SECTION 21 2200

NOVEC 1230 FIRE EXTINGUISHING SYSTEM

PART 1 - GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this specification section to the extent referenced. The publications are referred to within the text by the basic designation only. Use the latest edition, unless noted otherwise.

B. AMERICAN NATIONAL STANDARDS INSTITUTE
   1. ANSI B1.20.1 Standard for Pipe Threads, General Purpose

C. ASTM INTERNATIONAL (ASTM)

D. FM GLOBAL (FM)
   2. FM-5600 Approved Guide for Clean Agent Extinguishing System

E. INTERNATIONAL CODE COUNCIL
   3. [IMC (2012) International Mechanical Code]

F. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

G. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

H. SRP Codes
   1. SRP AFC SRP Administrative Fire Code
I. UNDERWRITERS LABORATORIES (UL)

1. UL 268 Smoke Detectors for Fire Protective Signaling Systems
2. UL 521 Heat Detectors for Fire Protective Signaling Systems
3. UL 668 Hose Valves for Fire Protection Service
4. UL 864 Standard for Safety for Control Units and Accessories for Fire Alarm Systems
5. UL 2166 Standard for Halocarbon Clean Agent Extinguishing System Units

1.2 NOTICE TO BIDDERS

A. Before submittal of bid, examine all drawings, specification, addenda, alternatives, special conditions, and all other bidding documents of all sections of this project, verifying all governing conditions at the site, and become fully informed as to the extent and character of the work required, as well as its relation to other work in the building. Submittal of a bid is an agreement to all requirements of the contract documents and no consideration will be granted for any claimed misunderstanding thereof.

B. Submittal of a bid is deemed a representation by the bidder that he is qualified in all respects to properly perform the work for which he is bidding and has experience with similar work. Bidders are deemed to be aware, on the basis of their background and experience, of materials which may be required in the discharge of their responsibilities, even though unspecified.

C. Any case of error, omission, discrepancy, inconsistency or lack of clarity in the specification or drawings shall be promptly identified to SRP.

1.3 DESCRIPTION OF WORK

A. Provide an approved high-pressure total flooding Novec 1230 fire extinguishing system conforming to NFPA 2001. The system shall be complete in all ways. It shall include all mechanical and electrical installation, all detection and control equipment, agent storage containers, agent, discharge nozzles, pipe and fittings, manual release and abort stations, audible and visual alarm devices, auxiliary devices and controls, shutdowns, alarm interface, caution/advisory signs, functional checkout and testing, training and all other operations necessary for a functional clean agent extinguishing system. Design discharge nozzles to uniformly distribute the clean agent throughout the hazard area. Arrange system for fully automatic and manually operated electronic control operation, with operating controls of the enclosed release type to prevent accidental operation. Discharge nozzles shall be provided, within the manufacturer's guidelines, to distribute the clean agent unobstructed throughout the protected space. The installed nozzles shall be designed to provide the proper clean agent quantity and distribution. Provide manual release stations, dead-man style abort stations and keyed override. Provide material and equipment that are listed. Each protected area shall have audible and visible notification appliances with separate and distinct audible and visual pre-discharge and discharge signals. The discharge signals shall be distinct from those used by the building fire evacuation system.

B. The design shall include fluid storage capacity to provide a single discharge to each zone. Each protected area shall have its own agent storage container and piping. One common control panel may control all systems individually. Each system shall include all materials, accessories and equipment inside and outside the building necessary to provide each system complete and ready for use.

C. Design and install each system to give full consideration to built-in spaces, piping, electrical equipment, ductwork and all other construction and equipment and to be free from operating and maintenance difficulties.
D. Design the total flooding system to a minimum concentration (by volume) of 4.5 percent for Class A fires, 5.9 percent for Class B fires, and 4.7 percent for Class C fires for 10 minutes. System design shall not exceed 10.0 percent for normally occupied spaces, adjusted for maximum space temperature anticipated, with provisions for room evacuation before agent release. Concentration shall be based upon shutting down the heating, ventilation and air conditioning (HVAC) systems at the time of agent discharge. The maximum liquid discharge time shall be 10 seconds.

E. The contractor shall be responsible for sealing and securing the protected space against agent loss and/or leakage during the 10-minute "hold" period.

F. Performance Requirements: Provide construction type, test, and mark of high-pressure cylinders in accordance with US Department of Transportation (USDOT) specifications for seamless steel cylinders. Each cylinder is to be provided with a safety device to relieve excess pressure safely, in advance of the rated cylinder test pressure. Devices are to be Interstate Commerce Commission approved frangible safety disks. Provide cylinder support racks that anchor to walls and floors.

G. Main System: Arrange system for fully automatic and manually operated electric control operation, with operating controls of the enclosed release type to prevent accidental operation. Also provide for manual release stations, dead-man style abort stations and keyed override operations as indicated on the drawings.

H. Clean Agent Recharging Station: The installing contractor shall maintain, or have access to, a clean agent recharging station. The installing contractor shall provide proof of his ability to recharge the system with clean agent within 24 hours of notification.

I. Reserve Cylinders: If requested by the SRP Fire Marshal, provide and install a connected reserve cylinder bank supply.

J. Work also included, but is not limited to the following:

1. Installation of required pressure gauges, signs to identify all valves, interconnection to the fire alarm control unit (releasing panel), hangers, and audible and visible notification appliances. Any necessary core drilling through concrete or masonry floors or walls, with approval of SRP and or a structural engineer. Firestopping of all extinguishing system piping and conduit penetrations through fire-rated walls, partitions, and floor-ceiling assemblies. Through-penetration firestop details, including Underwriter's Laboratories reference number, shall be shown on the shop drawings.

2. The contractor shall verify Novec 1230 supply information for those systems that are reconnected, refurbished, or expanded to comply with the applicable Codes and Standards.

K. It is the contractor's responsibility to consult other specification sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete operational installation.

L. The work shall meet IBC and IFC requirements, SRP requirements and includes all labor, materials, tools, equipment, transportation, and temporary construction necessary to design, fabricate, install and test complete Novec 1230 fire extinguishing systems specified hereinafter.

