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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Preparing Activity: KSC

NASA/KSC-21 13 26.00 98 (October 2007)

Superseding
NASA/KSC-21 13 26.00 98 (April 2006)

References are in agreement with UMRL dated October 2007

Revised throughout - changes not indicated by CHG tags

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DIVISION 21 - FIRE SUPPRESSION

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DELUGE FIRE-SUPPRESSION SPRINKLER SYSTEMS

10/07

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SECTION 21 13 26.00 98

DELUGE FIRE-SUPPRESSION SPRINKLER SYSTEMS
10/07

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NOTE: This specification covers the requirements for automatic deluge, and pre-action fire extinguishing foam systems for aircraft hangars. Choose the type of system most appropriate for the hazard with input from the NASA Lead Design Engineer and NASA Fire Protection Engineer (AHJ). Deluge systems are primarily intended for fire protection of aircraft hangar facilities. Pre-action systems could be required even though NFPA 409 recommends deluge systems for aircraft hangars. 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 occurs. Deluge systems provide the fastest fire extinguishment. Areas larger than 3,000 square feet 279 sq meters 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 be coordinated with the Kennedy Space Center Fire Protection Office Authority Having Jurisdiction.

This is a performance based type specification, with the Contractor responsible for providing professional engineering services associated with hydraulic calculations, head layout and detailed design. The preparer must estimate the system water flow demand requirements to determine the adequacy of the water supply and ascertain the need for a fire pump or water storage.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

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

present.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).
****

****
NOTE: Show the following information on the project drawings:

1. Location and detail of each foam system supply riser, deluge, or pre-action valve, fire department inlet connection, foam hydrant, hand hose station, 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 or monitor nozzle location.

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

6. For pipe larger than 12 inches 305 millimeter, 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. Indicate connection of equipment 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 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 are automatically 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	(2002; R 2003) Metal-Seated Gate Valves for Water Supply Service
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains

ASTM INTERNATIONAL (ASTM)

ASTM A 53/A 53M	(2006a) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

FM GLOBAL (FM)

FM P7825	(2005) Approval Guide

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	(2005; TIA 2006) Low-, Medium- and High-Expansion Foam Systems
NFPA 13	(2006) Installation of Sprinkler Systems

NFPA 14	(2006) Standard for the Installation of Standpipe, Private Hydrants and Hose Systems
NFPA 15	(2006) Water Spray Fixed Systems for Fire Protection
NFPA 16	(2006) Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
NFPA 24	(2006) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 30	(2003; Errata 2004; Errata 2006) Flammable and Combustible Liquids Code
NFPA 409	(2004; TIA 2005; TIA 2006) Standard on Aircraft Hangers
NFPA 70	(2005; TIA 2005) National Electrical Code
NFPA 72	(2006) National Fire Alarm Code

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	(2003) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

THE 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) Paint Specification No. 25Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel Type I and Type II
SSPC SP 11	(1987; E 2004) Power Tool Cleaning to Bare Metal
SSPC SP 6	(2000; E 2004) Commercial Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-F-24385	(Rev F; Am 1) Fire Extinguishing Agent, Aqueous Film Forming Foam (AFFF) Liquid Concentrate, for Fresh and Seawater
MIL-P-24441	(Rev C; Supp 1; INT Am 1) Paint, Epoxy-Polyamide

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-58092	Tape, Antiseize, Polytetrafluoroethylene
FS WW-S-2739	(Basic) Strainers, Sediment: Pipeline, Water, Air, Gas, Oil, or Steam

UNDERWRITERS LABORATORIES (UL)

UL 262	(2004) Standard for Gate Valves for Fire-Protection Service
UL 789	(2004) Indicator Posts for Fire-Protection Service
UL Fire Prot Dir	(2007) Fire Protection Equipment Directory

1.2 RELATED REQUIREMENTS

Section 23 05 00.00 40 COMMON WORK RESULTS FOR HVAC 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] [preaction] sprinkler system(s) [and under-wing supplemental protection system] for [_____]. System must provide uniform distribution of AFFF solution to provide complete coverage throughout the [building] [areas indicated]. The design, equipment, materials, installation, and workmanship must 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 must 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 must 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 P7825. In the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" had been substituted for "must" wherever it appears; interpret reference to the "authority having jurisdiction" to mean the Kennedy Space Center Fire Protection Engineer.

