UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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DIVISION 21 - FIRE SUPPRESSION

SECTION 21 13 20.00 20

FOAM FIRE EXTINGUISHING FOR AIRCRAFT HANGARS

11/09

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USACE / NAVFAC / AFCEC / NASA **UFGS-21 13 20.00 20 (November 2009)**

Preparing Activity: NAVFAC **Superseding**
UFGS-21 13 20.00 20 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023

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SECTION 21 13 20.00 20

FOAM FIRE EXTINGUISHING FOR AIRCRAFT HANGARS
11/09

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NOTE: This guide specification covers the requirements for automatic deluge, and pre-action fire extinguishing foam systems for aircraft hangars.

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).

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NOTE: For fuel tank farm protection use Section 21 13 21.00 20 FOAM FIRE EXTINGUISHING FOR FUEL TANK PROTECTION. For hazardous and flammable handling and storage facilities such as truck or rail loading/unloading racks, hazardous/flammable liquid warehouses, fuel pump houses and laboratories, use Section 21 13 22.00 20 FOAM FIRE EXTINGUISHING FOR HAZ/FLAM MATERIAL FACILITY. Choose the type of system most appropriate for the hazard. Deluge systems are primarily intended for fire protection of aircraft hangar facilities. Pre-action systems may be required for Air Force hangars even though NFPA 409 recommends deluge systems for aircraft hangars. Consult the current edition of AFR 88-15, "Criteria and Standards for Air Force Construction" for Air Force projects. Pre-action systems provide

added safety against accidental discharge by requiring both actuation of a detector and fusing of a sprinkler head before foam discharge will occur. Deluge systems provide the fastest fire extinguishment. Areas larger than 279 sq meters 3,000 square feet and all deluge systems must be hydraulically designed for uniform distribution. Assure that up to date reliable hydraulic data is used in design of the project. Do not show sprinkler piping layout and heads on project drawings. System requirements must conform to the current edition of UFC 3-600-01, "Fire Protection Engineering for Facilities".

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NOTE: If there are questions concerning type of foam systems required, consult the Engineering Field Division, Naval Facilities Engineering Systems Command.

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NOTE: The following information shall be shown on the project drawings:

1. Location and detail of each foam system supply riser, deluge, or pre-action valve, water motor alarm, fire department inlet connection, foam hydrant, hand hose station, monitor nozzle, air compressor(s), and associated electrical connections.

2. Point of connection to the existing water distribution system.

3. Location of foam system control valves and post indicator valves.

4. Area(s) of foam system coverage, with zone designations (if multiple zones). Do not show piping layout.

5. Location and design of draft curtains as required by NFPA 409 for aircraft hangar.

6. For pipe larger than 305 mm 12 inches, detail methods of anchoring pipe including pipe clamps and tie rods.

7. Location of foam proportioning equipment and storage tank.

8. Show locations of control panel, annunciator(s), alarm devices, manual actuation stations, point of connection to the building fire evacuation alarm system, remote trouble device, point of connection to the incoming power supply and fusible safety switch. Do not show conduit sizes or number of conductors for DC circuits. Do not show locations

of detectors.

9. Show single line riser diagram for all detection, activation, and alarm circuits. Connection of equipment shall be indicated by circuit runs and not conduit runs. Do not indicate number and size of conductors for interconnection of fire alarm components.

****

PART 1 GENERAL

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.

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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 WATER WORKS ASSOCIATION (AWWA)

AWWA C500	(2019) Metal-Seated Gate Valves for Water Supply Service
AWWA C651	(2014) Standard for Disinfecting Water Mains

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2022) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

FM GLOBAL (FM)

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

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR List	(continuously updated) List of Approved Backflow Prevention Assemblies

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 14	(2019; TIA 19-1) Standard for the Installation of Standpipes and Hose Systems
NFPA 15	(2022) Standard for Water Spray Fixed Systems for Fire Protection
NFPA 16	(2015) Standard for Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
NFPA 24	(2022) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 30	(2024) Flammable and Combustible Liquids Code
NFPA 70	(2023) National Electrical Code
NFPA 72	(2022; ERTA 22-1) National Fire Alarm and Signaling Code
NFPA 409	(2022) Standard on Aircraft Hangars

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 22	(1982; E 2004) Paint Specification No. 22 Epoxy-Polyamide Paints (Primer, Intermediate, and Topcoat)
SSPC Paint 25	(1997; E 2004) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II
SSPC SP 3	(2018) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
SSPC SP 11	(2020) Surface Preparation Standard No. 11 - Power Tool Cleaning to Bare Metal

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-24441	(2009; Rev D; Notice 1 2021) Paint, Epoxy-Polyamide, General Specification for

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

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-2962	(Rev A; Notice 2) Enamel, Alkyd, Gloss, Low VOC Content
CID A-A-58092	(Basic; Notice 1; Notice 2) Tape, Antiseize, Polytetrafluoroethylene
FS WW-S-2739	(Basic; Notice 1; Notice 2) Strainers, Sediment: Pipeline, Water, Air, Gas, Oil, or Steam

UNDERWRITERS LABORATORIES (UL)

UL 262	(2004; Reprint Oct 2011) Gate Valves for Fire-Protection Service
UL 789	(2004; Reprint May 2017) UL Standard for Safety Indicator Posts for Fire-Protection Service
UL Fire Prot Dir	(2012) Fire Protection Equipment Directory

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

1.3.1 Design Requirements

****
NOTE: Identify the rooms, spaces or areas, as appropriate, which are to be protected by each system.
****

****
NOTE: Include only those NFPA codes applicable to the specific project.
****

Design and [provide a new][and][modify an existing] automatic aqueous film forming foam (AFFF) [deluge][pre-action] sprinkler system(s)[and under-wing supplemental protection system] for [_____]. System shall provide uniform distribution of AFFF solution to provide complete coverage throughout the [building][areas indicated]. The design, equipment, materials, installation, and workmanship shall be in strict accordance with the required and advisory provisions of NFPA 11, NFPA 13, [NFPA 14,] [NFPA 15,] NFPA 16, [NFPA 24,] [NFPA 30,] NFPA 70, NFPA 72, and NFPA 409, except as modified herein. Each system [shall be designed for earthquakes and] shall include all materials, accessories and equipment necessary to

provide each system complete and ready for use. Design and install each system to give full consideration to blind spaces, piping, electrical equipment, ductwork, and all other construction and equipment to provide complete coverage in accordance with the drawings to be submitted for approval. Devices and equipment for fire protection service shall be of a make and type listed by the Underwriter's Laboratories Inc. in the UL Fire Prot Dir, or approved by the Factory Mutual System and listed in FM APP GUIDE. In the publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the [[_____] Division, Naval Facilities Engineering Systems Command Fire Protection Engineer] [Corps of Engineers Contracting Officer]. Begin work at the point indicated.

1.3.1.1 Shop Drawings

Prepare shop drawings for fire extinguishing system in accordance with the requirements for "Plans" as specified in NFPA 11 and "Working Plans" as specified in NFPA 13. Each drawing shall be A1 841 by 594 mm 34 by 22 inches. Do not commence work until the design of each system and the various components have been approved. Show:

a. Room, space or area layout and include data essential to the proper installation of each system

b. Sprinkler heads, discharge nozzles and system piping layout annotated with reference points for design calculations

c. Field wiring diagrams showing locations of devices and points of connection and terminals used for all electrical field connections in the system, with wiring color code scheme

[d. UV-IR detector manufacturer's recommended detector layout (plan view) including horizontal and vertical angles for correct aiming.

]1.3.1.2 Calculations

Submit design calculations for the system.

a. Hydraulic calculations showing basis for design in accordance with NFPA 11 and NFPA 13.

b. Pressure discharge graphs or tables showing pressure discharge relationship for sprinkler heads and discharge nozzles.

****

NOTE: Regarding the text below, consult with the Division Fire Protection Engineer before specifying 2-wire smoke detectors as a Contractor option. 2-wire detectors must be carefully matched to the control panel by the manufacturer, and are not universally interchangeable between systems for maintenance purposes.

****

c. Substantiating battery standby power requirements calculationsshowing battery capacity, supervisory and alarm power requirements.[If 2-wire smoke detectors are proposed for use show comparison of the

detector power requirements per zone versus the control panel smoke detector power output per zone in both the standby and alarm modes.]

****
NOTE: Include the text below for Air Force Projects only.
****

[d. System surge analysis showing surge pressure occurring throughout the system at both design flow and nonflow conditions.

]1.3.1.3 AFFF Containment and Disposal Plan

Submit AFFF containment and disposal plan as required under paragraph ENVIRONMENTAL PROTECTION.

1.3.1.4 As-Built Drawings for the Fire Extinguishing System

Upon completion, and before final acceptance of the work, submit a complete set of as-built drawings for the fire extinguishing system [, including complete as-built circuit diagrams]. Submit A1 841 by 594 mm 34 by 22 inch reproducible as-built drawings on mylar film with 200 by 100 mm 8 by 4 inch title block similar to contract drawings. Submit as-built drawings in addition to the record drawings required by Division 1.

1.3.2 System Operation

Flow of water and AFFF shall be controlled by [deluge] [pre-action] valves. Foam proportioning equipment shall activate automatically upon tripping of the [deluge] [pre-action] valve(s) for the corresponding foam system(s). [Deluge][Pre-action] valves shall be tripped by independent detection systems. No valve will be operated by the building fire evacuation alarm system. Use of motor-operated valves is prohibited. Once activated, system(s) shall operate until shut down manually. Provide separate circuits from the control panel to each zone of initiating devices. Transmission of signals from more than one zone over a common circuit is prohibited.