1.4 SYSTEM SEQUENCE

A. [Automatic operation of each protected area with spot-type detection shall be as follows:

1. Actuation of one detector, within the system, shall:
a. Activate the "ALARM" indicator lamp on the releasing control panel (RCP).
b. Energize the alarm audible and visible notification device located in the hazard area for evacuation of the protected area.
c. Operate door holder/closures on access doors.
d. Transmit an alarm signal to the main fire alarm control unit (FACU).
e. Activate the building fire alarm system.
f. [Activate an individual visible indicator for that device on the graphic annunciator.]

2. Actuation of a second detector, within the system, shall:
   a. Activate the "PRE-DISCHARGE" indicator on the RCP.
   b. Energize the pre-discharge audible and visible notification device located in the hazard area.
   c. Shut down the HVAC system and close smoke dampers.
   d. Start time delay sequence (not to exceed 60 seconds).
   e. System abort sequence is enabled at this time.
   f. [Shunt power to protected equipment.]
   g. [Light an individual lamp for that device on the graphic annunciator.]

B. Automatic operation of each protected area with air-aspirating smoke detection shall be as follows:

1. Actuation of Alarm Level 1 (Alert) within the system shall:
   a. Activate the "ALERT" indicator lamp on the air-aspirating smoke detection control panel.
   b. Transmit a supervisory signal to the [main fire alarm control unit (FACU)][releasing control panel (RCP)].

2. Actuation of Alarm Level 2 (Action) within the system shall:
   a. Activate the "Alarm" indicator lamp on the releasing control panel (RCP).
   b. Energize the alarm audible and visible notification device located in the hazard area for evacuation of the protected area.
   c. Operate door holder/closures on access doors.
   d. Transmit an alarm signal to the main fire alarm control unit (FACU).
   e. Activate the building fire alarm system.
   f. [Activate an individual visible indicator for that device on the graphic annunciator.]

3. Actuation of Alarm Level 3 (Fire 1) within the system shall:
   a. Activate the "PRE-DISCHARGE" indicator on the RCP.
   b. Energize the pre-discharge audible and visible notification device located in the hazard area.
   c. Shut down the HVAC system and/or close dampers.
   d. Start time-delay sequence (not to exceed 60 seconds).
   e. System abort sequence is enabled at this time.
   f. Shunt power to protected equipment.
   g. Light an individual lamp for that device on the graphic annunciator.

C. After completion of the time-delay sequence, the clean agent fire extinguishing system shall activate and the following shall occur:

1. Activate the "RELEASE" indicator on the RCP.
2. Energize the visible notification device(s) outside the hazard area in which the discharge occurred.
3. [Energize the "System Release" audible device.]
4. Transmit a system release signal to the FACP.
The system shall be capable of being actuated by manual release stations located at each hazard exit. Operation of a manual release station shall duplicate the sequence description above except that the time delay and abort functions SHALL be bypassed. The manual release station shall be of the double-action, electrical actuation type and shall be supervised at the RCP.

1.5 SUBMITTALS

A. Submit installation drawings for Novec 1230 extinguishing system in accordance with the contract drawings, specification and applicable standards. Approval by SRP is required prior to installation.

B. Shop Drawings: Provide six copies of the shop drawings, no later than 21 days prior to the start of system installation. Detail drawings conforming to the requirements for "Plans" as prescribed in NFPA 2001; drawings shall be 34 x 22 inches. Drawings shall include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Annotate system piping layout with reference points for design. In field wiring diagrams, show locations of devices and points of the system. Include data essential to the proper installation of each system. Integrate with alarm and detection system specified. Each set of drawings shall include the following:

1. A descriptive index with drawings listed in sequence by number. A legend sheet identifying device symbols, nomenclature, and conventions used in the package.

2. Floor plans drawn to a scale not less than 1/8-inch equals 1-foot clearly showing locations of devices, equipment, risers, electrical power connections and other details required to clearly describe the proposed arrangement.

3. Riser layout drawings drawn to a scale of not less than 1/2-inch equals 1-foot to show details of each system component, clearances between each other and from other equipment and construction in the room.

4. Include details of equipment layout and design, including wire counts and approximate location of conduit. Indicate the general physical layout of all controls, manual release station[s], detectors, abort stations, and wiring details. Show isometric details of agent storage containers, mounting details and proposed pipe runs and sizes. Electrical layout drawings shall show the location of all devices and include point-to-point conduit runs and a description of the method(s) used for detector mounting. Provide an internal control panel wiring diagram which shall include power supply requirements and field wiring termination points.

5. Give full consideration to built-in spaces, piping, electrical equipment, ductwork, and all other construction and equipment for the layout of the system.

6. A complete sequence of operation shall be submitted detailing all alarm devices, shutdown functions, remote signaling, damper operation, time delay and agent discharge for each zone or system.

7. Details of each type of pipe hanger and related components.

8. Shop drawings and calculations shall be prepared by a qualified NICET Level III (or IV) Technician.

9. Provide electronic drawings in AutoCAD dwg format. Use standard AutoCAD fonts and line stiles and furnish the pcp file.
C. Calculations: Submit Novec 1230 discharge calculations verifying total storage requirements, flooding concentrations, discharge times, flow through the piping network, pipe sizes, and nozzle orifice sizes, in accordance with the manufacturer’s listed design manual and NFPA 2001.

D. Product Data: Submit product data for all equipment to be used, including but not limited to high-pressure cylinders, piping materials, pipe hangers and supports, pressure alarm switch, nozzle, manual release stations, abort stations, escutcheons, storage batteries, battery charger, smoke detectors, audible alarms, visual alarms, releasing control panel.

E. Battery Calculations: Submit battery calculations for the battery stand-by power supply taking into consideration the power requirements of all alarms, initiating devices and auxiliary components under full load conditions.

F. Test Procedures: Submit proposed procedures for preliminary tests, no later than 14 days prior to the proposed start of the tests and proposed date and time to begin the preliminary tests.