This is a performance based specification with the Contractor responsible for providing engineering design, installation and testing associated with the work to be performed. Design work must be performed by a "delegated engineer", as defined under Florida Statutes, Chapter 471, who must be a Professional Engineer, competent in fire protection engineering, licensed to practice in Florida.

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 must be 864 by 559 millimeter 34 by 22 inches. Do not commence work until the design of each system and the various components have been approved. In addition to hard copies, provide an electronic .DWG, .DXF, or .DGN computer format on a 1.44 MEG floppy disk or CD-ROM. "Plans" and "Working Plans" must be signed and sealed by a Professional Engineer licensed to practice in Florida.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

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. Calculations must be signed and sealed by a Professional Engineer licensed to practice in Florida.

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

c. Substantiating battery standby power requirements calculations showing battery capacity, supervisory and alarm power requirements.

1.3.1.3 AFFF Containment and Disposal Plan

Submit AFFF containment and disposal plan as required under paragraph entitled "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 864 by 559 millimeter 34 by 22 inch reproducible as-built drawings on mylar film with 203 by 102 millimeter 8 by 4 inch title block similar to contract drawings. In addition to hard copies, provide an electronic .DWG, .DXF, or .DGN computer format on a 1.44 MEG floppy disk or . Submit as-built drawings in addition to the record drawings required by Division 1.

1.3.2 System Operation

Flow of water and AFFF must be controlled by [deluge] [preaction] valves. Foam proportioning equipment must activate automatically upon tripping of the [deluge] [preaction] valve(s) for the corresponding foam system(s). [Deluge] [Preaction] valves must be tripped by independent detection systems. No valve is to be operated by the building fire evacuation alarm system. Use of motor-operated valves is prohibited. Once activated, system(s) must 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 must be controlled by [deluge] [preaction] valves operated by automatic detection systems and by remote manual release stations.

1.3.2.2 Floor System

Control floor [monitor][pop-up] foam nozzles 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

Control hose reels 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 to reflect only the submittals required for the project. Keep submittals to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

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

Air Force, and NASA projects.

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" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that reviews the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fire Extinguishing System

SD-03 Product Data

Pipe, Fittings, and Mechanical Couplings
[Deluge] [Preaction] Valves
Valves, Including Gate, Check, and Globe
Sprinkler Heads
Oscillating Monitor Nozzles
Floor Pop-Up Nozzles
Hose and Nozzles
Pipe Hangers and Supports
Pressure Switch
Fire Department Inlet Connections
Tank Mounted Air Compressor
Air Pressure Regulating Device
Foam Hydrants
AFFF Concentrate Storage Tanks
Proportioning Equipment
AFFF Concentrate
Strainers
Manual Activation Stations
Backflow preventers
Releasing (Control) Panel
Detection Devices

SD-05 Design Data

Hydraulic Calculations
Pressure Discharge Graphs or Tables
Battery Standby Power Requirements Calculations

SD-06 Test Reports

Preliminary Tests
Acceptance Tests

Submit for all inspections and tests specified under paragraph entitled "Field Quality Control."

Hydrostatic testing of the Diaphragm Pressure Proportioning Tanks

SD-07 Certificates

Qualifications of Installer

Submit installers qualifications as required under paragraph entitled Qualifications of Installer."

AFFF Containment and Disposal Plan
Backflow Preventers

SD-10 Operation and Maintenance Data

[Deluge] [Preaction] Valves, Data Package
Tank Mounted Air Compressor, Data Package
Proportioning Equipment, Data Package
Releasing Control Panel, Data Package
AFFF Concentrate Storage Tanks, Data Package
Oscillating Monitor Nozzles, Data Package

SD-11 Closeout Submittals

As-Built Drawings for the Fire Extinguishing System; G

1.5 QUALITY ASSURANCE

1.5.1 Qualifications of Installer

Qualifications of System Technician: Installation drawings, shop drawing and as-built drawings must 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 1014-7 as an engineering technician with minimum Level-III certification in Special Hazard System program. Submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of drawings.

