UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2022
****

SECTION TABLE OF CONTENTS

DIVISION 21 - FIRE SUPPRESSION

SECTION 21 13 24.00 10

AQUEOUS FILM-FORMING FOAM (AFFF) FIRE PROTECTION SYSTEM

10/07

PART 1 GENERAL

1.1 REFERENCES
1.2 SUBMITTALS
1.3 QUALITY ASSURANCE
1.3.1 Submittal Preparer's Qualifications
1.3.2 Installer's Qualifications
1.3.3 Detail Drawings
1.4 EXTRA MATERIALS

PART 2 PRODUCTS

2.1 SYSTEM REQUIREMENTS
2.2 STANDARD PRODUCTS
2.2.1 AFFF Concentrate
2.2.2 AFFF Concentrate Control Valve
2.2.3 AFFF Proportioning System
2.2.4 Control Panel
2.3 NAMEPLATES
2.4 REQUIREMENTS FOR FIRE PROTECTION SERVICE
2.5 PRESSURE RATINGS
2.6 UNDERGROUND PIPING SYSTEMS
2.7 ABOVEGROUND PIPING SYSTEMS FOR WATER OR AFFF SOLUTION
2.7.1 Pipe
2.7.2 Grooved Fittings and Couplings
2.7.3 Non-Grooved Fittings
2.7.4 Flanges and Gaskets
2.7.4.1 Bolts
2.7.4.2 Nuts
2.7.4.3 Washers
2.7.5 Pipe Hangers
2.7.6 Control Valve
2.7.7 Check Valve
2.8 ABOVEGROUND PIPING SYSTEMS FOR AFFF CONCENTRATE

2.8.1 Pipe
2.8.2 Fittings
2.8.3 Pipe Hangers
2.8.4 Control Valves
2.9 ALARM CHECK VALVE ASSEMBLY
2.10 AUTOMATIC WATER CONTROL VALVE ASSEMBLY (DELUGE VALVE)
2.11 MECHANICAL ALARM DEVICE
2.12 FIRE DEPARTMENT CONNECTION
2.13 BASKET STRAINER
2.14 REDUCED PRESSURE BACKFLOW PREVENTION ASSEMBLY
2.15 DISCHARGE DEVICES
2.15.1 Sprinkler
2.15.2 Fixed Nozzle
2.15.3 Oscillating Monitor Nozzle Assembly
2.16 AFFF LIQUID CONCENTRATE
2.17 DIAPHRAGM TANK BALANCED PRESSURE PROPORTIONING SYSTEM
2.18 PUMPED BALANCED PRESSURE PROPORTIONING SYSTEM
2.18.1 AFFF Concentrate Storage Tank
2.18.2 AFFF Concentrate Pump
2.18.3 AFFF Pump Controller
2.18.4 Power Supply
2.18.5 AFFF Pressure Maintenance Pump
2.18.6 Pressure Balancing Valve
2.18.7 Pressure Sustaining Valve
2.19 BALANCED PRESSURE PROPORTIONER (RATIO CONTROLLER)
2.20 AFFF CONCENTRATE CONTROL VALVE ASSEMBLY
2.21 FOAM SYSTEM CONTROLS
2.21.1 Zone Annunciator
2.21.2 System Zoning
2.21.3 Primary Power Supply
2.21.4 Emergency Power Supply
2.21.4.1 Storage Batteries
2.21.4.2 Battery Charger
2.22 ALARM INITIATING DEVICES
2.22.1 Waterflow Pressure Alarm Switch
2.22.2 Vane-type Waterflow Switch
2.22.3 Heat Detector-Spot Type
2.22.4 Continuous Linear Thermal Detector
2.22.5 Combination Ultraviolet-Infrared Flame Detector
2.22.6 Nozzle System Actuation Station
2.22.6.1 Enclosure
2.22.6.2 Horn
2.23 VALVE SUPERVISORY (TAMPER) SWITCH
2.24 NOTIFICATION APPLIANCES
2.24.1 Electronic Signaling Device
2.24.2 Alarm Horn

PART 3 EXECUTION

3.1 INSTALLATION
3.1.1 Aboveground Piping
3.1.1.1 Joints
3.1.1.2 Reducers
3.1.1.3 Sprinkler Riser Nipples (Sprigs)
3.1.1.4 Sprinkler Deflectors
3.1.1.5 Pipe Supports and Hangers
3.1.1.6 Pipe Penetrations
3.1.1.7 Piping Pitch
3.1.1.8 Escutcheons