G. Preliminary Test Report: Provide three copies of the completed preliminary test report, no later than 7 days after the completion of the preliminary tests. The preliminary test report shall be as outlined in NFPA 2001.

H. Final Acceptance Test report: Provide three copies of the completed final acceptance test reports, no later than 7 days after the completion of the final acceptance tests. Final acceptance test reports shall be as outlined in NFPA 2001.

I. Installer’s Qualifications: Data approved prior to submittal of any other data or drawings, to substantiate that the proposed installer is regularly engaged in the installation of the type and complexity of fire protection system included in this project. Data shall identify the location of three systems recently installed by the proposed installer which are comparable to the system specified. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months. Submit copy of license to perform work in the local jurisdiction.

J. As-Built Drawings: In addition to six hard copies, furnish one set of CD or DVD discs containing software back-up and CAD based drawings in the latest version of AutoCAD and DXF format and pdf copy of as-built drawings and schematics. A separate set of approved submittal drawings of the overall system, marked up to indicate as-built conditions, shall be maintained on-site. These drawings shall be maintained in a current condition at all times and shall be made available for review immediately upon request during normal working hours. Variations from the approved drawings, for whatever reason, including those occasioned by modifications, change orders, optional materials, and/or required for coordination between trades shall be indicated in sufficient detail to accurately reflect the as-built conditions. Submit a complete set of as-built (record) working drawings including complete as-built circuit diagrams of each clean agent system for record purposes within 14 calendar days after the final acceptance test of the system. At least two sets of as-built (marked-up) drawings shall be provided to SRP at the time of, or prior to the final acceptance test.

K. Operation and Maintenance Data: Six manuals in loose-leaf binder format and grouped by technical sections consisting of manufacturer’s brochures, schematics, printed instructions, general operating procedures, and safety precautions. Manuals shall be submitted and approved prior to on-site training. In addition to the items specified in Division 01 Section 01723 "Operation and Maintenance Data", the Manual shall include a narrative description of the sequence or sequences of operation of the overall fire protection system and a separate description of each major subsystem. Information to be provided shall include specific open/close settings for all adjustable valves. The manuals shall list routine maintenance procedures, possible breakdowns, and repairs, and troubleshooting guide. The manual shall include system piping layout, conduit layout, equipment layout, and simplified wiring and control diagrams for the system as installed. The manual shall include procedures and
instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

L. Training Documentation: Provide in manual format, lesson plans, operating instructions, maintenance procedures, and training data for the training courses. The operations training shall familiarize SRP’s designated personnel with proper operation of the installed system. The maintenance training course shall provide SRP’s designated personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

M. Schedule: Provide a schedule indicating the delivery dates of the equipment to be supplied; installation sequence; time frame, and the total amount of on-site technical assistance (in man-hours per phase) that the supplier of the equipment has included in their bid to comply with the requirements of this specification section and SRP’s requirements; and final acceptance test dates to meet SRP’s scheduled project completion dates.

N. Preliminary Equipment List: Provide a preliminary Equipment List identifying the type, quantity, make, and model number of each piece of equipment to be provided under this submittal. The Equipment List shall include the type, quantity, make and model of spare equipment. Types and quantities of equipment submitted shall coincide with the types and quantities of equipment used in the battery calculations and those shown on the shop drawings. A final Equipment List shall be submitted with the Operating and Maintenance (O&M) manual.

O. In the event that the contractor’s submittal package is required to be revised and resubmitted due to nonconformance with this specification section, illegibility of the submittal, incomplete submittals, noncompliance with the referenced local, state and national Codes, Standards and Regulations or nonconformance with pertinent documentation relative to the project, the Contractor shall pay all fees associated with the additional submittal review. Payment of the fee shall be solely the contractor’s responsibility.

1.6 QUALITY ASSURANCE

A. The recommended practices stated in the manufacturer’s literature or documentation shall be considered as mandatory requirements.

B. Qualifications - Contractor: The contractor shall be an approved distributor/installer for Novec 1230 fire extinguishing systems and be an Arizona licensed contractor in possession of a valid special hazard extinguishing systems contractor’s license. The design and installation must be performed by a qualified contractor whose business is located within a 75-mile radius of the project site. The contractor shall have a minimum of 5 years of experience in the installation of special hazards systems in similar facilities.

C. Qualifications – Special Hazard System Design Services: Shop (working) drawings and calculations shall be prepared under the direction of and signed by a qualified registered Professional Engineer or a NICET Level III in special hazard systems. For the purposes of meeting this requirement, a qualified engineer is defined as an individual meeting one of the following conditions:

1. A registered professional engineer having passed the NCEES examination in fire protection engineering.

2. Registered professional engineer with verification of experience and at least 5 years of current experience in the design of the fire protection and detection systems.

D. Qualifications - Installer: A NICET Level III (minimum) in special hazards systems shall supervise the installation of the fire extinguishing system.
E. Qualifications – Releasing System Installer: Releasing system installer with a minimum of 2 years of experience shall be permitted to assist in the installation of releasing system devices, cabinets and panels. An electrician shall be permitted to install wire, cable, conduit and backboxes for the releasing system.

F. Qualifications - Test Personnel: Special hazards system technicians with a minimum of 8 years of experience shall be utilized to test and certify the installation of the fire extinguishing system. The special hazards system technicians testing the equipment shall be factory-trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.7 REGULATORY REQUIREMENTS

A. All system components shall be listed or approved for their intended use and shall be compatible with the system and its components. Where the terms "listed" or "approved" appear in this specification section, they shall mean UL-listed (UL Fire Prot Dir), FM-approved (FM App Guide), or listed by a nationally recognized testing laboratory (NRTL). The omission of these terms under the description of any item of equipment described shall not be construed as waiving the requirement for listing or approval. All listings or approvals shall be based on an existing ANSI or UL published standard.

B. Compliance with NFPA standards is mandatory. In the event of a conflict between specific provisions of this specification section and applicable standards, this specification section shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean SRP or SRP’s Representative.

C. The fire protection installer and the contractor shall comply fully with all city, county and state laws, ordinances and regulations applicable to fire protection installations.

