CHEMGUARD

Engineering Specifications

Marine Dock – Deluge Foam-Water Systems

Section 21 13 00 – Fire Suppression Sprinkler Systems

Section 21 13 39 – Foam Water Systems

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 | Form No. CG-2026027

Johnson Controls

1. GENERAL

1.1 SYSTEM DESCRIPTION

This section describes the design and installation of the new [and modified] portions of the Fire Protection System and a new Foam Fire Protection System for the _____. The design flow rate shall be based on the information indicated on the drawings and this specification. The [modified and] new portion[s] of the fire protection system shall be in accordance with NFPA 11, NFPA 30, the Owner's insurance carrier _____, and the local fire protection authority having jurisdiction. The Contractor is responsible for designing, furnishing, and installing all Fire Protection services, including but not limited to piping, wiring, equipment, and devices as required for a complete, approved, and functioning system.

1.1.1 The Contractor shall provide a deluge foam-water fire protection system for the _____ loading areas. Include all detectors, switches, alarms, wiring, and controls.

1.1.2 The Contractor shall hydraulically calculate and size all fire protection equipment, piping, and devices to ensure adequate flow to all system components. The Contractor shall verify the latest flow test data available by performing flow test on the water supply as required by NFPA to use as the basis of the hydraulic calculations. Tests to be representative of known high water use periods.

1.2 RELATED WORK [MODIFY AS REQUIRED – SEE FOOTER]

The drawings and general provisions of this specification, including General and Supplementary conditions and Specification sections apply to work of this section. The _____ drawings and the _____ drawings describe the fire protection requirements. The Contractor shall also coordinate with other trades' drawings and Contractors.

A. Documents in Division 00 - Procurement Requirements apply to the work of this Section.

B. Sections in Division 01 - General Requirements apply to the work of this Section.

C. Sections in Division 21 – Fire Suppression

D. Sections in Division 26 – Electrical

E. Sections in Division 28 – Electronic Safety and Security

1.3 QUALITY ASSURANCE

A. Design Reliability:

The Designer of the fire protection systems shall meet one of the requirements below.

1. A registered Professional Engineer.

2. National Institute for Certification in Engineering Technologies (NICET) Level III in Water Based Systems Layout or Special Hazards Systems. Copies of the designer's certificate from NICET shall be submitted along with the drawings for approval.

3. The Contractor is responsible for the design and installation of the fire protection system (including required supports), in accordance with these specifications and the contract drawings. The Contractor shall coordinate with all related and applicable trades to ensure a properly designed and installed fire protection system for the specific building construction and occupancy classification.

B. Codes and Standards

The Contractor shall install the fire protection systems in accordance with the latest editions of the following Standards:

NFPA 11	Standard for Low-, Medium-, High-Expansion Foam
NFPA 13	Installation of Sprinkler Systems
NFPA 30	Flammable and Combustible Liquids Code
NFPA 70	National Electric Code
NFPA 72	National Fire Alarm Code
NFPA 101	Life Safety Code
NFPA 303	Fire Protection Standard for Marinas and Boatyards
NFPA 307	Standard for Construction and Fire Protection for Marine Terminals, Piers, and Wharves

National Electric Manufacturers Association (NEMA) Publication
Enclosures for Industrial Controls and Systems

Underwriters Laboratory, Inc. (U.L.) Publication – Fire Protection Equipment Directory

Factory Mutual (FM) Global requirements, if applicable to this project.

C. Materials and Equipment

All equipment and devices shall be of a make and type listed by UL and/or approved by FM, or other nationally recognized testing laboratory for the specific purpose for which it is intended.

The Contractor shall provide fire protection products in accordance with UL standards; provide UL label on each product.

If applicable to this project, the Contractor shall design and install the fire protection systems in accordance with FM requirements.

All products shall be listed and/or approved for fire protection service.

The fire protection systems shall be in conformance with all Federal, State, and Local requirements.

Inspect all materials to ensure that there is no damage and complies with approved product data submittals and drawings.

Contractors shall protect and store all system devices, equipment, piping and foam concentrate per manufacturer's recommendations.

1.4 SUBMITTALS

Submit under provisions of Section 01 33 00 – Submittals.

Product Data: Submit manufacturer’s product data, including type, model, and physical dimensions.