1.5.2 Components

Components used in the installation must be new, unused and not be greater than two years old from the date of manufacture.

PART 2 PRODUCTS

2.1 DESIGN OF FOAM SYSTEMS

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

2.1.1 Sprinkler Heads

Heads must have 12.7 [or 13.50] millimeter 1/2 [or 17/32] inch orifice. No o-rings are permitted in sprinkler heads. [For deluge systems, provide open heads.] [For preaction systems, the release element of each head must be of the ["intermediate"] ["high"] temperature rating or higher as suitable for the individual location installed.] Provide chromium plated ceiling plates and pendent sprinklers for 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 preaction valve within each building. The number and types of extra sprinkler heads must be as specified in NFPA 13.

2.1.3 [Deluge] [Pre-Action] Valves

Valves must be operated by a detection system listed for releasing service and independent of the building fire alarm system. Valve body must be constructed of ductile iron and be of the dome loaded diaphragm type. [[Deluge] [Preaction] valve clappers must incorporate a latching mechanism that is not affected by changes of pressure in the water system.] If 152 millimeter 6 inch valves are used in 203 millimeter 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] [preaction] 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 1.8 and 2.4 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 must be essentially uniform throughout the area in which it is assumed the sprinkler heads open. Variation in discharge from individual heads in the hydraulically most remote area must be between 100 and 115 percent of the specified density.]

[Distribution must be essentially uniform throughout the area. Variation in discharge from individual heads must 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 must 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 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 must be the hydraulically most remote [_____] square meter foot area as defined by NFPA 13.]

[Area must be [that protected by each riser] [based on the [15.25] [22.86] [30.48] meter [50] [75] [100] foot radius rule as determined in accordance with NFPA 409 for Type I aircraft hangars].]

2.1.7 Location of Sprinkler Heads

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

2.1.8 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 00.00 98 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 00.00 98 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 00.00 98 FIRE PUMPS].

2.1.9 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 must 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 must 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: Coordinate electric detection devices with the requirements specified in Section 28 31 00.00 98 FIRE DETECTION AND ALARM. The types of detectors must be discussed and agreed upon with input from the NASA Fire Protection Engineer.
****

Provide electric [heat detectors,] [and] [smoke detectors,] [and] [combination ultraviolet-infrared detectors] [Triple IR detectors]. All wiring must be supervised and installed in protective metal conduit or tubing. Devices must meet the requirements as specified in Section 28 31 00.00 98 FIRE DETECTION AND ALARM.

2.2.1 Releasing (Control) Panel

Foam system deluge control panel must be a UL listed and FM approved supervised microprocessor based release control panel designed to operate electric release devices (solenoid valves) to activate the system deluge valve. The panel must comply with specification section 28 31 00.00 98 FIRE DETECTION AND ALARM and NFPA 72 as a fire alarm control panel rated/listed for suppression system releasing. The panel must be specifically listed/approved for use with the deluge/solenoid release valves provided for the foam system. Foam system deluge control panel must be manufactured by [_____] and fully communicate with the fire alarm panel as an interactive peer, allowing for multiplexed communications between panels.

Form system releasing control panel must be steel, provided with a hinged cover and an integral pin-tumbler cylinder lock (Lock Cylinder No. Best Universal Lock Co. No. A8817-XUS26D-7KSC) with removable core that accepts the key presently in use with other control units existing in the area; lock core will be provided by the government. Switches and other controls must not be accessible without the use of a key. The control panel must 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 must 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.

Panel must utilize distributed processing, include an 80 character back lit alphanumeric display, provide 32 character custom messages, and include multiple levels of password protection. Panel must be Year 2000 compliant, with menu driven operator commands and be fully field programmable.

Provide panels with monitor zones, notification appliance circuits, remote auxiliary relays, and solid-state addressable modules as required to meet the sequence of operations and monitoring/control points indicated on the drawings. Panel must include all components and modules required for installation of a multiple addressable device network.

Panel devices must be fully incorporated into the base-wide color graphic screens. Refer to Section 28 31 00.00 98 FIRE DETECTION AND ALARM for additional requirements.