1.3.2.1 Overhead Systems

Overhead systems shall be controlled by [deluge] [pre-action] valves operated by automatic detection systems and by remote manual release stations.

1.3.2.2 Monitor System

Monitor nozzles shall be controlled by deluge valves operated by[the automatic detection systems and manual release stations which activate the corresponding overhead system(s)][independent ultraviolet-infrared (UV-IR) optical detection systems and manual stations][flow of AFFF solution in the overhead system].

1.3.2.3 Hose System

Hose reels shall be controlled by deluge valves operated by remote manual release stations, separate from those used for overhead systems and monitor nozzles.

1.4 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:

[The fire protection engineer, [_____] Division, Naval Facilities Engineering Systems Command will review any approve all submittals in this section requiring Government approval.]

****

NOTE: For projects administered by the Pacific Division, Naval Facilities Engineering Systems Command, use the optional "SUBMITTALS" article immediately below and delete the general "SUBMITTALS" article above.

****

[The [_____] Division, Naval Facilities Engineering Systems Command, Fire

Protection Engineer delegates the authority to the Quality Control (QC) Representative's U.S. Registered Fire Protection Engineer for review and approval of submittals required by this section. Submit to the [_____] Division, Naval Facilities Engineering Systems Command, Fire Protection Engineer one set of all approved submittals and drawings immediately after approval but no more later than 15 working days prior to final inspection.]

SD-02 Shop Drawings

Fire Extinguishing System; G[, [_____]]

SD-03 Product Data

Pipe, Fittings, and Mechanical Couplings; G[, [_____]]

[Deluge] [Pre-action] Valves; G[, [_____]]

Valves, including gate, check, and globe; G[, [_____]]

Water Motor Alarms; G[, [_____]]

Sprinkler Heads; G[, [_____]]

Monitor Nozzles; G[, [_____]]

Hose and Nozzles; G[, [_____]]

Pipe Hangers and Supports; G[, [_____]]

Pressure Switch; G[, [_____]]

Fire department Inlet Connections; G[, [_____]]

Tank Mounted Air Compressor; G[, [_____]]

Air Pressure Regulating Device; G[, [_____]]

Air Compressor (pneumatic detection system); G[, [_____]]

Low Air Pressure Trouble Alarm; G[, [_____]]

Detection Devices; G[, [_____]]

Storage Batteries; G[, [_____]]

Alarm Bells; G[, [_____]]

Alarm Horns; G[, [_____]]

Annunciator Panel; G[, [_____]]

Foam Hydrants; G[, [_____]]

AFFF Concentrate Storage Tanks; G[, [_____]]

Proportioning Equipment; G[, [_____]]

AFFF concentrate; G[, [_____]]

[Strainers; G[, [_____]]

] Manual Release Stations; G[, [_____]]

Backflow Preventers; G[, [_____]]

Control Panel; G[, [_____]]

Battery Charger; G[, [_____]]

Data which describe more than one type of item shall be clearly marked to indicate which type the Contractor intends to provide. Submit only originals. Photocopies will not be accepted. Partial submittals will not be accepted.

SD-05 Design Data

Hydraulic Calculations; G[, [_____]]

Pressure Discharge Graphs or Tables; G[, [_____]]

Battery Standby Power Requirements Calculations; G[, [_____]]

[System Surge Analysis; G[, [_____]]

] SD-06 Test Reports

****

NOTE: Consult with the Division Fire Protection Engineer before specifying 2-wire smoke detectors as a Contractor option. 2-wire detectors must be carefully matched to the control panel by the manufacturer, and are not universally interchangeable between systems for maintenance purposes.

****

Open-area (Spot-Type) 2-wire Smoke Detectors; G[, [_____]]

Submit copies of UL listing or FM approval data showing compatibility of the smoke detector model being provided with the control panel being provided, if 2-wire detectors are proposed for use.

Preliminary Tests; G[, [_____]]

Acceptance Tests; G[, [_____]]

Submit for all inspections and tests specified under the paragraph FIELD QUALITY CONTROL.

Hydrostatic Testing of the Diaphragm Pressure Proportioning Tanks; G[, [_____]]

SD-07 Certificates

Qualifications of Installer; G[, [_____]]

Submit installers qualifications as required under paragraph

QUALIFICATIONS OF INSTALLER.

AFFF Containment and Disposal Plan; G[, [_____]]

Backflow Preventers; G[, [_____]]

SD-10 Operation and Maintenance Data

[Deluge] [Pre-action] Valves, Data Package 3; G[, [_____]]

Tank Mounted Air Compressor, Data Package 3; G[, [_____]]

Proportioning Equipment, Data Package 3; G[, [_____]]

Control Panel, Data Package 3; G[, [_____]]

AFFF Concentrate Storage Tanks, Data Package 3; G[, [_____]]

Monitor Nozzles, Data Package 3; G[, [_____]]

Instructions for Operating the Fire Extinguishing System, Data Package 4; G[, [_____]]

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Furnish one complete set of data prior to the time that final acceptance tests are performed, and furnish the remaining sets before the contract is completed.

SD-11 Closeout Submittals

As-built Drawings for the Fire Extinguishing System; G[, [_____]]

1.5 QUALITY ASSURANCE

1.5.1 Qualifications of Installer

Prior to commencing work, submit data showing that the Contractor has successfully installed automatic foam fire extinguishing sprinkler systems of the same type and design as specified herein, or that he has a firm contractual agreement with a subcontractor having the required experience. Include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system, and certify that the system has performed satisfactorily for a period of at least 18 months.

****

NOTE: For projects administered by the Pacific Division, Naval Facilities Engineering Systems Command, include the following optional paragraph requiring the minimum qualification of a NICET Level-III technician for preparation of all fire protection system drawings.

****

[Qualifications of System Technician: Installation drawings, shop drawing and as-built drawings shall be prepared, by or under the supervision of, an individual who is experienced with the types of works specified herein, and is currently certified by the National Institute for Certification in

Engineering Technologies (NICET) as an engineering technician with minimum Level-III certification in Special Hazard System program. Contractor shall submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of drawings.

]1.6 SPARE PARTS

Furnish the following spare parts:

a. Two of each type of detector installed.

b. One of each type of audible and/or visual alarm device installed.

c. Two of each type of fuse required by the system.

d. Five complete sets of system keys.

PART 2 PRODUCTS

2.1 DESIGN OF FOAM SYSTEMS

Design of [deluge] [pre-action] fire extinguishing foam systems shall be by hydraulic calculations for uniform distribution of AFFF solution over the protected area and shall conform to the NFPA standards listed above and to the requirements as specified herein.

2.1.1 Sprinkler Heads

Heads shall have 15[or 13.50] mm 1/2[or 17/32] inch orifice. No o-rings will be permitted in sprinkler heads.[For deluge systems, provide open heads.] [For pre-action systems, the release element of each head shall be of the ["intermediate"] ["high"] temperature rating or higher as suitable for the individual location installed.] Provide chromium plated ceiling plates and pendent sprinklers below suspended ceilings. Provide corrosion resistant sprinkler heads and sprinkler head guards as required by NFPA 13.

2.1.2 Cabinet

****
NOTE: Deluge systems do not require a sprinkler head cabinet.
****

Provide extra sprinkler heads and sprinkler head wrench in a metal cabinet adjacent to the pre-action valve within each building. The number and types of extra sprinkler heads shall be as specified in NFPA 13.

2.1.3 [Deluge] [Pre-Action] Valves

Valves shall be operated by a detection system listed for releasing service and independent of the building fire alarm system.[[Deluge][Pre-action] valve clappers shall incorporate a latching mechanism that will not be affected by changes of pressure in the water system.] If 150 mm 6 inch valves are used in 200 mm 8 inch risers, provide smoothly tapered connections. In addition to automatic operation, arrange each valve for manual release at the valve. Provide pressure gages and other appurtenances at the [deluge] [pre-action] valves as required by NFPA 13.

Provide a detection device at the end of each actuation circuit to test the circuit and mount the device[adjacent to the valve] between 1.80 and 2.40 meters 6 and 8 feet above the finish floor. Label each testing device to indicate the valve it activates.[Provide remote manual releases[at [_____]][where shown].]

2.1.4 AFFF Solution Distribution

****
NOTE: Select the first option for pre-action systems. Select the second option for deluge systems.
****

[Distribution shall be essentially uniform throughout the area in which it is assumed the sprinkler heads will open. Variation in discharge from individual heads in the hydraulically most remote area shall be between 100 and 115 percent of the specified density.

][Distribution shall be essentially uniform throughout the area. Variation in discharge from individual heads shall be between 100 and 115 percent of the specified density.

]2.1.5 AFFF Solution Application Density

Size system to provide the specified density when the system is discharging the specified total maximum required flow. Application to horizontal surfaces below the ceiling sprinklers shall be 110 mL/sec per sq meter 0.16 gallons per minute (gpm) per square foot with simultaneous operation of [_____] operating foam monitor nozzles, [and] [_____] operating foam hose lines[, and with outside water hose stream requirements of [_____] mL/sec gpm].