Complete literature and instructions provided by the manufacturer of all installed equipment and devices describing proper operation, maintenance, and safety requirements.

Piping layout drawings, electrical interface schematics, and hydraulic calculations, and Contract Drawings shall be submitted to and approved by the owner’s insurance carrier and the local fire protection authority prior to installation.

Contractor shall provide certification indicating that the system is installed in compliance with the applicable codes and standards.

Contractor shall provide verification that the appropriate acceptance tests have been conducted in accordance with the local fire protection authority and the applicable codes and standards.

Contractor shall provide project record drawings indicating locations of all devices, piping, drains, etc. and include a sequence of operations.

1.5 DELUGE FOAM-WATER SYSTEM DESIGN CRITERIA

[NOTE - NFPA 30 has the minimum number of hose reels or hydrant-mounted fire monitors as required based on the vessel size that is utilized. Because individual locations will have many independent variables involved with transferring flammable or combustible liquids, the exact requirements are not provided. This specification outlines hazard areas for consideration and provides protection schemes that can exceed the minimum requirements of NFPA 11 but are considered comprehensive for these hazards.]

1.5.1 Provide a deluge, foam-water, fire protection system for the _____ hazard areas as shown on Drawing _____.

1.5.2 The system shall include all accessories required for a complete and operational system. The foam-water system shall include but not be limited to the foam concentrate, foam bladder tank, foam proportioner, foam discharge device, fire cross main, deluge valve, control panels, associated wiring, system piping, and all accessories necessary for a complete and operational system.

1.5.3 Design of the foam-water system shall utilize hydraulic calculations for uniform distribution of foam solution over the protected area, and shall conform to the NFPA standards listed above, and to the requirements specified herein.

1.5.4 Foam Concentrate

The foam concentrate shall be UL Listed or FM Approved for use on hydrocarbon fuels and/or polar solvent fuels present in the hazard area.

1.5.5 Distribution of Foam Solution

Distribution shall be essentially uniform throughout the area. Variation in discharge from individual discharge points shall be between 100 and 120 percent of the specified density.

1.5.6 Duration of Foam Discharge

System shall apply 3% foam solution over the discharge area for a minimum of 30 minutes. [50 minutes shall be used when intent is for protection of vessels that contain polar solvents]

1.5.7 Discharge Area

The most likely areas for spill fires shall be designed to be rapidly covered with foam. The primary focus of the system should be the product transfer areas of the dock or pier such as the loading areas, hoses, valve, and pump manifolds, and product control buildings, or as specified by the authority having jurisdiction (AHJ).

1.5.8 Solution Application Density

The Contractor shall size the system to provide the specified density when the system is discharging the specified total maximum required flow. Application to horizontal surfaces by the fixed monitor system shall be a minimum of [0.16 gpm/ft^2 for hydrocarbon fuels]. [_____gpm/ft^2 for _____ which is a polar solvent fuel.]

[NOTE - Blended fuels that exceed 10% polar solvent also require the use of CHEMGUARD NFF-331 [FM 332] 3%X3% Non-Fluorinated Foam Concentrate with minimum application rates as published by UL or FM or as directed by Chemguard Incorporated for the worst-case fuel].

Hydraulic calculations shall include an allowance for a 500 gpm (1892 Lpm) outside water hose stream.

1.5.9 Friction losses

Calculated losses in foam solution piping shall be in accordance with the Hazen Williams formula with C value of 120 for galvanized steel pipe.

Calculated losses in foam concentrate piping shall be calculated based on foam manufacturer's published data showing maximum pressure differential at designed flow.

1.5.10 Location of Discharge Devices

The quantity and location of the new discharge devices serving the _____ areas shall be in accordance with Drawing _____.

NOTE - Fixed foam monitor systems provide an effective means of providing a large foam solution application rate to the protected areas with a limited amount of piping. When considering monitor placement, the nozzles maximum range should be limited to 75% of the listed straight stream range to compensate for adverse wind conditions. The vessels empty deck height should be considered at high tide when considering if monitors should be located on elevated personnel accessible platforms. Water-oscillating monitors with placement to provide overlapping patterns would provide the most hands-off approach to fire protection. Oscillating monitors should be provided with means for manual operation for trained personnel to direct streams that most efficiently cover the required area. Electric driven remote control monitors should be used when monitors are mounted on towers with limited personnel access. Monitor

systems may be arranged to offer zones of protection with agent tank size and water flow requirements based on worst case anticipated event as approved by the AHJ. When the entire dock has potential risks, the zones of protection should be controlled to provide solution flow as required for each zone, but not to exceed total system design.

