JOINT BASE LEWIS – McCHORD DESIGN STANDARDS

SECTION 21 13 17.00 10 – DRY PIPE SPRINKLER SYSTEM, FIRE PROTECTION

Design Requirements

a. The governing primary code document is UFC 3-600-01; the secondary governing code document is applicable chapters of the NFPA 13.
b. All designs shall be reviewed by the Joint Base Lewis-McChord Public Works life safety systems manager and approved by Joint Base Lewis-McChord Public Works. All new construction installations, remodel and retrofit work requires inspection and acceptance by the Joint Base Lewis-McChord Public Works. All acceptance testing shall be coordinated with the Fire Prevention and Inspection Branch of the DES and the Joint Base Lewis-McChord Emergency Command Center to ensure availability of personnel to support operational testing.
c. Final acceptance testing must be scheduled 7 to 10 days prior to day of testing.
d. New pipe schedule designed systems are not acceptable, all new systems shall be hydraulically designed.
e. Plastic pipe is only acceptable in residential occupancies. However, plastic pipe is discouraged for use in any application given the military environment it is subjected to, and is not allowed when exposed and subjected to physical damage.
f. All system valves require tamper switches, excluding post indicator valves.
g. Back Flow Preventers require testing by a Washington State certified BPA tester. The tester shall complete and submit the required Joint Base Lewis-McChord BPA form linked to this design standard. The BPA shall be installed by a certified, licensed installer. Reduced pressure BPA's are not acceptable. Flushing the BPA is required after installation. Acceptable backflow preventers are listed on the Washington Dept. of Health approved backflow preventer list. The backflow preventer specific make, model, design, size, and approved installed orientation must match the approved list.
h. Residential sprinklers and intermediate level rack sprinklers shall be fast response type.
i. All designs shall be reviewed, approved, stamped, and signed by the Fire Protection Specialist prior to submitting for government approval.
j. Preliminary and Final Acceptance Testing shall be witnessed by the Fire Protection Specialist. The USACE representative and/or DPW representatives shall be invited to attend and witness, but are not required to be present.
k. The Joint Base Lewis-McChord Public Works Water and Sewer department shall be invited to witness all pipe flushing (above and below ground).
l. Underground pipe work will be performed by a State of Washington Level U Certificate of Competency underground contractor IAW WAC 212-80-093.
m. All drain valves require plugs or caps downstream of the drain valve.
n. Sprinkler systems are required to have a dedicated water supply feed pipe from the water main. Tapping into the fire suppression system water main to supply the building with domestic water is not acceptable. Supplying the fire sprinkler system from the domestic water feed is not acceptable.
o. All as-built drawings, test certificates, maintenance and repair manuals, and related system documentation shall be provided to JBLM DPW.
p. Heat tape, heat cable, and heat tracing are not allowed for any

application. All wet pipe systems including standpipes shall be in the interior of buildings and/or within heated enclosures.

q. Use only like materials on a sprinkler system, do not mix materials.
r. All metal pipe shall be a minimum of Schedule 40 regardless of CRR. Any pipe less than schedule 40 is not acceptable on JBLM.
s. All fire sprinkler system materials shall be domestically manufactured.
t. For dry pipe systems, install electric bell as secondary notification device.
u. The only color allowed for fire suppression pipe and related equipment is red.
v. For dry systems use belt-less and oil-less air compressors.
w. All fire sprinkler systems shall have line pressure gauges at riser for each system.
x. In new construction facilities, locate fire sprinkler risers in a separate riser room or mechanical room both having direct access from the exterior of the building, and located so it is accessible to DPW without entering secured areas. In renovation projects, locating a sprinkler riser inside a riser room is preferred, if the sprinkler riser is located in the open area of the building it must be enclosed inside a lockable cage to protect it from damage and tampering. Bollards may also be necessary in warehouse facilities.

DRY PIPE SPRINKLER SYSTEM, FIRE PROTECTION
07/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. Unless a specific document version or date is indicated, use criteria from the most current reference as of the date of solicitation or if amended, date of solicitation amendment.

AMERICAN SOCIETY OF CIVIL ENGINEERS

ASCE 7	Minimum Design Loads for Buildings and Other Structures

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B40.100	(2013) Pressure Gauges and Gauge Attachments

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1015	Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084	Standard Methods for the Examination of Water and Wastewater
AWWA B300	Hypochlorites
AWWA B301	Liquid Chlorine
AWWA C104/A21.4	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151/A21.51	Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

AWWA C500	Metal-Seated Gate Valves for Water Supply Service
AWWA C606	Grooved and Shouldered Joints
AWWA C651	Disinfecting Water Mains
AWWA C652	Disinfection of Water-Storage Facilities

ASME INTERNATIONAL (ASME)

ASME B16.1	Gray Iron Pipe Flanges and Flanges Fittings: Classes 25, 125, and 250
ASME B16.11	Forged Fittings, Socket-Welding and Threaded
ASME B16.21	Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.39	Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300
ASME B16.4	Gray Iron Threaded Fittings: Classes 125 and 250
ASME B16.5	Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 2
ASME B16.9	Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.2	Nuts for General Applications: machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A 135/A 135M	Standard Specification for Electric-Resistance-Welded Steel Pipe
ASTM A 183	Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A 449	Standard Specifications for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A 47/A 47M	Standard Specification for Ferritic Malleable Iron Castings
ASTM A 53/A 53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and

	Seamless
ASTM A 536	Standard Specification for Ductile Iron Castings
ASTM A 795/A 795M	Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM F 436	Standard Specification for Hardened Steel Washers

FM GLOBAL (FM)

FM P7825a	Factory Mutual Research Approval Guide - Fire Protection
FM P7825b	Factory Mutual Research Approval Guide - Electrical Equipment
FM APP GUIDE	Approval Guide http://www.approvalguide.com/

INTERNATIONAL BUILDING CODES

IBC	International Building Code

Joint Base Lewis - McChord

JBLM Design Standards	http://www.lewis-Mcchord.army.mil/designstandards/index1.htm

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
MSS SP-71	Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-80	Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	Installation of Sprinkler Systems
NFPA 13R	Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height
NFPA 20	Standard for the Installation of Stationary Pumps for Fire Protection
NFPA 24	Standard for the Installation of Private Fire Service Mains and Their Appurtenances

NFPA 101	Life Safety Code
NFPA 291	Recommended Practice for Fire Flow Testing and Marking of Hydrants
NFPA 1963	Standard for Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL 262	Gate Valves for Fire-Protection Service
UL 668	Hose Valves for Fire Protection Service
UL Directory A	Building Materials Directory
UL Directory B	Fire Protection Equipment Directory

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	Structural Engineering
UFC 3-310-04	Seismic Design of Buildings
UFC 3-600-01	Fire Protection Engineering for Facilities
UFC 3-601-02	Operations and Maintenance: Inspection, Testing, and Maintenance of Fire Protection Systems

1.2 GENERAL REQUIREMENTS

a. Dry pipe sprinkler system shall be provided in areas indicated on the drawings or contained in the project's "Scope of Work" or "Statement of Work". The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with UFC 3-600-01, JBLM Design Standards, NFPA 13, and NFPA 13R. Pipe sizes which are not indicated on the drawings shall be determined by hydraulic calculation. Gridded systems shall not be used. The Contractor shall design any portion of the sprinkler system that are not indicated on the drawings including locating sprinklers, piping, and equipment, and size piping and equipment when this information is not indicated on the drawings or is not specified herein. The design of the sprinkler system shall be based on hydraulic calculations, and the other provisions specified herein.

b. Fire sprinkler system shall be a designated seismic system in accordance with IBC and ASCE 7. Importance factor Ip shall be equal to 1.5. Provide seismic protection for equipment in accordance with Section 26 05 48.00

10, UFC 3-600-01, JBLM Design Standards, NFPA 13, and IBC. Provide special inspections in accordance with Section 01 45 35 CODE REQUIRED SPECIAL INSPECTIONS, STRUCTURAL OBSERVATIONS, TESTS AND PROCEDURES. Provide designated seismic system certification for the Fire sprinkler system components listed in this section in accordance with ASCE 7. Comply with all applicable Special Inspector of Record requirements of UFC 3-301-01.

c. All water discharged from the inspector's test valves and drains in addition to water discharged during hydrant flow testing and full forward flow testing of the backflow preventer are subject to compliance with JBLM EPA issued Municipal Separate Storm Sewer (MS4) Permit and JBLM 200-3 for requirements for dechlorinization.

1.2.1 Multistory Buildings

Provide floor control valve assemblies for each respective floor of the building. Each sprinkler system floor control valve assembly shall consist of a control valve, dry pipe valve, air maintenance device, Nitrogen Generation System, check valve, pressure gauges, and a main drain valve.

1.2.2 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density over the hydraulically most demanding area indicated on the drawings. If design criteria is not provided on the drawings, the sprinkler system design shall be in accordance with UFC 3-600-01, NFPA 13, or NFPA 13R, whichever is more stringent. Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13. Water velocity in the piping shall not exceed 20 ft/s.

1.2.2.1 Hose Demand

An allowance for exterior hose streams shall be as indicated on the drawings. If hose stream demands are not provided on the drawings, the hose stream demands shall be in accordance with UFC 3-600-01 or NFPA 13, whichever is more stringent. Hose stream demands for Residential occupancy shall be 250 gpm. Hose stream demands shall be added to the sprinkler system demand at the fire hydrant shown on the drawings closest to the point where the water service enters the building or at the point of connection to the existing system, whichever is applicable. An allowance for interior hose stations shall be as indicated on the drawings and shall also be added to the sprinkler system demand.

1.2.2.2 Basis of Calculations

The design of the system shall be based upon a water supply with a static pressure and flow at the residual pressure indicated on the drawings or contained in a hydrant Flow Test Report provided by the Fire Protection Specialist. Water supply shall be presumed available at the point of connection to the existing system. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, and 100 for existing underground piping. Additionally, hydraulic calculations shall be based on operation of the fire pump(s) provided in Section 21 30 00 FIRE PUMPS.

