limited to: National Fire Protection Association (NFPA), American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), California Building Code Standards (CBC), American Welding Society (AWS), Uniform Plumbing Code (UPC), California State Fire Marshal Standards (CSFM)

SUBMITTALS:

Design team shall produce and submit a list of required submittals to be reviewed by the University and incorporated into the construction documents to be submitted by the contractor. See sample Fire Sprinkler System Submittal Checklist at the end of this document. Technical Specifications must be consistent with Division 1 Specifications. Submittals shall include but not limited to the following:

A. Evidence of current California C-16 Contractor's license and list of comparable installations required.

B. Materials shall include but not be limited: Sprinkler heads and accessories, pipe and fittings, valves, gauges, alarm flow switches, hangers and supports, fire department connections, valve supervisory switches, backflow preventer, hose cabinets, identification signs, hangers, escutcheons, fire stopping, earthquake restraints, sprinkler head cabinets, dry fire sprinkler systems, fasteners, test and drainage assemblies, … This list does not override requirements of NFPA 13.

C. CSFM listing numbers (alarm and supervisory devices).

D. Contractor shall provide detailed shop drawings with hydraulic calculations that shall be prepared and submitted for approval before fabrication. Shop drawings shall be submitted in complete sets (partial submission will not be acceptable) and shall bear the Contractor's license stamp, identity of the system designer and computer program used in the calculation of hydraulic information. The submittal package shall be stamped and signed by the manufacturer/fabricators qualified engineer registered in the State of California prior to submitting for review. Submittals having any content which is incomplete or unclear will be returned without review and approval. Discharge patterns and application data shall be included in submittals for sidewall, water curtain, and similar special purpose sprinklers.

E. Operations and Testing Instructions: Contractor shall provide instruction charts describing operation and proper maintenance of system equipment per Division 1 and NFPA 25.

F. Training – Contractor shall provide a minimum of 8 hours of training by a qualified representative of the fire sprinkler contractor. Training shall be provided at the jobsite after completion and approval of the fire sprinkler system. Produce and provide a comprehensive system testing and operations manual prior to the training to be used during the training.

G. Prior to final acceptance, Contractor shall provide NFPA 13 Contractors Material and Test Certificate for Aboveground Piping which shall be completed and provided to the DCFM. Such certificates shall be included in the Contract Documents.
COORDINATION WITH OTHER TRADES

Design Consultant shall coordinate placement of fire sprinkler lines with all trades to eliminate conflicts paying particular attention to structural requirement such as bearing and shear walls. Reflective ceiling plans shall show conflicts with lighting and other architectural, mechanical and plumbing elements.

The Contractor shall be required to coordinate work among the trades to avoid interference with the effectiveness of the fire protection system. Shop drawings shall include elevations of equipment and piping for other trades to assure coordination. Any changes required by field coordination, even after shop drawing review, shall be provided at no additional cost to the University. Fire sprinkler systems shall be designed and constructed to be as unobtrusive as possible being concealed from view or tucked up tight to the adjacent soffit. Contractor shall conduct a pre-installation meeting on site with all trades prior to any installation to discuss requirements and coordinate installation with other trades.

MATERIALS:

DESIGN TEAM SHALL SUBMIT A LIST OF ALL PROPOSED UNDERGROUND AND INTERIOR PIPING, VALVES, ETC FOR APPROVAL BY THE UNIVERSITY REPRESENTATIVE AND THE DCFM.

Underground Piping and Fittings:

Pipe sizes shall be determined by hydraulic calculations for the specific project. Design team shall not use hydraulic information for previous projects unless approved the University Representative and the DCFM.

Internally lined, ductile iron unless otherwise approved by the University Representation and the DCFM.

PVC piping for underground supply piping shall conform to AWWA C900.

Other Piping materials as allowed by NFPA 13 and approved by the University Representative and the DCFM.

Above Grade Piping – All piping shall conform to NFPA, ASTM, ASME and FM Global Standards.