3.1.1.9 Drains
3.1.1.10 Identification Signs
3.2 UNDERGROUND PIPING
3.3 ELECTRICAL WORK
3.3.1 Overcurrent and Surge Protection
3.3.2 Grounding
3.3.3 Wiring
3.3.4 Control Panel
3.3.5 Detectors
3.3.6 Manual Actuation Stations
3.3.7 Notification Appliances
3.4 PIPE PAINTING AND LABELING
3.4.1 Painting
3.4.2 Pipe Identification
3.5 PRELIMINARY TESTS
3.5.1 Flushing
3.5.2 Hydrostatic Tests
3.5.3 Alarm Check and Automatic Water Control Valves
3.5.4 Nozzles
3.5.5 AFFF Concentrate System
3.5.6 Control System Tests
3.6 FINAL TEST
3.6.1 Requirements
3.6.1.1 Pretest Requirements
3.6.1.2 Videotaping
3.6.1.3 Manufacturer's Services
3.6.1.4 Materials and Equipment
3.6.1.5 Facility and Environmental Protection
3.6.2 Control System Tests
3.6.3 AFFF Proportioning System Tests
3.6.4 Post-discharge Test Requirements
3.7 POSTED INSTRUCTIONS
3.8 TRAINING

-- End of Section Table of Contents --

****

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

References are in agreement with UMRL dated October 2022
****

SECTION 21 13 24.00 10

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

****

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 item(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

****

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.

****

1.1 REFERENCES

****

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 Reference Identifier (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.

****

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 MECHANICAL ENGINEERS (ASME)

ASME A13.1	(2020) Scheme for the Identification of Piping Systems
ASME B16.1	(2020) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2021) Gray Iron Threaded Fittings; Classes 125 and 250
ASME BPVC SEC VIII D1	(2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1013	(2021) Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2016) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2021) Ductile-Iron and Gray-Iron Fittings
AWWA C151/A21.51	(2017) Ductile-Iron Pipe, Centrifugally Cast

ASTM INTERNATIONAL (ASTM)

ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2022) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A183	(2014; R 2020) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A193/A193M	(2020) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A312/A312M	(2021) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A351/A351M	(2018) Standard Specification for Castings, Austenitic, for Pressure-Containing Parts
ASTM A403/A403M	(2022) Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
ASTM A449	(2014; R 2020) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
ASTM A563	(2015) 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	(2021) 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	(2021; TIA 21-1; TIA 21-2) Standard for Low-, Medium- and High- Expansion Foam
NFPA 13	(2022; ERTA 3 2022) Standard for the Installation of Sprinkler Systems
NFPA 16	(2015) Standard for Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
NFPA 20	(2022;TIA 21-1; TIA 21-2) Standard for the Installation of Stationary Pumps for Fire Protection
NFPA 24	(2022) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 70	(2020; TIA 22-1; ERTA 1 2022) National Electrical Code
NFPA 72	(2022) National Fire Alarm and Signaling Code
NFPA 1963	(2019) Standard for Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	(2012) 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-PRF-24385	(1992; Rev F; Am 1 1994; Am2 2017; Am3

	2019; Am4 2020) Fire Extinguishing Agent, Aqueous Film Forming Foam (AFFF) Liquid Concentrate, for Fresh and Seawater
UFC 3-301-01	(2019, with Change 1, 2022) Structural Engineering

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, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified 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 Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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

****

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

In the event of a conflict between referenced NFPA standards and this specification, this specification governs. Interpret reference to "authority having jurisdiction" to mean the Contracting Officer.

1.3.1 Submittal Preparer's Qualifications

Prepare fire protection system submittals, including as-built drawings, 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. Maintain a separate set of approved submittal drawings of the overall system, marked up to indicate as-built conditions, onsite in a current condition at all times and make available for review immediately upon request during normal working hours. Indicate variations from the approved drawings, for whatever reason, including those occasioned by modifications, change orders, optional materials, and/or required for coordination between trades 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 must be 841 x 594 mm 30 x 42 inches. Include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Include the following for each set of drawings:

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. Show sprinklers, nozzles and associated piping. Abbreviated presentation forms will not be accepted. Identify each type of fitting used and the locations of bushings, reducing couplings, and welded joints. Provide a separate plan 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. 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, indicate conduit routing and sizes, and the number of conductors contained in each.

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. Include identification and operation of each major component of the system. Supplement diagrams with a narrative description of the system. Point-to-point wiring diagrams must 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. Prepare such drawing specifically 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. 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, meet the requirements of NFPA 11, NFPA 13, NFPA 16, NFPA 24 and NFPA 72.

b. [Operate the wet-pipe sprinkler system 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. [Operate the single-interlocked preaction sprinkler system (without supervisory air) 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. [Operate the deluge sprinkler system 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. 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. Make certificates on a form for this purpose or on official letterhead of the manufacturer with specified information stated as required. Certificate must 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-PRF-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

Provide major components of equipment with 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

Provide equipment and material that has 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 terms 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 are not be construed as waiving this requirement.

2.5 PRESSURE RATINGS

Provide valves, fittings, couplings, proportioners, alarm switches,

strainers, and similar devices 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.

