**SECTION 13967**

**CLEAN-AGENT EXTINGUISHING SYSTEMS**

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## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes clean-agent extinguishing systems and the following:
   1. Piping and piping specialties.
   2. Extinguishing-agent containers.
   3. Extinguishing agent.
   4. Detection and alarm devices.
   5. Control and alarm panels.
   6. Accessories.
   7. Connection devices for and wiring between system components.
   8. Connection devices for power and integration into building's fire alarm system.

B. System concept drawings are included with this package for the building. These drawings only show locations where systems are to be installed. Design of the individual systems shall be in accordance with these specifications. CONTRACTOR is responsible for the detailed design and engineering for installation in accordance with these specifications. These specifications and drawings do not necessarily contain all information required for installation of the system, but are intended to be used as a guide for the purposes of designing the system and preparing bids. As such, they indicate:
   1. Requirements for fixed gaseous suppression system protection.
   2. Types and minimum installation criteria for system devices.
   3. Locations for system devices and equipment.
   4. . Minimum design requirements.

### 1.3 DEFINITIONS

A. ANSI: American National Standards Institute

B. ATS: Acceptance Testing Specifications.

C. ASME: American Society of Mechanical Engineers

D. AWS: American Welding Society

E. AWWA: American Water Works Association

F. EPO: Emergency Power Off.

G. FMG: Factory Mutual Global

H. NFPA: National Fire Protection Agency

I. NRTL: Nationally Recognized Testing Laboratory

J. UL: Underwriter's Laboratory

**1.4 REFERENCES**

A. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 300.

B. ANSI/ASME B16.9 - Factory Made Wrought Steel Buttwelding Fittings.

C. ANSI/ASME B31.1 - Power Piping.

D. ANSI/ASME SEC 9 - Welded and Brazing Qualifications.

E. ANSI/AWS D1.1 - Structural Welding Code.

F. ANSI/NFPA 2001 - Clean Agent Fire Extinguishing Systems.

G. ANSI/NFPA 70 - National Electric Code.

H. ANSI/NFPA 72A - Local Protective Signaling Systems.

I. ANSI/NFPA 72E - Automatic Fire Detectors.

J. ANS/NFPA 75 - Electronic Computer Systems.

K. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc coated, Welded and Seamless.

L. ASTM A106 - Seamless Carbon Steel Pipe for High-Temperature Service.

M. ASTM A197 - Cupola Malleable Iron.

N. ASTM 394 - Ductile Iron.

O. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

P. FM - Factory Mutual Approval Guide.

Q. NEMA - Enclosures for Industrial Controls and Systems.

R. UL - Fire Protection Equipment Directory.

S. Department of Transportation (DOT) Title 49 Code of Federal Regulations parts 100 to 199, transportation of hazardous materials.

T. Federal Communication Commission (FCC)

## 1.5 SYSTEM DESCRIPTION

A. Clean-agent fire-extinguishing system shall be an engineered system for total flooding of the hazard area including the room cavity below the ceiling and below the raised floor. Provide separate zones above and below the raised floor. If smoke is detected below the raised floor, agent shall be discharged in the underfloor zone only. If smoke is detected above the raised floor, agent shall be discharged in zones above and below the floor.

B. All work shall be performed in accordance with these specifications, including related division sections and drawings. The drawings indicate the areas to receive detection and fixed gaseous suppression systems. CONTRACTOR is to review all drawings so that all items affecting the operation of the fire detection/ suppression system (such as equipment location, air diffusers, damper closures, and door openings) are considered in the design of the engineered system.

## 1.6 PERFORMANCE REQUIREMENTS

A. Design clean-agent extinguishing system and obtain approval from authorities having jurisdiction. Design system for Class A and C fires as appropriate for areas being protected and include safety factor. Use clean agent indicated and in concentration suitable for normally occupied areas.
   1. Area 1- MIS computer equipment room.
   2. Area 2 – Surveillance equipment room.

B. Design of the total flooding system shall be performed by a currently certified NICET Engineering Technician Level II or greater in Fire Protection Engineering Technology, Special Hazards System layout.