Flanged fittings shall be used at above grade exterior locations.

Riser, cross mains and dry standpipe (where applicable) shall be ASTM A795 Schedule 40 black steel pipe.

Branch line piping shall be ASTM A795 schedule 40 black steel pipe.

All exposed exterior building piping shall be galvanized with galvanized fittings and painted per architectural requirements.

Connections and fittings shall be threaded, flanged, grooved, or welded. Grooveless clamp or saddle fittings are not acceptable. Fittings and couplings shall be Class 125 (standard) weight minimum.
Reducing fittings shall be tapered cast metal products. Where grooved couplings are used, there shall be a separate coupling for each connection to the reducing fitting.

For Residential Occupancies, chlorinated polyvinyl chloride (CPVC) pipe may be used and shall comply with ASTM F442, listed for the use in automatic sprinkler installations and FM approved.

Where solvent cement is used as the pipe and fittings bonding agent for CPVC, sprinklers shall not be installed in the fittings prior to the fittings being cemented in place.

Above Grade Valves- All valves shall conform to NFPA, ASTM, ASME and FM Global Standards.

Gate Valves:

Four-inch pipe size and larger: OS&Y type, iron body, resilient seated 175 psi.

Three-inch pipe size and smaller: OS&Y type, 175 psi bronze gate with solid wedge.

Angle Valves: 175 psi bronze angle valve with screw-in bonnet, integral seat, and renewable disc.

Globe Valves: 175 psi bronze globe valve.

Check Valves: 175 psi iron body, bronze mounted, horizontal swing check valve with bolted bonnet. Check valves shall be designed for replacement of internal parts without removal of valve body from piping. Bosses on each side of clapper shall be drilled and tapped for gauge installation.

Floor control/Butterfly Valves: 175 psi bronze body, stainless steel disc and stem, with integral tamper switch, and geared slow-close mechanism.

Ball valves shall not be used.

Double Check Valve Assembly: A double check backflow preventor shall consist of two independently operating, spring loaded check valves, and bypass assembly. The body shall be manufactured from 300 series stainless steel. The whole assembly with the exception of a Siamese fire department connection shall be painted with Frazee #6155N Monterey Pine green paint. Double check detector shall be Ames Model 3000ss Silver Bullet or approved equal.

Fire Hose Valve (where applicable): Cast Brass, 3” x 2-1/2” straight pattern, fixed brass orifice, rising stem, red hand wheel, brass cap and chain, 300 lb. Rated, UL listed, National Standard Threads. Potter – Roemer, Inc. 4235 or equal.

Fire Department Connections
Provide appropriate sized (four inch or larger, depending on system design) freestanding pipe mount, cast brass FDC (Fire Department Connections) with 2-1/2-inch individually clappered fire department inlet connections with breakable cast iron domed caps, one-inch cast lettering, painted red with Frazee #6355R Cherry paint.

Sprinkler Heads

Acceptable Manufacturers: Reliable, Viking, Tyco or approved equal.

Shall be UL listed or Factory Mutual approved and appropriately selected by the Contractor and shall be approved by the DCFM. Higher temperature ratings shall be applied in intermediate and high classification areas.

At exterior locations provide wax or Teflon-coated sprinkler heads. At corrosive locations provide stainless steel sprinkler heads.

Gauges

Pressure gauges shall be UL listed and labeled, minimum 3-1/2-inch dial, liquid filled type, moisture proof and weather resistant, 0-300 psi scale, five (5) psi increments.

Each pressure gauge shall be fitted with a three-way valve and 1/4-inch threaded test gauge connection.

Sleeves and Escutcheons

Packing: fire-resistive packing compound to achieve rating at least equal to that of the wall or floor penetrated. Annular space between sleeves and piping shall be sealed with UL through-penetration systems #49 (concrete) or #147 (gypsum/stud). Sleeves in floors on grade or exterior walls below grade shall be packed with oakum between pipe and sleeve flush with top of sleeve for floors and with outer surface for walls

Sleeve Material – Identify clearances between interior of sleeves and carrier pipes for review and approval by the University Representative and DCFM.

