UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2015
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DIVISION 21 - FIRE SUPPRESSION

SECTION 21 13 24.00 10

AQUEOUS FILM-FORMING FOAM (AFFF) FIRE PROTECTION SYSTEM

10/07

-- End of Section Table of Contents --

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USACE / NAVFAC / AFCEC / NASA | **UFGS-21 13 24.00 10 (October 2007)**

Preparing Activity: USACE | **Superseding UFGS-21 13 24.00 10 (April 2006)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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SECTION 21 13 24.00 10

AQUEOUS FILM-FORMING FOAM (AFFF) FIRE PROTECTION SYSTEM
10/07

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NOTE: This guide specification covers requirements for foam-water AFFF fire protection sprinkler and nozzle systems.

Adhere to UFC 1-300-02 **Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.**

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

****

PART 1 GENERAL

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NOTE: The complete design of the AFFF system must be shown on the project drawings. There are no provisions in this UFGS for the Contractor to perform hydraulic calculations or to lay out the system. (For aircraft hangar applications, refer to ETL 1110-3-484.) Use sprinkler hydraulics software for hydraulic calculation of the fire protection system. Assure that the design analysis clearly describes the design approach and includes hydraulic calculations. The drawings SHOULD include complete pipe and equipment layout WITH SPACE ENVELOPE REQUIRED FOR INSTALLATION AND OPERATION OF EACH SYSTEM COMPONENT SHOWN. THE DRAWINGS SHOULD ALSO INCLUDE sprinkler and nozzle locations, elevation views of the piping showing vertical location of

sprinklers and piping with respect to the ceiling and floor heat detectors, control panels, AFFF control panel zoning, wiring, foam storage tank, pumps, and other associated equipment. Consider pipe hanger requirements when laying out the system to ensure that the Contractor can provide hangers per NFPA 13.

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1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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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.

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1013	(2011) Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers - (ANSI approved 2010)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2013) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C151/A21.51	(2009) Ductile-Iron Pipe, Centrifugally Cast, for Water

ASME INTERNATIONAL (ASME)

ASME A13.1	(2007; R 2013) Scheme for the Identification of Piping Systems

ASME B16.1	(2010) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2011) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME BPVC SEC VIII D1	(2010) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A183	(2014) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A193/A193M	(2014a) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A312/A312M	(2015) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A351/A351M	(2014) Standard Specification for Castings, Austenitic, for Pressure-Containing Parts
ASTM A403/A403M	(2014) Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
ASTM A449	(2014) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A47/A47M	(1999; R 2014) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A536	(1984; R 2014) Standard Specification for Ductile Iron Castings
ASTM A563	(2007a; R2014) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A563M	(2007; R 2013) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM A795/A795M	(2013) Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

ASTM F436	(2011) Hardened Steel Washers
ASTM F436M	(2011) Hardened Steel Washers (Metric)

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 11	(2010; TIA 10-1) Standard for Low-, Medium- and High- Expansion Foam
NFPA 13	(2013; TIA 10-1; TIA 11-2; ERTA 2014; TIA 14-3) Standard for the Installation of Sprinkler Systems
NFPA 16	(2015) Standard for Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
NFPA 1963	(2014) Standard for Fire Hose Connections
NFPA 20	(2013) Standard for the Installation of Stationary Pumps for Fire Protection
NFPA 24	(2013) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code
NFPA 72	(2013) National Fire Alarm and Signaling Code

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	(2010) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-F-24385	(1992; Rev F; Am 1 1994) Fire Extinguishing Agent, Aqueous Film Forming Foam (AFFF) Liquid Concentrate, for Fresh and Seawater
UFC 3-310-04	(2013) Seismic Design for Buildings

UNDERWRITERS LABORATORIES (UL)

UL Fire Prot Dir	(2012) Fire Protection Equipment Directory

1.2 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

An "S" following a submittal item indicates that the submittal is required for the Sustainability Notebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the

Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G[, [_____]]

SD-03 Product Data

Materials and Equipment; G[, [_____]]
Spare Parts
AFFF System; G[, [_____]]
Installer's Qualifications; G[, [_____]]
Post-Discharge Test Requirements; G[, [_____]]

SD-06 Test Reports

Test Reports

SD-07 Certificates

Materials and Equipment

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G[, [_____]]

SD-11 Closeout Submittals

As-Built Drawings; G[, [_____]]

1.3 QUALITY ASSURANCE

The advisory provisions of NFPA standards and recommended practices specified shall be considered mandatory, as though the word "shall" had been substituted for "should" wherever it appears. In the event of a conflict between referenced NFPA standards and this specification, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.3.1 Submittal Preparer's Qualifications

The fire protection system submittals, including as-built drawings, shall be prepared by an individual who is either a registered professional engineer with ten years experience designing AFFF systems or who is certified as a Level IV Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. Submit one set of reproducibles and six copies, within 14 calendar days after successful completion of required testing. A separate set of approved submittal drawings of the overall system, marked up to indicate as-built conditions, shall be maintained onsite in a current condition at all times and shall be made available for review immediately upon request during normal working hours. Variations from the approved drawings, for whatever reason, including those occasioned by modifications, change orders, optional materials, and/or required for coordination between trades shall be indicated in sufficient detail to accurately reflect the as-built conditions.

1.3.2 Installer's Qualifications

Provide a statement attesting that the proposed installer is regularly engaged in the installation of the type and complexity of system included in this project. Submit, in addition, data identifying the locations of at least three systems recently installed by the proposed installer which are comparable to the system specified. Certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

1.3.3 Detail Drawings

Submit detail drawings conforming to the requirements prescribed in NFPA 13; drawings shall be 841 x 594 mm 30 x 42 inches. Drawings shall include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. A descriptive index with drawings listed in sequence by number. A legend sheet identifying device symbols, nomenclature, and conventions used in the package.

b. Floor plans drawn to a scale not less than 1:100 1/8 inch equals 1 foot clearly showing locations of devices, equipment, risers, electrical power connections, flame detector viewing areas, areas covered by each nozzle, and other details required to clearly describe the proposed arrangement.

c. Piping plan for each individual sprinkler system and each nozzle system. Sprinklers, nozzles and associated piping shall be shown. Abbreviated presentation forms will not be accepted. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be identified. A separate plan shall be provided for each overhead sprinkler system and each nozzle system.

d. Piping plan and isometric drawing of the AFFF concentrate system and details of all associated pumps, valves, fittings, and other components. Drawing shall indicate all operational features including, but not limited to, settings for pump start/stop, relief valve open/close, pressure sustaining valve open/close.

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; and from sprinkler feed mains, crossmains and branchlines to finished floor and roof or ceiling.

f. Location of control panels, detectors, manual stations, supervisory switches, solenoids, notification appliances, and other electrical devices. In addition, conduit routing and sizes, and the number of conductors contained in each shall be indicated.

g. Longitudinal and transverse building sections showing typical branch line and crossmain pipe routing and elevation of each typical sprinkler above finished floor.

h. Equipment room layout drawings drawn to a scale of not less than 1:20 1/2 inch equals 1 foot to show details of each system component, clearances between each other and from other equipment and construction

in the room.

i. Details of each type of pipe hanger, sway bracing for earthquake protection, restraint of underground water main at point-of-entry into the building, proportioners, nozzles and mounting details, AFFF system control valve header and related components.

j. Connection drawings and control diagrams indicating overall electrical and mechanical operation of the AFFF system. This shall include identification and operation of each major component of the system. Diagrams shall be supplemented with a narrative description of the system. Point-to-point wiring diagrams shall indicate foam system control panel wiring and make and model of devices and equipment connected thereto.

k. Detail drawings depicting actual wiring of AFFF pump controller and all interconnecting wiring to foam concentrate pumps and other components connected to the controller. Such drawing shall be specifically prepared for the project installation. Manufacturer's standard wiring diagrams will not be accepted.