****

Provide 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. Provide ductile iron fittings conforming to AWWA C110/A21.10. Piping more than 1.5 m 5 feet outside the building walls must be [outside-coated cement-lined ductile iron pipe] [provided under SECTION 33 11 00 WATER UTILITY DISTRIBUTION PIPING].

2.7 ABOVEGROUND PIPING SYSTEMS FOR WATER OR AFFF SOLUTION

2.7.1 Pipe

Provide standard weight pipe conforming to ASTM A795/A795M or ASTM A53/A53M. Pipe 150 mm 6 inch diameter and smaller must be Schedule 40. Mark pipe 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

Provide grooved fittings, couplings and bolts by the same manufacturer. Provide malleable iron fittings and couplings complying with ASTM A47/A47M or ductile iron complying with ASTM A536. Provide rigid type couplings except provide flexible type where flexible joints are specifically required by NFPA 13. Ensure coupling gaskets are Grade E (EPDM) approved for dry pipe fire protection service. Provide flush type gasket that fills the entire cavity between the coupling and the pipe. Provide heat-treated, cadmium plated or zinc electroplated steel nuts and bolts conforming to ASTM A183.

2.7.3 Non-Grooved Fittings

Provide threaded or flanged non-grooved fittings. Ensure threaded fittings are cast iron conforming to ASME B16.4 or malleable iron conforming to ASME B16.3. Ensure flanged fittings are cast iron conforming to ASME B16.1. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed must be threaded type. Do not use 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.

2.7.4 Flanges and Gaskets

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

2.7.4.1 Bolts

Ensure bolts are ASTM A449, Type [1] [2]. Extend bolts no less than three full threads beyond the nut with bolts tightened to the required torque.

2.7.4.2 Nuts

Provide [ASTM A193/A193M, Grade 5] [ASTM A563M ASTM A563, Grade [C3] [DH3]] nuts.

2.7.4.3 Washers

Meet the requirements of ASTM F436M ASTM F436. Provide flat circular washers under all bolt heads and nuts.

2.7.5 Pipe Hangers

Provide hangers listed in UL Fire Prot Dir or FM APP GUIDE and suitable for the application, construction and size pipe involved.

2.7.6 Control Valve

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

2.7.7 Check Valve

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

2.8 ABOVEGROUND PIPING SYSTEMS FOR AFFF CONCENTRATE

2.8.1 Pipe

Provide standard weight stainless steel pipe conforming to ASTM A312/A312M, Grade TP 304L.

2.8.2 Fittings

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

2.8.3 Pipe Hangers

Provide hangers listed in UL Fire Prot Dir or FM APP GUIDE and suitable for the application, construction and size pipe involved.

2.8.4 Control Valves

Provide indicating type valve with full port ball and operating handle that indicates the on/off position of the valve. Provide socket weld or

flanged type unit. Provide valve body and ball consisting of 316 stainless steel complying with ASTM A351/A351M. Provide the valve handle 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.
****

Provide variable pressure type alarm check valve assembly rated for working pressures of [1207 kPa175 psi] [1724 kPa250 psi]. Provide assembly with standard trimmings including pressure gauges, retarding chamber, alarm line vent, testing bypass, and necessary pipe, fittings, and accessories required for a complete installation. Provide brass valve trim piping. 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.
****

Provide an electrically-actuated type water control valve rated for a maximum working pressure of [1207 kPa175 psi] [1724 kPa250 psi] that is resettable without opening the valve and without the use of special tools. Electrical solenoid valve used to actuate the water control valve must be an integral component of the valve or approved for use by the water control valve manufacturer and the control panel manufacturer. Ensure solenoid valve is 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. Ensure solenoid valves used with diaphragm-type valves are rated for a maximum pressure equal to that of the associated valve. Equip water control valve with a means to prevent the valve from returning to the closed position until being manually reset. Provide complete assembly with the valve manufacturer's standard trim piping, drain and test valves, pressure gauges, and other required appurtenances. Include an emergency release device for manually tripping the water control valve in the event of a power or other system failure for each assembly. Ensure device is a standard accessory component of the valve manufacturer and labeled as to its function and method of operation. Use valves located in hazardous locations that are approved for the hazard classification of the area where located.