2.1.6 Sprinkler Discharge Area

****
NOTE: Select the first option for pre-action systems only and refer to MIL-HDBK-1008 and the appropriate NFPA standard(s) governing the particular facility to determine the discharge area required. Select the second option for deluge systems only and refer to NFPA 409 to determine the discharge area required for hangars.
****

[Area shall be the hydraulically most remote [_____] square meter foot area as defined by NFPA 13.

][Area shall be[that protected by each riser][based on the [15.25] [22.75] [30.50] meter [50] [75] [100] foot radius rule as determined in accordance with NFPA 409 for Type I aircraft hangars].

]2.1.7 Friction Losses

Calculate losses in pipe in accordance with the Hazen-Williams Formula with 'C' value of 100 for steel pipe[except 120 for steel pipe used in deluge systems], 150 for copper tube, and 140 for cement lined ductile iron pipe.

2.1.8 Location of Sprinkler Heads

Location of heads in relation to the ceiling and spacing of sprinkler heads shall conform to NFPA 13 for extra hazard occupancy. The spacing of sprinklers on the branch lines shall be essentially uniform.

2.1.9 Water Supply

****

NOTE: Select first option if the water supply is provided directly from the base water distribution system and show or specify the point of connection. Select second option if the water supply is provided from fire pumps dedicated to the AFFF system, which are taking suction from a static water source. Select third option if the water supply is provided from booster fire pumps being supplied from the base water distribution system, and show or specify the point of connection to the base system. Edit Section 21 30 00 FIRE PUMPS and include as part of the project specification when using the second or third option.

****

[Base hydraulic calculations on a static pressure of [_____] kPa (gage) with [_____] L/m pounds per square inch gage (psig) with [_____] gpm being available at a residual pressure of [_____] kPa (gage) psig at the point [indicated][of connection with the base water distribution system].

][Base hydraulic calculations on [_____] fire pump(s) running. Provide fire pumps as specified in Section 21 30 00 FIRE PUMPS.

][Base hydraulic calculations on [_____] fire pump(s) running, with a suction supply having a static pressure of [_____] kPa (gage) psig with [_____] L/m gpm being available at a residual pressure of [_____] kPa (gage) psig at the point [indicated][of connection with the base water distribution system]. Provide fire pumps as specified in Section 21 30 00 FIRE PUMPS.

]2.1.10 Duration of Discharge

****

NOTE: For sprinkler and monitors discharge duration, consult NFPA 409. For hose station discharge duration, consult NFPA 30 and NFPA 409.

****

System shall apply foam solution over the sprinkler discharge area for a minimum of [10] [_____] minutes while simultaneously discharging foam solution through monitors for a minimum of [10] [_____] minutes. Hose station discharge time shall be a minimum of [20] [_____] minutes. Reduction of the discharge duration based on a discharge rate higher than the specified minimum is not permitted.

2.2 ELECTRIC DETECTION DEVICES

****

NOTE: Electric detection system may be used with all detector types specified in this guide

specification and are necessary for complex controls.
****

Provide electric [heat detectors,][and] [smoke detectors,][and] [combination ultraviolet-infrared detectors]. All wiring shall be supervised and installed in protective metal conduit or tubing.

2.2.1 Control Panel

****
NOTE: Select either "Class B" or Class A" supervision ("Style B" or "Style D" as defined by NFPA 72). "Class B" supervision which will normally be used, provides a trouble indication when a failure occurs in a circuit. "Class A" supervision provides a trouble indication when a fault occurs in a circuit and at the same time allows continued operation of that circuit. "Class A" supervision should be used for strategically critical facilities. Select first ("Class B") or second ("Class A") supervisory option accordingly.
****

****
NOTE: Provide a remote trouble bell or buzzer in a constantly attended area if the control panel is not so located. Provide a trouble bell at the control panel if the panel is located in a high noise area. Coordinate location of remote trouble bell and remote annunciator panel when both are provided.
****

Modular type panel installed in a [flush] [surface] mounted steel cabinet with hinged door and cylinder lock. Switches and other controls shall not be accessible without the use of a key. The control panel shall be a neat, compact, factory-wired assembly containing all parts and equipment required to provide specified operating and supervisory functions of the system. Panel cabinet shall be finished on the inside and outside with factory-applied enamel finish. Provide main annunciator located on the exterior of the cabinet door or visible through the cabinet door. Provide audible trouble signal. Provide prominent engraved rigid plastic or metal identification plates, or silk-screened labels attached to the rear face of the panel viewing window, for all lamps and switches. System power shall be 120 volts AC service, transformed through a two winding isolation transformer and rectified to 24 volts DC for operation of all system initiating, actuating, signal sounding, trouble signal and fire alarm tripping circuits. System shall be electrically supervised on all circuits.[A ground fault condition or a single break in any circuit which prevents the required operation of the system shall result in the operation of the system trouble signal.][A single open or ground fault condition in any detection (initiating)[or signaling] circuit shall not result in any loss of system function, but shall cause the actuation of system trouble signals. A ground fault condition or single break in any other circuit shall result in the activation of the system trouble signals.] Loss of AC power, a break in the standby battery power circuits, or abnormal AC power or low battery voltage shall result in the operation of the system trouble signals. The abnormal position of any system switch in the control panel shall result in the operation of the system trouble signals. Trouble signals shall operate continuously until

the system has been restored to normal at the control panel. System trouble shall also be annunciated on the appropriate zone of the building fire alarm panel.[Provide a 100 mm 4 inch remote system trouble bell[or buzzer], installed[in a constantly attended area][where shown], arranged to operate in conjunction with the integral trouble signals of the panel. Provide remote bell[or buzzer] with a rigid plastic or metal identification sign which reads "Foam System Trouble." Lettering on identification sign shall be a minimum of 25 mm one inch high.] Control panel, batteries, and battery charger shall be weatherproof type or located in an area not subject to water damage. System control panel shall be UL listed or FM approved for extinguishing system control (releasing device service). Permanently label all switches. Provide panel with the following switches:

a. Trouble silencing switch which transfers audible trouble signals (including remote trouble devices, if provided) to an indicating lamp. Upon correction of the trouble condition, audible signals will again sound until the switch is returned to its normal position, or the trouble signal circuit shall be automatically restored to normal upon correction of the trouble condition. The silencing switch may be a momentary action, self-resetting type.

b. Alarm silencing switch which when activated will silence all associated alarm devices without resetting the panel, and cause operation of system trouble signals.

c. Individual zone disconnect switches which when operated will disable only their respective initiating circuit and cause operation of the system and zone trouble signals.

d. Reset switch which when activated will restore the system to normal standby status after the cause of the alarm has been corrected, and all activated initiating devices reset.[Operation of reset switch shall restore activated smoke detectors to normal standby status.]

e. Lamp test switch.

[f. City disconnect switch which when activated will disconnect the coded device and cause operation of the system trouble signal.

]2.2.1.1 Main Annunciator

Provide integral with the main control panel. Provide separate alarm and trouble lamps for each zone alarm initiating circuit as indicated below, located on the exterior of the cabinet door or visible through the cabinet door. Lamps shall be LED (Light Emitting Diode) type. Supervision will not be required provided a fault in the annunciator circuits results only in loss of annunciation and will not affect the normal functional operation of the remainder of the system. Each lamp shall provide specific identification of the [zone] [area] [device] by means of a permanent label. In no case shall zone identification consist of the words "Zone 1," "Zone 2," etc., but shall consist of the description of the [zone] [area] [device].

2.2.1.2 Initiating Zones

****

NOTE: List zones from 1 to x, with a brief description of each zone; e.g. "Zone 1: Hangar Bay

No. 1". Expand this list as necessary to identify all the zones required for the building.
****

Shall be arranged as follows:

Zone 1: [_____]

Zone 2: [_____]

Zone 3: [_____]

Zone x: [_____]

2.2.1.3 Remote Annunciator Panel

****
NOTE: Coordinate location of remote trouble bell and remote annunciator panel when both are provided. Locate panel at or near the building entrance to allow fire department quick access to panel.
****

Locate as shown. Panel shall duplicate all requirements specified for the main control panel annunciator, except that in lieu of individual zone trouble lamps a single common system trouble lamp may be provided. Lamps shall be LED (Light Emitting Diode) type, except lamps used in backlit panels shall be LED or neon type. Panel shall have a lamp test switch. Zone identification shall be by means of[permanently attached rigid plastic or metal plate(s)][silk-screened labels attached to the reverse face of backlighted viewing window(s)]. Panel shall be of the[interior][weatherproof] type,[flush][surface][pedestal]-mounted.

2.2.2 Auxiliary Power Supply

2.2.2.1 Storage Batteries

****
NOTE: Consult the Public Works Department for battery preference.
****

Provide [sealed lead calcium,] [or] [sealed lead acid,] [or] [vented wet cell nickel cadmium,] batteries and charger. Drycell batteries are not acceptable. House batteries in the control panel or in a well constructed vented steel cabinet with cylinder lock, non-corrosive base, and louvered vents. Provide batteries of adequate ampere-hour rating to operate the system under supervisory conditions for 60 hours, at the end of which time batteries shall be capable of operating the entire system in a full alarm condition for not less than [30] [15] minutes. Provide calculations substantiating the battery capacity. Provide reliable separation between cells to prevent contact between terminals of adjacent cells and between battery terminals and other metal parts. Provide batteries with post-and-nut, "L"-blade, or similar terminals. Slip-on tab type terminals are not acceptable. When a separate battery cabinet is used, provide a fuse block for battery leads within the cabinets. Finish the cabinet on the inside and outside with enamel paint. Locate the top of the battery cabinet not more than 1.20 meters 4 feet above floor level.