1.2.3 Sprinkler Coverage

Sprinklers shall be uniformly spaced on branch lines. In buildings protected by automatic sprinklers, sprinklers shall provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms, boiler rooms, switchgear rooms, elevator machine/mechanical rooms, transformer rooms, and other electrical and mechanical spaces. Coverage per sprinkler shall be in accordance with NFPA 13, but shall not exceed 100 square feet for Extra Hazard or Storage occupancies, 130 square feet for Ordinary Hazard occupancies, and 225 square feet for Light Hazard occupancies. Exceptions are as follows:

1) Sprinklers may be omitted from small rooms which are exempted for specific occupancies in accordance with NFPA 101 and UFC 3-600-01.

1.2.4 System Volume Limitations

Where the volume of any individual system piping volume exceeds 500 gallons the dry pipe valve shall be provided with a quick-opening device. The maximum system capacity controlled by one dry pipe valve shall not exceed 750 gallons. The calculated volume of each system shall be indicated on the Sprinkler System Shop Drawings adjacent to the riser detail.

1.3 COORDINATION OF TRADES

Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinklers shall be installed over and under ducts, piping and platforms when such equipment exceeding 48 inches in width. These obstructions can negatively affect or disrupt the sprinkler discharge pattern and coverage.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, sunlight, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval information only. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Shop drawings, manufacturer's catalog data, sway brace calculations, hydraulic calculations, preliminary system test procedures, final system test procedures, and contractor certifications, must be reviewed, approved, stamped, and signed by the Fire Protection Specialist prior to submitting for government approval per UFC 3-600-01.

SD-02 Shop Drawings

Shop Drawings; G

Submit two hard copies and one electronic (.pdf) version of the Sprinkler System Shop Drawings, no later than 21 days prior to the start of the Sprinkler System installation.

SD-03 Product Data

Materials and Equipment; G

The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, a complete table of contents that includes equipment description and model number shall be provided. Catalog data sheets shall also indicate U.L. Listing / FM approval and the country of manufacture.

Fire Protection Specialist Review Letter for Equipment Submittals; G

Graphic Map; G

Graphic maps, include representation of the graphic map to be providing locations of all drains and valves.

Preliminary Tests Procedures; G

Proposed procedures for Preliminary Acceptance Testing shall be approved by the government at least 14 days prior to the proposed start of the tests. Proposed date and time to begin Preliminary Acceptance Testing, shall be submitted with the Preliminary Acceptance Testing Procedures. Contractor to coordinate all tests with the Fire Protection Specialist and the USACE representative and/or the DPW representative.

Final Acceptance Test Procedures; G

Proposed procedures for Final Acceptance Testing shall be approved by the government, no later than 14 days prior to the proposed start of the tests. Proposed date and time to begin Final Acceptance Testing, shall be submitted with the Final Acceptance Testing Procedures. Contractor to coordinate all tests with the Fire Protection Specialist and the USACE representative and/or the DPW representative.

SD-05 Design Data

Flow Test Data; G

Sway Brace Details and Calculations; G

Details and load calculations shall be provided for sizing of sway bracing.

Hydraulic Calculations; G

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

SD-06 Test Reports

Preliminary Acceptance Testing Report; G

Electronic copies (.pdf) of the completed Preliminary Accetance Testing Report, no later than 14 days after the completion of the Preliminary Tests.

Fire Protection Specialist Preliminary Acceptance Testing Report; G

Final Acceptance Testing Report; G

Electronic copies (.pdf) of the completed Final Acceptance Testing Reports, no later than 14 days after the completion of the Final Acceptance Tests.

SD-07 Certificates

Fire Protection Specialist Certification; G

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system drawings and hydraulic calculations.

Final Acceptance Testing Certification Letter by Fire Protection Specialist; G

Qualifications of Welders; G

Qualifications of Installer; G

The name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

Certificates of qualifications, as specified; G

Seismic Certification of Dedicated Seismic Systems; G

State of Washington Certificate of Competency; G

Provide a State of Washington Certificate of Competency for any individual, business, or firm engaged in the inspecting, designing, testing, maintaining or servicing of fire and life safety systems.

SD-09 Field Reports

Inspections by Fire Protection Specialist; G

SD-10 Operation and Maintenance Data

Operation and Maintenance Instructions; G

Submit two hard copies and one electronic (.pdf) version of manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training.

SD-11 Closeout Submittals

As-Built Drawings

As-built shop drawings, at least 14 days after completion of the Final Tests. The Sprinkler System Drawings shall be updated to reflect as-built conditions after all related work is completed. Provide electronic drawings in AutoCAD format on a CD.

Warranty Letter

Spare Parts

A stock of spare sprinklers and head wrenches in accordance with the quantities defined in NFPA 13 shall be provided in a spare sprinkler cabinet that resides at the sprinkler riser.

Operation and Maintenance (O&M) Instructions; G

Instruction of Government Employees

On-site Training; G

After final system acceptance testing has been approved by the government, propose an On-site Training schedule along with proposed date and time at least 14 days prior to the proposed start of On-site Training.

1.6.1 Combined Submittals

The Shop Drawings, Materials and Equipment, Sway Bracing and Hydraulic Calculations shall be submitted in the same package so they can be reviewed at the same time.

1.7 HYDRAULIC CALCULATIONS

Hydraulic calculation procedures shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design criteria shown on the drawings or if design criteria is not provided on the drawings, the design criteria provided in UFC 3-600-01 and NFPA 13, whichever is more stringent. Calculations that uses typical k-factors for typical branch lines, sprigs (stub-ups), or drops is not acceptable. Calculations shall be based on the water supply data provided by the Fire Protection Specialist. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet indicating sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows

shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. If the submittal shop drawings cannot clearly identify hydraulic reference points (nodes) and remote areas, a drawing showing hydraulic reference points and pipe designations used in the calculations shall be included that is independent of shop drawings.

1.8 FIRE PROTECTION SPECIALIST (QUALIFIED FIRE PROTECTION ENGINEER)

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist (Qualified Fire Protection Engineer). The Fire Protection Specialist shall be an individual who is a registered professional engineer in the State of Washington and has NCEES licensing. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months. Any individual, business, or firm engaged in the inspecting, testing, maintaining, designing, or servicing of fire and life safety systems and equipment shall be certified to perform these activities in accordance with the State of Washington. The Fire Protection Specialist shall not be a part of the specialty subcontractor design team and shall have no business relationships (owner, partner, operating officer, distributor, salesman or technical representative) with any construction subcontractors involved with the project or with any fire protection equipment device manufacturers, suppliers or installers for any such equipment provided as part of this project.

1.9 QUALIFICATIONS OF INSTALLER

The contractor performing the Sprinkler System work shall be licensed to perform this type of work in the State of Washington in accordance with UFC 3-601-02 and hold a State of Washington "Certificate of Competency".

1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Interpret reference to "Authority Having Jurisdiction" to mean JBLM Public Works Life Safety Systems Manager.

1.11 SHOP DRAWINGS

The Sprinkler System Shop Drawings shall conform to the requirements established for "Working Plans" as prescribed in NFPA 13. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Submitted shop drawing size shall be ISO A1 (22x34).

b. Each submittal drawing shall bear the NICET stamp, designer's signature, and date of the signature. Submittal drawings not having this information will be returned without review by the Fire Protection Specialist.

c. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

d. Floor plans drawn to a scale not less than 1/8" = 1'-0" which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of reducing couplings, and welded joints shall be indicated.

e. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines, from end sprinklers to adjacent walls, from walls to branch lines, from sprinkler feed mains, cross-mains and branch lines to finished floors, roofs, and ceilings. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

f. Gridlines horizontally and vertically shall be provided as part of the backgrounds.

g. When the floor plan exceeds a single drawing, match lines shall be provided that indicate on which sheet the building continues.

h. When the floor plan exceeds a single drawing, a key plan shall also be provided that identifies which portion of the building is provided on that drawing and which drawings are used for other portions of the building.

i. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

j. Details of each type of riser assembly, each pipe hanger, each means of branch line restraint, restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

k. For all trapeze hangars, provide a table indicating the size of the pipe to be supported, size and type of the trapeze member, section modulus of the trapeze member, distance from the structure to pipe being supported (A and B dimensions), and the section modulus required.

l. Details for each sway brace configuration, orientation, angle, and structural connection along with calculations. The maximum L/R ratio shall be 200. The "total Calculated Load" divided by the "Allowable Load per Fastener" shall not exceed a maximum value of 0.90. A single sway brace calculation depicting a "worst case" calculation will not be acceptable.

1.12 QUALITY ASSURANCE

1.12.1 Qualifications of Welders

Submit certificates of each welder's qualifications prior to site welding; certifications shall not be more than one year old.

1.13 FIRE RISER AREA

If a fire suppression sprinkler riser is located within a facility and is not in a mechanical room or dedicated fire protection room, the riser shall be installed in a fenced enclosure adjacent to an exterior man door with access gate and means of locking (padlock) to prevent access by building occupants to valves and controls. DPW will provide padlock. Do not locate valves and controls in stairwells.

1.14 DRY PIPE SYSTEM RESETTING INSTRUCTIONS

Provide instructions that are printed on white bond paper, laminated, and securely mounted to each dry system riser using an approved method for permanent mounting. The instructions shall indicate step-by-step procedures for resetting of the dry pipe riser including step-by=step procedures for resetting of any installed accelerators, air maintenance device, and Nitrogen Generation System for use by DPW personnel in an emergency situation.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be domestically made and standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b. Submit manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. Manufacturer's catalog data shall be current and shall not indicate products that have been superseded or products that no longer are manufactured.