2.11 MECHANICAL ALARM DEVICE

Provide water-powered device including body housing, impeller wheel, drive shaft, striker assembly, gong, wall plate and related components necessary for complete operation. Provide minimum 19 mm 3/4 inch piping between the housing and the alarm line trim. Ensure drain piping from the body

housing is minimum 25 mm 1 inch steel and arranged to drain to the outside of the building. Galvanize piping 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.
****

Provide [projecting] [flush] type connection with cast brass body, a [polished brass] [chromium plated] finish, and matching wall escutcheon lettered "Auto Spkr". Ensure connection has two inlets with individual self-closing clappers, caps with drip drains, and chains. Provide female inlets with 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.
****

Provide unit with cast iron flanged body and cover flanges. Provide strainer basket that is formed of perforated brass or stainless steel sheet with 6 mm 1/4 inch perforations, with strainer size of [_____] mm inch and a maximum friction loss of [_____] kPa psi at a flow rate of [_____] L/second gpm. Assemble to 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.
****

Provide unit that is capable of preventing backsiphonage and back pressure backflow from the fire protection system into the potable water system. Include a pressure differential relief valve located in a zone between two positive seating check valves. Include resilient seated outside stem and yoke (OS&Y) gate valves upstream and downstream of the valve and test cocks. Provide main valve body consisting of ductile iron with fused bonded epoxy coating. Provide assembly in compliance with ASSE 1013 and listed in UL Fire Prot Dir or FM APP GUIDE.

2.15 DISCHARGE DEVICES

2.15.1 Sprinkler

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

Provide nozzle that is fixed constant flow type, cast brass construction [25] [40] [_____] mm [1] [1-1/2] [_____] inch male NPT, suitable for use with AFFF solution. Factory set nozzle for required discharge characteristic. Indicate discharge characteristic or k-factor(s) on the drawings. Nozzle discharge pattern must be field adjustable and lockable. Use nozzle flow and effective reach of discharge at various nozzle patterns that 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. Use factory set nozzle settings. Field disassembly, adjustment or assembly which could alter discharge characteristic will not be permitted.

2.15.3 Oscillating Monitor Nozzle Assembly

Include water-powered oscillator, monitor, nozzle, and related ancillary components which are to be the product of one manufacturer. Equip water-powered oscillating mechanism with a strainer. Include a test connection for operating the oscillator from an auxiliary water source without requiring discharge through the nozzle. Provide adjustable angle of elevation from 20 degrees below to 60 degrees above horizontal. Provide adjustable oscillation arc from 10 degrees to 165 degrees and adjustable speed from 0 degrees to 30 degrees per second. Components in contact with the AFFF solution must be compatible with the foam concentrate and metallic components must be brass, bronze or stainless steel. Provide manufacturer's standard model nozzle with a fixed discharge characteristic that has been determined by discharge tests. Provide monitor nozzle assembly approved by Factory Mutual and listed in FM APP GUIDE.

2.16 AFFF LIQUID CONCENTRATE

Provide 3 percent AFFF concentrate conforming to MIL-PRF-24385. Provide concentrate that is 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 must be a steel pressure vessel constructed in accordance with ASME BPVC SEC VIII D1. Affix ASME label permanently to the tank. Mount tank containing a full internal diaphragm (bladder) with a minimum capacity of [_____] L gallons horizontally on steel saddles. Provide nylon-reinforced Buna-N rubber diaphragm or other approved material conforming to the inside shape of the tank. Store AFFF concentrate inside the diaphragm and the concentrate.must not be in contact with the steel tank. Install perforated PVC tubes inside the diaphragm to assure full displacement of the stored concentrate. Equip tank 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 3-301-01 and Sections 13 48 73 and 23 05 48.19 must be included in the contract docments.

****

Design tank for storage of AFFF concentrate at atmospheric pressure consisting of vertical cylindrical, high density cross-linked polyethylene construction. Provide individual tank capacity a minimum of [_____] L gallons. Provide translucent tank equipped with level gauge strip for approximating quantity of tank contents. Equip tank 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 [in accordance with UFC 3-301-01 and Sections 13 48 73 SEISMIC CONTROL FOR MISCELLANEOUS EQUIPMENT and 23 05 48.19 [SEISMIC] BRACING FOR HVAC] [as shown on the drawings]. Install openings and tank connections at the factory, do not make holes in the tank shell in the field. 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.
****

Provide a positive displacement rotary gear or vane type pump operating at a speed no greater than 1800 rpm with a pump capacity of [_____] L/second gpm. Provide pump discharge pressure that is a minimum of [_____] kPa psi. Metallic pump components in contact with AFFF concentrate must be of bronze or stainless steel construction. Furnish each pump with suction strainer, relief valve, and suction and discharge gauges. Mount pump on a carbon steel base with guards over couplings. Direct-connect pump to electric motor with drip-proof enclosure. Provide minimum [_____] kW hp motor size.