2.2.2.2 Battery Charger

Provide completely automatic high/low charging rate type charger capable of recovery of the batteries from full discharge to full charge in 24 hours or less. Provide an ammeter for recording rate of charge and a voltmeter to indicate the state of battery charge under load. Meters shall be factory installed, or factory-supplied plug-in modules. Field installation of meters other than the panel manufacturer's plug-in modules is prohibited. Provide a trouble light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high-rate switch is provided. House charger in the control panel or battery cabinet.

2.3 PNEUMATIC DETECTION SYSTEM

****

NOTE: Pneumatic detection system may be used only with single acting rate-of-rise heat detectors. Consult with the Division Fire Protection Engineer for guidance on use of pneumatic detection systems.

****

Provide pneumatic single acting rate-of-rise heat detectors. All tubing shall be supervised and installed in protective metal conduit or tubing.

2.3.1 Air Compressor

Shall be automatic, electric motor driven and include piping, pressure switch, regulator, and tank if required. Provide compressor with a minimum capacity capable of charging the pneumatic detection system to normal system pressure in 15 minutes and shall include all controls necessary to maintain the system fully charged.[Provide at least one compressor for every [_____] detection circuits.]

2.3.2 Piping and Control Panel

Provide copper piping. Provide a control panel or equivalent device(s) to automatically maintain the required pneumatic pressure in the detection system, and limit the quantity of air that enters the detection/release system. Provide supply air and system air pressure gages.

2.4 PIPING SUPERVISION

****

NOTE: Include for projects involving pre-action sprinkler piping systems or pneumatic detection systems only.

****

[Pre-action sprinkler piping][and][Pneumatic detection system] shall be supervised. A break in the piping or tubing systems resulting in loss of pneumatic pressure shall result in the activation of a trouble signal. Provide a silencing switch which transfers trouble signals to an indicating lamp and arrange so that correction of the trouble condition will automatically transfer the trouble signal from the indicating lamp back to the trouble signal until the switch is restored to normal position.

2.5 MANUAL RELEASE STATIONS

Provide[combined] overhead system, and monitor nozzle release stations where shown, and separate hose station release stations at each hose station. Stations shall be of a type not subject to operation by jarring or vibration. Stations shall have a dual action release configuration to prevent accidental system discharge. Break-glass-front stations are not permitted; however a pull lever break-glass-rod type is acceptable. Station color shall be red. Station shall provide positive visible indication of operation. Restoration shall require use of a key or special tool. Place warning signs at each station indicating that operation of the station will cause immediate AFFF discharge. Where a building fire alarm pull station is also mounted in the vicinity of a foam release station, separate the stations by at least one meter 3 feet horizontally. Provided permanent engraved rigid plastic or metal labels to clearly distinguish foam release stations from building fire alarm stations, and to indicate the function of each foam release station. Stations shall be weatherproof type.

2.6 HEAT DETECTORS

****

NOTE: Select the type of heat detector most suited for application or design. Do not use rate-of-rise detectors in areas subject to rapid temperature changes (e.g. near main hangar doors, unit heaters, etc.). Consult the Division Fire Protection Engineer.

****

Designed for detection of fire by [combination fixed temperature rate-of-rise] [rate compensating] principle. Locate detectors in accordance with their listing by UL or FM and the requirements of NFPA 72, except provide at least two detectors in all rooms of 56 square meters 600 square feet or larger in area. Temperature rating of detectors shall be in accordance with NFPA 72. Reduce heat detector spacing in areas with ceiling heights exceeding 3 meters 10 feet, in accordance with NFPA 72. No detector shall be located closer than 305 mm 12 inches to any part of any lighting fixture nor closer than 610 mm 24 inches to any part of an air supply diffuser. Detectors, located in hazardous locations as defined by NFPA 70, shall be types approved for such locations. Provide with terminal screw type connections. Removal of detector head from its base shall cause activation of system trouble signal. Detectors shall be weatherproof type.

2.6.1 Combination Fixed Temperature Rate-of-Rise Detectors

****

NOTE: Only single acting rate-of-rise heat detectors may be specified for use with a pneumatic detection system.

****

Designed for [surface] [semi-flush] outlet box mounting and supported independently of conduit, tubing or wiring connections. Contacts shall be self-resetting after response to rate-of-rise actuation. Operation under fixed temperature actuation shall result in an external indication. Detector units located in areas subject to abnormal temperature changes shall operate on fixed temperature principle only.

2.6.2 Rate Compensating Detector

Designed for [surface] [flush] [vertical unit] outlet box mounting and supported independently of conduit, tubing or wiring connections. Detectors shall be hermetically sealed and automatically resetting type which will operate when ambient air temperature reaches detector setting regardless of rate of temperature rise. Detector operation shall not be subject to thermal time lag.

2.7 OPEN-AREA (SPOT-TYPE) SMOKE DETECTORS

****

NOTE: Consult with the Division Fire Protection Engineer before specifying 2 wire smoke detectors as a Contractor option. 2 wire detectors must be carefully matched to the control panel by the manufacturer, and are not universally interchangeable between systems for maintenance purposes.

****

Designed for detection of abnormal smoke densities by the [ionization][or][photoelectric] principle. Provide necessary control and power modules required for operation integral with the main control panel. Provide detectors and associated modules which are compatible with the main control panel and suitable for use in a supervised circuit. Detector circuits shall be of the 4 wire type whereby the detector operating power is transmitted over conductors separate from the initiating circuit. Provide a separate, fused, power circuit for each smoke detection initiating circuit (zone). Failure of the power circuit shall be indicated as a trouble condition on the corresponding initiating circuit.[As an alternate, detector circuits of the 2-wire type whereby the detector operating power is transmitted over the initiating circuit are permitted, provided the detectors used are approved by the control panel manufacturer for use with the control panel provided and are UL listed or FM approved as being compatible with the control panel (copies of the UL or FM listings showing compatibility shall be submitted). When 2-wire smoke detectorsare used, the total number of detectors on any detection circuit shall not exceed 80 percent of the maximum number of detectors allowed by the control panel manufacturer for that circuit and the standby current draw of the entire system shall not exceed 80 percent of the rated output of the system power supply module(s). Provide additional zones above those specified in the paragraph INITIATING ZONES if required to meet the above requirements. Calculations showing compliance with the power consumption limitation requirements specified above shall be submitted with the calculations required by the paragraph DESIGN DATA. The data submitted under the paragraph TEST REPORTS shall clearly indicate the compatibility of the detectors with the control panel provided and the maximum number of detectors permitted per zone.] Malfunction of the electrical circuits to the detector or its control or power units shall result in the operation of the system trouble signals. Equip each detector with a visible indicator lamp that flashes when the detector is in the normal standby mode and glows continuously when the detector is activated.[Provide remote indicator lamps for each detector that is concealed from view.] Provide plug-in type detectors with tab-lock or twist-lock, quick disconnect head and separate base in which the detector base contains screw terminals for making all wiring connections. Detector head shall be removable from its base without

disconnecting any wires. Removal of detector head from its base shall cause activation of system trouble signals. Provide each detector with an integral screen to prevent entrance of insects into the detection chamber(s).

2.7.1 Ionization Detectors

Multiple chamber type which is responsive to both visible and invisible particles of combustion. Detectors shall not be susceptible to operation by changes in relative humidity.

2.7.2 Photoelectric Detectors

Operate on a multiple cell concept using an infra-red light-emitting diode (LED) light source.

2.7.3 Detector Spacing and Location

NFPA 72, the manufacturer's recommendations and the requirements stated herein, however, in no case shall spacing exceed 9 by 9 meters 30 by 30 feet per detector, and 9 lineal meter 30 lineal feet per detector along corridors. Detectors shall not be placed closer than [1] [1.50] meter [3] [5] feet from any air discharge or return grille, nor closer than 305 mm 12 inches to any part of any lighting fixture.

2.8 COMBINATION ULTRAVIOLET-INFRARED FLAME DETECTORS

Flame detectors shall operate on the dual spectrum ultraviolet-infrared (UV-IR) principle. Detector shall employ a solar-blind UV sensor with a high signal-to-noise ratio, and a narrow band IR sensor. Detector logic shall require UV and IR signals to be present, in the proper ratio or signature as emitted by a hydrocarbon fire, before the detector initiates an alarm.[Detectors shall respond within 5 seconds to a JP-4 fire 3 meters 10 feet square, 46 meters 150 feet from the detector.] Detector shall not be activated by non-fire sources such as continuous or intermittent direct or reflected solar radiation, arc-welding, lightning, radiant heat, x-rays, artificial lighting, radio transmissions, and normal jet engine functions. 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 signals. Logic circuits necessary for operation of the detector shall be integral to the detector or located in separate flame detector control panel(s) located adjacent to the foam system control panel(s). Each detector in alarm shall be individually annunciated by an LED on the detector or at the detector control panel. Primary and auxiliary power supply shall be taken from the foam system control panel(s). Detectors, and associated control panels if required, shall be compatible with the foam system control panel(s). Detectors and associated control panels shall be weatherproof, or housed in weatherproof enclosure(s) when in an area subject to system discharge and shall also be explosion-proof when located in hazardous areas as defined by NFPA 70. Detector spacing and location shall be in accordance with NFPA 72, their UL listing or FM approval, and the manufacturer's recommendations. The detector manufacturer shall determine or approve the detector layout. Detector layout drawings shall include horizontal and vertical angles for correct aiming. Locate detectors so that every portion of the protected [floor] area is within the field of view of at least [two] [three] detectors, taking into account fixed obstructions. Provide detectors with

manufacturer's swivel mounting bracket. Provide a permanent engraved rigid plastic or metal label at each detector location with detector aiming information (degrees horizontal and vertical) for the corresponding detector.