In addition to product transfer areas both on the vessel and the dock, consideration should be given to the dock caissons or support pilings where product spills could easily spread and are hidden from the monitors' field of view. An under-dock zone of protection should be considered for these areas. Coverage of the under-dock area can be with foam-water sprinklers, spray nozzles, foam makers, or high-backpressure foam makers are often used for these areas in accordance with manufacturer's recommendations and AHJ approval.

1.5.11 Drainage

Each riser shall be arranged so that it can be drained entirely after system use. The intent is to limit the number of auxiliary drains in the system due to trapped sections of piping. All piping in the system shall be pitched to a drain point accessible for the containment and collection of foam solution.

1.6 The foam fire protection system shall be automatically activated when remote manual pull stations or one or more fire detectors activate.

1.6.1 Upon activation of any manual pull or detector the following shall immediately occur:

1.6.2 Activation of the deluge valve to send foam solution to the discharge devices.

1.6.3 An alarm shall be sent to the local fire alarm system.

1.6.4 Audible and visual alarms shall sound and light locally and on the foam fire protection system control panel.

2. PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. **CHEMGUARD® (a brand of Johnson Controls)**, One Stanton St., Marinette, WI 54143, Tel: 715-735-7415, (Toll Free) Tel: 800-862-6785, www.chemguard.com

B. **ANSUL® (a brand of Johnson Controls)**, One Stanton St., Marinette, WI 54143, Tel: 715-735-7415, (Toll Free) Tel: 800-862-6785, www.ansul.com

C. **TYCO (a brand of Johnson Controls)**, 1476 Elmwood Ave., Cranston, RI 02910, (Toll Free) Tel: 800-381-9312, www.tyco-fire.com

D. **Johnson Controls**, 5757 N. Green Bay Ave, Milwaukee, WI 53201, (Toll Free) Tel: 800-746-7539, www.johnsoncontrols.com

E. Proposed substitutions of other manufacturers not listed in specifications, must comply with provisions of Sections 00 43 25 and 01 25 00. Contractor must submit a Substitution Request Form. All substitutions must be pre-approved.

2.1.1 All equipment and components shall be new and the manufacturer's current model.

2.1.2 All equipment and components shall be installed in strict compliance with manufacturer's requirements.

2.1.3 All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. Fasteners and supports shall be adequate to support the required load.

2.1.4 Sprinkler heads shall be standard pendent or upright type in all spaces except that sprinkler heads under grating, pipe racks, equipment, etc. shall be modified with splash guards to maintain their operating integrity.

2.2 DELUGE VALVES

Valves shall be operated by a detection and control system listed for the releasing service. The deluge valve shall be provided with electrical solenoids compatible with the voltage and current supplied by the control panel. If 6 in. valves are used in larger risers, provide smoothly tapered fittings. In addition to the automatic operation, arrange each valve for manual hydraulic release at the valve. Provide pressure gauges and the other appurtenances at the deluge valve. The Deluge Valve shall be TYCO Model DV-5A with associated trim, or approved equal. Where system pressures could exceed listed operating pressures the TYCO Pressure Regulating Model DV-5A Deluge Valve shall be used.

Specifier Notes: This product guide specification is written according to the Construction Specifications Institute (CSI) 3-Part Format, including *MasterFormat, SectionFormat,* and *PageFormat,* as described in *The Project Resource Manual—CSI Manual of Practice, 2026 Edition.* This section must be carefully reviewed and edited by the Architect to meet the requirements of the project and local building code. Coordinate this section with other specification sections and the Drawings. Delete all Specifier Notes after editing this section.