2.18.3 AFFF Pump Controller

Provide automatic type controller that is UL listed or FM approved for fire pump service and arranged for automatic start and stop, and manual push-button stop of the AFFF pump it controls. Provide controller that is 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. Equip the controller with an externally operable isolating switch which manually operates the motor circuit. Provide means in the controller for measuring current for all motor circuit conductors. Controller must cause pump to run for a minimum of ten (10) minutes prior to automatic shutdown. Accomplish automatic stopping only after all starting causes have returned to normal and after the minimum pump run time has elapsed. Controller must also cause pump to stop upon signal from low liquid level switch installed in the AFFF concentrate tank. 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. Label each alarm lamp with rigid etched plastic labels. Equip the controller 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. 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.
****

Provide source and arrangement of power supply to the pumps 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.
****

Provide pump as indicated to maintain pressure on the AFFF concentrate distribution piping. Pump construction and components must be similar to those provided for the primary AFFF concentrate pump. Provide pressure maintenance pump with 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).
****

Provide diaphragm type pressure balancing valve for balancing AFFF concentrate with water pressure. Provide bronze or stainless steel valve body and other metallic components normally in contact with the AFFF concentrate. Provide unit rated for working pressure of 1379 kPa 200 psi and 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.
****

Provide pressure regulating valve that is 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. Provide valve body and other metallic components normally in contact with the AFFF concentrate consisting of bronze or stainless steel construction. Design valve body with flat-faced flanges to match flanges of the same nominal size. Valve must pass the unused portion of the AFFF liquid back to the storage tank under low system flow conditions. Size valve 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.

****

Provide [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 must be brass, bronze or stainless steel. Mark the body clearly with a flow-direction arrow, and the type and percent of AFFF concentrate that it was designed to proportion. Provide proportioner size of [150] [_____] mm [6] [_____] inch with a maximum friction loss of [_____] kPa psi at a flow rate of [_____] L/second gpm. The in-line balanced pressure proportioner must 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 must be factory assembled and tested as an assembly by one manufacturer. Field disassembly or assembly of any component part will not be accepted. Provide components that are the make/model required by the specific UL listing or FM approval.

2.20 AFFF CONCENTRATE CONTROL VALVE ASSEMBLY

Design and construct assembly specifically to control AFFF concentrate to proportioners and arrange to open upon application of water or AFFF solution pressure from the alarm check or automatic water control valve to which it is connected. Provide valve that is a listed or approved automatic control valve specifically intended for this application or a full port ball valve. Construct all components of brass, bronze or stainless steel, except provide the internal portions of listed or approved fire protection valves subjected to AFFF concentrate with a coating warranted by the manufacturer to protect the valve from the deleterious effects of the concentrate. All components must be rated for working pressure of 1200 kPa 175 psi or maximum working pressure to which they could be subjected, whichever is greater. Valve must be certified by the manufacturer to be operable with water inlet pressure as low as 207 kPa 30 psi. Provide brass, bronze or stainless steel valve components.

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.

****

Provide UL listed or FM approved panel for "Releasing Device Service" or

have modules approved for this purpose. Panel must contain components and equipment required to provide the specified operational and supervisory functions of the system. House components in a [surface] [flush] mounted steel cabinet with hinged door and cylinder lock. Provide a clean, uncluttered, and orderly factory assembled and wired unit. Include integral "power on," "alarm," and "trouble" lamps with annunciation of each alarm, supervisory and trouble signal. Provide panel that has prominent rigid plastic or metal identification plates for zones, indicating lights, controls, meters, and switches. Identify lamps and fuses mounted on circuit boards by permanent markings on the circuit board. Also include ampere rating on nameplates for fuses. Locate control panel switches within the locked cabinet. Provide a suitable means for testing the control panel visual indicating devices (meter and lamps). Ensure meters and lamps are plainly visible when the cabinet door is closed. Provide signals to indicate and annunciate, by zone, any alarm, supervisory or trouble condition on the system. Upon restoration of power, start-up automatically, and do not require manual operation. Do not affect the transmission of alarm, supervisory or trouble signals, due to the loss of primary power or the sequence of applying primary or emergency power. Where the panel controls continuous linear thermal detection cable, the panel must be fully compatible with the cable, as certified by the cable manufacturer. In such applications, control multiple independent adjustable fixed temperature set points to achieve the effect of a rate-of-rise detector. Provide panel that is 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

Provide visual annunciators for each active zone and spare zone. Provide a separate alarm and trouble lamp for each zone and locate them on the exterior of the cabinet door or be visible through the door. Provide a minimum of [two] [_____] spare alarm zones that are fully operational. Provide specific identification of the zone by permanently attaching a rigid plastic or metal sign with either raised, engraved or silk-screened letters to each lamp. Provide zone identification consisting of a unique zone number as well as a word description of the zone. Arrange zones 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.

****

Zone the system 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.
****

Supply primary power and trouble alarm power to control panel from two 120 VAC circuits. [Provide power to the control panel as indicated.] [Provide a [separate panel] [fused two-pole disconnect switch] connected ahead of [the main building panel] [the indicated panel].] Equip panel with two 20-amp circuit breakers for each control panel and with key lock. Permanently mark [panel] [disconnect switch] "FOAM FIRE PROTECTION SYSTEM".