In concrete slabs and walls: Schedule 40 black steel pipe.

Sleeves through waterproof membranes: Sleeves set in walls and slabs may be either cast iron or steel and shall be provided with a flashing clamp device and corrosion-resistant clamping holes.

Escutcheons: Furnish and install prime-coated steel or chrome finished escutcheons on all exposed pipes passing through walls, floors, ceilings, (except for sprinkler heads) and partitions.

Flow Switches:

Acceptable Manufacturers: Potter or approved equal.
Provide CSFM listed paddle type flow switches with automatic recycle retard and S.P.D.T. contacts.

Tamper Switches

Acceptable Manufacturers: Potter or approved equal.

Provide CSFM listed tamper switches on all control valves. OS&Y switches shall monitor stem movement and shall be complete with mounting J-bolts.

Plug and loop type tamper switches shall require DCFM approval.

Alarm Bells

Provide weatherproof electronic bell with weatherproof back box and bird screen mounted over bell. Potter or approved equal.

Provide signage directly on the bell. Information supplied on the sign shall read “ALARM SOUNDS – CALL 911” or as approved by the University Representative and the DCFM.

The bell shall be located on the face of the protected building adjacent to the FDC with a mounting height of eight to ten feet above finished grade and placed to alert the public of fire condition. Location shall be by the University and DCFM and approved during design and construction.

Provide necessary seismic supports.

Pipe Hangers and Supports

Provide in accordance with referenced standards. All beam clamps shall be fitted with steel retainer straps. Hanger rods of less than 3/8-inch diameter are not permitted.

Piping shall be hung with hangers and supports independent of any other hangers, support systems, or devices. Non-related materials may not be suspended from or attached to sprinkler piping or components.

Powder-driven supports or anchors shall not be used.

Identification Signs:

Provide in accordance with referenced standards and as directed by the DCFM.

Spare Sprinkler Cabinet:

Supply cabinet with a minimum of 12 spare sprinklers (24 for systems exceeding 1000 heads), including at least three of each type and rating; include sprinkler wrenches recommended by manufacturer for each type of sprinkler. Cabinet shall be mounted in a secure location as approved by the University Representative and the Campus Fire Marshal.
FM Approved Test and Drain Assembly: To be located at the main riser and each floor control valve assembly.

Drain shall terminate into a 4” sanitary sewer line.

Supply an air bleed valve at the end of the most remote branch line for all zones

CONNECTION (Site to Building):

Designer Team shall coordinate work with civil, electrical, plumbing and landscape consultants.

Contractor shall coordinate placement of fire sprinkler system with subcontractors.

INSTALLATION:

General

Installation shall not be started until the Submittals are approved by the University Representative and the DCFM.

Installation of each system shall be installed according to applicable codes and standards including Div. 1 of the Contract Documents.

Clean and de-burr all piping. Keep fittings and interiors of piping clean throughout installation. Provide caps on ends of cleaned piping.

All piping shall be installed plumb with offset fittings used where alignment adjustment is necessary.

Unions may be used for piping up to 2” and at in exposed locations.

All field welded piping and assemblies must be inspected by the University Representative and the DCFM prior to installation.

On-site ‘Hot Work’ permits shall be obtained from the University prior to commencing any welding, soldering or grinding work.

All piping shall be installed to permit thorough draining. Auxiliary drains shall be installed with the lowest fire sprinkler head underneath stairways. Auxiliary drains shall be installed where there is trapped water over 5 gals.

All piping that penetrates fire rated construction shall be firestopped in accordance with the Contract Documents.

Design team shall coordinate location of proposed fire sprinkler pipes with Structural and MEP disciplines to ensure placement will not be in conflict MEP piping and structural elements.

Contractor shall be required to show layout of proposed utilities and restrictions on structural elements prior to installation of utilities to ensure all can be installed correctly and within these guidelines.

All exposed system elements shall be painted per architectural requirements.

