CHEMGUARD

Engineering Specifications

TPW Closed-Head Foam Water Sprinkler Systems

Section 21 13 00 – Fire Suppression Sprinkler Systems

Section 21 13 39 – Foam Water Systems

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 | Form No. CG-2026017

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 portions of the fire protection system shall be in accordance with NFPA 11, NFPA 13, NFPA 30 and as required by 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, switches, equipment and devices as required for a complete, approved, and functioning system.

1.1.1 [NOTE – MODIFICATIONS ONLY - The Contractor shall modify the existing wet pipe sprinkler system to accommodate the new Foam Fire Protection System for _____ and for the existing adjacent areas as required.]

[NOTE – NEW INSTALLATIONS ONLY - The Contractor shall provide a closed head, foam-water, fire sprinkler system for the _____ 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]

Drawings and general provisions of Contract, 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 the 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 for 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 supports, in accordance with these specifications and the contract drawings. The contractor shall coordinate with architectural, civil, mechanical, and electrical, design and construction documents, to ensure a properly designed fire protection system for the 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 16 Installation of Foam-Water Sprinkler and Foam-Water Spray Systems

NFPA 30 Flammable and Combustible Liquids Code

NFPA 70 National Electric Code

NFPA 72 National Fire Alarm Code

NFPA 101 Life Safety Code

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

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

C. Materials and Equipment

All equipment and devices shall be of a make and type listed by UL 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.

All products shall be listed for fire protection service.

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

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

Contractor 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.

All 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, 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.

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

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

1.5 [NOTE – DELETE IF NOT APPLICABLE] EXISTING WET PIPE SPRINKLER SYSTEM

1.5.1 The Contractor shall modify the existing system, as required, from the existing ___" riser to the _____ hazard areas. The new fire protection criteria shall be as noted on Drawing _____.

1.5.2 The quantity and location of the new sprinklers serving the _____ area(s) shall be in accordance with Drawing _____. If the quantity and/or locations of the sprinkler heads shown on Drawing _____ must be modified to meet the design criteria, the Contractor shall resubmit the modified layout to _____ for approval.

1.5.3 The Contractor shall modify the sprinkler piping, fittings and sprinkler locations serving adjacent areas as required to accommodate new walls, ductwork, piping, and lighting. The existing fire protection criteria shall be reused for portions of the building outside the _____ hazard areas. The Contractor shall add new sprinklers as required due to new wall locations.

1.6 CLOSED-HEAD FOAM WATER SYSTEM DESIGN CRITERIA

[NOTE - NFPA 30 systems shall be either wet pipe systems or single interlock preaction systems used to protect areas storing large amounts of combustible and/or flammable liquids either stored in racks or stacked storage. NFPA 11 systems shall be either wet pipe, dry pipe or preaction systems used to protect spill type/production areas.]

1.6.1 Provide a closed head foam-water fire protection system for the _____ hazard areas as shown on Drawing _____.

1.6.2 The system shall include all accessories as are necessary 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, fire cross main, system valves, control panel(s), associated wiring, sprinkler piping and sprinklers, and all accessories necessary for a complete and operational system.

1.6.3 Design of the foam-water system shall be by 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.

1.6.4 Foam Concentrate

The foam concentrate shall be CHEMGUARD® NFF-331 3%X3% Non-Fluorinated Foam Concentrate for hydrocarbon and polar solvents fuels.

1.6.5 Distribution of Foam Solution

Piping shall be hydraulically designed to obtain uniform foam and water distribution. Two sets of calculations shall be performed: one calculation will be for the demand flow and pressure based on the most hydraulically demanding condition and the second will be for the demand and flow based on the least hydraulically demanding design area. Both shall be balanced to the available water supply to verify the actual system discharge will not exceed the foam concentrate supply to provide foam solution for the required discharge duration.

1.6.6 Duration of Foam Discharge

System shall apply 3% foam solution over the sprinkler discharge area for a minimum of _____minutes. [10 minutes per NFPA 11] or [15 minutes per NFPA 30] or [20 minutes or longer per some insurance carrier requirements duration.]

1.6.7 Sprinkler Discharge Area

The sprinkler system design area shall be hydraulically most remote _____ ft^2 (_____m^2). [maximum of 5000 ft^2 per NFPA 11][maximum of 3000 ft^2 per NFPA 30] [containment/drainage area of liquid spills shall not be greater than the design area of the ceiling sprinkler system.]