1.4 EXTRA MATERIALS

Submit spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. Include a list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor.

PART 2 PRODUCTS

2.1 SYSTEM REQUIREMENTS

****
NOTE: General operation of the system should be described here. This description is not intended to replace a controls matrix or sequence of operation otherwise required or provided on the drawings. Select the appropriate system and delete the others.
****

a. Provide an AFFF System consisting of an automatic [wet-pipe] [preaction] [deluge] foam-water fire protection system used for the areas indicated on the drawings. Submit a copy of the proposed diagrams and instructions for the overall AFFF system, prior to posting. Except as modified herein, the system shall meet the requirements of NFPA 11, NFPA 13, NFPA 16, NFPA 24 and NFPA 72.

b. [The wet-pipe sprinkler system shall operate so that actuation of a single sprinkler will cause water to flow through the alarm check valve, foam concentrate to enter the affected proportioners, and foam-water solution to be discharged from actuated sprinklers and the nozzle system.]

c. [The single-interlocked preaction sprinkler system (without supervisory air) shall operate so that actuation of a single heat detector or manual release will cause the automatic water control (deluge) valve to open, foam concentrate to enter the affected proportioners, and

foam-water solution to be discharged from actuated sprinklers and the nozzle system.]

d. [The deluge sprinkler system shall operate so that actuation of a single heat detector or manual release will cause the automatic water control (deluge) valve to open, foam concentrate to enter the affected proportioners, and foam-water solution to be discharged from all sprinklers on the system and the nozzle system.]

2.2 STANDARD PRODUCTS

Provide materials and equipment which are standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Submit manufacturer's catalog data for each separate piece of equipment proposed for use in the system. Data shall indicate the name of the manufacturer of each item of equipment, with data highlighted to indicate model, size, options, etc. proposed for installation. In addition, provide a complete equipment list with equipment description, model number, and quantity and certificates from manufacturers to substantiate that components, equipment and material proposed for installation and use meet requirements as specified. Certificates shall be on a form for this purpose or on official letterhead of the manufacturer with specified information stated as required. Certificate shall be signed by an officer of the corporation. Submit certificates for the following:

2.2.1 AFFF Concentrate

Certification that AFFF concentrate proposed for use has been tested and is in compliance with MIL-F-24385.

2.2.2 AFFF Concentrate Control Valve

Certification that the valve is designed and, constructed as specified and will function as intended.

2.2.3 AFFF Proportioning System

Certification that the foam proportioning system complies with contract specifications and manufacturer's recommendations.

2.2.4 Control Panel

Certification that the control panel releasing module is electrically compatible with the electrically-actuated automatic water control valve.

2.3 NAMEPLATES

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate permanently affixed to the item of equipment.

2.4 REQUIREMENTS FOR FIRE PROTECTION SERVICE

All equipment and material shall have been tested by Underwriters Laboratories, and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or

FM APP GUIDE. The omission of these terms under the description of any item of equipment described shall not be construed as waiving this requirement.

2.5 PRESSURE RATINGS

Valves, fittings, couplings, proportioners, alarm switches, strainers, and similar devices shall be rated for the maximum working pressures that can be experienced in the system, but in no case less than 1200 kPa 175 psi.

2.6 UNDERGROUND PIPING SYSTEMS

****

NOTE: Assure that this provision is coordinated with drawings and other specification sections.

****

Pipe shall be ductile iron pipe conforming to AWWA C151/A21.51, working pressure not less than 1034 kPa 150 psi, with cement-mortar lining conforming to AWWA C104/A21.4 for piping under the building and to a point 1.5 m 5 feet outside the building walls. Fittings shall be ductile iron conforming to AWWA C110/A21.10. Piping more than 1.5 m 5 feet outside the building walls shall be [outside-coated cement-lined ductile iron pipe] [provided under SECTION 33 11 00 WATER DISTRIBUTION].

2.7 ABOVEGROUND PIPING SYSTEMS FOR WATER OR AFFF SOLUTION

2.7.1 Pipe

Pipe shall be standard weight conforming to ASTM A795/A795M or ASTM A53/A53M. Pipe 150 mm 6 inch diameter and smaller shall be Schedule 40. Pipe shall be marked as to the brand or name of the manufacturer, kind of pipe and the ASTM designation in accordance with the "Product Marking" provisions of the ASTM standard.

2.7.2 Grooved Fittings and Couplings

Grooved fittings, couplings and bolts shall be provided by the same manufacturer. Fittings and couplings shall be malleable iron complying with ASTM A47/A47M or ductile iron complying with ASTM A536. Couplings shall be of the rigid type except that flexible type will be provided where flexible joints are specifically required by NFPA 13. Coupling gaskets shall be Grade E (EPDM) approved for dry pipe fire protection service. Gasket shall be the flush type that fills the entire cavity between the coupling and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A183 and shall be cadmium plated or zinc electroplated.

2.7.3 Non-Grooved Fittings

Non-grooved fittings shall be threaded or flanged. Threaded fittings shall be cast iron conforming to ASME B16.4 or malleable iron conforming to ASME B16.3. Flanged fittings shall be cast iron conforming to ASME B16.1. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings which require drilling a hole in the pipe, and fittings which use steel gripping devices to bite into the pipe, shall not be used.

2.7.4 Flanges and Gaskets

Flanges shall conform to NFPA 13 and ASME B16.1. Flanges shall be the type that are welded or threaded to the pipe. Flanges which are bolted to grooved pipe will not be permitted. Gaskets shall be full face type EPDM or other approved material.

2.7.4.1 Bolts

Bolts shall be ASTM A449, Type [1] [2]. Bolts shall extend no less than three full threads beyond the nut with bolts tightened to the required torque.

2.7.4.2 Nuts

Nuts shall be [ASTM A193/A193M, Grade 5] [ASTM A563M ASTM A563, Grade [C3] [DH3]].

2.7.4.3 Washers

Washers shall meet the requirements of ASTM F436M ASTM F436. Flat circular washers shall be provided under all bolt heads and nuts.

2.7.5 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM APP GUIDE and be of the type suitable for the application, construction and size pipe involved.

2.7.6 Control Valve

Unless otherwise indicated, valves shall be indicating type in accordance with NFPA 13. Valves 65 mm 2-1/2 inch and larger shall be flanged outside screw and yoke (OS&Y) type.

2.7.7 Check Valve

Check valves 100 mm 4 inches and larger shall be flanged, swing type, cast or ductile iron body and cover, cast or ductile iron clapper with replaceable EPDM rubber facing. Valves shall be suitable for either vertical or horizontal mounting and equipped with a removable handhole cover. The direction of flow shall be indicated by an arrow cast in the valve body. The valve body shall include plugged pipe thread connections for a 50 mm 2 inch drain.

2.8 ABOVEGROUND PIPING SYSTEMS FOR AFFF CONCENTRATE

2.8.1 Pipe

Pipe shall be standard weight stainless steel conforming to ASTM A312/A312M, Grade TP 304L.

2.8.2 Fittings

Seamless socket weld type or flanged type fittings shall conform to ASTM A403/A403M, Grade WP 304L, and shall be compatible with the pipe. Grooved type fittings and couplings shall be of Type 316 Stainless Steel conforming to ASTM A351/A351M.

2.8.3 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM APP GUIDE and be of the type suitable for the application, construction and size pipe involved.