2.4 UNDERGROUND PIPING COMPONENTS

2.4.1 Pipe

Provide outside-coated, cement mortar-lined, Class 52 ductile-iron pipe with a rated working pressure rating of Class 125 of 175 p.s.i. conforming to

NFPA 24 for piping under the building and less than 5 feet outside of the building walls. Piping with a working pressure exceeding 175 p.s.i. shall be Class 250 having a minimum rated working pressure of 300 p.s.i. Minimum pipe size for UFC 3-600-01 and NFPA 13 systems shall be 6 inches. Minimum pipe size for NFPA 13D and NFPA 13R systems shall be 4 inches. Piping more than 5 feet outside of the building walls shall be outside coated, AWWA C104/A21.4 cement mortar-lined, AWWA C151/A21.51 ductile-iron pipe, and AWWA C110/A21.10 fittings conforming to NFPA 24 or provided under Section 33 11 00 WATER DISTRIBUTION.

2.4.2 Fittings and Gaskets

Flanged elbows or bends (straight sizes), tees, crosses, concentric reducers, base elbows (except reducing size) and bottom base tees shall be Class 125 ductile iron conforming to AWWA C110/A21.10. Fittings with a working pressure exceeding 175 p.s.i. shall be Class 250 having a minimum rated working pressure of 300 p.s.i. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111/A21.11.

2.4.3 Valves and Valve Boxes

Valves shall be gate valves conforming to AWWA C500 or UL 262. Valves shall have cast-iron body and bronze trim. Valve shall open by counterclockwise rotation. Except for post indicator valves, all underground valves shall be provided with an adjustable cast-iron or ductile iron valve box of a size suitable for the valve on which the box is to be used, but not less than 5.25 inches in diameter. The box shall be coated with bituminous coating. A cast-iron or ductile-iron cover with the word "WATER" cast on the cover shall be provided for each box.

2.4.4 Gate Valve and Indicator Posts

Gate valves for underground installation shall be of the inside screw type with counter-clockwise rotation to open. Where indicating type valves are shown or required, indicating valves shall be gate valves with an approved indicator post of a length to permit the top of the post to be located 3 feet above finished grade. Gate valves for use with indicator post shall conform to UL 262. Indictor post shall conform to UL 789. Provide each indicator post with one coat of primer and two coats of red enamel paint.

2.4.5 Buried Utility Warning and Identification Tape

Detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping shall be provided for all buried piping. Tape shall be detectable by an electronic detection instrument. Tape shall be provided in rolls, 3 inches minimum width, color-coded for the utility involved and imprinted in bold black letters continuously and repeatedly over the entire tape length. Warning and identification shall be "CAUTION BURIED WATER PIPING BELOW" or similar wording. Code and lettering shall be permanent and unaffected by moisture and other substances contained in the trench backfill material. Tape shall be buried at a depth of 12 inches below the top surface of earth or the top surface of the subgrade under pavement.

2.5 ABOVEGROUND PIPING COMPONENTS

Aboveground piping shall be steel for NFPA 13 and NFPA 13R designs.

2.5.1 Steel Piping Components

2.5.1.1 Steel Pipe

Except as modified herein, Steel Pipe shall be black with a working pressure rating of Class 125 of 175 p.s.i. as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A 795/A 795M, ASTM A 53/A 53M, or ASTM A 135/A 135M. Piping with a working pressure exceeding 175 p.s.i. shall be Class 250 having a minimum rated working pressure of 300 p.s.i. Pipe in which threads are cut, grooves are cut, grooves are rolled formed, or flanges are installed shall be Schedule 40, except Schedule 30 piping is allowed for sizes 8 inches and greater in diameter. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.5.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be Class 125 with a minimum working pressure rating of 175 p.s.i. and shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Fittings with a working pressure exceeding 175 p.s.i. shall be Class 250 having a minimum rated working pressure of 300 p.s.i. Steel press fittings shall be approved for fire protection systems. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.5.1.3 Grooved Mechanical Joints and Fittings

Joints an fittings shall be Class 125 with a minimum working pressure rating of 175 p.s.i. and shall be the product of the same manufacturer along with the grooving tools. Fittings with a working pressure exceeding 175 p.s.i. shall be Class 250 having a minimum rated working pressure of 300 p.s.i. Segmentally welded fittings shall not be used. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510, and ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.5.1.4 Flanges

Class 150 Flanges shall conform to NFPA 13 and ASME B16.1. Flanges with a working pressure exceeding 175 p.s.i. shall be Class 250 having a minimum rated working pressure of 300 p.s.i.

2.5.1.5 Gaskets

Gaskets shall be AWWA C111/A21.11, cloth inserted red rubber or non-asbestos compressed material in accordance with ASME B16.21, 1/16" thick, and full face or self-centering flat ring type.

2.5.1.6 Bolts

Bolts shall be ASTM A 449, Type 1 or 2, Grade 5. Bolts shall extend no less

than three full threads beyond the nut with Bolts tightened to the required torque.

2.5.1.7 Nuts

Nuts shall be ASTM A 193/A 193M or ASTM A 194/A 194M, Grade 5.

2.5.1.8 Washers

Washers shall meet the requirements of ASTM F 436. Flat circular Washers shall be provided under all bolt heads and nuts.

2.5.2 Pipe Hangers and Supports

Pipe Hangers and supports shall meet MSS SP-58 and MSS SP-69 requirements and shall be listed in UL Fire Prot Dir, FM P7825a, and FM P7825b for fire protection use. Pipe Hangers and Supports shall be adjustable and of the type suitable for the application, construction, and pipe type and sized to be supported. Finish of rods, nuts, washers, hangers, and supports shall be zinc-plated after fabrication.

2.5.3 Valves

Valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire protection service. Valves shall have flange, grooved, or threaded end connections.

2.5.3.1 Control Valves and Gate Valves

Manually operated sprinkler control valve may be butterfly style with an integral tamper switch or gates valve style with an externally mounted tamper switch. Gate valve shall be outside stem and yoke (OS&Y) type, counter clock wise opening, and shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b.

2.5.3.2 Check Valves

Check Valves 2 inches and larger shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. Check Valves 4 inches and larger shall be of the swing type with flanged or grooved cast iron body, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.5.3.3 Hose Valves

Hose Valves shall comply with UL 668 and shall have a minimum rating of 300 psi. Hose Valves shall be non-rising stem, all bronze, 90 degree angle or straight pattern type, with 2-1/2 inch American National Standard Fire Hose Screw Thread (NH) male outlet in accordance with NFPA 1963. Hose Valves shall be equipped with 2-1/2 inch lugged cap, cap, gasket, and chain. Valve finish shall be polished brass or rough chrome plated.

2.5.5.4 Pressure Reducing Valves

Pressure Reducing Valves shall be factory-assembled and fully trimmed for pressure control that can be installed in either the horizontal or vertical position. Pressure Reducing Valves shall be used on water filled pipe where it is necessary to reduce a higher inlet pressure to a lower delivery

pressure under static and/or residual flowing conditions. Pressure Reducing Valves shall automatically maintain the outlet "set pressure" (static and residual) within a close range, regardless of fluctuations in the higher pressure inlet line or varying flow rates. Pressure Reducing Valves shall be field settable between 80 p.s.i. and 225 p.s.i. Pressure Reducing Valve bodies shall be provided with flanged or grooved ends. The valve body and diaphragm cover shall be ductile iron meeting ASTM A536-77, Grade 65-45-12. The diaphragm shall be nylon fabric-reinforced natural rubber with the Pilot Valve, Strainer, tube, fitting, and needles valve being brass and stainless steel.

2.6 DRY PIPE VALVE ASSEMBLY

The Dry Pipe Valve Assembly shall be a latching differential type listed in UL Fire Prot Dir or FM P7825a and FM P7825b and shall be complete with trim piping, valves, fittings, pressure gauges, priming water fill cup, velocity drip check, drip cup, and other ancillary components as required for proper operation. The Dry Pipe Valve Assembly shall include a quick-opening device by the same manufacturer as the Dry Pipe Valve Assembly for systems over 500 gallons in capacity.

2.7 NITROGEN GENERATION SYSTEM

Nitrogen Generation System shall be in accordance with UFC 3-600-01 and NFPA 13. Provide a Nitrogen Generation System that is capable of delivering a minimum of 98 percent nitrogen throughout all of the system piping within 14 days from the commencement of the inerting process. The Nitrogen Generation System must be self-contained with "drop-in" operability with a simple one step direct connection of the nitrogen gas supply line to each zone. The use of stand-alone compressed nitrogen bottle system is not permitted. A process that involves continuous venting of the piping network is not permitted. Design the Nitrogen Generation System so all equipment is installed within the confines of the riser room with the exception of the Nitrogen Purge Valve Assembly. The Nitrogen Generation system shall be sized to pressurize the largest dry pipe sprinkler system within 30 minutes.

2.7.1 Nitrogen Generation

Nitrogen Generation shall be beltless single stage oil-free type with a single point power connection. The Nitrogen Generation shall consist of a control panel that does not require software or programming with a LED display for a fully automatic system. The Nitrogen Generation system shall also consist of a safety relief valves, automatic drains, gauges, a minimum 10 gallon compressed air storage tank, a minimum 10 gallon nitrogen storage tank, shutoff valve, Form C dry contacts for trouble connection to the building Fire Alarm System, and pressure switch for automatic starting and stopping. The compressed air system shall be factory set to operate between approximately 80 p.s.i. to approximately 100 p.s.i. The compressed nitrogen system shall be factory set to operate between approximately 60 p.s.i. to approximately 80 p.s.i.

2.7.2 Nitrogen Pressure Maintenance Device

Nitrogen Pressure Maintenance Device shall be a pressure regulator that automatically reduces supply nitrogen to provide the pressure required to be maintained in the piping system. The device shall have a cast bronze body

and valve housing complete with diaphragm assembly, spring, filter, ball check to prevent backflow, 1/16 inch restriction to prevent rapid pressurization of the system, and adjustment screw. The device shall be capable of reducing an inlet pressure of up to 100 psig to a fixed outlet pressure adjustable to 10 psig.