Addressable modules must connect to the panel using multiplexed communication techniques suitable for supervised Style 6 operation. Module power must be derived from the panel and be supervised with trouble conditions indicated and reported for invalid address setting, component failure or power failure.

The system must be electrically supervised on all circuits. Provide trouble signals for any ground fault, single break in a circuit, loss of AC power, low battery, abnormal switch positions and similar conditions. Trouble signals must operate continuously until the system is restored to normal.

The panel must include trouble silencing switch, alarm silencing switch, individual zone disconnect switches, system reset switch and lamp test switch.

Panel must include a main annunciator with separate alarm and trouble indication for each device using an LCD display visible without opening the panel. All devices must be addressable.

Control panel must operate with a 120 VAC power supply, with integral charger and 24 volt batteries for a minimum of 24 hours of operation during AC power failure. The panel display must include alarm, trouble and supervisory LED's and alarm with push-to-silence button. Panel must include electrical surge/spike protection on all circuits, including power supply, [circuits interfacing with the fire pump,] alarms, and initiating circuits.

2.3 PIPING SUPERVISION

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

Preaction sprinkler piping must be supervised. A break in the piping or tubing systems resulting in loss of pneumatic pressure must result in the activation of a supervisory signal to the building fire alarm system.

2.4 FOAM SYSTEM MANUAL ACTIVATION STATIONS

Provide foam system manual activation stations where shown. Devices must meet the requirements specified for manual alarm stations in Section 28 31 00.00 98 FIRE DETECTION AND ALARM except as modified herein. Devices must not be spring loaded or constructed of plastics or composite materials. Stations must be of a type not subject to operation by jarring or vibration. Stations must have a dual action release configuration to prevent accidental system discharge, which must include lifting a clear lexan cover and breaking a lead seal, and releasing a pull lever. Station

color must be fluorescent lime-yellow. Station shape must differ distinctively in shape from manual alarm stations associated with the fire alarm system. Station must provide positive visible indication of operation. Restoration must require use of a key or special tool. Where a building fire alarm pull station is also mounted in the vicinity of a foam release station, separate the stations by at least 0.5 meters 18 inches horizontally. Provided permanent engraved rigid plastic or metal labels to clearly distinguish foam release stations from building fire alarm stations, stating "START FOAM SYSTEM" in red lettering not less than 3 inches 76.2 millimeter tall on a lime-yellow background.

2.5 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 00.00 98 FIRE DETECTION AND ALARM in the project specification. When project requires only tying into an existing building fire alarm system, specify fire alarm wiring in this section.
****

Electrical work is specified in Section 26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL and Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS except for control [and fire alarm] wiring. Fire alarm system work is specified in Section 28 31 00.00 98 FIRE DETECTION AND ALARM.

2.5.1 Wiring

Provide control wiring and connections to fire alarm systems, under this section and conforming to NFPA 70 and NFPA 72.

2.5.2 Operating Power

Power must 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 must be fully automatic and must 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.

2.5.3 Conductor Identification

Identify circuit conductors within each enclosure where a tap 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 does not permit accidental detachment. Properly identify control circuit terminations.

2.5.4 Solenoid Valve

The solenoid valve must be an electrically operated control valve UL listed or FM approved for releasing of [deluge][preaction] sprinkler valves. The solenoid must be the normally closed type and must be electrically energized to open.

The solenoid valve must incorporate a safing key switch (Best Lock, Model 1W702-S4D), which opens both the positive and negative conductors. Solenoid positive conductors must be color-coded yellow, negative conductors must be violet. Wiring must comply with standard KSC solenoid valve wiring standards.

2.6 SYSTEM ACTIVATION

2.6.1 Overhead System Activation

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

Each zone must 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 must activate.

2.6.2 Monitor System Activation

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

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

2.6.3 Hose System Activation

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

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

2.7 ALARMS

2.7.1 Building Fire Alarm

The foam system releasing panel must provide for the automatic transmittal of alarm, trouble and supervisory conditions to the building fire alarm system. Arrange so that the detection system and the flow of solution in each system initiates an alarm condition for the fire alarm system. [Activation of a single UV-IR detector must not cause activation of the foam system but must initiate a trouble condition for the fire alarm system].

2.7.1.1 Pressure Switch

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

2.8 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 must 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.