2.8.4 Control Valves

Valve shall be indicating type with full port ball and operating handle that indicates the on/off position of the valve. Unit shall be socket weld or flanged type. Valve body and ball shall be of 316 stainless steel complying with ASTM A351/A351M. The valve handle shall be provided with a suitable and substantial means for securing the valve open with a key-operated locking device.

2.9 ALARM CHECK VALVE ASSEMBLY

****
NOTE: Specify 1724 kPa 250 psi rated valve for applications where the working pressure exceeds, or may exceed, 1207 kPa 175 psi.
****

Alarm check valve assembly shall be of the variable pressure type rated for working pressures of [1207 kPa175 psi] [1724 kPa250 psi]. Assembly shall be provided with standard trimmings including pressure gauges, retarding chamber, alarm line vent, testing bypass, and necessary pipe, fittings, and accessories required for a complete installation. Valve trim piping shall be brass. Such piping shall include provision for installing an alarm pressure switch in a non-interruptible arrangement whereby shutting off of other alarm devices will not shutoff the switch in the non-interruptible location.

2.10 AUTOMATIC WATER CONTROL VALVE ASSEMBLY (DELUGE VALVE)

****
NOTE: The term "automatic water control valve" is found in the FM Approval Guide and is synonymous with "special system water control valves" found in the UL Fire Prot Dir. This term is used for "deluge," "preaction" and "flow control" valves.
****

Water control valve shall be an electrically-actuated type rated for a maximum working pressure of [1207 kPa175 psi] [1724 kPa250 psi]. The control valve shall be resettable without opening the valve and without the use of special tools. Electrical solenoid valve used to actuate the water control valve shall be an integral component of the valve or shall be approved for use by the water control valve manufacturer and the control panel manufacturer. Solenoid valve shall be of the normally closed, de-energized type which opens when energized upon receipt of an electrical signal from the control panel to which it is connected. Solenoid valves used with diaphragm-type valves shall be rated for a maximum pressure equal to that of the associated valve. Water control valve shall be equipped with a means to prevent the valve from returning to the closed position until being manually reset. Assembly shall be complete with the valve manufacturer's standard trim piping, drain and test valves, pressure gauges, and other required appurtenances. Each assembly shall include an emergency release device for manually tripping the water control valve in the event of a power or other system failure. Device shall be a standard

accessory component of the valve manufacturer and shall be labeled as to its function and method of operation. Valves located in hazardous locations shall be approved for the hazard classification of the area where located.

2.11 MECHANICAL ALARM DEVICE

Device shall be water-powered and shall include a body housing, impeller wheel, drive shaft, striker assembly, gong, wall plate and related components necessary for complete operation. Minimum 19 mm 3/4 inch piping shall be provided between the housing and the alarm line trim. Drain piping from the body housing shall be minimum 25 mm 1 inch steel and shall be arranged to drain to the outside of the building. Piping shall be galvanized both on the inside and on the outside surfaces.

2.12 FIRE DEPARTMENT CONNECTION

****
NOTE: Verify the type of threads used by the local fire department.
****

Connection shall be [projecting] [flush] type with cast brass body, a [polished brass] [chromium plated] finish, and matching wall escutcheon lettered "Auto Spkr". The connection shall have two inlets with individual self-closing clappers, caps with drip drains, and chains. Female inlets shall have 65 mm 2-1/2 inch diameter American National Fire Hose Connection Screw Threads (NH) in accordance with NFPA 1963.

2.13 BASKET STRAINER

****
NOTE: Strainers are generally not required on systems utilizing only wet-pipe sprinklers. Indicate strainer size and friction loss limits based upon specific design.
****

Unit shall have cast iron flanged body and cover flanges. The strainer basket shall be formed of perforated brass or stainless steel sheet with 6 mm 1/4 inch perforations. Strainer size shall be [_____] mm inch and shall have a maximum friction loss of [_____] kPa psi at a flow rate of [_____] L/second gpm. Assembly shall allow access to the strainer basket by removing the flange on the top of the strainer.

2.14 REDUCED PRESSURE BACKFLOW PREVENTION ASSEMBLY

****
NOTE: Backflow preventers are not required in systems supplied by dedicated fire protection storage and pumping facilities. Where systems are supplied from domestic water systems, reduced pressure type backflow preventers are required and must be located on the discharge side of booster fire pumps directly supplying the system.
****

The unit shall be capable of preventing backsiphonage and back pressure backflow from the fire protection system into the potable water system.

The assembly shall include a pressure differential relief valve located in a zone between two positive seating check valves. The assembly shall include resilient seated outside stem and yoke (OS&Y) gate valves upstream and downstream of the valve and test cocks. Main valve body shall be ductile iron with fused bonded epoxy coating. The assembly shall comply with ASSE 1013 and be listed in UL Fire Prot Dir or FM APP GUIDE.

2.15 DISCHARGE DEVICES

2.15.1 Sprinkler

Sprinkler shall be 13 mm 1/2 inch orifice spray type. For deluge systems, sprinkler shall be open type without heat responsive and actuating elements. For wet-pipe or preaction systems, sprinkler shall be upright type with [standard response] [quick response] glass bulb heat responsive and actuating element having a temperature rating of [79 degrees C 175 degrees F] [_____]. Spare sprinklers in accordance with NFPA 13 shall be housed in metal or plastic containers.

2.15.2 Fixed Nozzle

****
NOTE: Verify availability of nozzles required to meet design flows and pressures as needed to achieve nozzle coverage indicated on the drawings.
****

Nozzle shall be of fixed constant flow type, cast brass construction [25] [40] [_____] mm [1] [1-1/2] [_____] inch male NPT, suitable for use with AFFF solution. Nozzle shall be factory set for required discharge characteristic. Discharge characteristic or k-factor(s) shall be as indicated on the drawings. Nozzle discharge pattern shall be field adjustable and lockable. Nozzle flow and effective reach of discharge at various nozzle patterns shall have been determined by the manufacturer's actual discharge tests with nozzles in horizontal pattern at nozzle pressures of 345 kPa 50 psi, 517 kPa 75 psi and 689 kPa 100 psi. Nozzle settings shall be factory set. Field disassembly, adjustment or assembly which could alter discharge characteristic will not be permitted.

2.15.3 Oscillating Monitor Nozzle Assembly

Assembly shall include water-powered oscillator, monitor, nozzle, and related ancillary components which shall be the product of one manufacturer. Water-powered oscillating mechanism shall be equipped with a strainer. Assembly shall include a test connection for operating the oscillator from an auxiliary water source without requiring discharge through the nozzle. Angle of elevation shall be adjustable from 20 degrees below to 60 degrees above horizontal. Oscillation arc shall be adjustable from 10 degrees to 165 degrees and speed shall be adjustable from 0 degrees to 30 degrees per second. Components in contact with the AFFF solution shall be compatible with the foam concentrate and metallic components shall be brass, bronze or stainless steel. Nozzle shall be a standard model of the manufacturer and shall have a fixed discharge characteristic. Nozzle discharge characteristic shall have been determined by discharge tests. Monitor nozzle assembly shall be approved by Factory Mutual and listed in FM APP GUIDE.

2.16 AFFF LIQUID CONCENTRATE

AFFF concentrate shall be 3 percent conforming to MIL-F-24385. Concentrate shall be the product of one manufacturer. Mixing of non-identical brands of concentrate will not be permitted.