2.9 ELECTRICAL WORK

****
NOTE: Edit Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and include as part of the project specification.
****

****
NOTE: When project includes requirement for a building fire alarm system, include Section [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] [28 31 76 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM, ADDRESSABLE] in the project specification. When project requires only tying into an existing building fire alarm system, fire alarm wiring should be specified in this section. Select the appropriate Section title when using the basic NAVFAC guide specification covering the subject work or select the second title when using the EFD regional guide specification covering the subject work.
****

Electrical work is specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, except for control [and fire alarm] wiring.[Fire alarm system is specified in Section [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] [28 31 76 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM, ADDRESSABLE] ["Fire Alarm and Fire Detecting Systems (Local)"].]

2.9.1 Wiring

Provide control wiring and connections to fire alarm systems, under this section and conforming to NFPA 70 and NFPA 72. Wire for 120 volt circuits shall be No. 12 AWG minimum solid conductor. Wire for low voltage DC circuits shall be No. [14] [16] AWG minimum solid conductor [, except wire to remote annunciators, if provided, may be 18 AWG minimum solid conductor]. All wiring shall be color coded. Wiring, conduit and devices exposed to water or foam discharge shall be weatherproof. Wiring, conduit and devices located in hazardous atmospheres, as defined by NFPA 70[and as shown], shall be explosion proof. All conduit shall be minimum 20 mm 3/4 inch size.

2.9.2 Operating Power

Power shall be 120 volts AC service, transformed through a two winding isolation type transformer and rectified to 24 volts DC for operation of all signal initiating, signal sounding, trouble signal, and actuating (releasing) circuits. Provide secondary DC power supply for operation of system in the event of failure of the AC supply. Transfer from normal to

emergency power or restoration from emergency to normal power shall be fully automatic and shall not cause transmission of a false alarm. Obtain AC operating power for control panel,[and]battery charger[, and air compressor] from the line side of the incoming building power source ahead of all building services. Provide independent properly fused safety switch, with provisions for locking the cover and operating handle in the "POWER ON" position for these connections and locate adjacent to the main distribution panel. Paint switch box red and suitably identify by a lettered designation.

2.9.3 Conductor Identification

Identify circuit conductors within each enclosure where a tap, splice or termination is made. Identify conductors by plastic coated self sticking printed markers or by heat-shrink type sleeves. Attach the markers in a manner that will not permit accidental detachment. Properly identify control circuit terminations.

2.10 SYSTEM ACTIVATION

2.10.1 Overhead System Activation

****
NOTE: Provide one or more risers per hangar bay as required by NFPA 409 based on size of bay. Overhead systems, monitor systems and hose systems shall be served by separate risers.
****

Each zone shall encompass the area[protected by each riser][of one hangar bay]. Upon activation of the detection system or overhead system manual release station(s), the corresponding overhead system protecting that area shall activate.

2.10.2 Monitor System Activation

****
NOTE: Overhead systems, monitor systems and hose systems shall be served by separate risers.
****

Each zone shall encompass[one hangar bay][the monitors indicated]. Upon activation of [[detectors for] the overhead system] [two UV-IR detectors for more than 5 seconds] or activation of a manual release station, all monitors in that zone shall be activated.

2.10.3 Hose System Activation

****
NOTE: Overhead systems, monitor systems and hose systems shall be served by separate risers.
****

[Each][The] zone shall encompass [all hose stations] [the hose stations indicated]. Hose stations shall be activated upon activation of a hose station manual release station. Provide a manual release station at each hose station.

2.11 ALARMS

2.11.1 Water Motor Alarms

Provide weatherproof and guarded type alarm for each [group of] [deluge] [pre-action] valve(s). Alarms shall sound locally on the flow of foam solution in each system to which it is connected. Mount alarms on the outside of the outer walls of each building, at locations indicated. When more than one alarm gong is provided, provide permanent engraved rigid plastic or metal signs indicating to which system each gong is connected.

2.11.2 Local Alarm

****
NOTE: Delete if a building fire alarm system exists in the building or is being provided under this project.
****

Provide electric [alarm horns] [alarm bells] to sound locally on operation of any system, regardless of whether water flows or not. When more than one alarm is provided, provide permanent engraved rigid plastic or metal signs indicating to which system each alarm is connected.

2.11.3 Fire Alarm

Provide equipment for the automatic transmittal of an alarm over the building fire alarm system. Arrange so that the detection system and the flow of solution in each system will actuate the alarm. [Activation of a single UV-IR detector shall not cause activation of the foam system but shall cause activation of the fire alarm system].

2.11.3.1 Pressure Switch

Provide switch with SPDT contacts to automatically transmit alarms upon flow of water or AFFF. Alarm actuating device shall [have mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and shall] instantly recycle.

2.11.4 Trouble Alarm

****
NOTE: Delete if a building fire alarm system exists in the building or is being provided under this project.
****

****
NOTE: Pre-action sprinkler piping systems require supervision.
****

Provide local[100 mm 4 inch] electric alarm [bell] [horn] [_____] to indicate trouble [or failure of the [detection system][or][pre-action sprinkler piping system]]. Also connect trouble alarm into the building fire alarm control panel to indicate "trouble" on a separate zone labeled "Foam System Trouble".

2.12 TANK MOUNTED AIR COMPRESSOR

****

NOTE: Include for projects involving pre-action sprinkler piping systems only.

****

Provide an approved automatic type electric motor driven air compressor including pressure switch, air piping, and [38 liter] [10 gallon][_____] minimum capacity tank. Compressor shall have a minimum capacity capable of charging the complete sprinkler system to normal system air pressure within 30 minutes. Provide each system with an approved automatic air pressure regulating device.

2.13 AFFF CONCENTRATE

****

NOTE: Consult the facility fire department and the Division Fire Protection Engineer to determine percentage.

****

MIL-PRF-24385, [3] [6] percent.

2.13.1 Concentrate Fill Pump

Provide one pump to fill foam system tank. Pump shall have a minimum flow rate of 27 L/m 7 gpm. Pump shall be complete with 115 VAC motor, fused switch, power cord with plug and 3 meters 10 foot minimum suction and clear discharge hoses.

2.14 DIAPHRAGM PRESSURE PROPORTIONING EQUIPMENT

****

NOTE: Select the method of proportioning best suited for the project. For hangars, NFPA 409 requires dual pumps (main and reserve) for each system.

Diaphragm pressure proportioning systems operate by water pressure, require no electrical power, and minimal control circuitry for automatic operation. Maintenance requirements are minimal, however refilling the tank is a difficult operation requiring the services of a qualified technician to avoid rupturing the diaphragm.

Balanced pressure proportioning systems require reliable electrical power and more complex control circuitry for automatic operation. In some cases an emergency generator will be required. The primary advantage of the non-diaphragm systems is the ease in refilling the tanks. Tanks may be refilled even while the system is in operation, if necessary.

Skid-mounted balanced pressure proportioning systems perform proportioning at a central location, avoiding long runs of concentrate lines. They are well suited for systems such as deluge sprinklers

and monitor nozzles which have a relative narrow range of flow rates.

In-line balanced pressure proportioning is useful when there are multiple hazards with widely varying discharge rates which are to be supplied from the same proportioning system, and any time it is desired to proportion foam remotely at risers or discharge devices instead of at the pump room. Their disadvantage is the need for much more concentrate piping in the field.

****

Foam solution shall be produced by introducing AFFF concentrate into the water stream by the balanced pressure proportioning method using a diaphragm pressure tank and ratio controller.[Provide proportioning system and storage tanks for hose lines independent of main proportioning system and tanks.]

2.14.1 Diaphragm Pressure Proportioning Tanks

****

NOTE: When large quantities of AFFF concentrate are required, consider two or more tanks in parallel vs one large tank. (This is in addition to reserve tanks.) Approved diaphragm tanks larger than 9.50 to 11.40 cu meters 2,500 to 3,000 gallons are not readily available.

****

****

NOTE: Designer must calculate foam tank capacity based on maximum flow for maximum duration to determine size of tank and space required. Do not label foam tank capacity on drawing. Exact tank size (which may be larger) will be determined by Contractor's hydraulic calculations.