1.6.8 SFFF 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 below the sprinkler system shall be a minimum of _____. The hydraulic calculations shall include an allowance for a 250 gpm (946 Lpm) hose stream allowance for NFPA 11 systems and a 500 gpm (1892 Lpm) hose stream allowance for NFPA 30 systems. The hose stream allowance shall not be included in the total foam concentrate required for the system.

[NOTE - NFPA 11 systems shall be designed for_____ over the most remote 5,000 ft² (464.5 m²). (Per NFPA 11 the system shall have a minimum design density of 0.16 gpm/ft). Consult with manufacturer listings for design densities to be used with fuel and sprinkler types.]

[NOTE - NFPA 30 systems shall be designed for _____ over the most remote 3000 ft² (139.4 m²) (Per NFPA 30 the system shall have a minimum design density of 0.30 gpm/ft^2). Area reduction will not be allowed with the use of NFF-331 for pre-primed systems. CHEMGUARD NFF-331 is not allowed to be installed with pre-primed systems. Consult with the AHJ for use of single interlock pre-action systems for the approval to utilize the area reduction. Consult with manufacturer listings for design densities to be used with fuel and sprinkler types.]

[NOTE - If the area of coverage is less than the most remote areas, the system calculation is based on the actual area of coverage.]

[NOTE - Also per some insurance carrier requirements addition of inside foam hose or outside hose stream allowance based on the applicable standards].

[NOTE - In some cases, in-rack sprinklers may also be required. Typical worst case for in-racks will be 6 remote heads on each of the upper three levels for a total of 18 heads at 30 gpm each. Check applicable NFPA standard or insurance carrier requirements for design criteria. Calculated in-rack sprinkler reduction will not be allowed with the use of NFF-331 for pre-primed systems. CHEMGUARD NFF-331 is not allowed to be installed with pre-primed systems. Consult with the AHJ for use of single interlock preaction system for the approval to utilize the allowed reduction in NFPA 30.]

1.6.9 Friction Losses

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

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

1.6.10 Location of Sprinklers

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

Location of sprinklers in relation to the ceiling and spacing of sprinklers shall conform to NFPA 11 and/or NFPA 30. The spacing of sprinklers on the branch lines shall be essentially uniform.

1.6.11 Drainage

Each sprinkler riser shall be arranged so that it can be drained entirely through the main drain. 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.

1.7 The foam fire protection sprinkler system shall be automatically activated when one or more sprinkler heads operate.

1.7.1 Upon activation of any sprinkler head the following shall immediately occur:

1.7.2 Activation of the alarm check valve, preaction, or dry valve to send foam solution to the open sprinkler head(s).

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

1.7.4 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 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 these 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 recommendations.

2.1.3 All equipment shall be attached to the structure and shall be held firmly in place. Fasteners and supports shall be adequate to support the required load per NFPA 13.

2.1.4 Sprinklers 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 and prevent cold soldering. All sprinklers shall be listed for use with the foam concentrate.

2.2 ALARM CHECK VALVES

Valves shall automatically actuate electrically and/or hydraulically operated alarms when there is a steady flow of water into the system, which is equivalent to one or more sprinklers. Alarm check valve shall be TYCO Model AV-1 with retard chamber and associated trim, or approved equal.

2.3 PREACTION VALVES

The preaction valve shall be a diaphragm type, utilizing a single, one-piece EPDM diaphragm. The valve shall be rated for a maximum working pressure of 300 psi. Actuation trim shall be factory preassembled and galvanized to include electric solenoid, main drain, gauges, switches, and manual release valve. The valve shall have an external reset. Provide supervisory air (or nitrogen) to monitor for pipe leaks. The preaction valve shall be a TYCO DV-5A or approved equal.

2.4 DRY PIPE VALVES

The dry pipe valve shall have a ductile iron body and single clapper. The valve shall be rated for a maximum working pressure of 250 psi. Trim shall be factory preassembled and galvanized to include main drain, gauges, switches, and have an external reset plunger. Provide air compressor or nitrogen generator appropriately sized for the system. The dry pipe valve shall be a TYCO DPV-1 or approved equal.