2.9 AFFF CONCENTRATE

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

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

2.9.1 Concentrate Fill Pump

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

2.10 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 is required. The primary advantage of the non-diaphragm systems is the ease in refilling the tanks. Refill tanks 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 must 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.]

2.10.1 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 - 11.40 cu meters 2,500 - 3,000 gallonsare 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 could be larger) is to be determined by Contractor's hydraulic calculations.

****

Tanks must 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 must 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 must 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 to a surface profile not to exceed 0.076 millimeter 2.0 mils and provide a MIL-P-24441 or SSPC coating system to the tank exterior. Prime tank exterior with one coat of MIL-P-24441/1, Formula 150 or SSPC Paint 22 primer applied to a dry film thickness of 0.076 millimeter 3 mils and topcoat with one coat of MIL-P-24441/7 Formula 156 (red) or SSPC Paint 22 topcoat (red) applied to a dry film thickness of 0.076 millimeter 3 mils.

2.10.2 Concentrate Ratio Controller

Ratio controller must 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).

2.11 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 is required. The primary advantage of the non-diaphragm systems is the ease in refilling the tanks. Refill tanks 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 must 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.]

[2.11.1 Skid-Mounted Balanced Pressure Proportioning System

****

NOTE: Choose this paragraph or the paragraph below, entitled "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 must 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 must be of materials resistant to the corrosive effects of the AFFF concentrate. Concentrate pump must be electric motor driven, drip proof, 240/480 volts, 60 Hz AC. Activation and operation of system must 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.]

[2.11.2 In-Line Balanced Pressure Proportioning System

Size system for required flow rates. AFFF concentrate pump must be positive displacement, electric motor driven, drip proof, 240/480 volts, 60 Hz AC. System operation must 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 must 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.]

2.11.3 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 could be larger) is to be determined by Contractor's hydraulic calculations.

****

Tank must be designed for storage of AFFF concentrate at atmospheric pressure, and must be [horizontal] [or] [vertical] cylindrical, fiberglass or polyethylene construction. Tank must 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. Install all openings and tank connections at the factory, make no holes in the tank shell in the field. Tank must 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.

2.12 FLOOR FOAM NOZZLES

****

NOTE: Refer to the NASA AHJ 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.

****

2.12.1 Oscillating Monitor Nozzles

Fixed oscillating monitor nozzles, water motor operated, [with] [without] override to allow manual aiming. Oscillation arc must be adjustable from at least 0 to 2.88 radian165 degrees. Oscillation speed must be adjustable from 0 - 0.52 radian 30 degrees per second. Nozzle must 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 must be [non aspirating] [air aspirating] type, adjustable while in operation from straight stream to fan-spray. Nozzle must be capable of retaining the adjusted setting once the desired pattern has been set. [Nozzle must produce a straight stream of 46 meters 150 feet at 1892 L/m 500 gpm [_____] and 690 kPa (gage)] [_____] 100 psig. [Nozzles must 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.

2.12.2 Pop-Up Foam Nozzles

Fixed floor pop-up nozzles, water pressure activated [non-]aspirating pop-up type, designed specifically for application of foam-water solutions. Devices must be suitable for in-slab flush mounting with [H-20] load carrying capacity. Devices must be spaced to provide a minimum application rate of square meters[0.10][_____] gpm per square foot over [the entire floor area][[_____] square feet of floor area underneath the aircraft wings

and fuselage].

2.13 HAND HOSE LINES

Provide each hose station with flow-through reel and [_____] 38 millimeter feet of 1 1/2 inch hard rubber hose and nozzles. Nozzle must have pistol-grip ball shutoff valve. Nozzle must be [non aspirating] [air aspirating] type. Provide normally closed quarter-turn ball valve in supply line at each hose station. Nozzle flow rate must be [228 L/m] [60 gpm] [_____] minimum.

2.14 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 250 gpm 948 L/m of design flow, up to a maximum of 8 outlets.
****

Provide [dual] [triple] [_____] outlet connections with integral gate valves and locate about 914 millimeter 3 feet above grade. Provide each outlet with 63.5 millimeter 2 1/2 inch male National Standard hose threads with cap and chain. Hydrant must be controlled by OS&Y gate valve located inside foam room. Provide wall escutcheon plate with "FOAM HYDRANT" in raised letters cast in plate. [Hydrant must permit testing of each preaction system riser at full design flow without charging the system supplied by the riser.]