2.21.4 Emergency Power Supply

Provide emergency power for system operation in the event of failure of the primary power supply consisting of rechargeable storage battery system. Provide automatic transfer from normal to emergency power or restoration from emergency to normal power and do 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.
****

Provide sealed, lead-calcium type storage batteries that require no additional water. Provide batteries that 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 must have ample capacity to operate alarm indicating devices in the alarm mode for a minimum period of [15] [_____] minutes. Battery cabinet must be a separate [compartment within the control panel] [cabinet]. Provide battery compartment or cabinet that is twice the volume of the batteries. Set batteries on a non-corrosive and non-conductive base or pad. Locate batteries in the control panel at the bottom of the panel.

2.21.4.2 Battery Charger

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

****

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 in unit. Provide factory adjusted switches to transfer the contacts at 27.6 to 55.1 kPa 4 to 8 psi on rising pressure. Include a water-tight NEMA 4 die-cast aluminum housing with a tamper resistant cover which requires a special key for removal. Provide cover with a tamper switch which will operate upon removal of the cover. Use units on wet-pipe systems that have an adjustable, instantly recycling pneumatic retard to prevent false alarms due to water pressure variation. Factory set retard adjustment 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.

****

Provide assembly consisting of a cast aluminum pipe saddle housing an electro-mechanical device to which is attached a flexible, low-density polyethylene paddle. Provide paddle conforming to the inside diameter of the fire protection pipe and sense water or solution movements. Provide waterflow indicator capable of detecting a sustained flow exceeding 0.63 L/second 10 gpm. Assembly must contain a pneumatic retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. Include two sets of SPDT (Form C) contacts. Equip the unit 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.
****

Provide weatherproof detector, of the rate-compensation type with a nominal temperature rating of [76] [_____] degrees C [170] [_____] degrees F. Detector must 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. Provide six spare detectors of each type and temperature rating.

2.22.4 Continuous Linear Thermal Detector

Provide detector consisting of 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. Construct the detector cable of a center conductor having a maximum diameter of 2.2 mm 0.087 inch, a ceramic thermistor core and an outer metallic sheath. Provide center conductor with a maximum diameter of 2.2 mm 0.087 inch. Provide individual cable sections no greater than 15 m 50 ft in length and equip with hermetically sealed connectors. It must 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 must 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 must 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 must 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. Ensure cable is fully compatible with the control panel to which it is connected.

2.22.5 Combination Ultraviolet-Infrared Flame Detector

Operate flame detector on the dual spectrum ultraviolet/infrared (UV-IR) principle. Utilize a solar-blind UV sensor with a high signal-to-noise ratio and a narrow band IR sensor. Detector logic must 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 must 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. Provide detector with an automatic through-the-lens self-testing feature. Ensure 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, causes operation of the system trouble alarm. Logic circuits necessary for operation of the detector must be integral to the detector or located in a separate flame detector control panel mounted adjacent to the foam system control panel. Provide detector with 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 must 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.

****

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

2.22.6.1 Enclosure

Provide unit consisting of a tamper-resistant, clear polycarbonate shield and frame that fits over the manual actuation station. The unit must 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. Include a spacer as required to accommodate its use with a surface mounted manual actuation station.

2.22.6.2 Horn

Include an 85 db at 3 m 10 ft integral horn powered by a 9 VDC alkaline battery. Upon lifting of the cover, provide a local supervisory alarm. Suitably label the enclosure "TO ACTIVATE NOZZLES, LIFT COVER AND OPERATE STATION."

2.23 VALVE SUPERVISORY (TAMPER) SWITCH

Design switch to monitor the open condition of each water or AFFF concentrate control valve to which it is mounted. 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 must 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 Sections 28 31 60 INTERIOR FIRE ALARM SYSTEM, NON-ADDRESSABLE; 28 31 66 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM, NON-ADDRESSABLE; 28 31 70 INTERIOR FIRE ALARM SYSTEM, ADDRESSABLE; and 28 31 76 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM, ADDRESSABLE.

****

Provide notification appliances that are suitable for connection to supervised alarm indicating circuits. Provide 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.

****

Provide surface-mounted device which can be mounted to a standard 100 mm 4 inch square back box. Operate electronic device on nominal 24 VDC, polarize for line supervision and have screw terminals for in-out wiring. Provide device 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

Provide surface mounted horn, with the matching mounting back box [surface mounted] [recessed] [[single] [double] projector,] [grill and] vibrating type suitable for use in an electrically supervised circuit. Operate horns on nominal 24 VDC and have screw terminals for in-out wiring connection. Provide a minimum of [85] [_____] DBA at 3 m 10 feet sound output. Use horns in exterior locations that are specifically listed or approved for outdoor use and provide with metal housing and protective grills.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Aboveground Piping

Install piping straight and bear evenly on hangers and supports. Pitch preaction sprinkler system piping as if it were being installed in areas subject to freezing. Conceal piping in areas with suspended ceiling and inspect, test and approve before concealing.