****

Tanks shall be cylindrical steel ASME pressure vessels with a full Buna-N impregnated nylon inner tank or bladder designed to contain AFFF concentrate and to be used in conjunction with the concentrate ratio controller. Tanks shall be designed for working pressure of [1206 kPa (gage)] [175 psig] [_____] and hydrostatically tested at 1.5 times the working pressure in accordance with ASME standards at the factory. Tanks shall have UL or FM label and ASME stamp affixed to the vessel. Size tank to provide sufficient AFFF concentrate for the time specified when the system is discharging foam solution at total maximum system flow. Also provide connected reserve tanks(s) of equal capacity. Permanently label each tank with its capacity, type and percentage of concentrate, which system(s) it serves, and whether it is a main or reserve tank. Conspicuously post filling instructions near each group of tanks. Provide a gage or unbreakable sight glass to permit visual determination of level of tank contents. Prior to shop painting, abrasive blast clean tank exterior surface in accordance with SSPC SP 6/NACE No.3 to a surface profile not to exceed 0.05 mm 2.0 mils and provide a MIL-DTL-24441 or SSPC coating system to the tank exterior. Prime tank exterior with one coat of MIL-DTL-24441/1, Formula 150 or SSPC Paint 22 primer applied to a dry film thickness of 0.076 mm 3 mils and topcoat with one coat of MIL-DTL-24441/7

Formula 156 (red) or SSPC Paint 22 topcoat (red) applied to a dry film thickness of 0.076 mm 3 mils.

2.14.2 Concentrate Ratio Controller

Ratio controller shall be a modified venturi device with AFFF concentrate feed line from diaphragm tank(s), and integral concentrate metering orifice. Size for specified flow rate(s).

2.15 BALANCED PRESSURE PROPORTIONING SYSTEM

****

NOTE: Select the method of proportioning best suited for the project. For hangars, NFPA 409 requires dual pumps (main and reserve) for each system.

Diaphragm pressure proportioning systems operate by water pressure, require no electrical power, and minimal control circuitry for automatic operation. Maintenance requirements are minimal, however refilling the tank is a difficult operation requiring the services of a qualified technician to avoid rupturing the diaphragm.

Balanced pressure proportioning systems require reliable electrical power and more complex control circuitry for automatic operation. In some cases an emergency generator will be required. The primary advantage of the non-diaphragm systems is the ease in refilling the tanks. Tanks may be refilled even while the system is in operation, if necessary.

Skid-mounted balanced pressure proportioning systems perform proportioning at a central location, avoiding long runs of concentrate lines. They are well suited for systems such as deluge sprinklers and monitor nozzles which have a relative narrow range of flow rates.

In-line balanced pressure proportioning is useful when there are multiple hazards with widely varying discharge rates which are to be supplied from the same proportioning system, and any time it is desired to proportion foam remotely at risers or discharge devices instead of at the pump room. Their disadvantage is the need for much more concentrate piping in the field.

****

Foam solution shall be produced by introducing AFFF concentrate into the water stream by the balanced pressure proportioning method using a pump and proportioner. [Provide proportioning system and storage tanks for hose lines independent of main proportioning system and tanks.]

[2.15.1 Skid-Mounted Balanced Pressure Proportioning System

****

NOTE: Choose this paragraph or the paragraph below,

IN-LINE BALANCED PRESSURE PROPORTIONING SYSTEM.
****

Self-contained, skid-mounted system, fully assembled at the factory and delivered complete and ready for use. Field connections shall be limited to water, electrical, and AFFF concentrate inputs, foam solution output, and foam concentrate return line to storage tank. Size system for required flow rate(s). The concentrate pump and all piping, valves, and fittings in contact with foam concentrate shall be of materials resistant to the corrosive effects of the AFFF concentrate. Concentrate pump shall be electric motor driven, drip proof, 240/480 volts, 60 Hz AC. Activation and operation of system shall be fully automatic, with manual over-ride and manual shut-down. Provide permanent engraved rigid plastic or corrosion resistant metal instruction plate for emergency manual operation, along with a similarly constructed label for each control device.

][2.15.2 In-Line Balanced Pressure Proportioning System

Size system for required flow rates. AFFF concentrate pump shall be positive displacement, electric motor driven, drip proof, 240/480 volts, 60 Hz AC. System operation shall be fully automatic, with manual over-ride and manual shut-down. Provide a pressure regulating device in the AFFF concentrate pump return line to maintain constant pressure on the concentrate piping system at all AFFF solution flow rates. Provide an in-line balanced pressure proportioning device at each system riser to automatically balance the AFFF concentrate pressure with the water pressure at the riser to provide correct proportioning over the range of flow rates calculated for that riser. The pump and all piping, valves, and fittings in contact with the foam concentrate shall be of materials resistant to the corrosive effects of the AFFF concentrate. Provide permanent engraved rigid plastic or corrosion-resistant metal instruction plate for emergency manual operation, along with a similarly constructed label for each control device.

]2.15.3 AFFF Concentrate Storage Tanks

****
NOTE: Designer must calculate foam tank capacity based on maximum flow for maximum duration to determine size of tank and space required. Do not label foam tank capacity on drawing. Exact tank size (which may be larger) will be determined by Contractor's hydraulic calculations.
****

Tank shall be designed for storage of AFFF concentrate at atmospheric pressure, and shall be [horizontal][or][vertical] cylindrical, fiberglass or polyethylene construction. Tank shall have the following: Drain valve located at the lowest point in the tank, connections for concentrate supply and return lines to the proportioners, top-mounted fill connections and inspection hatch, and a pressure/vacuum relief vent. All 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 all necessary supports for free-standing installation. Provide a gage or unbreakable sight glass to permit visual determination of level of tank contents, unless liquid level is clearly visible through shell of tank. Size tank to provide sufficient AFFF concentrate for the time specified when the system is discharging foam solution at total maximum system

flow. Also provide connected reserve tank(s) of equal capacity. Permanently label each tank with its capacity, type and percentage of concentrate, which system it serves, and whether it is a main or reserve tank.

2.16 OSCILLATING MONITOR NOZZLES

****

NOTE: Refer to MIL-HDBK-1008 and the appropriate NFPA standard(s) governing the particular facility to determine the density required. Consult the activity for the floor area under the wings and fuselage.

****

Fixed, water motor operated, [with] [without] override to allow manual aiming. Oscillation arc shall be adjustable from at least 0 to 2.88 radian 165 degrees. Oscillation speed shall be adjustable from 0 to 0.52 radian 30 degrees per second. Nozzle shall be adjustable while in operation from 0.52 radian 30 degrees below to 1.40 radian 80 degrees above horizontal, with lock or latching mechanism. Nozzle shall be [non aspirating] [air aspirating] type, adjustable while in operation from straight stream to fan-spray. Nozzle shall be capable of retaining the adjusted setting once the desired pattern has been set.[Nozzle shall produce a straight stream of 46 meters 150 feet at [1920 L/m] [500 gpm] [_____] and [690 kPa (gage)] [100 psig] [_____].][Nozzles shall provide a minimum application rate of [4.2] [_____] L/m per sq meter [0.10] [_____] gpm per square foot over [the entire floor area] [[_____] square meter feet of floor area underneath the aircraft wings and fuselage]]. Provide normally open 0S&Y gate valve in supply line at each monitor location.

2.17 HAND HOSE LINES

Provide each hose station with flow-through reel and [_____] meter of 40 mm feet of 1 1/2 inch hard rubber hose and nozzles. Nozzle shall have pistol-grip ball shutoff valve. Nozzle shall be [non aspirating] [air aspirating] type. Provide normally closed quarter-turn ball valve in supply line at each hose station. Nozzle flow rate shall be [228 L/m] [60 gpm] [_____] minimum.

2.18 WALL FOAM HYDRANTS

****

NOTE: Provide wall foam hydrants for testing of proportioners on pre-action systems or where additional foam hand hose lines are required. Determine number of outlet connections based upon a ratio of one outlet for each 948 L/m 250 gpm of design flow, up to a maximum of 8 outlets.

****

Provide [dual] [triple] [_____] outlet connections with integral gate valves and locate about one meter 3 feet above grade. Provide each outlet with 65 mm 2 1/2 inch male National Standard hose threads with cap and chain. Hydrant shall be controlled by 0S&Y gate valve located inside foam room. Provide wall escutcheon plate with "FOAM HYDRANT" in raised letters cast in plate.[Hydrant shall permit testing of each pre-action system riser at full design flow without charging the system supplied by the riser.]

2.19 ABOVEGROUND PIPING SYSTEMS

2.19.1 Pipe, Fittings, and Mechanical Couplings

NFPA 13, except steel piping shall be Schedule 40 for sizes smaller than 200 mm 8 inches, and Schedule 30 or 40 for sizes 200 mm 8 inches and larger. Pipe nipples 150 mm 6 inches long and shorter shall be Schedule 80 steel pipe. Water motor alarm piping shall be zinc-coated steel pipe and fittings. Rubber gasketed grooved-end pipe and fittings with mechanical couplings shall only be permitted in pipe sizes 40 mm 1 1/2 inches and larger. Rubber gaskets shall be UL listed for use in dry-pipe sprinkler systems. Use of restriction orifices, reducing flanges, and plain-end fittings with mechanical couplings (which utilize steel gripping devices to bite into the pipe when pressure is applied) are not permitted. Pipe and fittings in contact with AFFF concentrate shall be [material resistant to the corrosive effects of AFFF concentrate as approved by the manufacturer of the proportioning system] [stainless steel]. [Fittings on concentrate lines shall be flanged or welded only. Screwed or mechanical fittings will not be permitted.]

2.19.2 Jointing Material

CID A-A-58092, Polytetrafluoroethylene (PTFE) tape. Pipe joint compound (pipe dope) is not acceptable.