D. Should any change in plans or specification be required to comply with governmental regulations, the contractor shall notify the Engineer at the time of submitting his bid.

E. A Work Authorization is required for all Novec 1230 work. The SRP Project Manager (PM) shall apply for and receive the Work Authorization. The fire protection contractor will receive the Work Authorization from the SRP PM. The Work Authorization must be prominently displayed at the jobsite before any work, to include demolition, can begin. Upon completion of the work, a final inspection by the SRP Fire Marshal, and the satisfactory resolution of all issues identified by the Final Inspection, the SRP Fire Marshal shall sign and close out the Work Authorization which indicates acceptance of the permitted work.

1.8 VERIFYING ACTUAL FIELD CONDITIONS

A. Before commencing work, examine all adjoining work on which the contractor’s work is in any way dependent for perfect workmanship according to the intent of this specification section, and report to the SRP Representative any condition which prevents performance of first class work. No "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed before submittal of a proposal.

B. The contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the SRP Representative of any discrepancy before performing the work.

1.9 COORDINATION OF TRADES
A. The contract documents are not intended to serve as coordinated construction drawings showing all minor adjustments in locations required for a fully coordinated installation that respects the work of all trades.

B. Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

C. Wherever the contractor’s work interconnects with work of other contractors, the contractor shall coordinate his work with other contractors to ensure that all contractors have the information necessary so that they may properly install all necessary connections and equipment. Identify all work items needing access (dampers, etc.) concealed above hung ceilings by permanent colored pins/tabs in the ceiling directly below the item.

D. Provide required supports and hangers for piping, conduit and equipment, so that loading will not exceed allowable loadings of structure. Submittal of a bid shall be a deemed representation that the contractor submitting such bid has ascertained allowable loadings and has included in his estimates the costs associated in furnishing required supports.

E. Field drilling and cutting of holes in structural decks, roofs, walls, etc., required for work under this section shall be coordinated through various trades in their respective materials and approved by the SRP Representative. All such drilling, cutting, and reinforcing costs shall be borne by the contractor.

F. Due to the type of installation, a fixed sequence of construction is required to properly install the complete systems. It shall be the responsibility of the contractor to coordinate, protect, and schedule his work with other trades in accordance with the construction sequence.

G. Cooperate with all other contractors and subcontractors to facilitate the completion of the work as a whole, subject to the direction of the SRP Representative.

1.10 SCHEDULING

A. Provide a schedule to SRP indicating the installation sequence and timeframe prior to beginning work. Provide weekly updates to SRP. All wiring, circuit testing and device installation shall be completed in time for the equipment supplier to make all final connections and to conduct all tests as outlined in this specification section.

B. Coordinate the Acceptance Test for each fire alarm system with the SRP Fire Marshal and other necessary parties identified by SRP.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment delivered and placed in storage from the weather, humidity, and temperature variation, dirt and dust, and other contaminants in accordance with manufacturer’s instructions.

B. All pipes and fittings shall either be capped or plugged until installation.

C. Coordinate the storage arrangement and location with SRP.

D. Deliver and store products in shipping containers/boxes, with labeling in place.

1.12 WASTE REMOVAL
A. At the conclusion of each day's work, clean up and stockpile on site all waste, debris, and trash, which may have accumulated during the day as a result of work by the contractor and of his presence on the job.

B. Sidewalks and street adjoining the property shall be kept broom clean and free of waste, debris, trash and obstructions of any kind caused by work of the contractor, which will affect the condition and safety of streets, walks, utilities and property.

1.13 SPARE PARTS

A. Repair Service/Replacement Parts: During warranty period, the service technician shall be on-site within 24 hours after notification. All repairs shall be completed within 24 hours of arrival on-site.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Standard Products: Material and equipment shall be the standard products of a manufacturer, where possible, and not a combination of manufacturers for any particular classification of materials. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. All materials and equipment supplied shall be new, first quality and the manufacturer’s best type and latest model capable of complying with all requirements of this specification section and shall have been in continuous production and in continuous service in commercial applications for at least 1-year. Obsolete equipment shall not be used. All equipment furnished shall be new and listed for its intended application.

B. Nameplates: Major components of equipment shall have the manufacturer's name, model or serial number, and date of installation provided on a new plate permanently affixed to the item or equipment. Nameplates shall be etched metal or plastic, permanently attached by screws to panels or adjacent walls.

2.2 COMPONENTS

A. Piping: Pipe shall be steel conforming to ASTM 53, nonferrous drawn seamless copper tubing conforming to ASTM B88, and flexible metallic hose conforming to UL 536. Provide fittings for changes in direction of piping and for all connections. Reduce pipe sizes in the fitting. Do not use flush bushings. Fuse brazed joints, when used, with an alloy with a melting point above 1,000 degrees F. Provide pipe and fittings having a minimum bursting pressure of 5,000 per square inch (psi). For 1/2-inch and 3/4-inch iron pipe size (ips) provide schedule 40. For 1-inch or greater, use only schedule 80 pipe. Standard malleable iron banded fittings or ductile iron fittings through 2-inch igns. Use forged steel fittings in all sizes over 2 inches.

B. Discharge Nozzle: Permanently mark discharge nozzles to identify the nozzle and to show the equivalent single orifice diameter regardless of shape and number of orifices. Nozzles shall be available in NPT sizes 1/4-inch to 2.0-inch and shall be available in 180-degree and 360-degree distribution patterns.

C. Pipe Hangers and Supports: Provide pipe hangers and supports conforming to NFPA 2001 and manufacturer's recommendations.

D. Pipe Sleeves: Provide where piping passes through masonry or concrete walls, floors, roofs, and partitions. Use standard weight zinc-coated steel pipe sleeves in outside walls below and above grade, in floor and in roof slabs. Zinc coat sheet steel sleeves in partitions having a nominal weight
of not less than 0.90 pounds per square foot. Ensure space between piping and the sleeve is not less than 1/2-inch. Use sleeves of sufficient length to pass through the entire thickness of walls, partitions and slabs. Pack space between the pipe and sleeve with asbestos-free insulation and approved sealant based on the material and the fire rating of the wall.