2.17 DIAPHRAGM TANK BALANCED PRESSURE PROPORTIONING SYSTEM

****
NOTE: Delete paragraph PUMPED BALANCED PRESSURE PROPORTIONING SYSTEM if this paragraph is used. Specify tank to be horizontal type unless project requirements specifically require vertical.
****

Tank shall be a steel pressure vessel constructed in accordance with ASME BPVC SEC VIII D1. ASME label shall be permanently affixed to the tank. Tank shall be horizontally mounted on steel saddles and shall contain a full internal diaphragm (bladder) having a minimum capacity of [_____] L gallons. Diaphragm shall be nylon-reinforced Buna-N rubber or other approved material conforming to the inside shape of the tank. AFFF concentrate shall be stored inside the diaphragm and the concentrate shall not be in contact with the steel tank. The tank shall have perforated PVC tubes installed inside the diaphragm to assure full displacement of the stored concentrate. Tank shall be equipped with the manufacturer's standard fittings and trim, including AFFF fill and drain connections, water fill and drain connections, and concentrate sight gauge.

2.18 PUMPED BALANCED PRESSURE PROPORTIONING SYSTEM

****
NOTE: Delete paragraph DIAPHRAGM TANK BALANCED PRESSURE PROPORTIONING SYSTEM if the following paragraphs are used.
****

2.18.1 AFFF Concentrate Storage Tank

****
NOTE: Provide seismic details, if a Government designer (either Corps office or A/E) is the Engineer of Record, and show on the drawings. Remove the second bracketed phrase if seismic details are not provided. Pertinent portions of UFC 3-310-04 and Sections 13 48 00 and 13 48 00.00 10 must be included in the contract docments.
****

Tank shall be designed for storage of AFFF concentrate at atmospheric pressure and shall be vertical cylindrical, high density cross-linked polyethylene construction. Individual tank capacity shall be a minimum of [_____] L gallons. Tank shall be translucent and equipped with level gauge strip for approximating quantity of tank contents. Tank shall be equipped with the following: inspection hatch; valved drain/fill connection; foam concentrate pump suction and return connections (with flex connectors); pressure/vacuum vent; low liquid level float switch; seismic tie downs and other accessories required for proper operation shall be [in accordance with UFC 3-310-04 and Sections 13 48 00 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 13 48 00.00 10 SEISMIC PROTECTION FOR

MECHANICAL EQUIPMENT] [as shown on the drawings]. Openings and tank connections shall be installed at the factory, no holes shall be made in the tank shell in the field. Tank shall include necessary supports for free standing installation.

2.18.2 AFFF Concentrate Pump

****

NOTE: Pump capacity must be sufficient to supply AFFF concentrate under design conditions with operation of sprinklers and nozzles as provided. Pump pressure should be approximately 206 kPa 30 psi above maximum system water pressure.

****

Pump shall be a positive displacement rotary gear or vane type operating at a speed not greater than 1800 rpm. Pump capacity shall be [_____] L/second gpm. Pump discharge pressure shall be a minimum of [_____] kPa psi. Metallic pump components in contact with AFFF concentrate shall be of bronze or stainless steel construction. Each pump shall be furnished with suction strainer, relief valve, and suction and discharge gauges. Pump shall be mounted on a carbon steel base and shall have guards over couplings. Pump shall be direct-connected to electric motor with drip-proof enclosure. Motor size shall be minimum [_____] kW hp.

2.18.3 AFFF Pump Controller

Controller shall be the automatic type and UL listed or FM approved for fire pump service and shall be arranged for automatic start and stop, and manual push-button stop of the AFFF pump it controls. Controller shall be completely terminally wired, ready for field connections, and mounted in a [NEMA Type 2 drip-proof] [NEMA Type 4 watertight and dust tight] enclosure arranged so that controller current carrying parts will not be less than 300 mm 12 inches above the floor. The controller shall be equipped with an externally operable isolating switch which manually operates the motor circuit. Means shall be provided in the controller for measuring current for all motor circuit conductors. Controller shall cause pump to run for a minimum of ten (10) minutes prior to automatic shutdown. Automatic stopping shall be accomplished only after all starting causes have returned to normal and after the minimum pump run time has elapsed. Controller shall also cause pump to stop upon signal from low liquid level switch installed in the AFFF concentrate tank. Controller shall monitor and provide individually displayed audible and visual alarms on the front panel for loss of a phase or line power, phase reversal, low AFFF concentrate level, and pump room temperature. Each alarm lamp shall be labeled with rigid etched plastic labels. The controller shall be equipped with the following:

a. Voltage surge arresters installed in accordance with NFPA 20.

b. Bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments, automatic starting relay actuated from normally closed contacts, visual alarm lamps and supervisory power light.

c. Thermostat switch with adjustable setting to monitor the pump room temperature and to provide an alarm when temperatures falls below 5 degrees C 40 degrees F.

d. Terminals for remote monitoring of pump running, pump power supply trouble (loss of power or phase and phase reversal), and pump room trouble (pump room temperature and low reservoir level, and for remote start.

e. A 7-day electric pressure recorder with 24-hour spring wound back-up. The pressure recorder shall provide a readout of the system pressure from 0 to 2067 kPa 0 to 300 psi, time, and date.

2.18.4 Power Supply

****
NOTE: Verify that project drawings indicate power supply in accordance with NFPA 20 requirements.
****

The source and arrangement of power supply to the pumps shall be as shown on the drawings and in accordance with NFPA 20.

2.18.5 AFFF Pressure Maintenance Pump

****
NOTE: A pressure maintenance pump is required only if AFFF concentrate piping length exceeds 15 meters 50 ft. or extends beyond the equipment room.
****

Pump shall be provided as indicated to maintain pressure on the AFFF concentrate distribution piping. Pump construction and components shall be similar to those provided for the primary AFFF concentrate pump. Pressure maintenance pump shall have a capacity and pressure rating of [_____] L/second gpm at a discharge pressure of at least [_____] kPa psi.

2.18.6 Pressure Balancing Valve

****
NOTE: This valve is used in pumped proportioning systems that do NOT utilize in-line balanced pressure proportioners (ILBP).
****

Pressure balancing valve shall be diaphragm type for balancing AFFF concentrate with water pressure. Valve body and other metallic components normally in contact with the AFFF concentrate shall be of bronze or stainless steel. Unit shall be rated for working pressure of 1379 kPa 200 psi and shall include a manual bypass and duplex gauge for monitoring water pressure and AFFF concentrate pressure.

2.18.7 Pressure Sustaining Valve

****
NOTE: A regulating valve is used in pumped proportioning systems to maintain constant pressure to in-line balanced pressure proportioners (ILBP). Delete this paragraph for applications using pressure balancing valves instead of ILBP's.
****

Pressure regulating valve shall be a pressure sustaining back pressure

type, hydraulically operated, pilot controlled, modulating type arranged to maintain constant upstream pressure in the AFFF concentrate piping system as the flow rate varies. Valve body and other metallic components normally in contact with the AFFF concentrate shall be of bronze or stainless steel construction. Valve body shall be designed with flat-faced flanges to match flanges of the same nominal size. Valve shall pass the unused portion of the AFFF liquid back to the storage tank under low system flow conditions. Valve shall be sized to pass the full AFFF liquid pump output of a single foam concentrate pump.

2.19 BALANCED PRESSURE PROPORTIONER (RATIO CONTROLLER)

****

NOTE: Edit this paragraph to suit the type and size or sizes of proportioners required. In-line type proportioners can be used only with concentrate pumping systems. The size of the foam proportioner (ratio controller) used in closed-head sprinkler systems is critical. If the proportioner is too large, it may not correctly proportion at low flows, and if it is too small, it may not correctly proportion at high flows. A 150 mm 6-inch proportioner will be appropriate for most sprinkler applications.