[2.19.3 Duplex Basket Strainers

****
NOTE: Include for deluge systems with high volume flow, and for untreated water supply.
****

FS WW-S-2739, Style Y (Y pattern). Provide duplex basket strainers with removable screens having standard perforations, 3 mm 0.125 inch in diameter in the riser beneath the deluge valves.

]2.19.4 Pipe Hangers and Supports

NFPA 13.

2.19.5 Valves

Provide valves as required by NFPA 13 and of types approved for fire service. Gate valves shall open by counterclockwise rotation. Check valves shall be flanged clear opening swing check type with flanged inspection and access cover plate for sizes 100 mm 4 inches and larger. Provide an OS&Y valve beneath each [deluge] [pre-action] valve in each riser, when more than one valve is supplied from the same water supply pipe. Butterfly valves are not acceptable.

2.19.6 Identification Signs

Attach properly lettered approved metal signs conforming to NFPA 13 to each valve and alarm device. Permanently affix design data nameplates to the riser of each system.

[2.19.7 Inspector's Test Connection

****
NOTE: Include for pre-action systems.
****

Provide test connections about 2 meters 6 feet above the floor for each sprinkler system and locate at the hydraulically most remote part of each system. Provide test connection piping to a location where the discharge will be readily visible and where water may be discharged without damage.

]2.19.8 Main Drains

Provide drain piping to discharge at safe points outside each building or to sight cones attached to drains of adequate size to readily receive the full flow from each drain under maximum pressure. Provide auxiliary drains as required by NFPA 13.

2.19.9 Pipe Sleeves

Provide where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 6 mm 1/4 inch space between exterior of piping and interior of sleeve. Firmly pack space with insulation and caulk at both ends of the sleeve with plastic waterproof cement.

2.19.9.1 Sleeves in Masonry and Concrete Walls, Floors, Roofs

ASTM A53/A53M, schedule 40 or standard weight, zinc-coated steel pipe sleeves. Extend sleeves in floor slabs 80 mm 3 inches above the finished floor.

2.19.9.2 Sleeves in Partitions

Provide zinc-coated steel sheet having a nominal weight of not less than 4.40 kg per sq meter 0.90 pounds per square foot.

2.19.10 Escutcheon Plates

Provide one piece or split hinge type plates for piping passing through floors, walls and ceilings, in both exposed and concealed areas. Provide chromium plated metal plates where pipe passes through finished ceilings. Provide other plates of steel or cast iron with aluminum paint finish. Securely anchor plates in place.

2.19.11 Fire Department Inlet Connections

[Two][Three] way type with 65 mm 2 1/2 inch National Standard female hose threads with plug, chain, and identifying fire department connection escutcheon plate. Provide inlet connections about one meter 3 feet above grade.

2.19.12 Backflow Preventers

****
NOTE: When the water supply for the AFFF system is non-potable water delete this paragraph.

****

Reduced pressure principle type. Proof shall be furnished that each make, model/design, and size of backflow preventer being furnished for the project is approved by and has a current "Certificate of Approval" from the FCCCHR List. Listing of the particular make, model/design, and size in the current FCCCHR List will be acceptable as the required proof.

2.20 BURIED PIPING SYSTEMS

2.20.1 Pipe and Fittings

****

NOTE: For pipe sizes larger than 305 mm 12 inches, method for pipe anchorage including pipe clamps and the rods shall be shown on the drawings. Avoid velocities greater than 4.60 meters per second 15 feet per second.

****

****

NOTE: Select first bracketed phrase for connection to an existing water distribution system located a short distance from the building. Select second bracketed phrase when a new water distribution line is being provided as part of this project. For new water distribution system, select and edit Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING and include as part of the project specification.

****

NFPA 24, outside coated cement lined ductile iron pipe and fittings for piping under the building and to a point 1.50 meters 5 feet outside the building walls. Anchor the joints in accordance with NFPA 24 using pipe clamps and steel rods. Minimum pipe size shall be 150 mm 6 inches. Minimum depth of cover shall be [_____] [one meter] [3 feet]. Piping more than 1.50 meters 5 feet outside the building walls shall be [outside coated cement lined ductile iron pipe and fittings conforming to NFPA 24] [provided under Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING].

2.20.2 Valves

****

NOTE: If Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING is included as part of the project specification, requirements for buried gate valves, post indicator valves, and valve boxes may be deleted here and specified in Section 33 11 00. Careful coordination is required to insure that materials rated for fire service are specified.

****

Provide as required by NFPA 24 for fire service. Gate valves shall conform to AWWA C500 or UL 262 with cast iron body and bronze trim, and shall open by counterclockwise rotation.

2.20.3 Post Indicator Valves

****

NOTE: If Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING is included as part of the project specification, requirements for buried gate valves, post indicator valves, and valve boxes may be deleted here and specified in Section 33 11 00. Careful coordination is required to insure that materials rated for fire service are specified.
****

Provide with operating nut located about one meter 3 feet above grade. Gate valves for use with indicator post shall conform to UL 262. Indicator posts shall conform to UL 789. Paint each indicator post with one coat of primer and two coats of red enamel paint.

2.20.4 Valve Boxes

****
NOTE: If Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING is included as part of the project specification, requirements for buried gate valves, post indicator valves, and valve boxes may be deleted here and specified in Section 33 11 00. Careful coordination is required to insure that materials rated for fire service are specified.
****

Except where indicator posts are provided, provide each gate valve in buried piping with an adjustable cast-iron valve box of a size suitable for the valve on which it is to be used. Boxes outside of paved areas may be of Acrylonitrile-Butadiene-Styrene (ABS) plastic or of inorganic fiber reinforced black polyolefin plastic. The head shall be round and the lid shall have the word WATER cast on it. The least diameter of the shaft of the box shall be 133 mm 5 1/4 inches. Coat each cast-iron box with bituminous paint.

2.20.5 Buried Utility Warning and Identification Tape

Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 76 mm 3 inches minimum width, color coded for the utility involved, with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be CAUTION BURIED WATER PIPING BELOW or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with the printed side up at a depth of 305 mm 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

PART 3 EXECUTION

3.1 EXCAVATION, BACKFILLING, AND COMPACTING

****
NOTE: Select and edit Section 31 00 00 EARTHWORK and include as part of the project specification.
****

Provide under this section as specified in Section 31 00 00 EARTHWORK.

3.2 CONNECTIONS TO EXISTING WATER SUPPLY SYSTEMS

Use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure. Bolt sleeves around the mains; bolt valve conforming to AWWA C500 or UL 262 to the branch. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, all without interruption of service. Notify the Contracting Officer in writing at least [_____] [15] calendar days prior to the date the connections are required; approval shall be received before any service is interrupted. Furnish all material required to make connections into the existing water supply systems, and perform all excavating, backfilling, and other incidental labor as required. [Furnish] [Government will furnish only] the labor and the tapping or drilling machine for making the actual connections to the existing systems.

3.3 AFFF SYSTEM INSTALLATION

Equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with the NFPA standards referenced herein. Install piping straight and true to bear evenly on hangers and supports. Conceal piping to the maximum extent possible. Piping shall be inspected, tested and approved before being concealed. Provide fittings for changes in direction of piping and for all connections. Make changes in piping sizes through standard reducing pipe fittings; do not use bushings. Cut pipe accurately and work into place without springing or forcing. Ream pipe ends and free pipe and fittings from burrs. Clean with solvent to remove all varnish and cutting oil prior to assembly. Make screw joints with PTFE tape applied to male thread only.

3.4 DISINFECTION

****

NOTE: When the water supply for the AFFF system is non-potable water delete this paragraph.

****

Disinfect new water piping from the system control valve to the point of connection at the water main and existing water piping affected by the Contractor's operation in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 mg/kg parts per million (ppm) of free available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 mg/kg ppm.

3.5 FIELD PAINTING

****

NOTE: For facilities located in a marine environment specify SSPC SP 11 cleaning and specify a second topcoat.

****

Clean, prime, and paint new foam systems including valves, piping, conduit, hangers, miscellaneous metal work, and accessories. Apply coatings to clean dry surfaces using clean brushes. Clean the surfaces in accordance with [SSPC SP 3] [SSPC SP 11]. Immediately after cleaning,

prime the metal surfaces with one coat of SSPC Paint 25 or SSPC Paint 25 primer applied to a minimum dry film thickness of 0.04 mm 1.5 mils. Exercise care to avoid the painting of sprinkler heads and operating devices. Upon completion of painting, remove materials which were used to protect sprinkler heads and operating devices while painting is in process. Remove sprinkler heads and operating devices which have been inadvertently painted and provide new clean sprinkler heads and operating devices of the proper type. Finish primed surfaces as follows:

3.5.1 Foam Systems in Unfinished Areas

****
NOTE: For facilities located in a marine environment specify SSPC SP 11 cleaning and specify a second topcoat.
****

Unfinished areas are defined as attic spaces, spaces above suspended ceilings, crawl spaces, foam rooms, pump rooms, pipe chases, and other spaces where ceilings are not painted or not constructed of a prefinished material. Paint primed surfaces with [one] [two] coat[s] of CID A-A-2962 red enamel applied to a minimum dry film thickness of 0.04 mm 1.5 mils.

3.5.2 Foam Systems in All Other Areas

****
NOTE: For facilities located in a marine environment specify SSPC SP 11 cleaning and specify a second topcoat.
****

Paint primed surfaces with two coats of paint to match adjacent surfaces, except paint valves and operating accessories with [one] [two] coat[s] of CID A-A-2962 red enamel applied to a minimum dry film thickness of 0.04 mm 1.5 mils. Provide piping with 50 mm 2 inch wide red bands spaced at maximum 6 meters 20 foot intervals throughout the piping systems. Bands shall be red enamel or self adhering red plastic tape.