C. Performance Requirements: Discharge agent within 10 seconds and maintain 7.1 percent concentration by volume at 70 deg F (21 deg C) for 10-minute holding time in hazard areas.
   1. HFC 227ea concentration in hazard areas greater than [9.0] <Insert percent> percent immediately after discharge or less than 5.8 percent throughout holding time will not be accepted without written authorization from Owner and authorities having jurisdiction.
   2. System Capabilities: Minimum 620-psig (4278-kPa) calculated working pressure and 360-psig (2484-kPa) initial charging pressure.

D. Verified Detection: Devices located in single zone. Sound alarm on activating single-detection device and discharge extinguishing agent on actuating second-detection device.

E. System Operating Sequence:

1. Activation of the system shall be via cross zoned smoke detection. The detectors shall be alternated throughout the protected areas with the system requiring two (2) detectors in alarm prior to automatic agent release.
   a. Activation of any single smoke detector in any detection zone shall:
      (i) Cause a first-stage alarm.
      (ii) Energize a lamp on the activated detector and control panel.
      (iii) Activate audible (bells) devices in the affected areas.
      (iv) Transmit a first-stage alarm to the building's fire alarm system.
   b. Activation of a second smoke detector shall:
      (i) Transmit a second-stage alarm signal to the building fire alarm panel.
      (ii) Cause a second-stage (pre-discharge) alarm to operate.
      (iii) Operate auxiliary contacts for air conditioning shutdowns and automatic dampers.
      (iv) Initiate a programmable time delay (agent release).
      (v) Activate audible and visual (horns and strobes) devices in the affected areas.
   c. Upon completion of the time delay, the system shall:
      (i) Cause a discharge alarm to be activated.
      (ii) Operate auxiliary contacts for emergency power off of all electrical equipment (excluding lighting and emergency circuits for life safety).
      (iii) Continue to activate visual and audible alarms.
      (iv) Energize control solenoid for agent cylinders releasing gaseous agent into the protected area.
      (v) Transmit a discharge signal to the building's fire alarm system.

G. System Operating Sequence: System shall be cross-zoned, air-sampling detectors and photoelectric detectors reporting to a fully programmable microprocessor-based control panel programmed to operate as follows:
   1. If one photoelectric detector and air-sampling detector reaches the third detection level (Fire 1), agent discharge will be initiated as described for the third detection level (Fire 1) below.
   2. Air-Sampling System:
      a. First Detection Level (Alert): Mild audible and visual indication on annunciator panel. Strobe lights flash slowly in the protected area.
      b. Second Detection Level (Action): Strong audible and visual indication on annunciator panel. Strobe lights flash rapidly in the protected area.
      c. Third Detection Level (Fire 1): Strong audible and visual indication on annunciator panel. Energize horn(s), bell(s), and strobe light(s) in the protected area and outside entry doors. Shut down air-conditioning and ventilating systems serving the protected area, and close doors in the protected area. Send signal to fire alarm system, initiate 30-second time delay for extinguishing-agent discharge, and discharge extinguishing agent. At agent discharge, terminate power to equipment in the protected area, and release preaction valve to allow water flow to sprinkler system.
      d. Fourth Detection Level (Fire 2): Same as Fire 1.

H. Double action manual stations shall immediately discharge extinguishing agent when activated and cause all audible/visual alarms to activate. In addition, activation shall cause immediate shunt drop of air handling equipment, dampers, and power circuits..

I. Abort stations shall, when operated, interrupt the discharge of the agent and emergency power-off functions. The abort stations shall be momentary devices (dead-man) requiring constant pressure to maintain contact closure. Manual Releasing Station activation shall override any abort station. Abort station operation shall be per IRI and FM guidelines.

J. An addressable monitor module shall be provided to monitor the suppression system through the building fire alarm.

K. The maintenance lock-out switch shall be used where it is desired to disable the fire suppression system during routine maintenance.

L. A fully-charged reserve agent supply shall consist of not less than 100 percent of and in addition to the primary agent supply required for system operation. The connected reserve agent supply shall be manifolded and piped to feed into the automatic system. The reserve supply will be actuated by manual operation only.