****

The proportioner shall be [a standard] [an in-line] balanced pressure type unit capable of proportioning AFFF liquid at 3 percent, (3 parts concentrate to 97 parts water by volume solution) at flow rates within the flow range of the proportioner. Major components of the proportioner, including the body, inlet nozzle and metering orifice shall be of brass, bronze or stainless steel. The body shall be clearly marked with a flow-direction arrow, and the type and percent of AFFF concentrate that it was designed to proportion. The proportioner size shall be [150] [_____] mm [6] [_____] inch and shall have a maximum friction loss of [_____] kPa psi at a flow rate of [_____] L/second gpm. The in-line balanced pressure proportioner shall be an assembly that includes a proportioner as described, integral pressure balancing valve with duplex pressure gauge, inlet pressure gauge and manual ball valve. The proportioner assembly shall be factory assembled and tested as an assembly by one manufacturer. Field disassembly or assembly of any component part will not be accepted. Components shall be of the make/model required by the specific UL listing or FM approval.

2.20 AFFF CONCENTRATE CONTROL VALVE ASSEMBLY

Assembly shall be specifically designed and constructed to control AFFF concentrate to proportioners and shall be arranged to open upon application of water or AFFF solution pressure from the alarm check or automatic water control valve to which it is connected. Valve shall be a listed or approved automatic control valve specifically intended for this application or a full port ball valve. All components shall be constructed of brass, bronze or stainless steel, except that the internal portions of listed or approved fire protection valves subjected to AFFF concentrate may be provided with a coating warranted by the manufacturer to protect the valve from the deleterious effects of the concentrate. All components shall be rated for working pressure of 1200 kPa 175 psi or maximum working pressure to which they could be subjected, whichever is greater. Valve shall be certified by the manufacturer to be operable with water inlet pressure as

low as 207 kPa 30 psi. Valve components shall be brass, bronze or stainless steel.

2.21 FOAM SYSTEM CONTROLS

****

NOTE: A foam system control panel is required for preaction and deluge sprinkler systems, as well as for systems with nozzles. Systems using "hardwired" devices are the simplest and will provide reliable service with minimum maintenance and testing. Such systems are appropriate for most applications.

****

Panel shall be UL listed or FM approved for "Releasing Device Service" or shall have modules approved for this purpose. Panel shall contain components and equipment required to provide the specified operational and supervisory functions of the system. Components shall be housed in a [surface] [flush] mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly factory assembled and wired unit. Panel shall include integral "power on," "alarm," and "trouble" lamps with annunciation of each alarm, supervisory and trouble signal. The panel shall have prominent rigid plastic or metal identification plates for zones, indicating lights, controls, meters, and switches. Lamps and fuses mounted on circuit boards shall be identified by permanent markings on the circuit board. Nameplates for fuses shall also include ampere rating. Control panel switches shall be within the locked cabinet. A suitable means shall be provided for testing the control panel visual indicating devices (meter and lamps). Meters and lamps shall be plainly visible when the cabinet door is closed. Signals shall be provided to indicate and annunciate, by zone, any alarm, supervisory or trouble condition on the system. Upon restoration of power, start-up shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals. Where the panel controls continuous linear thermal detection cable, the panel shall be fully compatible with the cable, as certified by the cable manufacturer. In such applications, the panel shall be capable of controlling multiple independent adjustable fixed temperature set points to achieve the effect of a rate-of-rise detector. The panel shall be capable of identifying the location of a hot spot along the length of the detector cable and providing a constant temperature readout.

2.21.1 Zone Annunciator

Visual annunciators shall be provided for each active zone and spare zone. A separate alarm and trouble lamp shall be provided for each zone and shall be located on the exterior of the cabinet door or be visible through the door. A minimum of [two] [_____] spare alarm zones that are fully operational shall be provided. Each lamp shall provide specific identification of the zone by means of a permanently attached rigid plastic or metal sign with either raised, engraved or silk-screened letters. Zone identification shall consist of a unique zone number as well as a word description of the zone. Zones shall be arranged as shown on the drawings.

2.21.2 System Zoning

****

NOTE: Correlate the zoning of the foam system

control panel with what is shown in the riser diagram/schematic and controls matrix shown on the drawings. Differentiate groups of ALARM zones and SUPERVISORY zones as well as indicate specific devices in each circuit or zone. Generally, separate alarm initiating zones will be for heat detectors, waterflow switches, manual actuation stations, etc.

****

The system shall be zoned as follows:

ZONE NO.	DESCRIPTION
[_____]	[_____]
[_____]	[_____]
[_____]	[_____]
[_____]	[_____]

2.21.3 Primary Power Supply

****

NOTE: The drawings will indicate a dedicated power supply circuit for each preaction and deluge sprinkler system control panel. The power circuit will be arranged so that power and lighting system can be shut down for building modifications without shutting down primary power to the control panel.

****

Primary power and trouble alarm power to Control Panel shall be supplied from two 120 VAC circuits. [Power to the control panel shall be as indicated.] [A [separate panel] [fused two-pole disconnect switch] connected ahead of [the main building panel] [the indicated panel] shall be provided.] Panel shall be equipped with two 20-amp circuit breakers for each control panel and with key lock. [Panel] [Disconnect switch] shall be permanently marked "FOAM FIRE PROTECTION SYSTEM".

2.21.4 Emergency Power Supply

Emergency power shall be provided for system operation in the event of failure of the primary power supply and shall consist of rechargeable storage battery system. Transfer from normal to emergency power or restoration from emergency to normal power shall be automatic and shall not cause transmission of a false alarm.

2.21.4.1 Storage Batteries

****

NOTE: Indicate if batteries will be located in a compartment within the control panel or in a separate cabinet. Delete last sentence when battery is not located within the control panel.

****

Storage Batteries shall be sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the system for a period of 90 hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate alarm indicating devices in the alarm mode for a minimum period of [15] [_____] minutes. Battery cabinet shall be a separate [compartment within the control panel] [cabinet]. The battery compartment or cabinet shall have twice the volume of the batteries. Batteries shall set on a non-corrosive and non-conductive base or pad. Batteries in the control panel shall be located at the bottom of the panel.

2.21.4.2 Battery Charger

Battery charger shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 24 hours. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state of the battery charge. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly if a high rate switch is provided. Charger shall be located in control panel cabinet.

2.22 ALARM INITIATING DEVICES

2.22.1 Waterflow Pressure Alarm Switch

****
NOTE: The adjustable retard switch is similar to the Potter Model WFSR-F and should be used where detection of sprinkler waterflow is used to perform critical functions such as actuating nozzles. This switch should be piped in the alarm valve trim such that it cannot be shutoff. The retard feature is not appropriate for use in preaction or deluge systems. "Standard" pressure switches are typically installed downstream of the retard chamber of the alarm valve alarm line trim.
****

Unit shall include a 13 mm 1/2 inch NPT male pipe thread, two 13 mm 1/2 inch conduit knockouts, and two sets of SPDT (Form C) contacts. The switches shall be factory adjusted to transfer the contacts at 27.6 to 55.1 kPa 4 to 8 psi on rising pressure. Unit shall include a water-tight NEMA 4 die-cast aluminum housing with a tamper resistant cover which requires a special key for removal. The cover shall be provided with a tamper switch which shall operate upon removal of the cover. Units used on wet-pipe systems shall have an adjustable, instantly recycling pneumatic retard to prevent false alarms due to water pressure variation. Retard adjustment shall be factory set at approximately 20-40 seconds and adjustable between 0-90 seconds.