2.3 FOAM CONCENTRATE INJECTION

[NOTE - The foam proportioner shall be a modified venturi type designed to accurately proportion and control the mixing of pressurized foam concentrate into the water system. The proportioners shall have either NPT threaded (2 in. and 2 1/2 in. sizes) or between flange type (3 in., 4 in., 6 in. and 8 in. sizes) designed to fit between two 150 lb pipe flanges. Proportioners shall be sized for the specified flow rates and shall be UL Listed and/or FM Approved with the type of foam concentrate and bladder tanks being used. A fixed metering orifice secured with a stainless steel retaining ring shall be sized according to the type and percentage of foam concentrate used.]

[NOTE - Foam concentrate shall be metered into the system risers by the use of balance pressure proportioning, utilizing positive displacement concentrate pumps, atmospheric concentrate tank, and a factory assembled and tested in-line balanced pressure (IBP) proportioners. This system shall include all piping and appurtenances necessary to form a complete working system. Systems shall be designed to proportion at 3%.]

The proportioners shall be a CHEMGUARD Part No. _____.

2.4 HYDRAULIC CONCENTRATE CONTROL VALVE

The hydraulic concentrate control valve shall be factory assembled and tested. For Factory Mutual standard designs, the hydraulic concentrate control valve shall be an FM Approved assembly. It shall include a threaded bronze body ball valve with mounting kit for securely attaching the hydraulic actuator to ball valve. The ball valve shall be designed for a minimum 400 psi (27.6 bar) WOG. The valve shall be fitted with a stainless steel ball, stem, and packing nut. Valve seats shall be of glass reinforced TEFLON* material. The Stainless Steel Hydraulic Actuator must be approved by the manufacturer for using water as the medium to operate the actuator. The actuator shall have a position indicator and have the capability for manual override. The actuator shall be designed to operate the valve with a minimum of 30 psi (2.1 bar) water pressure and shall contain no external moving parts which could cause fouling of adjacent equipment, injury to personnel, misalignment problems common to external linkage systems, or potential for disengagement caused by tampering.

The valves shall be a CHEMGUARD Part No. _____.

2.5 FOAM CONCENTRATE

The foam concentrate shall be CHEMGUARD NFF-331 3%X3% Non-Fluorinated Foam Concentrate. CHEMGUARD NFF-3H 3% Non-Fluorinated Foam Concentrate may also be utilized for hydrocarbons only. For Factory Mutual standard designs, the foam concentrate shall be CHEMGUARD NFF-332 3%x3% Non-Fluorinated Foam for hydrocarbons and polar solvents.

[NOTE - The Authority having jurisdiction shall advise on means of providing reserve supply of foam concentrate. NFPA 11 requires reserve supplies to be available for tank recharge within 24 hours. Many AHJs may require use of reserve tank in equal capacity to main tank especially when owners cannot afford a shut down while waiting on reserve foam delivery.]

2.6 FOAM SYSTEM BLADDER TANKS

Tanks shall be (vertical) (horizontal) cylindrical steel ASME coded pressure rated vessel with a UL Listed and/or FM Approved bladder shaped to conform to the inner pressure vessel configuration. Tanks shall be designed for a working pressure of 175 psi (12.1 bar) and hydrostatically tested to at least 255 psi (17.6 bar). The tank interior shall be coated with a high build epoxy sealer for additional corrosion resistance. The bladder tanks shall be UL Listed and/or FM Approved, together with the type of concentrate and proportioner being used in the system. The bladder tank is to have a minimum _____ gal (_____L) capacity to provide sufficient foam concentrate for the time specified when the system is discharging foam solution at total discharge flow. The bladder tank shall be complete with all necessary outlets and supports such as a two welded saddles for horizontal bladder tanks or four welded legs for vertical bladder tanks. Associated trim on the bladder tank shall include bronze pipe and fittings, four bronze ball valves, minimum of 1 in., for concentrate and water vents and drains with secured nameplate depicting the valve name and operating position, and a clear 1 in. PVC sight gauge. The bladder tanks, proportioners and foam concentrate shall be the product of CHEMGUARD.

2.7 FOAM CONCENTRATE ATMOSPHERIC STORAGE TANK

Tanks shall be designed for storage of foam concentrate at atmospheric pressure and shall be of vertical, cylindrical, high-density cross-linked polyethylene construction. Tank shall be equipped with the following: valve drain/fill connection, foam concentrate pump suction and return connections, inspection hatch, and pressure/vacuum vent valve. The tank shall be semi-translucent to allow visual indication of concentrate level in tank. The foam concentrate shall have a minimum _____ gal (_____L) capacity to provide sufficient foam concentrate for the time specified when the system is discharging foam solution at total maximum system flow.