E. Escutcheons: Provide approved type escutcheons for piping passing through floors, walls and ceilings, consisting of one-piece or split-type. Provide chrome plated escutcheons where pipe passes through finished ceilings. Other escutcheons may be steel or cast-iron with aluminum paint finish. Securely fasten escutcheons in place with setscrews or other positive means.

F. Storage cylinders shall be constructed of high strength alloy steel, conforming to all applicable specifications of the Department of Transportation. Container design shall permit on-site reconditioning and refilling when required. Safety valves, manifolds, pressure gauges, and pressure switches shall be furnished and installed. Each container shall meet the following:

1. A pressure gauge to provide visual and electrical supervision of the container pressure. The pressure gauge shall be color-coded to provide an easy, visual indication of container pressure.

2. A pressure relief provision that automatically operates when the internal temperature exceeds 130 degrees F. Each container shall have a safety device to relieve excess pressure safely, in advance of the rated cylinder test pressure.

3. The requirements of the US Department of Transportation specifications if used as shipping containers. If not used as a shipping container, each container shall be designed, fabricated, inspected, certified, and stamped in accordance with Section VIII of ASME BPVC.

4. Provided with support racks that anchor to walls and floors.

5. A permanent nameplate or other permanent marking that indicates the agent, tare and gross weights and super-pressurization level (where applicable) of the container.

2.3 LOW-PRESSURE ALARM SWITCH

A. The tanks shall have a low-pressure switch to warn of clean agent tank depressurization. The low-pressure switch shall be wired to the RCP to provide an audible and visual "Supervisory" signal in the event the container pressure drops 5 percent below normal operating pressure.

2.4 RELEASING CONTROL PANEL (RCP)

A. Provide an approved releasing control panel that is compatible with the system, devices, and functions specified. The control system and its components shall be UL-listed or FM-approved for use as a local fire alarm system with releasing device service. The control system shall perform all functions necessary to operate the system detection, actuation, and auxiliary functions. The control system shall be microprocessor-based utilizing distributed processing concept. A single microprocessor failure shall not impact operation of additional modules on the system. The control system shall be capable of supporting an air-aspirating smoke detection system. The control system shall have four initiating circuits that are capable of Class A or Class B operation. Each circuit shall be capable of monitoring contact devices configured for manual release, manual alarm, system abort, trouble input or auxiliary (non-fire) input. The control panel shall release circuits for activation of an extinguishing/supervision system(s). Each circuit shall be rated for 1.5 amp @ 24 VDC. The control panel shall contain at least two indicating appliance circuits for annunciation. Each circuit shall be capable of Class A or Class B operation. Each circuit shall be rated for 1.5 amp @ 24 VDC.
B. Primary Power Supply: Provide a system which operates from a power supply with 120 grounded VAC and 24 VDC output satisfactorily with power input voltage varying from 85 to 110 percent of nominal value. Ensure that the power supply output is capable of powering all initiation signaling, annunciation, and control devices during alarm condition with 25 percent minimum space capacity.

C. Secondary Power Supply: Provide batteries, charger, and power transfer equipment which supplies the means of automatically supplying the entire system with battery backup power in the event of a primary power system failure, and switches to battery power in the event of AC power failure, and switches back to AC power upon return of primary power. Provide a control panel which operates when the backup batteries are disconnected for any reason, and controls charging currents and floating voltage levels to maintain batteries in optimum condition. Provide capability to recharge batteries in event of discharge. Fuse wiring to protect against battery over-current and polarity reversal. The battery charger and battery shall comply with the relevant codes, standards or regulations. Typically, 24 hours standby battery backup is required followed by 5 minutes in an alarm condition, unless site specific standby battery criteria is required. Follow local power supply standards that may apply. UL 1481 listed (provided the power supply and standby batteries have been appropriately sized/rated to accommodate the system's power requirements).

D. Storage Batteries: Provide sealed and spill-proof battery modules (no corrosive fumes). Utilize only batteries which are listed

2.5 MANUAL RELEASE STATIONS

A. Stations shall be of the type not subject to operation by jarring or vibration. Stations shall have a dual-action release configuration. Break-glass front stations are not permitted; however, a pull lever break-glass rod type is acceptable. Manual release stations shall be a different color (such as yellow or orange) from building fire alarm pull stations.

2.6 AIR SAMPLING SMOKE DETECTORS

A. Detector Assembly: The detector, filter, aspirator and relay outputs shall be housed in a mounting box and shall be arranged in such a way that air is drawn from the fire risk and a sample passed through the dual stage filter and detector by the aspirator. Detection units shall be compact type and provided with scanning to identify which sampling pipe is carrying smoke. The scanning mechanism shall:

1. Be integrated into the detector.
2. Begin to sample each pipe individually upon detection of smoke.
3. Be used to identify the level of smoke in each pipe.
4. Be used to indicate in which pipe an alarm was first detected.
5. Operate upon manual activation of the scan button on the display.
6. Be automatically tested daily to ensure uninterrupted protection.

B. The detector shall be laser-based type and shall have an obscuration sensitivity range of 0.0015 percent/obsc/ft to 6 percent obsc/ft. The detector shall have four independent field programmable smoke alarm thresholds per pipe (sector) and a programmable scan time delay.

C. The aspirator shall be a purpose-designed rotary vane air pump capable of allowing for multiple sampling pipe runs up to 600 feet in total (four pipe runs per detector).
D. The assembly must contain relays for alarm and fault conditions. The relays shall be software programmable to the required functions. The assembly shall be able to be surface-mounted to a wall or recessed in the wall cavity (the unit may be inverted in either option). The assembly shall have built-in events and smoke logging. It shall store smoke levels, alarm condition, operator actions and faults. The date and time of each event shall be recorded. Each detector (zone) shall be capable of storing up to 18,000 events and does not require the presence of a display in order to do so.

E. Display: The display shall provide the following features at a minimum:

1. A 20 segment bar graph display.
2. Four independent high intensity alarm indicators; Alert, Action, Fire 1 and Fire 2, corresponding to the four alarm thresholds of the indicated sector.
4. LED indication that the first alarm sector is established.