2.5 FOAM CONCENTRATE INJECTION

Foam concentrate shall be metered into the system riser(s) by the use of balance pressure proportioning utilizing an CHEMGUARD TPW proportioner(s) and bladder tank. This system shall include all piping and appurtenances necessary to form a complete working system. System shall be designed to proportion at 3% foam concentrate and 97% water at the flow rate of the (4) most remote heads as required by NFPA 11 and NFPA 30.

2.6 HYDRAULIC CONCENTRATE CONTROL VALVE

The hydraulic concentrate control valve shall be a UL Listed assembly that is factory assembled and tested. 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 valve(s) shall be a CHEMGUARD Part No. _____.

2.7 FOAM CONCENTRATE

Foam concentrate shall be a UL Listed CHEMGUARD NFF-331 3%x3% for 3% proportioning for use on _____ [hydrocarbon or (and/or) polar solvents liquids].

Contractor shall supply sufficient concentrate to fill the tank(s) and for testing of the foam system.

2.8 FOAM SYSTEM BLADDER TANKS

Tanks shall be (vertical) (horizontal) cylindrical steel ASME coded pressure rated vessel with a UL 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, together with the type of concentrate and proportioner being used in the system. The bladder tank shall have adequate 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 PVC sight gauge. The tank exterior shall be primed and painted red enamel. The bladder tank, proportioner, and foam concentrate shall be the product of a single manufacturer.

[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 AHJ's may require use of reserve tank in equal capacity to main tank especially when owners cannot afford plant shut down while waiting on reserve foam delivery.]

2.9 FOAM PROPORTIONER

The foam proportioner shall have the capability to accurately proportion and control the mixing of pressurized foam concentrate into the water system at variable total system flow rates between 55 to 3000 gpm (95 to 11,356 Lpm), at a maximum working pressure of 250 psi (17.2 bar). The proportioner body shall be cast brass, with stainless steel deflector, stainless steel spring, and stainless steel foam metering cone. The proportioner shall be designed to fit between two 6 in. pipe flanges.

Proportioners shall be UL Listed with the type of foam concentrate and bladder tanks being used in the system.

The foam proportioner shall be an CHEMGUARD TPW MK3 Wide Range Proportioner. The TPW MK3 Wide Range Proportioner is recommended to be installed on the supply side of the system control valve or where acceptable in the supply header piping for multiple risers.

2.10 PIPING AND FITTINGS

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

Piping for sprinkler 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.

2.11 SPRINKLERS

Standard coverage sprinklers are to be basis for design unless noted otherwise on the plans. Sprinklers shall be cast brass or bronze finish unless corrosion resistant sprinklers are required. Sprinklers shall be UL Listed for the foam concentrate. Provide quantity of spare sprinklers as required per NFPA 13.

2.12 CONTROL SYSTEM – GENERAL

All control systems shall be UL Listed and/or FM approved and be utilized with listed or approved compatible operating devices and shall be 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

2.13 CONTROL PANEL

The control panel shall be a UL Listed microprocessor-controlled control panel. Provide AUTOPULSE® Release 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.

2.14 POWER SUPPLY

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

It shall provide a battery charger for 24 hours of standby.

It shall provide an earth detection circuit.

It shall provide optional meters to indicate battery voltage and charging current.

2.15 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.

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

2.17 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 Owner any activity requiring an interface with existing plant services or other contractors to implement fire protection in the Building.

3.1.2 The Contractor shall coordinate with the Owner to 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 work into place 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 Listed supervisory switches for sprinkler control valves.

3.1.13 Waterflow Alarm Switches: Install UL Listed waterflow switch and adjacent valves in easily accessible locations.

3.1.14 Mains, test connections, and other equipment shall be labeled as per 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 of the 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 All piping shall be closely coordinated with other trades to avoid interferences (process piping, utility piping, HVAC, plumbing, electrical, general construction).

3.1.21 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 head connections. Sprinklers and piping shall not be located directly above electrical equipment.

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 any debris which may have been left as well as 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 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. For the hydrostatic test, the water pressure 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 installation 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

As a minimum test the system at the flow of the (4) most remote heads 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. A second test is required at the systems minimum design flow rate. Example .30/3000ft^2 = 900 gpm is the systems minimum design flow rate.

The manufacturer's representative shall test samples of foam solution to ensure proper SFFF 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.

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: Subject system to tests 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