M. EPO: Will terminate power to protected equipment immediately on actuation.

N. Low-Agent Pressure Switch: Initiate trouble alarm if sensing less than set pressure.

O. Power Transfer Switch: Transfer from normal to stand-by power source.

P. Seismic Performance: Fire-suppression piping and containers shall be capable of withstanding the effects of earthquake motions determined according to the current International Building Code

## 1.7 SUBMITTALS

A. The following shall be submitted for approval prior to delivery of materials:
   1. Material and equipment information shall include manufacturer's catalog data sheet and technical data for each component or device used in the system. This shall include, but not be limited to, the following:
      a. Detectors
      b. Manual discharge switches
      c. Control panel
      d. Release devices
      e. Alarm devices
      f. Agent storage cylinders
      g. Mounting brackets
      h. Discharge nozzles
      i. Abort stations
      j. Piping isometrics

2. Computerized verification of flow calculations shall be submitted for the fixed gaseous suppression systems and shall include the following data as a minimum:
   a. Quantity of agent per nozzle
   b. Type of nozzle
   c. Pressure at nozzle (psi)
   d. Nozzle body nominal pipe size (inches)
   e. Number and size of cylinders
   f. Total agent
   g. Pipe size per pipe section
   h. Pipe schedule per pipe section
   i. Number, size and type of fitting per pipe section
   j. Actual length per pipe section (feet)
   k. Equivalent length per pipe section (feet)
   l. Discharge time (seconds)

B. Provide information outlining the warranty of each component or device used in the system.

C. Provide information detailing the operation and maintenance procedures that will be required of OWNER. This information shall explain any special knowledge or tools OWNER will be required to employ and all spare parts that should be readily available.

D. Provide drawings indicating locations, installation details and operation details of all equipment associated with the gaseous suppression system. Floor plans shall be provided showing equipment locations, piping, point-to-point wiring and other details as required. Floor plans shall be drawn to a scale of not less than 1/8"=1'-0". Elevations, cross sections and other details shall be drawn to a larger scale as required. Isometric piping layouts shall be provided with the shop drawings. In addition, point-to-point electrical layout drawings shall be provided.

E. Sequence of operation, electrical schematics and connection diagrams shall be provided to completely describe the operation of the suppression system controls.

F. Operation and Maintenance Manual.
   1. CONTRACTOR shall provide OWNER with a loose-leaf manual containing:
      a. A detailed description of the system.
      b. A detailed description of routine maintenance required or recommended or as would be provided under a maintenance contract including a maintenance schedule and detailed maintenance instructions for each type of device installed.
      c. Manufacturer's data sheets and installation manuals/instructions for all equipment installed.
      d. A list of recommended spare parts.
      e. Service directory which includes the main 24-hour emergency service number and at least three alternate numbers which are monitored on a 24-hour basis.
      f. Small scale (11 inches by 17 inches) Contractor record drawings of the system.

g. A detailed description of the operation of the system, including operator responses. The approved sequence of operation shall be placed in, or adjacent to, the operator's control panel.

h. A printout copy of all system programming, listing all addresses within the system (both active and spare), address functions, and program activities of control relays.

2. Prior to acceptance of the work by OWNER, Operation and Maintenance manuals shall be delivered to OWNER.

G. Contractor Record Drawings.

1. CONTRACTOR shall provide and maintain on the site an up-to-date record set of approved shop drawing prints which shall be marked to show each and every change made to the system from the original approved engineering drawings.

2. Upon completion of the work, the record set of prints shall be used to prepare complete, accurate final record drawings reflecting any and all changes and deviations made to the system. Final record drawings and calculations shall be prepared for final submittal to OWNER and Clark County Fire Department.

3. Upon completion of the work, record drawings shall be submitted to OWNER for review. These drawings shall be an updated set of the approved drawings in a record drawing format as required by these specifications.

4. Upon review of the blueline record drawings before final approval, two (2) sets of As-built final record drawings shall be delivered to OWNER for delivery to OWNER.

5. CONTRACTOR record drawings are required to identify quantities of junction boxes, spare conductors, splices, device backboxes, terminal strips and all other system components as installed.

6. As-built drawings shall show final system program messages, descriptors and program information.

H. Test Record.

1. The date and time of each test.

2. A reference set of Contractor record drawings, numerically identifying the individual components and circuits tested, test locations, and indicating the measured sound level recorded during alarm conditions.