2.8 FOAM CONCENTRATE PUMP

Pumps shall be a positive displacement type constructed of materials compatible with manufacturer's foam concentrate. The pumps shall be rated for a minimum _____ gpm (_____ Lpm) at _____ psi (_____bar) using the type of foam concentrate as specified. Each pump shall be furnished with a pressure safety relief valve sized appropriately to the rated

pump capacity. Pump shall be mounted on a carbon steel base and shall have guards over all couplings. Concentrate pump shall be electric motor drive, open drip-proof enclosure, __ phase, ___ HZ, ____ Volts AC.

[NOTE - If foam concentrate lines from the foam concentrate pumps to the IBPs are run underground or above ground for more than 50 ft (15.2 m), a foam jockey pump and controller may be required.]

2.9 PUMP CONTROLLER

The foam concentrate pumps shall operate automatically and shall be controlled by a listed or approved full service or limited service (providing the electric motor driver is 30 HP or less) fire pump controllers. Controllers shall be installed as per power supply requirements of NFPA 20.

2.10 PRESSURE CONTROL VALVE

The pressure control valve (returning excess foam concentrate back to the storage tank) shall be a pressure-sustaining, back pressure, hydraulically operated, pilot-controlled, modulating type arranged to maintain constant upstream pressure in the foam concentrate piping as the flow rate varies. Valve shall be sized to pass the full foam concentrate pump output through. Materials of construction shall be compatible with the foam concentrate type.

2.11 FOAM PROPORTIONER

The in-line balanced pressure (IBP) proportioner assembly for a pump system shall be UL Listed and/or FM Approved with the type of foam concentrate being used in the system. The IBP proportioner shall be a self-contained unit fully assembled and tested at the factory and delivered complete and ready for use. Field connections shall be limited to water, foam concentrate input, and foam solution outlet. The IBP proportioners shall include a proportioner, integral pressure balancing spool valve, duplex gauge, inlet pressure gauge, check valve and manual ball valve with nameplate. Principal components such as pipe and fittings shall be constructed of either brass or stainless steel.

6 in. PPW MK3 Wide Range proportioners are UL Listed devices that are designed to proportion and control the mixing of foam concentrate into a water stream over a wide range of flow rates and pressures.

The IBP or PPW proportioners shall be a CHEMGUARD Part No. _____ or equal.

2.12 PIPING AND FITTINGS

A. Foam Concentrate:

Piping for foam concentrate shall be brass, bronze, stainless steel or copper nickel in accordance with NFPA 11. Mechanical joints shall be UL Listed and/or FM Approved. Pipe thread sealant and PTFE tape shall be compatible with foam concentrate.

B. Above Grade:

Piping for wet systems shall be carbon steel ASTM A795. Fittings shall be malleable or ductile iron, ASTM A197, ANSI B16.3 threaded, ASTM A34, ANSI 16.9, butt weld or grooved end mechanical joints. Pipe and fittings shall be in accordance with NFPA 13. Mechanical joints shall be UL Listed and/or FM Approved.

Piping for deluge foam sprinkler systems shall be schedule 40 galvanized steel and fittings shall have a hot dipped zinc-coated galvanized finish. Steel pipe welded and seamless, Type F, Grade A, ASTM A53; welded and seamless steel pipe for fire protection use, Type F, ASTM A795; electric resistance welded steel pipe, Grade A, ASTM A135. Pipe and fittings shall be in accordance with NFPA 11 and NFPA 13. Mechanical joints shall be UL Listed and/or FM Approved.

2.13 CONTROL SYSTEM – GENERAL

All control systems shall be UL Listed and/or FM Approved with listed or approved compatible operating devices capable of the following functions:

Ground fault indication

Supervised alarm circuits

Supervised primary power circuit

Remote Trouble Alarm

Battery standby

Front panel indicating lamps (LEDs) or (LCD) display

Key lock steel enclosure

2.14 CONTROL PANEL

The control panel shall be a UL Listed and FM Approved microprocessor-controlled panel. Provide AUTOPULSE® Releasing Panel or approved equal.