F. Detector Alarm Levels: The laser-based air sampling detection system shall have four alarm thresholds per pipe (sector). The four alarm levels may be used as follows:

1. Alarm Level 1 (Alert): 0.025% obsc/ft.
2. Alarm Level 2 (Action): 0.044% obsc/ft.
3. Alarm Level 3 (Fire 1): 0.062% obsc/ft.
4. Alarm Level 4 (Fire 2): 0.61% obsc/ft.

G. Fault Alarms: The detector fault relay shall be connected to the appropriate alarm zone on the RCP in such a way that a detector fault would register a fault condition on the FACU.

2.7 [SMOKE DETECTORS]

A. [Photoelectric Smoke Detectors: Provide addressable photoelectric smoke detectors as follows:

1. Provide analog/addressable photoelectric smoke detectors utilizing the photoelectric light scattering principle for operation in accordance with UL 268. Smoke detectors shall be listed for use with the fire alarm control unit.
2. Provide self-restoring type detectors that do not require any re-adjustment after actuation at the RCP to restore them to normal operation.
3. Components shall be rust and corrosion resistant. Vibration shall have no effect on the detector’s operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen shall not inhibit the movement of smoke particles into the chamber.
4. Provide twist lock bases constructed of white, high impact polycarbonate designed for mounting on a standard 3 1/2-inch or 4-inch octagonal or 4-inch square outlet box for detectors. The detectors shall maintain contact with their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on screw terminals. The detector shall have a visual indicator to show actuation. Insertion of an incorrect detector type into the base shall cause a "Wrong Device" trouble
condition at the RCP until the proper type of detector is installed, or the system is reprogrammed. The system program shall recognize the insertion of a wrong device and shall automatically default to the set point values corresponding to the inserted device and shall monitor alarm and trouble conditions according to the default parameters.

5. The detector address shall identify the particular unit, its location within the system, and its sensitivity setting. Detectors shall be of the low voltage type rated for use on a 24 VCD system.

6. An operator at the control unit, having the proper access level, shall have the capability to manually access the following information for each initiating device:
   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Detector range (normal, dirty, etc.).

B. Laser Smoke Detectors: Provide addressable laser smoke detectors as follows:

1. Provide analog/addressable laser smoke detectors utilizing laser diode and patented smoke sensing chamber, designed to amplify signals from smoke but diminish stray internal reflections and shall, on command from the control panel, send data to the panel representing the analog level of smoke density. Smoke detectors shall be listed for use with the releasing control panel.

2. Detector shall be able to achieve sensitivities from 0.02 percent per foot to 2 percent per foot obscuration. Laser smoke detector shall provide point identification of the fire location through addressability, shall experience no delay in response time due to smoke dilution or smoke transportation time, and shall offer complete supervision of wiring and detector.

3. Provide self-restoring type detectors that do not require any re-adjustment after actuation at the releasing control panel to restore them to normal operation. Detectors shall be UL-listed as smoke-automatic fire detectors.

4. Components shall be rust and corrosion resistant. Vibration shall have no effect on the sensor’s operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen shall not inhibit the movement of smoke particles into the chamber.

5. Provide twist lock bases for detectors. The detectors shall maintain contact with their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on the screw terminals. The sensor shall have a visual indicator to show actuation.

6. The sensor address shall identify the particular unit, its location within the system, and its sensitivity type. Detectors shall be of the low voltage type rated for use on a 24 VDC system.

7. An operator at the control panel, having the proper access level, shall have the capability to manually access the following information for each initiating device:
   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).]
C. **[Duct Smoke Detectors]**: Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Smoke Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between 500 and 4000 fpm. Detectors shall be powered from RCP.

1. Sampling tubes shall run the full width of the duct. The control functions, operation, reset, and bypass shall be controlled from the RCP.

2. Lights to indicate the operation and alarm condition, and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Remote indicators shall be provided where required by NFPA 72 and these shall be provided with key-operated test and reset switches.

3. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. Detectors shall provide for control of auxiliary contacts for shutdown. Auxiliary contacts provided for this function shall be located within 3 feet of the controlled circuit or appliance.

4. The detectors shall be compatible with the RCP to ensure complete system compatibility.

2.8 **ABORT STATIONS**

A. Abort station shall be guarded, spring-loaded type which operates only when pressure is manually applied to the switch. Upon release of manual pressure, switch de-activates allowing delayed functions to resume. After start of agent discharge switch has no effect. Activation of the abort switch during normal (non-alarm) conditions causes activation of system trouble signal.

2.9 **ALARM SIGNALING DEVICES**

A. Audible Alarms: Audible notification appliance shall be [surface][flush]-mounted, vibrating type alarm horns suitable for use in an electrically supervised circuit and having a sound output rating of at least 90 decibels at 10 feet.

B. Visual Alarms: [Surface][Flush]-mounted lamp assembly suitable for use in a electrically supervised circuit. Provide flashing strobe type lamps, powered from the releasing control panel alarm circuit. Provide lamps with a minimum 15 candela. Flash rate is between 60 and 120 flashes per minute. Protect lamps by a thermostatic lens, red for pre-discharge alarms and blue for discharge alarms. Visual alarms may be part of an audio-visual alarm assembly.

2.10 **ELECTROMAGNETIC DOOR HOLDER RELEASE**

A. Devices shall be designed to operate on 24 VDC and require not more than 3 watts of power to develop 25 psi of holding force. Under normal conditions, the magnets shall attract and hold the doors open. Operation shall be fail safe with no moving parts. Electromagnetic door hold-open devices shall not be required to be held open during building power failure. The device shall be listed based upon UL 228.

2.11 **ELECTRICAL WORK**

A. Wiring: Provide power, control, and fire alarm wiring, including connections to the fire alarm systems under this section and conform to NFPA 70. Wiring for 120 volt circuits is No. 12 AWG minimum. Wiring for low voltage DC circuits is No. 16 AWG minimum. Color code all wiring. Use rigid metal...
Conduit or intermediate metal conduit, except electrical metallic tubing may be used in dry locations not enclosed in concrete or where not subject to mechanical damage.