2.15 ABOVEGROUND PIPING SYSTEMS

2.15.1 Pipe, Fittings, and Mechanical Couplings

Comply with NFPA 13 requirements, except steel piping must be Schedule 40 for sizes smaller than 200 millimeter 8 inches, and Schedule 30 or 40 for sizes 203 millimeter 8 inches and larger. Pipe nipples 152 millimeter 6 inches long and shorter must be Schedule 80 steel pipe. Water motor alarm piping must be zinc-coated steel pipe and fittings. Rubber gasketed grooved-end pipe and fittings with mechanical couplings must only be permitted in pipe sizes 38 millimeter 1 1/2 inches and larger. Rubber gaskets must 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 must 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 must be flanged or welded only. Screwed or mechanical fittings are not permitted.]

2.15.2 Jointing Material

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

[2.15.3 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 millimeter 0.125 inch in diameter in the riser beneath the deluge valves.]

2.15.4 Pipe Hangers and Supports

Comply with NFPA 13 requirements, except that in no case must "C" clamps (MSS type 19 and 23) be used.

2.15.5 Valves

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

2.15.6 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.

2.15.7 Inspector's Test Connection

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

Provide test connections about 1.5 meters 5 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 is readily visible and where water can be discharged without damage.

The inspector's test valve must be a combination test and drain device, bronze body and three (3) position bronze ball valve (off, test, drain) with an internal orifice sized to match the sprinkler head orifice size. The inspector's test valve must also have a replaceable sight glass.

2.15.8 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.

2.15.9 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 millimeter 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. Where piping penetrates rated walls and floor, provide UL listed sleeve firestop assemblies with a rating equal to or greater than the wall and/or floor penetrated.

2.15.9.1 Sleeves in Masonry and Concrete Walls, Floors, Roofs

ASTM A 53/A 53M, schedule 40 or standard weight, zinc-coated steel pipe sleeves. Extend sleeves in floor slabs 76.2 millimeter 3 inches above the finished floor.

2.15.9.2 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.

2.15.10 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.

2.15.11 Fire Department Inlet Connections

[Two] [Three] way type with 63.5 millimeter 2 1/2 inch National Standard female hose threads with plug, chain, and identifying fire department connection escutcheon plate. Provide inlet connections about 914 millimeter 3 feet above grade.

2.15.12 Backflow Preventers

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

Reduced pressure principle type. Furnish proof 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 is acceptable as the required proof.

2.16 BURIED PIPING SYSTEMS

2.16.1 Pipe and Fittings

****
NOTE: For pipe sizes larger than 12 inches 305 millimeter , method for pipe anchorage including pipe clamps and the rods must be shown on the drawings. Avoid velocities greater than 4.60 meters 15 ft./sec per sec .
****

****
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 DISTRIBUTION 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 must be 152 millimeter 6 inches. Minimum depth of cover must be [_____] [one meter] [3 feet] 914 millimeter 3 feet. Piping more than 1.50 meters 5 feet outside the building walls must be [outside coated cement lined ductile iron pipe and fittings conforming to NFPA 24].

2.16.2 Valves

****
NOTE: If Section 03 11 00 WATER DISTRIBUTION is included as part of the project specification, delete requirements for buried gate valves, post indicator valves, and valve boxes here and specify in Section 03 11 00 WATER DISTRIBUTION. 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 must conform to AWWA C500 or UL 262 with cast iron body and bronze trim, and must open by counterclockwise rotation.

2.16.3 Post Indicator Valves

****
NOTE: If Section 03 11 00 WATER DISTRIBUTION is included as part of the project specification, delete requirements for buried gate valves, post indicator valves, and valve boxes and specified in Section 03 11 00 WATER DISTRIBUTION. Careful coordination is required to insure that materials rated for fire service are specified.
****

Provide with operating nut located about 914 millimeter 3 feet above grade. Gate valves for use with indicator post must conform to UL 262. Indicator posts must conform to UL 789. Paint each indicator post with one coat of primer and two coats of red enamel paint.