The door shall provide a key lock and include a glass or other transparent opening for viewing of all indicators.

All interfaces and associated equipment are to be protected so they will not be affected by voltage surges or line transients.

The control panel shall receive one (1) 120 volt dedicated power feed.

2.15 POWER SUPPLY

Each power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the foam fire protection system.

Provide a battery charger for 24 hours of standby.

Provide an earth detection circuit.

Provide optional meters to indicate battery voltage and charging current.

2.16 BATTERIES

Batteries shall be 12 volt.

Batteries shall have sufficient capacity to power each fire alarm system for not less than 24 hours in standby, plus 5 minutes of alarm upon a normal AC power failure.

Batteries are to be completely maintenance free. No liquids are required. Fluid level checks, refilling, spills, and leakage are not acceptable.

2.17 CONDUIT

Conduit shall be in accordance with the National Electrical Code (NEC, local, and state requirements).

Conduit shall not exceed 40 percent of interior cross-sectional area where three or more cables are contained within a single conduit.

Cable must be separated from all open conductors of power or Class 1 circuits, and shall not be placed in any conduit, junction box, or raceway containing these conductors, per NEC Article 760-29.

2.18 WIRE

All fire alarm system wiring shall be new.

Wiring shall be in accordance with local, state, and national codes (e.g., NEC Article 760). Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and 14 AWG for notification device circuits.

All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling (fire alarm) system.

3. EXECUTION

3.1 INSTALLATION

3.1.1 The Contractor shall coordinate with the Owner any activity requiring an interface with existing dock services or other contractors to implement fire protection in the area.

3.1.2 The Contractor shall protect wet piping and system components from freezing in exterior or unheated spaces.

3.1.3 Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed to supervise the installation and testing of the system.

3.1.4 Installation of Piping: Accurately cut pipe to measurements established by the installer and install without springing or forcing. In any situation where bending of the pipe is required, use a standard pipe-bending template per NFPA 13.

3.1.5 Install the proportioner with the required minimum straight pipe lengths of the same nominal diameter before and after the proportioner. Must be 5 times before (upstream) and 2.5 times after (downstream).

3.1.6 Welding: Conform to the requirements and recommendations of NFPA 13.

3.1.7 Affix cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections to the respective waterflow switch or pipe connection near to the pipe from where they were cut.

3.1.8 Pipe hangers and supports shall comply with NFPA.

3.1.9 Sprinkler piping shall be installed so that the entire system may be drained.

3.1.10 Drains: Fire protection drains shall be piped to the exterior. If fire protection drains need to be piped to interior drains, the drains shall be of adequate size to readily carry the full flow from each drain under maximum pressure and be dedicated to fire protection use only. Install drips and drains where necessary and required by NFPA 13.

3.1.11 Test connections shall be provided as required by NFPA and the local fire marshal.

3.1.12 Supervisory Switches: Provide UL/ FM supervisory switches for sprinkler control valves.

3.1.13 Waterflow Alarm Switches: Install UL/FM waterflow switches and adjacent valves in easily accessible locations.

3.1.14 Mains, test connections, and other equipment shall be labeled as per UL, FM, and NFPA.

3.1.15 Securely attach identification signs to control valves, drain valves, and test valves. Locate hydraulic placard information signs at each sectional control valve where there is a zone water flow switch. Make sure identification placards for the proportioner and bladder tank are visible.

3.1.16 Provide the service of a competent factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all adjustments and tests for the system. The factory representative shall demonstrate that the Foam Fire Protection Systems function properly in every respect.

3.1.17 Electrical and fire alarm installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

3.1.18 All conduit, junction boxes, conduit supports, and hangers shall be concealed in finished areas and may be exposed in unfinished areas.

3.1.19 All fire detection and alarm system devices, control panels, and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

3.1.20 Fire Protection systems installed in electrical rooms noted on the drawings shall have welded sprinkler piping. All screwed connections shall be back-welded except sprinkler connections. Sprinklers and piping shall not be located directly above electrical equipment.

3.1.21 All piping shall be closely coordinated with other trades (process piping, utility piping, HVAC, plumbing, electrical, general construction) to avoid interferences.