3. A description of each test performed.

4. A checklist of each device and circuit tested, indicating the results of each test.

5. The names and signatures of the individuals conducting and witnessing each test.

6. System certification and documentation of system testing by CONTRACTOR shall be submitted to OWNER for review and approval at least 14 calendar days prior to the final acceptance test.

7. Certification shall be on the forms required by Clark County Fire Department, NFPA 13, 72, and 2001 transmitted under the letterhead of CONTRACTOR.

I. Training Manuals.

1. CONTRACTOR shall submit a proposed training agenda for OWNER's review. The final, approved training agenda shall be submitted 14 days prior to the final system acceptance test.

2. Provide each operator with complete, printed operating instruction and subsystem description in manual or handbook form.

J. Special Tools.
1. CONTRACTOR shall supply, as a part of the contract, three complete sets of any special tools or keys necessary for normal operation and maintenance of the system.

K. System Program.
1. No later than 30 calendar days prior to expiration of the warranty period, CONTRACTOR shall deliver to OWNER a copy of the entire final system program in suitable diskette format.

## 1.8 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of clean-agent extinguishing systems that are similar to those indicated for this Project in material, design, and extent.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of clean-agent extinguishing systems and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Installer: The installer shall be trained and certified by the manufacturer to design, install, test and maintain the clean agent fire suppression systems and maintain required licensing for Clark County and the State of Nevada. Installer shall have at least five years experience installing this type of work.

## 1.9 REGULATORY REQUIREMENTS

A. Contractors shall hold all required licenses, permits and certification from the manufacturer, Clark County and the State of Nevada to perform this work and shall have at least five years of installing systems of this type.

B. Referenced Standards: All work shall conform to the applicable portions of the following standards, and form a part of this specification to the extent indicated by the reference (latest edition):
1. National Fire Protection Association (NFPA) Standards:

a. NFPA 13, Standard for the Installation of Sprinkler Systems
b. NFPA 2001, Standard for the Installation of Clean Agent Fire Extinguishing Systems
c. NFPA 70, National Electrical Code
d. NFPA 72, National Fire Alarm Code

2. Factory Mutual Systems (FM) Publications and Factory Mutual Approval Guide.
3. Underwriters Laboratories, Inc. (UL) Publication and Fire Protection Equipment Directory with quarterly supplements.
4. Title 24, Americans with Disabilities Act
5. National Electrical Manufacturers Association (NEMA) Publication, Enclosures for Industrial Controls and Systems.
6. Industrial Risk Insurers Interpretive Guide (Detection & Controls)
7. Environmental Protection Agency, Protection of Stratospheric Ozone
8. Requirements of the Clark County Building and Fire Departments.

C. CONTRACTOR shall be responsible for filing of all documents, paying all fees and securing all permits, inspections, and approvals necessary for conducting this work. Upon receipt of approved permits from the local officials, CONTRACTOR shall immediately forward copies to OWNER.

D. All equipment and devices used shall be listed in the UL Fire Protection Equipment and Factory Mutual Approved Guide.

### 1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.
1. Detection Devices: Not less than 20 percent of amount of each type installed.
2. Container Valves: Not less than 10 percent of amount of each size and type installed.
3. Nozzles: Not less than 20 percent of amount of each type installed.
4. Extinguishing Agent: Not less than 100 percent of amount installed in largest hazard area. Include pressure-rated containers with valves.

## PART 2 - PRODUCTS

### 2.1 GENERAL

A. Materials and equipment shall be of a single manufacturer (INERGEN, FM 200, or equal). The name of the manufacturer and the serial numbers shall appear on all major components. All components shall be approved by Clark County Fire Department and OWNER.

B. All equipment and devices used shall be listed in both the UL Fire Equipment Directory and the Factory Mutual Approval Guide.

### 2.2 GENERAL MATERIALS - ELECTRICAL

A. All electrical enclosures, raceways and conduits shall be provided and installed in accordance with applicable codes and intended use and contain only those electrical circuits associated with the fire detection and control system and shall not contain any circuit that is unrelated to the system.

B. Unless specifically provided otherwise in each case, all conductors shall be enclosed in rigid or thin wall steel conduit, as conditions dictate.