2.7.3 Nitrogen Supply Piping System

System shall be configured so that each dry pipe system is equipped with a separate air maintenance device, shutoff valve, bypass valve, and pressure gauge. Piping shall be galvanized steel in accordance with ASTM A 795/A 795M or ASTM A 53/A 53M. Any air maintenance device used in conjunction with the nitrogen generation system must be listed or approved for use on sprinkler systems. The connection pipe from the Nitrogen Generation System shall not be less than 1/2 inch in diameter and shall enter the system above the priming water level of the dry pipe valve. A check valve shall be installed in the system supply nitrogen piping from the compressor. A shutoff valve of the renewable disc type shall be installed upstream of this check valve.

2.7.4 Nitrogen Purge Valve Assembly

Unless otherwise indicated, a Nitrogen Purge Valve Assembly shall be installed at the remote end of the dry pipe system. Nitrogen Purge Valve Assemblies installed in the mechanical room or at the location of the Nitrogen Generation control panel will not be allowed. The Nitrogen Purge Valve Assembly shall be fully automatic with a 120 Volts A.C. power connection. The Nitrogen Purge Valve Assembly shall have LED displays that indicates nitrogen concentration levels and a purge timer to indicate the number of days remaining until purging is complete. The Nitrogen Purge Valve Assembly shall have a built-in nitrogen analyzer that samples the exiting nitrogen levels. Once the nitrogen concentration level reaches 98 percent nitrogen, the Nitrogen Purge Valve Assembly shall automatically stop purging. After the system has stopped purging, periodic samples shall be taken to ensure concentration levels are being maintained. A set of Form C dry contacts shall be provided connection to the building Fire Alarm System.

2.8 WATERFLOW ALARM

Electrically operated, exterior-mounted, water flow alarm bell shall be provided and installed in accordance with NFPA 13. Waterflow alarm bell shall be 10 inch in diameter, rated for 24 VDC, and shall be connected to the Fire Alarm Control Panel in accordance with Section 28 31 74 INTERIOR FIRE DETECTION AND ALARM SYSTEM or Section 28 31 76 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM.

2.9 ALARM INITIATING AND SUPERVISORY DEVICES

2.9.1 Sprinkler Pressure (Waterflow) Alarm Switch

Pressure switch shall include a metal housing with a neoprene diaphragm, SPDT snap action switches and a 1/2 inch NPT male pipe thread. The switch shall have a maximum service pressure rating of 175 psi. There shall be two SPDT (Form C) contacts factory adjusted to operate at 4 to 8 psi. The switch shall be capable of being mounted in any position in the alarm line trim piping of the dry pipe valve.

2.9.2 High / Low Air Pressure Supervisory Switch

The High / Low Air Pressure Supervisory Switch shall supervise the air pressure in system and shall be set to activate at 10 psi above the Dry Pipe Valve Assembly trip point pressure. The High / Low Air Pressure Supervisory Switch shall have an adjustable range between 5 and 80 psi. The High / Low Air Pressure Supervisory Switch shall have screw terminal connection and shall be capable of being wired for normally open or normally closed circuit.

2.9.3 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised in the normally open position or in the normally closed position. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon closure/opening of the valve of more than two rotations of the valve stem from its normal position.

2.10 FIRE DEPARTMENT CONNECTION

Fire Department Connection shall be projecting or flush type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a chromium plated or brass finish. The Fire Department Connection shall have two inlets with individual self-closing clappers, lugged caps, and chains. Female inlets shall have 2-1/2 inch diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

2.11 SPRINKLERS

Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed coverage limitations. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Extended coverage sprinklers shall not be used.

2.11.1 Concealed Sprinkler

Concealed sprinklers shall be brass finished quick-response type and shall have a minimum nominal 1/2 inch orifice with a white escutcheon plate that is flat in profile. Escutcheon plates that are dome in profile will not be allowed.

2.11.2 Recessed Sprinkler

Recessed sprinklers shall be white finished quick-response type and shall have a minimum nominal 1/2 inch orifice.

2.11.3 Pendent Sprinkler

Pendent sprinklers shall be white finished in occupied spaces and brass finished in exposed structure areas. Pendent sprinklers shall be quick-response type with a minimum nominal 1/2 inch orifice.

2.11.4 Upright Sprinkler

Upright sprinklers shall be brass finished quick-response type and shall have a minimum nominal 1/2 inch orifice.

2.11.5 Sidewall Sprinkler

Sidewall sprinklers shall be white finished in occupied spaces and brass finished in exposed structure areas. Sidewall sprinklers shall be quick-response type with a minimum nominal 1/2 inch orifice.

2.11.6 Intermediate Level Rack Sprinkler

Intermediate level rack sprinklers shall be brass finished upright or pendent type with a minimum nominal 1/2 inch orifice. The sprinkler shall be equipped with a deflector plate to shield the fusible element from water discharged above it.

2.11.7 Corrosion Resistant Sprinkler

Corrosion resistant sprinklers shall be the upright or pendent type installed in locations of high humidity (showers, kitchens, etc.), exterior of building, and as required by NFPA 13. Corrosion resistant coatings of Lead or Nickel-Teflon shall be factory-applied by the sprinkler manufacturer.

2.11.8 Dry Sprinkler Assembly

Dry sprinkler assembly shall be polished chrome finished pendent, upright, sidewall, or 45-degree type with a minimum nominal 1/2 inch orifice. Assembly shall include an integral escutcheon. Maximum length shall not exceed maximum indicated in UL Fire Prot Dir. Sprinkles shall have a polished chrome finish.

2.12 DISINFECTING MATERIALS

All portions of the fire protection sprinkler system installed on the potable side of the backflow preventer shall be disinfected.

2.12.1 Liquid Chlorine

Liquid Chlorine shall conform to AWWA B301.

2.12.2 Hypochlorites

Calcium Hypochlorite and sodium Hypochlorite shall conform to AWWA B300.

2.13 ACCESSORIES

2.13.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one manufacturers wrench for each type of sprinkler installed shall be provided. Provide a list of sprinklers installed in the building in accordance with NFPA 13 in the sprinkler cabinet.

2.13.2 Recessed Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 3/4 inch and suitable for installation on recessed sprinklers. The escutcheon shall have a factory finish that matches the finish of the pendent sprinkler head.

2.13.3 Oversized Ceiling Penetration Escutcheon

Oversized escutcheon shall be one-piece metallic type that has a recessed area to accommodate a standard recessed sprinkler escutcheon. The oversized escutcheon shall have a factory white finish that matches the finish of the recessed pendent sprinkler head.

2.13.4 Pipe Escutcheon

Provide one-piece or split-hinge metal Escutcheon Plates for piping penetrating floors, walls, and ceilings in exposed areas. Escutcheon Plates shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Plates shall be secured in place by internal spring tension or set screw.

2.13.5 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided for sprinklers installed at an elevation less than 8'-0" above finished floor.

2.13.6 Identification Signs

2.13.6.1 Identification Signs

Valve Identification Signs shall be minimum 6 inches wide x 2 inches high with enamel baked finish on minimum 18 gauge steel or 0.024 inch aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "control valve", "main drain", "auxiliary drain", "inspector's test", "alarm test", "alarm line", and similar wording as required by NFPA 13 to identify operational components. All Fire Protection Sprinkler System valves must be marked with permanent tags indicating "Normally Open" or "Normally Closed".

2.13.6.2 Signage in Buildings

All auxiliary drains, remote inspector's test, and control valves shall be identified with signage on the access panel for items placed in access panels or at the ceiling for items installed above ceilings. Signage shall be metal or phenolic having a white background with a minimum 2 inch high red letters that is chain hung, the use of a "Sharpie" to write information will not be allowed. Locations of signage shall match locations identified on the Graphic Maps.

2.13.6.3 Fire/Smoke Wall, Ceiling, and Floor Assembly Marking and Identification

Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions or any other wall, ceiling, or floor assembly required to have protected openings that are penetrated by Fire Protection Sprinkler System piping and equipment shall be provided with markings and identification in

accordance with the IBC and NFPA 101. Wall, Ceiling, and Floor Assembly Marking and Identification shall meet the following criteria at a minimum:

a. Be located in accessible concealed floor, floor/ceiling, or attic spaces.

b. Be located within 15'-0" of the end of each wall.

c. At intervals not exceeding 30'-0" measured horizontally along the wall or partition.

d. Include lettering not less than 3" in height with a minimum 3/8" stroke in a contrasting color.

e. Identify the wall type and its fire-resistance rating, as applicable.

2.13.6.4 Equipment Signage

Equipment Signage shall have a white background with a minimum 2 inch high red letters unless indicated differently below, the use of a "Sharpie" to write information will not be allowed. Exterior wall mounted signs shall be located at an elevation not exceeding 8 feet above exterior grade. Equipment signage shall be provided for the following items:

a. Fire Department Connection: Wall mounted fire department connection shall be provided with a metal weatherproof sign that shall be placed on the exterior wall of the building directly over the fire department connection. The sign shall be a minimum of 20 inches long by 15 inches tall and shall state "FIRE DEPARTMENT CONNECTION". If facing a parking area, 'No Parking' signage shall be provided. Striping will be painted on the pavement in front of the device.

b. Fire Department Connection: Yard mounted fire department connection shall be provided with 2 inch high white reflective stenciling/labeling along the length of the exposed fire department connection piping. The stenciling/labeling shall indicate the building number (XXXX) that it serves and state "FDC XXXXX". If facing a parking area, 'No Parking' signage shall be provided. Striping will be painted on the pavement in front of the device.

c. Wall Mounted Post Indicating Valve:

(1) Wall mounted post indicating valve shall be provided with a metal weatherproof metal sign that shall be placed on the exterior wall of the building directly over the post indicating valve. The sign shall be a minimum of 20 inches long by 15 inches tall and shall state "POST INDICATING VALVE".

(2) Each post indicating valve shall be provided with a weatherproof metal sign that shall be placed on the exterior wall of the building directly over the post indicating valve. The sign shall indicate the area of the facility that the post indicating valve covers. Sign shall be a minimum of 8 inches long and 4 inches high and will have a white background with a minimum 1 inch high red letters.

d. Yard Mounted Post Indicating Valve:

(1) Yard mounted post indicating valve shall be provided with 2 inch high white reflective stenciling along the length of the yard post indicator housing. The stenciling shall indicate the building number (XXXX) that it serves and state "PIV XXXXX".