Piping Accessories and Equipment Installation:
Underground Piping

All bolts, nuts, washers and rodding used for the installation of underground piping, valves and fittings from the riser flange back to, and including, all parts of the water main tap shall be coated with non fibered emulsion type “Henry’s 208” or equal after tightening then wrapped with 10 mil polyethylene sheeting. The above materials shall be left visible for inspection by the University Representative and the DCFM prior to backfilling. Ferrous material should not be in direct contact with concrete thrust blocks.

When tapping into the water mainline, provide a ductile iron, flanged tee with shut off valves to isolate the system.

Underground piping shall terminate in a flanged fitting 6 inches above finished floor

Piping shall have a minimum cover of 36 inches under driveways, fire lanes, roads, street, and in open areas. Cover shall be measured from finished grade to top of pipe. Provide sand bedding around the pipe. Place proper locator tape on top of the sand and 12 inches below finished grade.

Continuous tracer wire shall be wrapped and taped to non-metallic piping at maximum 20 foot intervals.

When the system riser is close to a foundation or footing, underground fittings of proper length shall be used to avoid pipe joints located in or under the wall or footing. When the connection passes through a foundation or footing below grade, a one to three inch clearance shall be provided around the pipe, and the clear space filled with asphalt mastic or similar flexible waterproofing material at the ends.

All completed underground work is to be tested in accordance with referenced standards; the Contractor shall complete a NFPA 24 Contractor’s Material and Test Certificate for Private Fire Service Mains and provide it to the DCFM.

PVC piping conforming to AWWA C900 for underground supply piping shall transition to ferrous piping conforming to AWWA C200, C108, or C104. The transition from PVC to ferrous pipe shall be accomplished at the following locations with the following clearances:

- A minimum distance of five feet from a 90° elbow designed to supply a sprinkler riser.
- A minimum distance of five feet from the underground elbows on the supply and service side of an above ground exterior check valve and other above grade exposed piping, fittings, connections or valves.
- A minimum distance of five feet before entering a building.
- A minimum distance of five feet is required prior to passing under or through a footing or retaining wall.

Threaded Pipe and Fittings
Remove all fins and burrs; apply sealant to male threads only.

All pendent heads shall be installed with a return bend, all branch lines shall be installed with a sprig up where applicable.

‘U’ bolt style saddles will not be allowed.

Valves

Check valves shall not be buried. Check valves shall be unobstructed and readily accessible for repair and replacement.

Underground piping of FDC shall be wet pipe under system pressure with check valve at FDC.

Test and drain valves shall be installed in conveniently accessible locations. Discharge shall be to an approved sanitary sewer or as approved by the University Representative and the DCFM.

Install valves to isolate each floor.

Identification Signs:

Install in accordance with NFPA 13 and as directed by the University Representative and the DCFM.

Pipe Hangers:

Install in accordance with NFPA 13. Retainer straps shall be used with all beam clamps and dissimilar materials shall be isolated from each other. Use of hangers can only be used if they are listed for the use.

Gauges:

A pressure gauge with a connection not smaller than ¼ in. shall be installed at the system main drain, at each main drain associated with a floor control valve, and on the inlet and outlet side of each pressure reducing valve.

Water flow and Tamper Switches:

Install water flow switches to monitor by building and floor. Install tamper switches on all control valves.

Fire Department Connection (FDC):

FDC shall be located not less than 25 feet from the buildings and preferably along designated fire access roads. Where conditions do not permit, the FDC shall be placed where readily accessible in case of fire and not liable to injury or fire exposure. All FDC locations shall be approved by the University Representative and the DCFM. FDC shall front the street of primary fire department vehicular access and shall be located within 25 feet of a fire hydrant. FDC inlets shall be located 30 to 36 inches above grade on street front and as measured at all inlets. Where FDC is subjected to damage, protection shall be
provided. The means of protection shall be approved and shall be arranged in a manner which will not interfere with the connection to inlets. Place FDC a min. of 30 inches behind back of curb. Provide solid protection if FDC is placed closure. Maintain a 36-inch clear radius around the FDC. Grade variation within this radius shall not exceed 1:12. The FDC shall be arranged so that hose lines can be readily and conveniently attached to inlets without interference from any nearby objects including buildings, fences, posts, or other FDC. The FDC shall be clearly visible from the street and provided with identification sign as approved by the University Representative and DCFM.