3.5.3 Piping Labels

Provide permanent labels in foam rooms, spaced at 6 meters 20 foot maximum intervals along pipe, indicating "WATER", "FOAM CONCENTRATE", and "FOAM SOLUTION" on corresponding piping.

3.5.4 Field Touch-Up

Clean damaged areas of shop coated tanks in accordance with SSPC SP 11 and coat cleaned areas with the same materials used for the shop applied coating system.

3.6 ELECTRICAL WORK

****
NOTE: Edit Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and include as part of the project specification.
****

****

NOTE: When project includes requirement for a building fire alarm system, include Section [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] [28 31 76 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM, ADDRESSABLE] in the project specification. When project requires only tying into an existing building fire alarm system, fire alarm wiring should be specified in this section. Select the firstappropriate Section title when using the basic NAVFAC guide specification covering the subject work, or select the second title when using the EFD regional guide specification covering the subject work.
****

Electrical work is specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, except for control [and fire alarm] wiring.[Fire alarm system is specified in Section [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] [28 31 76 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM, ADDRESSABLE] ["Fire Alarm and Fire Detecting Systems (Local)"].]

3.6.1 Wiring

Provide control wiring, and connections to fire alarm systems, under this section in accordance with NFPA 70 and NFPA 72. Provide wiring in rigid metal conduit or intermediate metal conduit, except electrical metallic tubing may be used in dry locations not enclosed in concrete or where not subject to mechanical damage. Do not run low voltage DC circuits in the same conduit with AC circuits.[Run wiring to UV-IR detectors alone in separate conduit if required by the detector manufacturer.]

3.7 FLUSHING

Flush the piping system with potable water in accordance with NFPA 13. Continue flushing operation until water is clear, but for not less than 10 minutes.

3.8 FIELD QUALITY CONTROL

Prior to initial operation, inspect equipment and piping systems for compliance with drawings, specifications, and manufacturer's submittals. Perform tests in the presence of the Contracting Officer to determine conformance with the specified requirements.

3.8.1 Preliminary Tests

****
NOTE: Specify hydrostatic test not less than 1379 kPa 200 psi or 345 kPa 50 psi above the maximum working pressure when the maximum working pressure is greater than 1034 kPa 150 psi.
****

Each piping system shall be hydrostatically tested at [1379 kPa (gage)] [200 psig] [_____] in accordance with NFPA 13 and shall show no leakage or

reduction in gage pressure after 2 hours. The Contractor shall conduct complete preliminary tests, which shall encompass all aspects of system operation. Individually test all detectors, manual actuation stations, alarms, control panels, and all other components and accessories to demonstrate proper functioning. Test water flow alarms by flowing water through the inspector's test connection. When tests have been completed and all necessary corrections made, submit to the Contracting Officer a signed and dated certificate, similar to that specified in NFPA 13, attesting to the satisfactory completion of all testing and stating that the system is in operating condition. Also include a written request for a formal inspection and test.

3.8.2 Formal Inspection and Tests (Acceptance Tests)

The [_____] Division, Naval Facilities Engineering Systems Command Fire Protection Engineer, will witness formal tests and approve all systems before they are accepted. The system shall be considered ready for such testing only after all necessary preliminary tests have been made and all deficiencies found have been corrected to the satisfaction of the equipment manufacturer's technical representative and written certification to this effect is received by the Division Fire Protection Engineer. Submit the request for formal inspection at least 15 working days prior to the date the inspection is to take place. The control panel(s) and detection system(s) shall be in continuous service for a "break-in" period of at least 15 consecutive days prior to the formal inspection. Experienced technicians regularly employed by the Contractor in the installation of both the mechanical and electrical portions of such systems shall be present during the inspection and shall conduct the testing. All AFFF concentrate, instruments, [including UV-IR detector test lamp and function test kit,] personnel, appliances and equipment for testing shall be furnished by the Contractor. All necessary tests encompassing all aspects of system operation shall be made including the following, and any deficiency found shall be corrected and the system retested at no cost to the Government.

3.8.2.1 Systems and Device Testing

The entire initiating, alarm, actuation systems shall be operated. As a minimum, operation and supervision of the following functions and devices shall be demonstrated:

a. All operational and supervisory functions of the control and annunciator panels.

b. Each manual actuation station and associated circuit(s).

c. All detectors and associated circuits.

d. All alarms and associated circuits.

e. All actuator circuits and system control valve(s) (without foam discharge).

f. Activation of the building fire evacuation alarm system.

g. Activation of the Base fire alarm system (receipt of fire alarm at alarm office).

h. All of the above tests shall then be repeated with the system on

battery power only.

3.8.2.2 AFFF Discharge and Concentration Testing

When all of the initiating, alarm, actuation, and supervisory functions of the system operate to the satisfaction of the system manufacturer's technical representative and the Division Fire Protection Engineer, a complete discharge test of each system shall be performed to demonstrate satisfactory performance, proper AFFF concentration, mechanical operation and operation of valves, release devices, alarms, and interlocks which control the protected areas. These tests shall be conducted by experienced personnel according to the equipment and AFFF manufacturers' recommendations.

[a. Test each deluge system by full flow of foam solution from the individual systems or combination of systems to achieve maximum design flow rate for at least 60 seconds.

][b. Test each pre-action system at their design flow rate for at least 60 seconds with temporary hose lines and nozzles connected to a test header. Furnish hose and nozzles required for tests.

] c. Test all hose lines and monitor nozzles by full flow of foam solution for at least 60 seconds.

The manufacturer's representative shall test samples of foam solution taken from each system to ensure proper AFFF concentration. Provide protection for all electrical fixtures and equipment exposed to possible damage during tests and protect doors and other openings leading from the protected area(s), to prevent migration of foam solution into other areas or spaces.

3.8.2.3 Flushing and Rinsing

After completion of tests flush all piping carrying AFFF concentrate and solution with fresh water. Piping normally containing AFFF concentrate when the system is in standby mode need not be flushed. Rinse with fresh water all equipment and building surfaces exposed to AFFF discharge.

3.8.3 Environmental Protection

****

NOTE: Consult facility and the Division or District environmental officials to determine local requirements for containment and disposal of discharged AFFF. In sufficient concentrations, AFFF may cause disruption of processes in sewage treatment plants and damage to fisheries. Edit the paragraph as appropriate.

****

Provide temporary measures to prevent AFFF from entering storm drains, [sanitary sewers,] drainage ditches, streams and water courses.[Do not allow AFFF concentrate or solution to come in contact with earth. Contain all discharged AFFF on paved surfaces.][Collect all discharged AFFF and rinse and flushing water and dispose of it in an EPA - approved waste-water treatment facility which provides secondary (biological) treatment]. At least 15 days prior to the date flow testing is to take

place, submit written plan for AFFF containment [and disposal] methods(s) to the Contracting Officer for approval.

3.8.4 Additional Tests

When deficiencies, defects or malfunctions develop during the tests required, all further testing of the system shall be suspended until proper adjustments, corrections or revisions have been made to assure proper performance of the system. If these revisions require more than a nominal delay, the Contracting Officer shall be notified when the additional work has been completed, to arrange a new inspection and test of the system. All tests required shall be repeated prior to final acceptance, unless directed otherwise.

3.8.5 AFFF Concentrate Storage Tanks Fill-Up

****

NOTE: Consult facility to determine whether the Government or the Contractor will furnish the initial fill-up of AFFF concentrate.

****

Fill storage tanks including reserve tanks and piping normally containing concentrate when the system is in standby mode with [Contractor] [Government] furnished AFFF concentrate after acceptance of the system.

3.8.6 Manufacturer's Representative

Provide the services of representatives or technicians from the manufacturers of the foam system, [and] control panel [, and UV-IR detectors], experienced in the installation and operation of the type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of the system and to provide instruction to Government personnel.

3.9 OPERATING INSTRUCTIONS

Provide operating instructions at control equipment and at each remote control station. Instructions shall clearly indicate all necessary steps for the operation of the system. Submit the proposed legend for operating instructions for approval prior to installation. Instructions shall be in engraved white letters on red rigid plastic or red enameled steel backgrounds and shall be of adequate size to permit them to be easily read.

3.10 TRAINING REQUIREMENTS

Prior to final acceptance, the Contractor shall provide two sessions of 4 hours each of operation and maintenance training to the Base Fire Department and [Public Works] [Civil Engineering] personnel on two different days to accommodate both shifts of the Base Fire Department. Each training session shall include emergency procedures, and unique maintenance and safety requirements. Training areas will be provided by the Government in the same building as the protected areas. The training conducted shall use operation and maintenance manuals specified in paragraph OPERATIONS AND MAINTENANCE MANUALS. Dates and times of the training period shall be coordinated through the Contracting Officer not

less than two weeks prior to the session.

3.11 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurement, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements shown are as follows:

Products	Inch-Pound	Metric
a. Air Compressor Tank Capacity	10 gallons	38 liters
b. Concentrate Fill Pump Flow Rate	7 gpm	27 L/m
c. Diaphragm Pressure Proportioning Tanks Working Pressure	175 psig	1206 kPa (gage)

-- End of Section --