2.22.2 Vane-type Waterflow Switch

****
NOTE: Vane-type flow switches cannot be used on preaction, deluge or other system piping which is not normally filled with water or AFFF solution.
****

Assembly shall consist of a cast aluminum pipe saddle housing an electro-mechanical device to which is attached a flexible, low-density polyethylene paddle. The paddle shall conform to the inside diameter of the fire protection pipe and sense water or solution movements. The waterflow indicator shall be capable of detecting a sustained flow exceeding 0.63 L/second 10 gpm. Assembly shall contain a pneumatic retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The unit shall include two sets of SPDT (Form C) contacts. The unit shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

2.22.3 Heat Detector-Spot Type

****

NOTE: Include description of the type of heat detection shown on drawings. Delete the inapplicable type.

****

Detector shall be weatherproof, of the rate-compensation type with a nominal temperature rating of [76] [_____] degrees C [170] [_____] degrees F. Detector shall be listed or approved for spacing between detectors as shown. Detectors listed or approved as "rate anticipation" type will be accepted. Detectors utilizing the fixed-temperature, rate-of-rise, or combination fixed-temperature/rate-of-rise principles will not be accepted. Six spare detectors of each type and temperature rating shall be provided.

2.22.4 Continuous Linear Thermal Detector

Detector shall be line-type electrical conductivity fixed temperature coaxial wire capable of sensing temperature changes along its entire length and operate over a wide range of temperatures. The detector cable shall be constructed of a center conductor having a maximum diameter of 2.2 mm 0.087 inch, a ceramic thermistor core and an outer metallic sheath. The center conductor shall have a maximum diameter of 2.2 mm 0.087 inch. Individual cable sections shall be not greater than 15 m 50 ft in length and shall be equipped with hermetically sealed connectors. It shall be possible to couple together lengths of cable not greater than 15 m 50 ft together to form maximum lengths of 305 m 1,000 ft for individual circuit configurations. The detector shall be able to sense temperatures from 21 up to 649 degrees C 70 up to 1,200 degrees F and withstand temperature extremes of from -51.1 to 1,093 degrees C -60 to 2,000 degrees F. The detector cable shall be self-restoring and thus not require replacement of affected portions of the cable after exposure to a high temperature such as would occur in a fire situation. It shall be possible to supervise the cable against an open or short circuit along the entire length of the cable such that either condition will cause a "trouble" signal on the control panel to which it is connected. The cable shall be fully compatible with the control panel to which it is connected.

2.22.5 Combination Ultraviolet-Infrared Flame Detector

Flame detector shall operate on the dual spectrum ultraviolet/infrared (UV-IR) principle. Detector shall utilize a solar-blind UV sensor with a high signal-to-noise ratio and a narrow band IR sensor. Detector logic shall require both UV and IR signals to be present, in a predetermined ratio or signature as emitted by a hydrocarbon fire, to put the detector in

an alarm condition. Detector shall not respond to non-fire sources of UV or IR radiation, including intermittent or continuous solar radiation, arc welding, lightning, radiant heat, x-ray, artificial lighting, radio transmissions and jet engine exhaust. Detector shall have an automatic through-the-lens self-testing feature. Malfunction of the detector circuitry, or degradation of the sensors' lens cleanliness to the point where the detector will not detect the design fire signature, shall cause operation of the system trouble alarm. Logic circuits necessary for operation of the detector shall be integral to the detector or located in a separate flame detector control panel mounted adjacent to the foam system control panel. Detector shall have a 120 degrees field-of-view, capable of operating in a temperature range of -40 to 85 degrees C -40 to 186 degrees F, and suitable for use in Class I, Division I hazardous locations. The detector shall be listed or approved for use with the control panel to which it is connected.

2.22.6 Nozzle System Actuation Station

****
NOTE: Modify as appropriate to achieve required operation. Assure that stations are clearly labeled and distinguished from other fire alarm system stations which might be similar.
****

Unit shall be dual-action type requiring the lifting of a cover and pulling of a ring to actuate. It shall not require the breaking of glass to actuate. Unit shall be painted [lime yellow] [_____] and include a cast or engraved label indicating [Foam Nozzle System] [_____] with operating instructions clearly marked on the station cover. Alarm contacts shall have a minimum rating of 120 VAC, 60 Hz, 6 amps. Contact gap distance shall be factory set and not be field adjustable. Unit shall be compatible with the control panel to which it is connected. Unit [shall] [shall not] be listed or approved for use in hazardous locations.

2.22.6.1 Enclosure

Unit shall consist of a tamper-resistant, clear polycarbonate shield and frame that fits over the manual actuation station. The unit shall be hinged of the top and suitably labeled "Lift Here" on the bottom to indicate means of gaining access to the manual actuation station it protects. It shall include a spacer as required to accommodate its use with a surface mounted manual actuation station.

2.22.6.2 Horn

The unit shall include an 85 db at 3 m 10 ft integral horn powered by a 9 VDC alkaline battery. Upon lifting of the cover, the horn shall provide a local supervisory alarm. The enclosure shall be suitably labeled "TO ACTIVATE NOZZLES, LIFT COVER AND OPERATE STATION."

2.23 VALVE SUPERVISORY (TAMPER) SWITCH

Switch shall be designed to monitor the open condition of each water or AFFF concentrate control valve to which it is mounted. It shall include a cast aluminum housing, tamper proof cover, two sets of single pole, double throw (SPDT) contacts and brackets and J-bolts needed for mounting. Removal of the cover shall cause both switches to operate.

2.24 NOTIFICATION APPLIANCES

****

NOTE: The notification appliances are for providing local notification of a system operation. They are not intended to provide general building fire alarm evacuation. Fire alarm evacuation systems are covered in SECTION 28 31 64.00 10 FIRE DETECTION AND ALARM SYSTEM ADDRESSABLE.

****

Notification appliances shall be suitable for connection to supervised alarm indicating circuits. Appliance shall have a separate screw terminal for each conductor.

2.24.1 Electronic Signaling Device

****

NOTE: It's important that AFFF system audible signals be distinctively different from building evacuation alarms, door alarms, etc. Because of their field-selectable sounds and higher sound output levels, electronic devices are recommended.

****

Device shall be surface-mounted type which can be mounted to a standard 100 mm 4 inch square back box. Electronic device shall operate on nominal 24 VDC, shall be polarized for line supervision and shall have screw terminals for in-out wiring. Device shall be provided with three field-selectable sounds (horn, warble, siren) and three sound output levels to 102 DBA in an anechoic chamber at 3 m 10 feet.

2.24.2 Alarm Horn

Horn shall be surface mounted, with the matching mounting back box [surface mounted] [recessed] [[single] [double] projector,] [grill and] vibrating type suitable for use in an electrically supervised circuit. Horns shall operate on nominal 24 VDC and have screw terminals for in-out wiring connection. Sound output shall be a minimum of [85] [_____] DBA at 3 m 10 feet. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grills.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Aboveground Piping

Piping shall be installed straight and bear evenly on hangers and supports. Preaction sprinkler system piping shall be pitched as if it were being installed in areas subject to freezing. Piping shall be concealed in areas with suspended ceiling and shall be inspected, tested and approved before being concealed.

3.1.1.1 Joints

Pipe joints shall conform to NFPA 13. Not more than four threads shall show after joint is made up. Joint compound shall be applied to male

threads only. Joints shall be faced true, provided with gaskets and made square and tight. Flanged joints or mechanical groove couplings shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published installation instructions. All grooved couplings and fittings shall be from the same manufacturer. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.1.1.2 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 13 mm 1/2 inch.

3.1.1.3 Sprinkler Riser Nipples (Sprigs)

Riser nipples (sprigs) 25 mm 1 inch in size between sprinkler branch lines and individual sprinklers shall not be used unless necessitated by roof or ceiling conditions. In such cases, fittings shall not be installed between the branch line tee and the reducing coupling below the sprinkler.