3.1.1.1 Joints

Provide pipe joints conforming to NFPA 13. Do not show more than four threads after joint is made up. Apply joint compound to male threads only. Ensure joints are faced true, provided with gaskets and made square and tight. Provide flanged joints or mechanical groove couplings where indicated or required by NFPA 13. Prepare grooved pipe and fittings in accordance with the manufacturer's latest published installation instructions. Provide grooved couplings and fittings from the same manufacturer. Do not use grooved joints 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

Make reductions in pipe sizes 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, install face bushings with the outer face flush with the face of the fitting opening being reduced. Do not use bushings 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)

Do not use riser nipples (sprigs) 25 mm 1 inch in size between sprinkler branch lines and individual sprinklers unless necessitated by roof or ceiling conditions. In such cases, do not installfittings between the branch line tee and the reducing coupling below the sprinkler.

3.1.1.4 Sprinkler Deflectors

Install sprinkler deflectors parallel to the roof or ceiling. Ensure deflector distances from the underside of the roof or ceiling are in accordance with NFPA 13 except do not exceed, in no case, a distance of 300 mm 12 inches. Sprinkler clearances from obstructions must 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 3-301-01 for any aspect of seismic design.

****

Installation methods outlined in NFPA 13 are mandatory. Protect piping against damage from earthquakes. Provide longitudinal and lateral sway bracing 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. Provide pipes penetrating concrete or masonry walls or concrete floors with pipe sleeves fitted into place at the time of construction through its respective wall or floor, and cut flush with each surface. Provide sleeve sizes and clearance between pipe and sleeve in accordance with NFPA 13. Where pipes pass through fire walls, fire partitions, or floors, place a fire seal between the pipe and sleeve in accordance with Section 07 84 00 FIRESTOPPING.

3.1.1.7 Piping Pitch

Pitch piping to the main drain or to auxiliary drains provided as required to facilitate draining. Pitch branch lines at least 4 mm in 1 m 1/2 inch in 10 feet and pitch crossmains and feedmains to at least 2 mm in 1 m 1/4 inch in 10 feet.

3.1.1.8 Escutcheons

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

3.1.1.9 Drains

Provide main drain piping to discharge at safe points outside each building. Provide drains of adequate size to readily receive the full flow from each drain under maximum pressure. Provide auxiliary drains as required by NFPA 13 except use drain valves where drain plugs are otherwise permitted. Where branch lines terminate at low points and form trapped sections, manifold such branch lines to a common drain line. Provide each drain valve with a metal sign identifying the type of drain connection or function of the valve.

3.1.1.10 Identification Signs

Provide signs in accordance with NFPA 13. Affix properly lettered and approved metal signs 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.

****

Lay the fire protection water main and anchor joints in accordance with NFPA 24. Provide minimum cover depth of [1] [_____] m [3] [_____] feet. Terminate the supply line inside the building with a flanged piece, set the bottom no less than 150 mm 6 inches) above the finished floor. Install a blind flange temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. Provide a concrete thrust block at the elbow where the pipe turns up toward the floor. In addition, anchor joints 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. Coat buried steel components with a bituminous material.

3.3 ELECTRICAL WORK

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

3.3.1 Overcurrent and Surge Protection

Protect equipment connected to alternating current circuits from surges in accordance with IEEE C62.41.1, IEEE C62.41.2 and NFPA 70. Install surge protection circuits at each end of cables and conductors which serve as communication links, except fiber optics. Do not use fuses for surge protection.

3.3.2 Grounding

Provide grounding to building ground.

3.3.3 Wiring

Install system field wiring in 19 mm 3/4 inch minimum diameter electrical metallic tubing or metallic conduit. Install wiring for the sprinkler system fire detection and control system in tubing or conduits dedicated for that use only and do not install in conduit, outlet boxes or junction boxes which contain lighting and power wiring or equipment. Connect circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet to screw terminals with each terminal marked and label in accordance with the wiring diagram. Install no more than one conductor under any screw terminal. Make connections and splices using screw terminal blocks. The use of wire nut type connectors is not permitted. Provide wiring within any control equipment that is readily accessible without removing any component parts. Color code conductors and identify within each enclosure where a connection or termination is made. Identify conductor by plastic coated, self-sticking, printed markers, or by heat-shrink type sleeves. Wire circuits to maintain electrical supervision so that removal of any single wire from any device will cause a "trouble" condition on the control panel.

3.3.4 Control Panel

Mount the control panel and its assorted components 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

Ceiling mount detectors in accordance with NFPA 72 at least 300 mm 12 inches from any part of any lighting fixture. Locate detectors at least 900 mm 3 feet from diffusers of air handling systems. Provide each detector with appropriate mounting hardware as required by its mounting location.

3.3.6 Manual Actuation Stations

Mount manual actuation stations readily accessible and 1060 mm 42 inches above the finished floor.