(2) If facing a parking area, 'No Parking' signage shall be provided. Striping will be painted on the pavement in front of the device.

(3) Each yard mounted post indicating valve shall be provided with a weatherproof metal sign that is secured to the post indicting valve housing with (2) stainless steel hose clamps. The sign shall indicate the area of the facility that the post indicating valve covers. Sign shall be a minimum of 8 inches long and 4 inches high and will have a white background with a minimum 1 inch high red letters.

e. Backflow Preventer Test valves: The test valves utilized for full forward flow testing of the backflow preventer shall be provided with a metal weatherproof sign that shall be placed on the exterior wall of the building directly over the backflow preventer test valves. The sign shall be a minimum of 20 inches long by 15 inches tall and shall state "BACKFLOW TEST VALVES".

f. Sprinkler Riser:

(1) Each sprinkler system riser shall be provided with a metal or phenolic sign that is chain hung on the sprinkler system riser. The sign shall indicate the area of the facility that the sprinkler system riser covers. Sign shall be a minimum of 8 inches long and 4 inches high and will have a white background with a minimum 1 inch high red letters.

(2) Paint a 3 inch wide red painted stripe on the floor a minimum of 36 inches away from the fire protection riser equipment consisting of backflow preventer, Nitrogen Generation System, and all system risers.

g. Fire Sprinkler Room: The room in which the fire sprinkler riser has been installed shall be provided with a metal or phenolic sign. The sign shall be placed on the exterior side of the door of the room containing the fire sprinkler riser. The sign shall be a minimum of 16 inches long by 3 inches tall and shall state "SPRINKLER ROOM".

h. Access Panels: Each access panel shall be provided with a metal or phenolic sign. The sign shall indicate the valve in the access panel. Sign shall be a minimum of 3 inches long by 2 inches tall with 1 inch high red text that states "AUXILIARY DRAIN", "INSPECTOR'S TEST VALVE", "ELEVATOR MACHINE ROOM CONTROL VALVE", "ELEVATOR PIT CONTROL VALVE", "TOP OF ELEVATOR SHAFT CONTROL VALVE", etc.

i. Gas Shutoff: The building gas meter control valve shall be provided with a metal weatherproof sign that shall be placed on the exterior wall of the building directly over the gas meter. The sign shall be a minimum of 20 inches long by 15 inches tall and shall state "GAS SHUTOFF".

j. POL Storage Buildings: POL storage buildings shall be provided with a metal weatherproof signage at each exterior door. The sign shall be a

minimum of 16 inches long by 3 inches tall and shall state "POL STORAGE".

k. HAZMAT Storage Buildings: HAZMAT storage buildings shall be provided with a metal weatherproof signage at each exterior door. The sign shall be a minimum of 16 inches long by 3 inches tall and shall state "HAZMAT STORAGE".

l. Lawnmower Storage Buildings: Lawnmower storage buildings shall be provided with a metal weatherproof signage at each exterior door. The sign shall be a minimum of 16 inches long by 3 inches tall and shall state "LAWNMOWER STORAGE".

2.13.6.5 Dry System Capacity Signage

Provide signage that is printed on white bond paper, laminated, and securely mounted to the wall using an approved method for permanent mounting. The signage shall indicate the actual calculated capacity of the dry system that was the basis for the Nitrogen Generation System installed.

2.14 FLEXIBLE SPRINKLER HOSE

Standard installation is hard-pipe sprinkler head connections. The use of Flexible Sprinkler Hose must be approved by the Designated Fire Protection Engineer (DFPE) in accordance with Section 9-7.6.8 of UFC 3-600-01 through an RFI to the project manager. Approval is not assured. Provide Flexible Sprinkler Hose with fittings intended for direct connection to sprinklers that are UL listed and FM approved for use in fire protection sprinkler systems to 175 p.s.i. The Flexible Sprinkler Hose assembly shall utilize braided type 304 stainless steel covering with factory installed zinc plated steel adapters (1 inch Male Pipe Thread (MPT) or grooved for connection to the sprinkler system piping and 1/2 inch or 3/4 inch Female Pipe Thread (FPT) for connection of the sprinkler head) that are fully welded or use compression fittings to form a single unit. The Flexible Sprinkler Hose unit shall be held securely to acoustical ceiling assemblies by using mounting brackets or tube steel cross member that attach to the ceiling runners that utilize self-tapping screws to secure to the ceiling runner. The flexible hose assembly shall be held securely to gypsum wallboard ceilings by securing the mounting bracket with four self-tapping screws (two on each end) into metal or wood ceiling framing members. Flexible Sprinkler Hose shall be installed in accordance with the manufacturer's literature in regards to the FM bend radius and number of bends allowed.

2.15 SEISMIC SEPARATION OR BUILDING EXPANSION / SEPARATION ASSEMBLIES

Provide a Seismic Separation Assembly or Building Expansion / Separation Assembly that is capable of allowing movement along all (3) axes of movement (up/down, Left/right, and in/out). Seismic Separation Assembly or Building Expansion / Separation Assembly shall be provided with grooved flexible couplings and installed where the overhead sprinkler piping crosses a seismic separation joint or a building expansion / separation joint. Seismic Separation Assembly or Building Expansion / Separation Assembly shall consist of either (2) flexible sections of braded hose, (2) 90° elbows, and (1) 180° return or (2) flexible section of braided hose, (2) 45° elbows, and (1) 90° elbow. Seismic Separation Assembly or Building Expansion / Separation Assembly shall include a factory supplied center support nut located at the midpoint of the assembly for hanging and a drain

plug. Seismic Separation Assembly or Building Expansion / Separation Assembly comprised of (6) 90° elbows with grooved flexible couplings shall not be allowed.

2.16 AIR PRESSURE GAUGES

Each pneumatic air system shall have permanently installed stainless steel pressure gauges to provide visual supervision of the air pressure contained within the dry pipe sprinkler system. Each air pressure gauge shall be provided with a ball valve for easy air pressure gauge replacement without shutting down the system. Provide a minimum 3-1/2" diameter pressure gauge with a 1/4" national pipe thread connection. The pressure gauge shall have an accuracy of 3-2-3% over the range of the gauge per ASME B40.100 (3% over the first 1/4 of the gauge range, 2% over the middle 1/2 of the gauge range, and 3% over the last 1/4 of the gauge range). The pressure gauge shall be calibrated to register up to a maximum of 80 p.s.i.

2.17 WATER PRESSURE GAUGES

Each wet system shall have permanently installed pressure gauges to provide visual supervision of the water pressure. Each water pressure gauge shall be provided with a ball valve for easy water pressure gauge replacement without shutting down the system. Provide a minimum 3-1/2" diameter pressure gauge with a 1/4" national pipe thread connection. The pressure gauge shall have an accuracy of 3-2-3% over the range of the gauge per ASME B40.100 (3% over the first 1/4 of the gauge range, 2% over the middle 1/2 of the gauge range, and 3% over the last 1/4 of the gauge range). The pressure gauge shall be calibrated to register up to a maximum of 300 p.s.i. for static water pressures less than 175 p.s.i. and a minimum of 50 p.s.i. above static water pressure when the static water pressure exceeds 175 p.s.i.

2.18 BACKFLOW PREVENTION ASSEMBLY

2.18.1 Double Check Valve Backflow Preventer Assembly

Double Check Valve Backflow Prevention Assembly shall be used on all sprinkler systems not using chemicals (i.e. AFFF, Hi-Ex Foam, Anti-Freeze) in the sprinkler system and shall comply with ASSE 1015. The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include pressure gauge test ports and OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 175 psi. A test port for a pressure gauge shall be provided on the supply side and on the discharge side of the Double Check Valve Backflow Prevention Assembly valves. The supply side and discharge side of the backflow preventer shall be provided with a permanently installed water pressure gauge in accordance with NFPA 13. Backflow preventers installed in Washington State must meet the State of Washington requirements.

2.18.2 Pressure Loss Through Double Check Valve Backflow Preventer Assembly

The pressure loss utilized in hydraulic calculations through the Double Check Valve Backflow Prevention Assembly shall be the greater of 8 psi or the pressure drop documented in the manufacturers pressure loss curve at a flow rate equal to the sprinkler water demand, at the location of the

Double Check Valve Backflow Prevention Assembly.

2.18.3 Reduced Pressure Backflow Preventer Assembly

Reduced Pressure Backflow Prevention Assembly shall be used on all sprinkler systems using chemicals (i.e. AFFF, Hi-Ex Foam, Anti-Freeze) in the sprinkler system and shall comply with ASSE 1015. The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include pressure gauge test ports and OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 175 psi. Provide a funnel drain beneath the intermediate chamber that is routed to discharge on the outside of the building over a 2 foot by 2 foot concrete splash block to minimize damage to adjacent construction or landscaping unless discharge is directly over a hard surface such as concrete or asphalt. A test port for a pressure gauge shall be provided on the supply side and on the discharge side of the Reduced Pressure Backflow Prevention Assembly valves. The supply side and discharge side of the backflow preventer shall be provided with a permanently installed water pressure gauge in accordance with NFPA 13. Backflow preventers installed in Washington State must meet the State of Washington requirements.

2.18.4 Pressure Loss Through Reduced Pressure Backflow Preventer Assembly

The pressure loss utilized in hydraulic calculations through the Reduced Pressure Backflow Prevention Assembly shall be the greater of 12 psi or the pressure drop documented in the manufacturers pressure loss curve at a flow rate equal to the sprinkler water demand, at the location of the Reduced Pressure Backflow Prevention Assembly.