3.1.1.4 Sprinkler Deflectors

Sprinkler deflectors shall be installed parallel to the roof or ceiling. Deflector distances from the underside of the roof or ceiling shall be in accordance with NFPA 13 except that in no case shall distance exceed 300 mm 12 inches. Sprinkler clearances from obstructions shall be in accordance with NFPA 13.

3.1.1.5 Pipe Supports and Hangers

****
NOTE: To provide added protection against damage from pressure transients, specify thrust restraint for earthquake protection to be in accordance with NFPA 13 requirements for earthquake protection. Consult UFC 3-310-04 for any aspect of seismic design.
****

Installation methods outlined in NFPA 13 are mandatory. Protection of piping against damage from earthquakes shall be provided. Longitudinal and lateral sway bracing shall be provided for piping 65 mm 2-1/2 inch diameter and larger.

3.1.1.6 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes penetrating concrete or masonry walls or concrete floors shall be provided with pipe sleeves fitted into place at the time of construction through its respective wall or floor, and shall be cut flush with each surface. Sleeve sizes and clearance between pipe and sleeve shall be in accordance with NFPA 13. Where pipes pass

through fire walls, fire partitions, or floors, a fire seal shall be placed between the pipe and sleeve in accordance with Section 07 84 00 FIRESTOPPING.

3.1.1.7 Piping Pitch

Piping shall be pitched to the main drain or to auxiliary drains provided as required to facilitate draining. Branch lines shall be pitched at least 4 mm in 1 m 1/2 inch in 10 feet and crossmains and feedmains shall be pitched to at least 2 mm in 1 m 1/4 inch in 10 feet.

3.1.1.8 Escutcheons

Escutcheons shall be provided at finished surfaces where exposed piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe and shall be chromium-plated iron or chromium-plated brass, either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.1.1.9 Drains

Main drain piping shall be provided to discharge at safe points outside each building. Drains shall be of adequate size to readily receive the full flow from each drain under maximum pressure. Auxiliary drains shall be provided as required by NFPA 13 except that drain valves shall be used where drain plugs are otherwise permitted. Where branch lines terminate at low points and form trapped sections, such branch lines shall be manifolded to a common drain line. Each drain valve shall be provided with a metal sign identifying the type of drain connection or function of the valve.

3.1.1.10 Identification Signs

Signs shall be in accordance with NFPA 13. Properly lettered and approved metal signs shall be suitably affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate.

3.2 UNDERGROUND PIPING

****
NOTE: Coordinate selections with drawings. Restraint of the riser under the floor will be detailed on the drawings to be consistent with the description included here.
****

The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover shall be [1] [_____] m [3] [_____] feet. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 150 mm 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. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be coated with a bituminous material.

3.3 ELECTRICAL WORK

Unless otherwise specified, power supply equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.3.1 Overcurrent and Surge Protection

Equipment connected to alternating current circuits shall be protected from surges in accordance with IEEE C62.41.1, IEEE C62.41.2 and NFPA 70. Cables and conductors which serve as communication links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for surge protection.

3.3.2 Grounding

Grounding shall be provided to building ground.

3.3.3 Wiring

System field wiring shall be installed in 19 mm 3/4 inch minimum diameter electrical metallic tubing or metallic conduit. Wiring for the sprinkler system fire detection and control system shall be installed in tubing or conduits dedicated for that use only and shall not be installed in conduit, outlet boxes or junction boxes which contain lighting and power wiring or equipment. Circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be connected to screw terminals with each terminal marked and labeled in accordance with the wiring diagram. No more than one conductor shall be installed under any screw terminal. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors is not permitted. Wiring within any control equipment shall be readily accessible without removing any component parts. Conductors shall be color coded and shall be identified within each enclosure where a connection or termination is made. Conductor identification shall be by plastic coated, self-sticking, printed markers, or by heat-shrink type sleeves. Circuits shall be wired to maintain electrical supervision so that removal of any single wire from any device shall cause a "trouble" condition on the control panel.

3.3.4 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 600 mm 24 inches nor more than 2000 mm 78 inches above the finished floor.

3.3.5 Detectors

Detectors shall be ceiling mounted in accordance with NFPA 72 and shall be at least 300 mm 12 inches from any part of any lighting fixture. Detectors shall be located at least 900 mm 3 feet from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location.

3.3.6 Manual Actuation Stations

Manual actuation stations shall be mounted readily accessible and 1060 mm 42 inches above the finished floor.

3.3.7 Notification Appliances

Notification appliances shall be mounted a minimum of 2400 mm 8 feet above the finished floor unless limited by ceiling height.

3.4 PIPE PAINTING AND LABELING

3.4.1 Painting

Black steel pipe shall be painted in accordance with the requirements specified under SECTION 09 90 00 PAINTS AND COATINGS. Pipe in equipment rooms shall be painted red. Pipe in other areas shall be painted to match finishes in those areas. Stainless steel pipe shall not be painted.

3.4.2 Pipe Identification

Aboveground pipe 50 mm 2 inch diameter and larger shall be identified with legends. Legends shall include FOAM CONCENTRATE, FOAM-WATER SPRINKLER, FOAM-WATER NOZZLE, and FIRE PROTECTION WATER. Legends shall utilize WHITE letters on a RED color field and shall include arrows to indicate the direction of flow. Length of color field, letter size and locations on piping shall be as recommended in ASME A13.1.

3.5 PRELIMINARY TESTS

Tests shall be performed to make adjustments in the fire protection system operation and to verify that the system will function as intended and that it is ready for service. Such tests shall include all components and subsystems. Test results shall be clearly documented and included with the written request for Final Test.

3.5.1 Flushing

Underground water mains shall be flushed in accordance with NFPA 13 and NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the maximum water demand rate of the system.

3.5.2 Hydrostatic Tests

The underground and aboveground piping systems, including AFFF concentrate, shall be hydrostatically tested in accordance with NFPA 13 at not less than 1379 kPa 200 psi, or 345 kPa 50 psi in excess of maximum system operating pressure, for 2 hours. There shall be no visible leakage from the piping when the system is subjected to the hydrostatic test.

3.5.3 Alarm Check and Automatic Water Control Valves

Each valve shall be tested to verify operation in accordance with manufacturer's published operating instructions. This shall include tests of valves and switches connected thereto.

3.5.4 Nozzles

Nozzles shall be discharge tested for proper operation and coverage. Oscillating nozzles shall be operated to verify that angle of elevation, angle of oscillation, and discharge range, are in accordance with requirements.

3.5.5 AFFF Concentrate System

Tests shall be conducted under the supervision of a technical representative employed by the AFFF concentrate manufacturer. The complete AFFF concentrate system shall be adjusted and tested to assure proper operation. Test results, including all pressure settings and readings, shall be recorded on an appropriate test form signed and dated by manufacturer's representative certifying that the system is in compliance with contract requirements and the manufacturer's recommended practices. Testing shall include, but not be limited to, the following:

a. Filling the AFFF concentrate tank.

b. Adjustment of pressure sustaining valves, pump relief valves, and proportioners.

c. Collection of AFFF samples and testing with a conductivity meter to verify proportioning accuracy.

d. Testing AFFF concentrate pumps for proper automatic operation. This shall include start and stop settings, automatic shutoff, and relief valve operation.

e. Testing low liquid level alarms and pump shutoff.

f. Other operational checks recommended by the AFFF proportioner manufacturer.