C. Any conduit or raceway exposed to weather or other similar conditions shall be properly sealed and installed to prevent damage. Provisions for draining and drying shall be employed.

D. NEMA rating and electrically hazardous classifications shall be observed and any equipment or materials installed must meet or exceed the requirements of service.

E. Any wiring shall be of the proper size to conduct the circuit current but shall not be smaller than #18 AWG unless otherwise specified for a given purpose. Wire that has scrapes, nicks, gouges or crushed insulation shall not be used. The use of aluminum wire is strictly prohibited.

F. Wire splices shall be made with appropriate devices suited for the purpose.

G. All wire terminations shall be made with crimp terminals unless the device at the termination is designed for bare wire terminations.

H. White colored wire shall be used exclusively for the identification of the neutral conductor of an alternating current circuit.

I. Green colored wire shall be used exclusively for the identification of the earth ground conductor of an AC or DC circuit.

J. Splicing of circuits shall be kept to a minimum and is only to be located in an electrical device suited for the purpose.

K. Wire spliced together shall have the same color insulation.

L. All electrical circuits shall be numerically tagged with suitable devices at the terminating point and/or splice. All circuit numbers shall correspond with the installation drawings.

M. Except as otherwise noted, the use of colored wires is encouraged but not required.

## 2.3 CONTROL SYSTEMS - GENERAL

A. All control systems shall be UL Listed or FM approved and be utilized with listed or approved compatible operating devices and shall be capable of providing the following features:

1. Ground fault indication

2. Supervised detection circuit(s)
3. Supervised alarm circuit(s)
4. Supervised release circuit(s)
5. Supervised manual release station circuit (if applicable)
6. Supervised primary power circuit
7. Alarm overrides trouble logic
8. Battery standby
9. Front panel indicating lamps (LEDs)
10. Key lock steel enclosure
11. Programmable time delay
12. Programmable detection logic
13. Prioritized trouble logic
14. Microprocessor based logic

## 2.4 CONTROL PANEL

A. The Automatic Control Panel (ACP) shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, notification appliances, annunciators, and other system controlled devices.

B. System Capacity and General Operation.

1. The system shall include Form-C alarm and trouble relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include Class B (NFPA Style Y) programmable notification appliance circuits.

2. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the ACP.

3. The ACP shall provide the following features:

a. Drift Compensation to extend detector accuracy over life.
b. Sensitivity Test meeting requirements of NFPA 72.
c. Maintenance Alert to warn of excessive smoke detector dirt or dust accumulation.
d. Alarm Verification with verification counters.
e. PAS pre-signal, meeting NFPA 72 requirements.
f. Pre-alarm for advanced fire warning.
g. Cross Zoning with the capability of counting two detectors in alarm and two software zones in alarm.
h. March time and temporal coding options.
i. Walk Test with check for two detectors set to same address.

4. The ACP shall be capable of coding Notification circuits in March Time (120 PPM), and Temporal (NFPA 72) Code.

C. Display.

1. The display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.

2. The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.

3. The display shall provide an 80-character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide Light-Emitting-Diodes (LEDs), that will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, SIGNAL SILENCED, SUPERVISORY, and PRE-ALARM.

4. The display shall provide a key touch pad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.

5. The display shall include the following operator functions: SIGNAL SILENCE, RESET, DRILL, and ACKNOWLEDGE.

D. Signaling Line Circuit (SLC).

1. The SLC interface shall provide power to and communicate with intelligent detectors and modules. This shall be accomplished over a single SLC loop and shall be capable of NFPA 72 Style 4, Style 6, or Style 7 wiring.

2. The loop interface board shall receive analog information from all intelligent detectors that shall be processed to determine whether normal, alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

3. The detector software shall meet NFPA 72 requirements and be certified by UL as a calibrated sensitivity test instrument.

E. All interfaces and associated equipment are to be protected so they will not be affected by voltage surges or line transients consistent with UL standard 864.

F. Enclosures.

1. The control panel shall be housed in a UL listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

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

G. Power Supply.

1. The power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the ACP.

2. It shall provide a minimum of 5.0 amps of usable notification appliance power using a switching 24 VDC regulator. A minimum 3.0 amp notification expansion power supply shall be available for the requirements of UL 1971 and ADA devices.