2.19 FULL FORWARD FLOW TESTING CONNECTION

Provide (1) permanently installed 2½" hose valve for each 250 g.p.m. of interior system demand for full forward flow testing of the backflow preventer assembly. Hose valves shall be permanently installed on the exterior wall of the building. The piping serving the 2½" hose valves shall be provided with a normally closed grooved butterfly valve.

2.20 GRAPHIC MAP

Provide a full graphical representation of the floor plan(s) that shall be installed directly adjacent to the sprinkler riser. The Graphic Map shall be a minimum of 11"x17" in size, but shall be based upon the actual building footprint with all text being at a minimum of 1/8" scale.

2.20.1 Graphic Map Information

The Graphic Map shall include the following information at a minimum: Building Name(s) (and numbers where applicable), room names and numbers, doors, location of the sprinkler system riser, location of all auxiliary drains, location of all valves, location of remote inspector's test valves, and a "North" Arrow.

2.20.2 Graphic Map Material

The Graphic Map shall be printed on white bond paper, laminated, and

securely mounted to the wall using an approved method for permanent mounting.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Fire Protection Specialist, the USACE representative, and/or DPW representatives of any discrepancy before performing the work.

3.2 FIRE PROTECTION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation of the sprinkler system(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.3 INSTALLATION REQUIREMENTS

Equipment, materials, workmanship, fabrication, assembly, erection, installation, examination, inspection, and testing shall be in accordance with the applicable provisions of NFPA 13, NFPA 24, UFC 3-600-01, JBLM Design Standards, and publications referenced therein. Installation of in-rack sprinklers shall comply with applicable provisions of NFPA 13. Carefully remove materials so as not to damage material which is to remain. Replace existing work damaged by the Contractor's operations with new work of the same construction.

3.4 INSPECTIONS BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the sprinkler system periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements. The Fire Protection Specialist, after completion of each system inspection shall provide a site report within five working days that identifies the status of the installation and any corrections that are to be made to meet contract requirements. The site report is to be addressed to the General Contractor with a copy of the report being forwarded to the government representative acting as the Authority Having Jurisdiction.

3.5 ABOVEGROUND PIPING INSTALLATION

3.5.1 Protection of Piping Against Earthquake Damage

The system piping shall be seismically protected against damage from earthquakes. This requirement is not subject to determination under NFPA 13. Install the seismic protection of the system piping in accordance with UFC 3-310-04 and NFPA 13. Include the required features identified therein that are applicable to the specific piping system.

3.5.2 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors, or equipment access. Exposed horizontal piping, including drain

piping, shall be installed to provide maximum headroom.

3.5.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested, and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed and only installed exposed when piping cannot be concealed if approved by the Fire Protection Specialist.

3.5.4 Piping Installation Limitations

Install piping and seismic bracing at such heights and in such a manner so as not to obstruct any portion of windows, doorways, passageways, or lights. Coordinate installation of piping with all trades and field conditions to avoid conflicts and offset piping as required to clear any interferences that may occur. Install piping and seismic bracing at such heights and in such a manner so as not pose hazards to normal walking head heights, impact the minimum clear height requirements or present tripping hazards.

3.5.5 Pendent Sprinklers

Sprinklers installed in the pendent position shall be of the listed dry pendent type to prevent water or condensate from collecting in the drop nipple, unless otherwise indicated. Dry pendent sprinklers shall be of the required length to permit the sprinkler to be threaded directly into a branch line tee. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 12 inches for steel pipe or 6 inches for copper tubing. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space and all frame arms are aligned in the same orientation. The outlet of the reducing coupling shall not extend more than 1 inch below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 4 inches. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling, shall be no closer than 1 inch, shall not exceed the manufacturer's listed range, and shall be of uniform depth throughout the finished area.

3.5.5.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be a minimum of 12 inches from ceiling grid.

3.5.6 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 30 inches in length shall be individually supported.

3.5.7 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be

permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided as required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness, and size. Grooved couplings, fittings, and grooving tools shall be products of the same manufacturer. For copper tubing, pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, Vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is provided for servicing or adjusting the joint.

3.5.8 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

3.5.9 Pipe Penetrations

Cutting of existing or new structural members for passage of pipes or for pipe-hanger fastenings will not be permitted.

3.5.9.1 Non-Fire Rated Penetrations in Existing Construction

Pipes that must penetrate existing non-fire rated concrete walls, masonry walls, or concrete floors shall be core-drilled. All other existing wall, ceiling, or floor penetrations shall be provided with a sleeve. The space between the existing wall, ceiling, or floor and the new sleeve shall be patched, sealed, and painted to match the existing finish where the penetration occurs.

3.5.9.2 Fire Rated Penetrations in Existing Construction

Pipes that must penetrate existing fire rated concrete walls, masonry walls, or concrete floors shall be core-drilled. All other existing fire rated wall, ceiling, or floor penetrations shall be provided with a sleeve. The space between the core-drilled hole or sleeve and the pipe shall be firmly packed with mineral wool insulation. Seal space at both ends of the core-drilled hole or sleeve with plastic waterproof cement which will dry to a firm but pliable mass. Where piping penetrates fire walls, fire partitions, or fire floors the piping shall be provided with a fire seal and fire stopped in accordance with Section 07 84 00 FIRESTOPPING. The space between the existing fire rated wall, ceiling, or floor and the new sleeve shall be patched and sealed to maintain the fire rating of the wall, ceiling, or floor and painted to match the existing finish where the penetration occurs.

3.5.9.3 Non-Fire Rated Penetrations in High Moisture Spaces in Existing Construction

Pipes that must penetrate existing non-fire rated concrete walls, masonry walls, or concrete floors shall be core-drilled, including the underground supply piping that enters the building from the exterior. All other existing wall, ceiling, roof, or floor penetrations through high moisture areas (showers, coolers, freezers, exterior walls) shall be provided with a sleeve. The space between the core-drilled hole or sleeve and the pipe shall be firmly packed with mineral wool insulation. Seal space at both ends of the core-drilled hole or sleeve with plastic waterproof cement which will dry to a firm but pliable mass. Underground supply piping penetrations that allows water into the building shall be provided with a mechanically adjustable segmented elastomeric seal. The space between the existing wall, ceiling, roof, or floor and the new sleeve shall be patched, sealed, and painted to match the existing finish where the penetration occurs.

3.5.9.4 Non-Fire Rated Penetrations in New Construction

Pipes that must penetrate new non-fire rated concrete walls, masonry walls, concrete floors shall be core-drilled. The space between the wall, ceiling, or floor and the sleeve shall be patched, sealed, and painted where the penetration occurs.

3.5.9.5 Fire Rated Penetrations in New Construction

Pipes that must penetrate new fire rated concrete walls, masonry walls, or concrete floors shall be core-drilled. All other new fire rated wall, ceiling, or floor penetrations shall be provided with a sleeve. The space between the core-drilled hole or sleeve and the pipe shall be firmly packed with mineral wool insulation. Seal space at both ends of the core-drilled hole or sleeve with plastic waterproof cement which will dry to a firm but pliable mass. Where piping penetrates fire walls, fire partitions, or fire floors the piping shall be provided with a fire seal and fire stopped in accordance with Section 07 84 00 FIRESTOPPING. The space between the new fire rated wall, ceiling, or floor and the new sleeve shall be patched and sealed to maintain the fire rating of the wall, ceiling, or floor and painted to match the existing finish where the penetration occurs.

3.5.9.6 Non-Fire Rated Penetrations in High Moisture Spaces in New Construction

Pipes that must penetrate new non-fire rated concrete walls, masonry walls, or concrete floors shall be core-drilled, including the underground supply piping that enters the building from the exterior. All other new wall, ceiling, roof, or floor penetrations through high moisture areas (showers, coolers, freezers, exterior walls) shall be provided with a sleeve. The space between the core-drilled hole or sleeve and the pipe shall be firmly packed with mineral wool insulation. Seal space at both ends of the core-drilled hole or sleeve with plastic waterproof cement which will dry to a firm but pliable mass. Underground supply piping penetrations that allows water into the building shall be provided with a mechanically adjustable segmented elastomeric seal. The space between the new wall, ceiling, roof, or floor and the new sleeve shall be patched, sealed, and painted to match the existing finish where the penetration occurs.

3.5.10 Core-driller Holes

Core-driller holes shall provide required clearance between the pipe and the core-driller hole per NFPA 13. The installation of a flexible grooved coupling placed within 1 foot of each side of the core-driller hole will be allowable for the installation of an undersized core-drilled hole.

3.5.11 Sleeves

Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of wall, ceiling, or floor penetrations. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The installation of a flexible grooved coupling placed within 1 foot of each side of the penetration will not be an allowable substitution for an undersized sleeve. Sleeves shall be galvanized or black Schedule 40 steel pipe.

3.5.12 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes. Provide oversized ceiling penetration and oversized sprinkler escutcheons for hard piped sprinkler heads located in acoustical tile ceilings in accordance with the IBC and ASCE 7 requirements.

3.5.13 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 1 inch pipe connected to the remote branch line with the test valve being located approximately 5 feet above the floor. The discharge shall terminate with a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system. Provide a painted metal identification sign affixed to the valve with the words "Inspector's Test". Inspector's test valves installed in finished areas shall be installed in a lockable access panel. The discharge orifice shall be located outside the building wall and provided with a 2 foot by 2 foot concrete splash block to minimize damage to adjacent construction or landscaping during full flow discharge unless discharge is directly over a hard surface such as concrete or asphalt.

3.5.14 Drains

Main drain piping shall be provided to discharge at the location on the outside of the building. Auxiliary drains shall be provided as indicated and as required by NFPA 13 and piped to discharge on the outside of the building. All drains installed in finished areas shall be installed in a lockable access panel. All drain discharges shall be provided with a 2 foot by 2 foot concrete splash block to minimize damage to adjacent construction or landscaping during full flow discharge unless discharge is directly over a hard surface such as concrete or asphalt. When the capacity of trapped sections of pipe is less than 3 gallons, the auxiliary drain shall consist of a valve not smaller than 1/2 inch and a plug or nipple and cap. When the capacity of trapped sections of piping is more than 3 gallons, the auxiliary drain shall consist of two 1 inch valves and one 2 inch x 12 inch condensate nipple or equivalent, located in an accessible location. Tie-in drains shall be provided for multiple adjacent trapped branch pipes and shall be a minimum of 1 inch in diameter. Tie-in drain lines shall be pitched a minimum of 1/2 inch per 10 feet.