3.5.6 Control System Tests

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NOTE: The specified tests are based upon preaction and deluge systems with integral detection and control systems. Revise to suit applications using wet-pipe systems.
****

Tests shall be conducted under the supervision of a factory-trained representative of the control panel manufacturer. The electrical control system shall be tested to verify that the control panel and all wiring have been installed correctly and that all components function as intended. Tests shall be conducted using normal operating and battery power. Testing shall include, but not be limited to, each of the following:

a. Alarm initiating circuit and device. This shall include heat detectors, manual actuation stations, waterflow and pressure switches, and similar devices connected to the control panel.

b. Supervisory circuit and device. This shall include valve supervisory (tamper) switches, pump power circuits, pump running, low liquid level in foam concentrate tank, and similar circuits and devices.

c. Actuation circuit and device. This shall include circuits to automatic water control valves, foam concentrate pumps, fire pumps, and similar circuits related to system activation.

d. Annunciator lamp and notification appliance. This shall include bells, horns, electronic signaling, and similar devices.

3.6 FINAL TEST

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NOTE: This paragraph must be modified to suit specific project requirements and preferences.
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3.6.1 Requirements

The Final Test shall be a repeat of Preliminary Tests, except that flushing and hydrostatic tests shall not be repeated. In addition, the system shall be automatically actuated and allowed to discharge for a period of at least one minute prior to shutting the system off. Correct system failures and other deficiencies identified during testing and shall retest portions of the system affected by the required corrections.

3.6.1.1 Pretest Requirements

The system will be considered ready for final testing only after the following have been accomplished.

a. The required test plan has been submitted and approved.

b. Preliminary tests have been made and deficiencies determined to have been corrected to the satisfaction of the equipment manufacturer's technical representatives and the Contracting Officer.

c. Test reports, including the required videotape of the preliminary tests, have been submitted and approved.

d. The control panels and detection systems shall have been in service for a break-in period of at least 14 consecutive days prior to the final test.

e. The Contractor has provided written notification to the Contracting Officer, at least [21] [_____] days prior to date of Final Test, that preliminary tests have been successfully completed.

3.6.1.2 Videotaping

Videotape the tests in VHS format and record the date and time-lapse, in seconds, from start to finish of each portion of the test as directed by the Contracting Officer. Submit four copies of the tape before the system will be considered accepted.

3.6.1.3 Manufacturer's Services

Experienced technicians regularly employed by the Contractor in the installation of the system and manufacturer's representative referred to elsewhere in this specification shall conduct the testing.

3.6.1.4 Materials and Equipment

Provide AFFF concentrate, gauges, AFFF sample collection apparatus, instruments, hose, personnel, elevating platforms, scaffolding, ladders, appliances and any other equipment necessary to fulfill testing requirements specified.

3.6.1.5 Facility and Environmental Protection

Provide protection for the facility, including electrical and mechanical equipment exposed to possible damage during discharge tests. This shall include provision of sandbags or similar means for preventing migration of foam solution into adjacent areas. Temporary measures shall be provided to prevent AFFF solution from entering storm drains, sanitary sewers, drainage ditches, streams and other water sources. Discharged AFFF shall be contained on paved surfaces and shall not be allowed to come in contact with the earth.

3.6.2 Control System Tests

Operational features of the control system shall be tested and demonstrated. This shall include testing of control panels and each input and output circuit. Tests of circuits shall include actuation and simulated circuit fault at each initiating, notification, supervisory and actuation device or appliance. As a practical matter, these tests shall be a repeat of preliminary tests required under paragraph PRELIMINARY TESTS.

3.6.3 AFFF Proportioning System Tests

Each AFFF proportioner (ratio controller) shall be flow tested to determine that proportioning accuracy is within specified limits. Each proportioner supplying sprinkler systems with closed heads shall be tested at two flow rates; the minimum flow rate specified in the manufacturer's published data and a flow rate at least four times the minimum. Each proportioner supplying a deluge system or a nozzle system shall be tested at the design flow rate. Collecting AFFF samples from each proportioner shall be accomplished in accordance with NFPA 16, and the approved test plan. Foam solution concentrations shall be determined using the methods outlined in NFPA 16. Proportioning for nominal 3 percent concentrate shall be between 3 percent and 4 percent. If test results indicate proportioning below or above this range, make necessary adjustments and retest as directed by the Contracting Officer.

3.6.4 Post-discharge Test Requirements

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NOTE: Discharge tests using AFFF solution are necessary in order to verify proportioner accuracy as well as to demonstrate performance of the overall system at final acceptance. The collection and disposal of the solution is often a problem in many areas due to the real and perceived environmental effects of the solution. Thus it is important that the project design or the existing site addresses the need to collect and dispose of the solution. If adequate means are not otherwise available or provided, the responsibility for collection and disposal will have to be placed on the Contractor. This needs to be made clear in the project documents to preclude problems and misunderstandings at time of final testing.

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Following the successful completion of the tests, remove the foam solution from the site as indicated on the approved AFFF waste containment and disposal plan. Replenish AFFF concentrate consumed during the tests. The

entire fire protection system shall be returned to automatic operation and the facility restored to operational capability. Discharged solution shall be contained and disposed of in a manner acceptable to local authorities and as identified on the approved test plan. Once tests are completed, systems shall be returned to fully operational status, including filling of AFFF concentrate tanks with concentrate and filling of solution piping with premix as required. Submit details of method proposed for required tests at Final Acceptance, including step-by-step test procedures; list of equipment to be used; names, titles, and affiliations and qualifications of personnel who will participate in the tests; methods for protecting the facility and equipment during testing; means for containing the AFFF solution during discharge tests; and proposed means for disposal. Test plan shall include a drawing showing proposed number and arrangement of fire hoses and nozzles proposed for use in testing foam proportioners. Include blank forms to be used for recording test results. Submit test reports and videotapes as specified herein:

a. Reports as outlined in NFPA 13 documenting results of flushing and hydrostatic tests.

b. Trip tests of [alarm check] [and] [automatic water control] valves.

c. Test report of AFFF concentrate proportioning system. Report shall include all pressure readings and settings of pumps, pressure sustaining valves, relief valves and similar system components. Report shall include conductivity readings for foam samples taken from each AFFF proportioner. Report shall be signed by the factory-trained technical representative employed by the AFFF concentrate manufacturer.

d. Test report of the foam system control panel and initiating and indicating devices. Report shall include a unique identifier for each device with an indication of test results. Report shall be signed by the factory-trained technician employed by the control panel manufacturer.

e. Videotapes of tests specified to be recorded.

3.7 POSTED INSTRUCTIONS

Framed description of system operation, instructions and schematic diagrams of the overall AFFF system and each subsystem, shall be posted where directed. Condensed operating instructions explaining the system for normal operation, refilling the AFFF storage tank, and routine testing shall be included.

3.8 TRAINING

Provide at least two training sessions of at least 6 hours each to explain system's operation and maintenance. Training sessions shall be conducted on alternate days to afford flexibility by shift personnel and other attendees. Training aids shall be provided as necessary to clearly describe the systems. Training sessions shall include classroom instruction and explanation of approved Operation and Maintenance Manuals. Submit [6] [_____] manuals in loose-leaf binder format and grouped by technical sections consisting of manufacturer's brochures, schematics, printed instructions, general operating procedures, and safety precautions. Manuals shall include a narrative description of the sequence or sequences of operation of the overall fire protection system and a separate description for each major subsystem. Information to be provided

shall include specific start/stop settings for pumps, open/close settings for all adjustable valves (including pressure sustaining and relief valves). The manuals shall list routine maintenance procedures, possible breakdowns, and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout, simplified wiring and control diagrams for the system as installed, procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair. In addition to classroom instruction, systems shall be operated to provide hands-on demonstrations. Include a system actuation using water only, to demonstrate system operation and procedures for resetting the system. Training areas will be provided by the Government in the building where the systems are installed. Dates and times of the training sessions shall be coordinated with the Contracting Officer not less than 15 calendar days prior to the first session.

-- End of Section --