2.16.4 Valve Boxes

****
NOTE: If Section 03 11 00 WATER DISTRIBUTION is included as part of the project specification, delete requirements for buried gate valves, post

indicator valves, and valve boxes here and specify in Section 03 11 00 WATER DISTRIBUTION. 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 can be of Acrylonitrile-Butadiene-Styrene (ABS) plastic or of inorganic fiber reinforced black polyolefin plastic. The head must be round and the lid must have the word WATER cast on it. The least diameter of the shaft of the box must be 133 millimeter 5 1/4 inches. Coat each cast-iron box with bituminous paint.

2.16.5 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 must be detectable by an electronic detection instrument. Provide tape in rolls, 76 millimeter 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 must 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 millimeter 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 must 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 must 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 must 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 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 11. Immediately after cleaning, prime the metal surfaces with one coat of SSPC Paint 25 primer applied to a minimum dry film thickness of 0.04 millimeter 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 Finish Painting

Paint primed surfaces with two coats of color 11105 red enamel applied to a minimum dry film thickness of 0.04 millimeter 1.5 mils.

3.5.2 Piping Labels

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

3.5.3 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

Electrical work is specified in Section 26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL and Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS except for control [and fire alarm] wiring. Fire alarm system is specified in Section 28 31 00.00 98 FIRE DETECTION AND ALARM.

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 can 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 345 kPa 50 psi or 1379 kPa 200 psi above the maximum working pressure when the maximum working pressure is greater than 1034 kPa 150 psi.
****

Each piping system must be hydrostatically tested at 1379 kPa (gage) 200 psig [_____] in accordance with NFPA 13 and must show no leakage or reduction in gage pressure after 2 hours. Conduct complete preliminary tests, which 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.

Hydrostatically test below ground piping at not less than 1380 kilopascal

200 psi pressure for not less than 2 hours, or at 345 kilopascal 50 psi in excess of the maximum static pressure when the maximum static pressure is in excess of 150 psi 1030 kilopascal. Measure leakage in underground systems by pumping from a calibrated container at the required test pressure. For new piping, leakage must not exceed 1.89 liters 2 quarts per hour, per 100 gaskets or joints irrespective of pipe diameter. This rate can be adjusted upwards where the test section contains metal seated valves or dry barrel hydrants under pressure by the amounts specified in NFPA 24.

3.8.2 Formal Inspection and Tests (Acceptance Tests)

The Contracting Officer must witness formal tests and approve all systems before they are accepted. Consider the system 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) must 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 must be present during the inspection and must conduct the testing. Furnish all AFFF concentrate, instruments, [including UV-IR detector test lamp and function test kit,] personnel, appliances and equipment for testing. Make all necessary tests encompassing all aspects of system operation including the following, and correct any deficiency found and retest the system at no cost to the Government.

3.8.2.1 Systems and Device Testing

Operate the entire initiating, alarm, actuation systems. As a minimum, demonstrate operation and supervision of the following functions and devices:

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 Base fire alarm system (receipt of fire alarm at alarm office).

g. Repeat all of the above tests 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 Contracting Officer, perform a complete

discharge test of each system 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 must 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 preaction 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 must 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 can 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, suspend all further testing of the system 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, notify the Contracting Officer when the additional work has been

completed, to arrange a new inspection and test of the system. Repeat all tests required prior to final acceptance, unless directed otherwise.

3.8.5 AFFF Concentrate Storage Tanks Fill-Up

Fill storage tanks including reserve tanks and piping normally containing concentrate when the system is in standby mode with Contractor 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 must clearly indicate all necessary steps for the operation of the system. Submit the proposed legend for operating instructions for approval prior to installation. Instructions must be in engraved white letters on red rigid plastic or red enameled steel backgrounds and must be of adequate size to permit them to be easily read.

3.10 TRAINING REQUIREMENTS

Prior to final acceptance, provide two sessions of 4 hours each of operation and maintenance training to personnel on two different days to accommodate both shifts of the Base Fire Department. Each training session must 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 must use operation and maintenance manuals specified in paragraph entitled "Operations and Maintenance Manuals". Coordinate dates and times of the training period 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 --