3. It shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge.

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

H. Field Wiring Terminal Blocks.

1. For ease of service, all panel I/O wiring terminal blocks shall be the removable, plug-in type and have sufficient capacity for 18 to 12 AWG wire.

I. Operator Controls.

1. Acknowledge Switch:

a. Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition.
b. Depression of the acknowledge switch shall also silence all remote annunciator piezo sounders.

2. Signal Silence Switch: Activation of the signal silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards.

3. System Reset Switch: Activation of the system reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits to return to their normal condition.

4. Drill (Evacuate) Switch. The drill switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

J. Field Programming.

1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.

2. All field defined programs shall be stored in non-volatile memory.

3. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual on/off commands. A second (higher-level) is used for actual change of program information.

4. Program edit shall not interfere with normal operation and fire protection. If a fire condition is detected during programming operation, the system shall exit programming and perform fire protection functions as programmed.

5. A special program check function shall be provided to detect common operator errors.

K. Specific System Operations.

1. Smoke Detector Sensitivity Adjust: Means shall be provided for manually adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window.

2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The ACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

3. Point Disable: Any device in the system may be Enabled or Disabled through the system keypad.

4. System Status Reports: Upon command from a system operator, a status report will be generated and printed listing all system status.

5. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel and at the protected area. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level to assist in avoiding nuisance alarms.

L. Batteries.

1. Batteries shall be 12 volt, Gell-Cell type (two required).

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

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

## 2.5 ADDRESSABLE MANUAL RELEASE STATION

A. Addressable manual release station shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.

B. All operated stations shall have a positive, visual indication of operation and utilize a key-type reset.

C. Manual stations shall be metal with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front and both sides of the stations. Manual fire alarm stations shall be labeled “for agent release,” or similar.

D. Stations shall be suitable for surface mounting or semi-flush mounting.

E. Operation shall require two (2) actions.

F. Manual Release Stations shall be provided at each exit of the protected area and shall, when activated, cause total system release.

G. Manual stations shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.

## 2.6 SMOKE DETECTOR

A. Detectors shall be intelligent and addressable, and shall be connected to the release control panel addressable circuits.

B. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

C. Addressable smoke detectors shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions indicating that the detector is operational and in regular communication with the control panel. Both LEDs shall be placed into steady illumination by the control panel indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LEDs shall be optional through the system field

program. An output connection shall also be provided in the base to connect an external remote alarm LED.

D. Smoke detector sensitivity shall be set through the ACP and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.

E. Using software in the ACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.

F. The detectors shall be and shall include a separate twist-lock base with tamper-proof feature.

G. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.

H. Smoke detectors shall be installed at no more than 400 square feet (37 $m^2$) of coverage per detector. Each protected room or area shall be provided with a minimum of two detectors for cross-zoning purposes.

## 2.7 ADDRESSABLE DRY CONTACT MONITOR MODULE

A. Addressable monitor modules shall be provided to connect conventional alarm initiating devices to one of the ACP addressable loops.

B. The monitor module shall mount in a 4-inch square, 2-1/8" deep electrical box.

C. The IDC zone may be wired for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions indicating that the monitor module is operational and in regular communication with the control panel.

## 2.8 ABORT SWITCH

A. This switch shall be rated at 28 VDC @ 1.1 amp make/break or 6 amp continuous carry.

B. The terminal connections shall be of the screw type.

C. Abort stations shall be provided at each exit of the protected area.

D. This switch shall be a momentary contact "dead-man" type switch requiring constant pressure to transfer one set of contacts. Clear operating instructions shall be provided at the abort switch.

## 2.9 MAINTENANCE LOCK-OUT SWITCH

A. This switch shall be key operated allowing removal of the key in either the "Normal" or "Lock-Out" position. A red indicator lamp shall be included on the switch assembly to be illuminated when in the "Lock-Out" position. The control unit is to indicate a trouble condition when in the "Lock-Out" position.

B. The switch shall include one (1) set of normally open and one (1) set of normally closed contacts rated at 28 VDC @ 1.1 amp make/break or 6 amp continuous carry.