3.3.7 Notification Appliances

Mount notification appliances 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

Paint black steel pipe in accordance with the requirements specified under SECTION 09 90 00 PAINTS AND COATINGS. Paint pipe in equipment rooms red. Paint pipe in other areas to match finishes in those areas. Do not paint stainless steel pipe.

3.4.2 Pipe Identification

Identify aboveground pipe 50 mm 2 inch diameter and larger with legends. Include FOAM CONCENTRATE, FOAM-WATER SPRINKLER, FOAM-WATER NOZZLE, and FIRE PROTECTION WATER. Utilize WHITE letters on a RED color field and include arrows to indicate the direction of flow. Use length of color field, letter size and locations on piping as recommended in ASME A13.1.

3.5 PRELIMINARY TESTS

Perform tests 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. Include all components and subsystems in such tests. Clearly document and include test reports with the written request for Final Test.

3.5.1 Flushing

Flush underground water mains 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

Hydrostatically test the underground and aboveground piping systems, including AFFF concentrate, in accordance with NFPA 13 at no less than 1379 kPa 200 psi, or 345 kPa 50 psi in excess of maximum system operating pressure, for 2 hours. There must 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

Test each valve to verify operation in accordance with manufacturer's published operating instructions. This includes tests of valves and switches connected thereto.

3.5.4 Nozzles

Test nozzle discharge for proper operation and coverage. Operate oscillating nozzles to verify that angle of elevation, angle of oscillation, and discharge range, are in accordance with requirements.

3.5.5 AFFF Concentrate System

Conduct tests under the supervision of a technical representative employed by the AFFF concentrate manufacturer. Adjust the complete AFFF concentrate system and test to assure proper operation. Record test results, including all pressure settings and readings, 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 includes, but is not 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 includes 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

****
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.
****

Conduct tests under the supervision of a factory-trained representative of the control panel manufacturer. Test the electrical control system to verify that the control panel and all wiring have been installed correctly and that all components function as intended. Conduct tests using normal operating and battery power. Testing includes, but is not limited to, each of the following:

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

b. Supervisory circuit and device. 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. 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. Include bells, horns, electronic signaling, and similar devices.

3.6 FINAL TEST

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

3.6.1 Requirements

The Final Test is a repeat of Preliminary Tests, except do not repeat flushing and hydrostatic tests. In addition, actuate the system automatically and allow 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 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 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 must 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. Include provision of sandbags or similar means for preventing migration of foam solution into adjacent areas. Provide temporary measures to prevent AFFF solution from entering storm drains, sanitary sewers, drainage ditches, streams and other water sources. Contain discharged AFFF on paved surfaces and do not allow to come in contact with the earth.

3.6.2 Control System Tests

Test and demonstrate operational features of the control system. Include testing of control panels and each input and output circuit. Tests of circuits include actuation and simulated circuit fault at each initiating, notification, supervisory and actuation device or appliance. As a practical matter, these tests are a repeat of preliminary tests required

under paragraph PRELIMINARY TESTS.

3.6.3 AFFF Proportioning System Tests

Flow test each AFFF proportioner (ratio controller) to determine that proportioning accuracy is within specified limits. Test each proportioner supplying sprinkler systems with closed heads 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. Test each proportioner supplying a deluge system or a nozzle system at the design flow rate. Collect AFFF samples from each proportioner in accordance with NFPA 16, and the approved test plan. Determine foam solution concentrations using the methods outlined in NFPA 16. Proportioning for nominal 3 percent concentrate must 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

****

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.

****

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. Return the entire fire protection system to automatic operation and restore the facility operational capability. Contain and dispose discharged solution in a manner acceptable to local authorities and as identified on the approved test plan. Once tests are completed, return systems 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. Include a drawing showing proposed number and arrangement of fire hoses and nozzles proposed for use in testing foam proportioners in the test plan. 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. Include all pressure readings and settings of pumps, pressure sustaining valves, relief valves and similar system components. Include conductivity readings for foam samples taken from each AFFF proportioner. Report must 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. Include a unique identifier for each device with an indication of test results. Report must 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

Post framed description of system operation, instructions and schematic diagrams of the overall AFFF system and each subsystem, where directed. Include condensed operating instructions explaining the system for normal operation, refilling the AFFF storage tank, and routine testing.

3.8 TRAINING

Provide at least two training sessions of at least 6 hours each to explain system's operation and maintenance. Conduct training sessions on alternate days to afford flexibility by shift personnel and other attendees. Provide training aids as necessary to clearly describe the systems. Training sessions 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. 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. Include specific start/stop settings for pumps, open/close settings for all adjustable valves (including pressure sustaining and relief valves). List routine maintenance procedures, possible breakdowns, and repairs, and troubleshooting guide in the manuals. 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, operate systems 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. Coordinate dates and times of the training sessions with the Contracting Officer no less than 15 calendar days prior to the first session.

-- End of Section --