Sprinkler Heads:

All sprinkler heads installed below 7’ above finished floor or where subjected to potential damage shall be provided with a guard or cage.

Sleeves and Escutcheons:

Provide sleeves for all pipes passing through slabs, concrete walls, and lath and plaster ceilings (except drop nipples for heads) and partitions. Sleeves shall extend three inches above floors and be flush with walls, ceilings, and partitions. In concrete construction, sleeves shall be set in forms prior to pour. Clearance between sleeves and pipes shall be one-inch for pipes through 3-1/2-inches, two-inch for pipe sizes 4-inches and greater, and three-inch for seismic joints.

Packing:

For sleeves set in fire walls and floors, caulk space between pipe and sleeve with flexible caulking. Sleeves at seismic joints shall not be packed unless associated with a fire rated wall, partition, floor or floor ceiling assembly.

Earthquake Restraints:

Install per NFPA 13 and list locations on the contract documents.

TESTING:

All tests described and referenced in these standards shall be performed by the Contractor in the presence of the DCFM and the University’s Representative. Tests and inspections shall apply to all fire protection systems, including fire hydrants, sprinklers, standpipes, and all underground piping that is installed to supply these systems and devices.

All piping shall be hydrostatic-pressure tested in accordance with the following standards:

Sprinkler Piping: CBC and NFPA 13.


Standpipe Piping: NFPA 14.

Hydrostatic Test Preparation:
All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi or 50 psi in excess of the system working pressure, whichever is greater, and shall maintain that pressure without loss for 2 hours.

Underground piping shall be center loaded and all fittings, joints, strapping, and thrust blocking shall be exposed for hydrostatic pressure testing and inspection by the University Representative and the DCFM.

All above grade and interior piping, fittings, sprinkler heads and supports shall be exposed for inspections and hydrostatic testing.

A hydrostatic pre-test shall be conducted for both aboveground and underground piping prior to requesting the final acceptance test. Written confirmation of passed 100% pre-test shall be given to the Inspector of Record (IOR) prior to calling for final. All cost associated with delays caused by failure, to complete 100% operational pre-test shall be borne by the contractor. A Contractor’s Material and Test Certificate for ‘Above Ground Piping’ shall be filled out upon completion of testing per NFPA 13.

FDC and piping shall be included in hydrostatic testing and shall be back flushed until clear water is observed.

Underground mains and supply connections to sprinkler risers shall be flushed thoroughly before connections to sprinkler systems.

Tests of drainage facilities shall be conducted by opening each drain valve while the system control valves are open to the supply.

All water level sensors, alarm and supervisory signals, tanks and automatic valves shall be performance tested.

Water remaining in normally dry piping shall be drained at completion of testing.

PAINTING

Fire Sprinkler System - All exposed fire sprinkler system piping inclusive of fire connections, double check valve assemblies, shall be painted. Consult with University Representative and the DCFM for colors. Coordinated fire sprinkler painting requirements with technical painting specification.

Valve hand wheels - shall be painted ‘Cherry’, Frazee #6355.

FDC - painted red with Frazee #6355R Cherry paint

Fire Hydrant – Primed and painted with two coats of Chrome Yellow by Everguard, Plastic Enamel Visibility Yellow #5506, #719 Safety Yellow by Ameritone.

Double Detector Check Valve Assembly - #6355R (LH) Monterey Pine by Frazee

IDENTIFICATION

Provide identification of fire sprinkler system piping, FDC, valves, riser rooms and equipment to meet the requirements of referenced standards, codes and as directed by the University Representative and the DCFM.