B. Conductor Identification: Identify all circuit conductors within each enclosure where a tap, splice, or termination is made. Conductor identification is 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.

C. Alarm Wiring: The SLC wiring shall be [fiber optic] or [solid copper] cable in accordance with the manufacturer’s requirements. Copper signaling line circuits and initiating device circuit field wiring shall be No. [14][16][18][___] AWG size twisted and shielded solid conductors at a minimum. Visual notification appliance circuit conductors, that contain audible alarm appliances, shall be solid copper No. 14 AWG size twisted and shielded conductors at a minimum. Speaker circuits shall be copper No. [16][___] AWG size twisted and shielded conductors at a minimum. Wire size shall be sufficient to prevent voltage drop problems. Circuits operating at 24 VDC shall not operate at less than the UL-listed voltages for the sensors and/or appliances. Power wiring, operating at 120 VAC minimum, shall be a minimum No 12 AWG solid copper having similar insulation. Acceptable power-limited cables are FPL, FPLR or FPLP as appropriate with red colored covering. Non-power-limited cables shall comply with NFPA 70.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Install materials and equipment in accordance with NFPA 2001. Provide each system complete and ready for operation. Provide each system with an approved pressure relief device designed to operate between 2,000 and 3,300 psi and located between the storage cylinder manifolds and any normally closed valve.

B. The Work Authorization must be prominently displayed at the job site before any work, to include demolition, can begin.

C. Upon completion of the work, a final inspection by the SRP Fire Marshal, and the satisfactory resolution of all issues identified by the Final Inspection, the SRP Fire Marshal shall sign and close out the Work Authorization which indicates acceptance of the permitted work.

D. Distribution Piping and Fittings: Distribution piping and fittings shall be installed in accordance with the manufacturer’s requirements, NFPA 2001 and approved piping standards and guidelines. All distribution piping shall be installed by qualified individuals using good, accepted practices and quality procedures. All piping shall be adequately supported and anchored at all directional changes and nozzle locations. All piping shall be reamed, blown clear and swabbed with suitable solvents to remove burrs, mill varnish and cutting oils before assembly. All pipe threads shall be sealed with Teflon tape pipe sealant applied to the male threads ONLY.

E. Pipe Penetrations: Cutting structural members for passage of pipes or for pipe-hanger fastenings shall not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile-iron or cast-iron pipe shall extend through its respective wall or floor and be cut flush with each wall surface. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be firestopped in accordance with Section 07 8400 FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.
F. Escutcheons: Escutcheons shall be listed for piping passing through floors, walls, and ceilings, consisting of one-piece or split-type. Provide chrome plated escutcheons where pipe passes through walls and ceilings in finished areas. Other escutcheons may be steel or cast-iron, with aluminum paint finish. Securely fasten escutcheons in place with setscrews or other positive means.

G. Discharge Nozzle: Where clogging by external foreign material is likely, discharge nozzles shall be provided with frangible discs, blow-off caps, or other suitable devices.

H. Manual Release Stations: Provide manual release stations as indicated on the drawings. Mount stations so that their operating handles are 4 feet above the finished floor. Mount stations so they are located no farther than [5][___] feet from the exit door they serve, measured horizontally.

I. Smoke Detectors: Terminate field wiring on the screw terminals for all photoelectric and laser smoke detectors. Locate detectors [as required by NFPA 72 and their listings][as indicated] on a 4-inch mounting box. Locate smoke detectors on the ceiling. Smoke detectors are permitted to be on the wall no lower than 12 inches from the ceiling with no minimum distance from the ceiling. In raised floor spaces, install the smoke detectors to protect 225 square feet per detector. Install smoke detectors no close than 5 feet from air handling supply ducts.

J. Duct Smoke Detectors: Detectors mounted above 6 feet and those mounted below 6 feet that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset switches. Auxiliary contacts provided for this function shall be located within 3 feet of a controlled circuit or appliance.

K. Electromagnetic Door Holder Release: Doors shall be help open at a minimum of 90 degrees so as not to impede egress from the space. Mount the armature portion on the door and have an adjusting screw for seating the angle of the contact plate. Wall-mount the electromagnetic release, with a total horizontal projection not exceeding 4 inches. Ensure all doors release to close upon first stage (pre-discharge) alarm. Electrical supervision of wiring external of control panel for magnetic door holding circuits is not required.

L. Releasing Control Panel (RCP): The RCP shall be located in a year round environmentally conditioned space and not in the hazard area served but adjacent to it. Locate the RCP [where indicated on the drawings][____]. [Recess][Semi-recess][Surface-mount] the enclosure with the top of the cabinet 6 feet above the finished floor or center the cabinet at [5][___] feet, whichever is lower. Conductor terminations shall be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection shall be permanently mounted in the RCP.

M. Extinguishing System Saving/Disconnect Switch: Connect the positive and negative conductors of the Class B solenoid/actuator/electric release head circuitry in series to a lock switch. Provide and install the switch in an enclosure inside the facility. A clearly visible sign on the enclosure, or immediately adjacent, is to explicitly indicate its purpose as "FIRE EXTINGUISHING SYSTEM SAFING SWITCH".

N. Operating Instructions: Submit operating instructions for clean agent fire extinguishing systems consisting of raised or embossed white letter on red rigid plastic or enameled steel background and of adequate size to permit them to be easily read. Provide operating instructions at each remote control station. Instructions are to clearly indicate necessary steps for the operating of the system. Submit three copies of the Operation and Maintenance manuals 30 days prior to testing the clean agent fire extinguishing systems. Update and resubmit data for final approval no later than 30 days prior to contract completion.

O. Field Painting: Touch-up paint is to match equipment manufacturer’s original paint.
3.2 WARNING SIGNS

A. Provide three-layer red-white-red micarta engraved to show white letters on a red background, warning signs. Letters are to be uppercase. Warning signs are to be 1/8-inch thick with beveled edges.