3.1.22 Penetrations through fire walls and floors shall be provided using appropriate methods to maintain their integrity as per Section 07 84 00 Fire Stopping.

3.2 INSPECTION AND TESTING

3.2.1 Preliminary Testing: Flush newly installed systems prior to performing hydrostatic tests in order to remove debris, ensuring piping is unobstructed. Hydrostatically test system, including the fire department connections, as specified in NFPA 13. Test and flush underground water line prior to performing these hydrostatic tests.

3.2.2 The Contractor shall hydrostatically test the entire Fire Protection system at 200 psi (13.8 bar) for 2 hours or where system design pressure is in excess of 150 psi, test at a pressure 50 psi above system design pressure. Bladder tanks shall be isolated by manual valves and not be included in this test. Water pressure for hydrostatic test shall be increased in 50 psi (3.5 bar) increments with observations of the joint and gasket stability during each step increase. Increase pressure to the next increment only after joint and gasket stability has been demonstrated. After the required hydrostatic test pressure has been reached and maintained for one hour, the pressure shall be returned to zero while examining for leakage. The pressure shall be slowly increased again to the required hydrostatic test pressure and maintained for two hours while the leakage measurement is determined. All lines shall be relieved of pressure after completion of the test. In the event of repairs or additions, the affected piping shall be retested at the Contractor's expense. A Contractor's Material and Test Certificate shall be furnished by the Contractor and countersigned by the Owner's Representative. All shutoff valves shall be fully closed and opened under system pressure to ensure proper operation.

3.2.3 Foam Fire Protection Systems shall be tested only after all hydraulic testing and flushing is complete and all deficiencies found have been corrected to the satisfaction of the Owner.

3.2.4 Foam Discharge and Concentration Testing

Test each system riser at full design flow of foam solution from the individual riser or through temporary hose lines and nozzle to a test header for at least 60 seconds to collect a foam solution sample.

Test all foam-water hose lines by full flow of foam solution for at least 60 seconds to collect a foam solution sample.

The factory trained representative shall test samples of foam solution taken from each system to ensure proper NFF concentration by means of refractive index. Provide protection for all electrical fixtures and equipment exposed to possible damage during

the tests and protect doors and other openings leading from the protected area, to prevent migration of the foam solution into other areas or spaces.

3.2.5 Flushing and Rinsing

After completion of tests, flush all piping carrying foam solution with fresh water.

3.2.6 Foam Concentrate Storage Tank

After acceptance of the system testing, bladder tanks shall be charged to the required tank capacity per manufacturer's recommendations.

3.2.7 Environmental Protection

Provide temporary measures to prevent foam solution from entering storm drains, sanitary sewers, drainage ditches, streams and water courses. Contain all foam solution on paved surfaces or specific containment area. Collect all discharge foam solution and dispose of it in an EPA approved manner. If a wastewater treatment facility is approved for disposal, the wastewater treatment facility shall provide a secondary (biological) treatment.

3.2.8 Final Inspection and Testing: Tests shall be in accordance with NFPA 13. Connection to the fire alarm system shall have been in service for at least ten days prior to the final inspection, with adjustments made to prevent false alarms. Furnish all instruments, labor and materials required for the tests and provide the services of the installation foreman or other competent representative of the installer to perform the tests. Correct deficiencies and retest system as necessary, prior to the final acceptance. Include the operation of all features of the systems under normal operations in test.

3.3 OWNER TRAINING

3.3.1 Instruct Owner's personnel in the proper operation, maintenance and testing of systems and equipment provided as part of this project. Include not less than ___ hours of instruction, using the Operating and Maintenance manuals and record drawings during this instruction. Demonstrate testing, startup and shutdown procedures for all equipment. All training to be during normal working hours. Video record all instructions and provide Owner with copy.

3.4 WARRANTY

3.4.1 Warranty Terms

The Contractor shall warranty all work performed and all material and equipment furnished under this contract to be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance.

3.5 MAINTENANCE

3.5.1 Post-Contract Maintenance

Complete maintenance and repair service for the Foam Fire Protection systems shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the warranty. The Contractor shall indicate this cost with his bid.

Note: The converted values in this document are provided for dimensional reference only and do not reflect an actual measurement.

END OF SECTION