3.5.15 Installation of Fire Department Connection

Fire Department Connection shall be mounted on the exterior wall or adjacent to and on the sprinkler system side of the backflow preventer when installed in the yard. The Fire Department Connection shall be installed approximately 3 feet above finished grade. The piping between the Fire Department Connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside. The automatic ball drip for yard mounted Fire Department Connections shall be provided with a means of access for maintenance and inspections.

3.5.16 Installation of Waterflow Alarm Device

The Waterflow Alarm Device shall be installed on the exterior of the building approximately 10 feet above grade to the bottom of the Waterflow Alarm Device.

3.6 IDENTIFICATION SIGNS

3.6.1 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Signage shall be metal or phenolic having a white background with red letters that is chain hung and permanently affixed to each valve, the use of a "Sharpie" to write information will not be allowed.

3.6.2 Valve Tags

All sprinkler system valves shall be marked with permanent tags indicating "Normally Open" or "Normally Closed".

3.6.3 Hydraulic Placards

Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13. Signage shall be metal or phenolic having a red background with white letters that is chain hung and permanently affixed to the system riser, the use of a "Sharpie" to write information will not be allowed.

3.6.4 General Information Sign

General Information Sign shall be permanently affixed to each sprinkler riser as specified in NFPA 13. Signage shall be metal or phenolic having a red background with white letters that is chain hung and permanently affixed to the system riser, the use of a "Sharpie" to write information will not be allowed.

3.6.5 Full Forward Flow Test Sign

Full Forward Flow Test Sign shall be metal or phenolic having a red background with white letters that is chain hung and permanently affixed to the backflow preventer, the use of a "Sharpie" to write information will not be allowed. The Full Forward Flow Test Sign shall indicate the following information:

a. Pressure on the supply side of the backflow preventer assembly prior to

testing.
b. Pressure on the discharge side of the backflow preventer assembly prior to testing.
c. Pressure on the supply side of the backflow preventer assembly during testing.
d. Pressure on the discharge side of the backflow preventer assembly during testing.
e. Total pressure drop across the backflow preventer assembly during testing.
f. System test flow rate based upon hydraulic system demands.
g. Manufacturer's documented pressure drop data from the pressure drop flow curve.

3.6.6 List of Sprinkles

Provide a List of Sprinklers in accordance with NFPA 13 to be located in the spare head cabinet.

3.7 UNDERGROUND PIPING INSTALLATION

The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover shall be as required by NFPA 24, but no less than 3 feet. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 6 inches above the finished floor. A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. Anchor the fitting below the building in accordance with NFPA 24. Buried steel components shall be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 5 feet outside the building walls shall meet the requirements of Section 33 11 00 WATER DISTRIBUTION.

3.7.1 Underground Piping Restraint

Provide a concrete thrust block at the elbow where the pipe turns up toward the floor. In addition, the elbow shall be anchored by using steel rods from the elbow to the flange above the floor in the vertical direction and by using steel rods from the elbow to a pipe clamp on the horizontal run of piping at a point outside of the building's footing

3.7.2 Pipe and Fittings

Underground piping shall be inspected, tested and approved before burying, covering, or concealing. Fittings shall be provided for changes in direction of piping and for all connections. Changes in piping sizes shall be made using tapered reducing pipe fittings. Bushings shall not be used. Photograph all piping prior to burying, covering, or concealing.

3.7.3 Cleaning of Piping

Interior and ends of underground piping shall be clean and free of any water or foreign material. Piping shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of the piping shall be securely closed so that no water or foreign matter will enter the pipes or fittings. Piping shall be inspected before placing in position.

3.7.4 Threaded Connections

Jointing compound for underground pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape conforming to ASTM D 3308 and shall be applied to male threads only. Exposed underground ferrous pipe threads shall be provided with one coat of zinc molybdate primer applied to a minimum of dry film thickness of 1 mil.

3.7.5 Threaded Connections

Jointing compound for underground pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape conforming to ASTM D 3308 and shall be applied to male threads only. Exposed underground ferrous pipe threads shall be provided with one coat of zinc molybdate primer applied to a minimum of dry film thickness of 1 mil.

3.8 EARTHWORK

Earthwork shall be performed in accordance with applicable provisions of Section 31 00 00 EARTHWORK.

3.9 ELECTRICAL WORK

Except as modified herein, electric equipment and wiring shall be in accordance with Sections 28 31 74 INTERIOR FIRE DETECTION AND ALARM SYSTEM and 28 31 76 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Sections 28 31 74 INTERIOR FIRE DETECTION AND ALARM SYSTEM and 28 31 76 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM. All wiring for supervisory and alarm circuits shall be #16 AWG solid copper installed in metallic tubing or conduit. Wiring color code shall remain uniform throughout the system.

3.10 DISINFECTION

After all piping located on the potable side of the backflow preventer has been hydrostatically tested, the potable piping shall be disinfected. The potable piping shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system if filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA 10084. The testing method shall be either

the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained. After successful completion, verify installation of all sprinklers and plugs and pressure test the system.

3.11 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09 90 00 PAINTS AND COATINGS and in UFC 3-600-01.

3.12 SPECIAL INSPECTIONS AND SEISMIC CERTIFICATION

Special Certification Requirements for Designated Seismic Systems Certifications shall be provided in accordance with Section 13.2.2 of ASCE 7 for designated seismic systems assigned to Seismic Design Categories C through F as follows:

a. Active mechanical and electrical equipment that must remain operable following the design earthquake ground motion shall be certified by the manufacturer as operable whereby active parts or energized components shall be certified exclusively on the basis of approved shake table testing in accordance with Section 13.2.5 or experience data in accordance with Section 13.2.6 unless it can be shown that the component is inherently rugged by comparison with similar seismically qualified components.

b. Evidence demonstrating compliance with this requirement shall be submitted for approval to the authority having jurisdiction after review and acceptance by a registered design professional

3.12.1 Statement of Special Inspections

Where special inspection or testing is required by Section 1705 of the IBC, the registered design professional in responsible charge shall prepare a statement of special inspections in accordance with Section 1704.3.1 for submittal by the applicant in accordance with Section 1704.2.3.

Exception: The statement of special inspections is permitted to be prepared by a qualified person approved by the building official for construction not designed by a registered design professional.

3.12.2 Content of Statement of Special Inspections

In accordance with Section 1704.3.1 of the IBC, the statement of special inspections shall identify the following:

a. The materials, systems, components and work required to have special inspection or testing by the building official or by the registered design professional responsible for each portion of the work.

b. The type and extent of each special inspection.

c. The type and extent of each test.

d. Additional requirements for special inspection or testing for seismic or wind resistance as specified in Sections 1705.11, 1705.12 and 1705.13.

e. For each type of special inspection, identification as to whether it will be continuous special inspection, periodic special inspection, or performed in accordance with the notation used in the referenced standard where the inspections are identified.

3.12.3 Designated Seismic Systems

In accordance with Section 1705.12.4 of the IBC, the special inspector shall examine designated seismic systems requiring seismic qualification in accordance with Section 13.2.2 of ASCE 7 and verify that the label, anchorage or mounting conforms to the certificate of compliance.

3.13 TESTING PRIOR TO PRELIMINARY ACCEPTANCE TESTING

3.13.1 Underground Piping

3.13.1.1 Hydrostatic Testing

New underground piping shall be Hydrostatically Tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 2 quarts per hour per 100 gaskets or joints, regardless of pipe diameter. Hydrostatic Testing shall be in accordance with NFPA 24 at not less than 200 psi or 50 psi in excess of maximum system operating pressure whichever is greater for a 2 hour duration.

3.13.1.2 Flushing

Underground piping shall be Flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a minimum flow rate of not less than 10 feet per second or at the maximum sprinkler system water demand, whichever is greater. A copy of the underground flushing certificate shall be provided to the overhead sprinkler system contractor prior to connecting the overhead sprinkler system to the underground supply. If a flushing rate of 10 feet per second cannot be obtained, notify the contracting officer in writing no later than 3 working days after the date of testing. Flushing operations shall continue until water is clear, but not less than 10 minutes.

3.13.1.3 Disinfection

After Hydrostatic Tests and Flushing tests are successfully completed on the underground piping, the underground piping shall be Disinfected.

3.13.1.3.1 Chlorination

The chlorinating material shall be hypochlorites or liquid chlorine. The chlorinating material shall be fed into the underground piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire underground piping being tested is filled. The water shall

remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system.

3.13.1.3.2 Sample Testing

Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA 10084. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.13.2 Aboveground Piping

3.13.2.1 Hydrostatic Testing

Aboveground piping shall be Hydrostatically Tested in accordance with NFPA 13 at not less than 200 psi or 50 psi in excess of maximum system operating pressure whichever is greater and shall maintain that pressure without loss for a 2 hour duration. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the Hydrostatic Test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.13.1.2 Air Pressure Test

As specified in NFPA 13, an Air Pressure Test at 50 psi shall be conducted for a 24 hour duration. There shall be no drop in gauge pressure in excess of 1.5 psi for the 24 hour duration. This Air Pressure Test is in addition to the required hydrostatic test.

3.14 TESTING PRIOR TO PRELIMINARY ACCEPTANCE TESTING REPORT

3.14.1 Underground Piping

Upon completion of specified tests, the Contractor shall complete the Material & Test Certificates for the underground system as specified in paragraph SUBMITTALS. Preliminary Test Report shall be provided by the installing contractor to the government for review and approval. The Contractor's Preliminary Test Report for underground work shall be signed.