B. Inside Control Room: Permanently affix a sign adjacent to every audible/visual alarm activated due to agent discharge reading:

WARNING

THIS SPACE IS PROTECTED BY A NOVEC 1230 CLEAN AGENT EXTINGUISHING SYSTEM. DO NOT ENTER WITHOUT AUTHORIZATION DURING OR AFTER DISCHARGE. THIS STROBE INDICATES DISCHARGE.

C. Manual Activation of Release Station: Place a sign at every locations where manual operation of the system may occur reading:

WARNING

ACTUATION OF THIS DEVICE WILL CAUSE FIRE EXTINGUISHING GAS TO DISCHARGE. BEFORE ACTUATING, ENSURE THAT PERSONNEL ARE CLEAR OF THE AREA.

3.3 FIELD QUALITY CONTROL

A. After the system installation has been completed, the entire system shall be checked out, inspected and functionally tested by qualified, trained personnel, in accordance with the manufacturer's recommended procedures and NFPA standards in the presence of SRP.

B. Test Procedure: At least 14 days [___] prior to functional testing, the installing contractor shall submit a Test Plan describing the procedures to be used to test the control system(s). The Test Plan shall include a step-by-step description of all tests to be performed and shall indicate the type and location of test apparatus to be employed. The tests shall demonstrate that the operational and installation requirements of this specification section have been met. All tests shall be conducted in the presence of the SRP Representative and shall not be conducted until the Test Plan has been approved by SRP.

C. Experienced technicians regularly employed by the contractor in the installation of the system and manufacturer's representative referred to elsewhere in this section shall conduct the testing.

3.4 PRELIMINARY TESTS

A. Visual Inspection: Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals of Fire Alarm Systems" chapter.

B. Room Pressurization Test: After all construction is complete, conduct a room pressurization test in accordance with NFPA 2001 in each clean agent extinguishing system hazard area. Test shall conform enclosure's ability to retain the agent concentration level for the required hold time. If the test fails, the extinguishing system contractor shall coordinate room sealing with the general contractor. Additional tests shall be conducted until successful test results are achieved. Include final test results with the final record drawings.
1. A room pressurization test shall be conducted, in each protected space, to determine the presence of openings, which would affect the agent system concentration levels. The test(s) shall be conducted using the Retro-Tec Corp. Door Fan system, or equivalent, with integrated computer program. All testing shall be in accordance with NFPA 2001.

2. If room pressurization testing indicates openings exist that would result in leakage and/or loss of clean agent fire extinguishing agent, the installing contractor shall be responsible for coordinating the proper sealing of the protected space(s) by the general contractor or his subcontractor or agent. The general contractor shall be responsible for adequately sealing all protected space(s) against agent loss or leakage. The installing contractor shall inspect all work to ascertain that the protected space(s) have been adequately and properly sealed. THE CLEAN AGENT FIRE EXTINGUISHING SYSTEM INSTALLING CONTRACTOR SHALL BE RESPONSIBLE FOR THE SUCCESS OF THE ROOM PRESSURIZATION TESTS. If the first room pressurization test is not successful, in accordance with this specification section, the installing contractor shall inform the general contractor to determine and correct the cause of the test failure. If, after inspection of the additional sealing performed, the installing contractor is satisfied that the protected space is ready for retesting, the installing contractor shall conduct additional room pressurization tests, at no additional cost, until a successful test is obtained. Copies of successful test results shall be submitted to the SRP Representative.

C. Operational Test: After electrical circuitry has been energized, apply power to control panel and confirm proper unit operation. Comply with "Test Methods" table in "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72. Test and adjust controls and safeties.

D. Clean Agent Fire Extinguishing Systems Test: Using nitrogen or other inert gas, perform a flow test on the piping network to verify that flow is continuous and unobstructed through piping and nozzles.

E. Pressure/Leak Test: Pneumatically test the piping in a closed circuit for a period of 10 minutes at 40 psi. At the end of 10 minutes, the pressure drop shall not exceed 20 percent of the test pressure. Repair leaks and retest until no leaks exist.

F. Test and Inspection Reports: Factory authorized service representative shall prepare the "Fire Alarm System Record of Completion" and the "Inspection and Testing" documents from NFPA 72.

3.5 FINAL TESTS

A. The system will be considered ready for acceptance testing only after the following have been accomplished:

1. Preliminary tests have been made and deficiencies corrected.

2. Testing reports have been submitted and approved.

B. Final acceptance testing shall be coordinated and performed by the contractor, in the presence of SRP. In order to assure attendance of the necessary representatives, each representative scheduled to witness the test shall be provided a minimum of 5 working days’ notification of the proposed test date by the contractor. The test shall not be conducted until all parties agree on the scheduled test date. The contractor shall provide all the necessary personnel and equipment to conduct the tests.

C. The final acceptance test shall repeat 100 percent of preliminary tests.

D. If the Final Acceptance Test fails, the contractor shall pay all costs incurred to SRP for any and all retesting.
E. Upon satisfactory completion of the tests, the contractor shall leave the system in proper working order.

F. Warranty: Except as otherwise expressly provided in the contract documents, and excepting only items of routine maintenance, ordinary wear and tear or unusual abuse or neglect, contractor guarantees all work executed by the contractor and all supplies, materials, and devices of whatsoever nature incorporated in, or attached with the work, or otherwise delivered to SRP as part of the work pursuant to the contract to be absolutely free of all defects of workmanship and materials for a period of 2 years after final acceptance of the work by SRP. Include service directory with telephone numbers for 24-hour emergency service.

3.6 TRAINING

A. Instructor: Include in the project the services of an instructor, who has received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided. The instructor shall train the employees designated by SRP, in the care, adjustment, maintenance, and operation of the fire extinguishing system. Each instructor shall be thoroughly familiar with all parts of this installation. The instructor shall be trained in operating theory as well as in practical O&M work. Submit the instructor's information and qualifications including training history to SRP prior to training.

B. Required Instruction Time: Provide [4][8] hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as selected by SRP. The instruction may be divided into two or more periods at the discretion of SRP. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

END OF SECTION