3.14.2 Overhead Piping

Upon completion of specified tests, the Contractor shall complete the portion of the Material & Test Certificate for hydrostatic testing and air testing only and retain the Material & Test Certificate for Preliminary Testing. The Material & Test Certificate shall not be submitted to the government for review and approval until the remainder of the Preliminary Testing has been completed.

3.15 PRELIMINARY ACCEPTANCE TESTING PROCEDURES

Preliminary Acceptance Testing Procedures shall include detailed step-by-

step outline for each test and the expected test results to be performed at Preliminary System Acceptance Testing and shall be on its own page in the Preliminary Acceptance Testing Procedures. The Preliminary Acceptance Testing Procedures shall identify the sequence of testing, time estimate for each test, blank copies of the Material & Test Certificates. The Preliminary Acceptance Testing Procedures shall be in a check-off format (pass/fail) with space to add applicable test data. Preliminary Acceptance Tesingt Procedures shall include the following tests that would be applicable to the project's Scope of Work:

a. Backflow Prevention Assembly Forward Flow Test.

b. Trip Tests of Dry Pipe Valves.

c. Main Drain Flow Test.

d. Integration with the Fire Alarm System.

3.16 PRELIMINARY ACCEPTANCE TESTING PREPARATORY MEETING

A Preparatory Meeting may be held at the site to discuss the expectations and requirements of Preliminary Acceptance Testing by reviewing the Preliminary Acceptance Testing Procedures. The necessity of a Preparatory Meeting will be decided upon by the USACE representative and/or DPW representative that would be attending the Preliminary Acceptance Testing. The Preparatory Meeting shall involve the General Contractor, the sprinkler system contractor, and the USACE representative and/or DPW representative.

3.17 PRELIMINARY ACCEPTANCE TESTING

Preliminary Acceptance Testing (PAT)shall be performed in accordance with the approved Preliminary Test Procedures. Furnish instruments and personnel required for preliminary Acceptance Testing. The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. Preliminary Acceptance Testing shall be witnessed by the Fire Protection Specialist. The USACE representative and/or DPW representatives shall be invited to attend and witness the Preliminary Acceptance Test, but are not required to be present. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.17.1 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly shall be tested at system flow demand, including all applicable interior hose streams, as specified in NFPA 13. Backflow Preventers shall be tested in accordance with Washington State requirements. The Contractor shall provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5 inch or 3 inch diameter hoses, playpipe nozzles, Hose Monsters, calibrated pressure gauges, and pitot tube gauge. The Contractor shall provide all necessary supports to safely secure hoses and discharge outlets during the test. Full Forward Backflow Testing information shall include the following information: Pressure on the supply side of the backflow preventer assembly prior to testing, Pressure on the discharge side of the backflow preventer assembly prior to testing, Pressure on the supply side of the backflow preventer assembly during testing, Pressure on the discharge side of the backflow preventer assembly during testing, Total pressure drop across the

backflow preventer assembly during testing, System test flow rate based upon hydraulic system demands, and the Manufacturer's documented pressure drop data from the pressure drop flow curve.

3.17.2 Trip Tests of Dry Pipe Valves

Each dry pipe valve shall be trip-tested by reducing normal system air pressure through operation the inspector's test connection. Systems equipped with quick opening devices shall be first tested without the operation of the quick opening device and then with it in operation. Test results will be witnessed and recorded. Test results shall include the number of seconds elapsed between the time the test valve is opened and tripping of the dry valve; trip-point air pressure of the dry pipe valve; air pressure prior to valve tripping; elapse time for building Fire Alarm System to operate; and number of seconds elapsed between time the inspector's test valve is opened and water reaches the orifice. The maximum allowable time from operation of the inspector's test valve until water physically discharges from the inspector's test discharge shall be 60 seconds. Water delivery times must be measured starting at the normal nitrogen pressure on the system.

3.17.3 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.17.4 Integration with the Fire Alarm System Testing

Each normally open control valve shall be closed and each normally closed control valve shall be opened to verify that the Fire Alarm System Control Panel identifies the correct control valve operated.

3.18 PRELIMINARY ACCEPTANCE TESTING REPORTS

Upon completion of specified preliminary tests, the Contractor shall complete the Material & Test Certificates for overhead system as specified in paragraph SUBMITTALS. A Preliminary Acceptance Testing Report that provides an overview of all testing performed, results, and items needing corrections prior to Final Acceptance Testing shall be provided to the government for review and approval. The installing contractor shall provide a Preliminary Acceptance Testing Report to the government for review and approval that shall not be signed.

3.18.1 Fire Protection Specialist Preliminary Acceptance Testing Report

The Fire Protection Specialist shall generate a Preliminary Acceptance Testing Report (on company letterhead) summarizing all Preliminary Acceptance Testing performed along with the test results and a summary of items requiring corrections from Preliminary Acceptance Testing prior to Final Acceptance Testing. The Fire Protection Specialist Preliminary Test Report shall be addressed to and sent to the General Contract for corrections and to the government representative acting as the Authority Having Jurisdiction for their records.

3.19 FINAL ACCEPTANCE TESTING PROCEDURES

Final Acceptance Test Procedures shall include detailed step-by-step outline for each test and the expected test results to be performed at Final System Acceptance Testing and shall be on its own page in the Final Acceptance Testing Procedures. The Final Acceptance Testing Procedures shall identify the sequence of testing, time estimate for each test, blank copies of the Material & Test Certificates. The Final Acceptance Testing Procedures shall be in a check-off format (pass/fail) with space to add applicable test data. Final Test Procedures shall include the following tests that would be applicable to the project's Scope of Work:

a. Trip Tests of Dry Pipe Valves

b. Main Drain Flow Test

c. Integration with the Fire Alarm System

3.20 FINAL ACCEPTANCE TESTING PREPARATORY MEETING

A Preparatory Meeting may be held at the site to discuss the expectations and requirements of the Final Acceptance Testing by reviewing the Final Acceptance Testing Procedures. The necessity of a Preparatory Meeting will be decided upon by the USACE representative and/or DPW representative and JBLM Fire Prevention Representative that would be attending the Final Acceptance Testing. The Preparatory Meeting shall involve the General Contractor, the sprinkler system contractor, and the USACE representative and/or DPW representative.

3.21 FINAL ACCEPTANCE TESTING

Final System Acceptance Testing (FAT) shall begin only when the Preliminary Test Report has been approved. Coordinate with the Fire Protection Specialist and an USACE representative for required testing procedures. The Final Acceptance Testing shall be witnessed by the Fire Protection Specialist. The USACE representative and/or DPW representatives and JBLM Fire Prevention Representative shall be invited to attend and witness the Final Acceptance Testing, but are not required to be present. A backcheck inspection of deficiencies found during Preliminary Acceptance Testing will be conducted to verify corrections have been made. The contractor shall provide a complete demonstration of the operation of the system. The contractor shall provide copies of the current as-built drawings and certificates of tests previously conducted at the Preliminary Acceptance Testing. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

3.21.1 Trip Tests of Dry Pipe Valves

Each dry pipe valve shall be trip-tested by reducing normal system air pressure through operation the inspector's test connection. Systems equipped with quick opening devices shall be first tested without the operation of the quick opening device and then with it in operation. Test results will be witnessed and recorded. Test results shall include the number of seconds elapsed between the time the test valve is opened and tripping of the dry valve; trip-point air pressure of the dry pipe valve; air pressure prior to valve tripping; elapse time for building Fire Alarm System to operate; and

number of seconds elapsed between time the inspector's test valve is opened and water reaches the orifice. The maximum allowable time from operation of the inspector’s test valve until water physically discharges from the inspector’s test discharge shall be 60 seconds. Water delivery times must be measured starting at the normal nitrogen pressure on the system.

3.21.2 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.21.3 Integration with the Fire Alarm System Testing

Each normally open control valve shall be closed and each normally closed control valve shall be opened to verify that the Fire Alarm System Control Panel identifies the correct control valve operated.

3.22 FINAL ACCEPTANCE TESTING REPORTS

Upon completion of specified final acceptance tests, the Contractor shall complete the Material & Test Certificates for both the underground and overhead systems as specified in paragraph SUBMITTALS. Final Acceptance Testing Reports shall be provided by the installing contractor to the government for review and approval. The Contractor's Final Acceptance Testing Report shall be signed by the installing contractor, Fire Protection Specialist, and government representative acting as the Authority Having Jurisdiction.

3.22.1 Final Acceptance Testing Certification Letter

The Fire Projection Specialist shall certify in writing (on company letterhead) after completion of the Final Acceptance Testing that the sprinkler system performs as intended, has been installed in accordance with the contract requirements, and is ready to be put into service. The Certification Letter shall be addressed to and sent to the government representative acting as the Authority Having Jurisdiction for their records.

3.23 CLOSEOUT SUBMITTALS

The Fire Protection Sprinkler System Contractor shall submit the following items for JBLM records, review, and approval prior to any Operations and Maintenance Instructions or On-Site Training.

a. As-Built Drawings

b. Warranty Letter

c. Spare Parts

d. Operation and Maintenance (O&M) Instructions

e. Instruction of Government Employees

3.24 OPERATION AND MAINTENANCE INSTRUCTIONS

The contractor shall submit Operation and Maintenance Instructions prior to performing On-Site Training to the government representative acting as the Authority Having Jurisdiction for approval. Manuals shall include the manufacturer's name, model number, parts list, and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4-hour onsite response to a service call on an emergency basis.

3.25 ON-SITE TRAINING

The Contractor shall conduct a training course for operation and maintenance personnel as designated by the Contracting Officer. Coordinate the training requirements for suppression systems with training for the fire alarm system. Training shall be provided for a period of not less than 4 hours up to a maximum of 8 hours during normal working time. Training shall start after the system is functionally complete and after Final Acceptance Test. The On-Site Training shall cover all of the items contained in the approved Operating and Maintenance Instructions. Provide (1) copy of the On-Site Training on a DVD to the following:

a. JBLM Fire Department.

b. DPW Public Works.

c. JBLM Fire Alarm Shop.

-- End of Section --