C. The terminal connections shall be of the screw type.

D. Maintenance lock-out switches shall be provided adjacent to the respective ACP.

## 2.10 NOTIFICATION APPLIANCES

A. Provide notification appliances within and immediately outside each protected area to indicate both a first-stage and second-stage alarm.

B. Fire alarm bells shall be provided both within and outside each protected area, adequately spaced for proper audible coverage to indicate a first-stage alarm.

1. Bells shall be a minimum 4-inch diameter, 24 VDC, capable of producing an alarm signal of not less than 85 dB at 10 feet. Bells shall be supervised by the appropriate notification appliance circuit.

2. Bells shall be listed to UL Standard 464.

C. Fire alarm horn/strobe combination units shall be provided both within and outside each protected area, adequately spaced for proper coverage to indicate a second-stage alarm.

1. Horns shall be 24 VDC, and capable of producing an alarm signal of not less than 85 dB at 10 feet. Horns shall be listed to UL Standard 464.

2. Strobes shall be a minimum 15 candela rating and listed to UL Standard 1971.

3. Horn/strobes shall be supervised by the appropriate notification appliance circuit.

D. Permanent engraved signs or identification on each device shall be provided to indicate its function.

## 2.11 SUPPRESSION SYSTEM

A. A total flooding fire suppression system shall be of the engineered, permanently piped, fixed nozzle type with all pertinent components.

B. All agent storage cylinders shall be centrally located as vertical, free-standing cylinders with wall and/or floor mounted retaining brackets. A common manifold shall be employed for multiple cylinders.

C. On multiple cylinder arrangements one cylinder shall be designated as the pilot cylinder and employ both the restorable electric and mechanical manual actuators. All remaining cylinders shall be pneumatically operated from the agent discharge of the pilot cylinder into the manifold.

D. Manifolded cylinders shall employ a flexible discharge hose to facilitate installation and system maintenance. Each cylinder on a manifold shall also include an agent check valve installed to the manifold inlet.

## 2.12 PIPE MATERIAL - SUPPRESSION SYSTEM

A. System piping shall be of non-combustible materials having physical and chemical characteristics such that its integrity under stress can be predicted with reliability.

B. As a minimum, piping materials shall be black steel pipe conforming to ASTM A-53A ERW or ASTM A-106A seamless.

C. Under no conditions shall ordinary cast iron pipe, steel pipe conforming to ASTM A-120 or ASTM A-53/A-120 be used.

D. As a minimum, fittings beyond the orifice union/nipple shall be black, 300 lb. class fittings conforming to ANSI B-16.3. Ordinary cast iron fittings shall not be used.

E. The system manifold up to the orifice union nipple must be constructed of Schedule 80 piping and 2000 lb. or 3000 lb. forged steel fittings. Distribution piping downstream of the orifice union must be a minimum of Schedule 40 with 300 lb. fittings.

F. All piping shall comply with NFPA 13, 2001 and Clark County Fire Department.

G. Piping shall be installed in accordance with good commercial practice and NFPA 13, securely supported with UL Listed hangers and arranged with close attention to the design layout since deviations may alter the design flow performance as calculated.

H. Piping shall be bracketed within 12" (.3 m) of all discharge nozzles.

I. All piping shall be reamed, blown clear and swabbed with appropriate solvent to remove mill varnish and cutting oils before assembly.

J. Multi-outlet fittings, other than tees, shall not be permitted.

K. Assembly of all joints shall conform to the appropriate standards. Threaded pipe joints shall utilize Teflon tape applied to the male threads only.

## 2.13 EXTINGUISHING AGENT

A. The agent shall be INERGEN, FM 200, or equal.

## 2.14 STORAGE CYLINDERS

A. Cylinder assemblies shall be of steel construction. Each cylinder shall be equipped with a pressure seat type valve and gauge. When the system's capacity exceeds 40 cylinders, a second pilot valve shall be provided and used for cylinder activation. Each valve shall be constructed of forged brass and shall attach to the cylinder providing a leak tight seal. Each valve shall also include a safety pressure relief device which provides relief at 3000-3360 PSI per CGA test methods.

B. Filling of the cylinder assembly shall be by an authorized systems distributor in conjunction with a factory authorized agent filling station. Initial filling and recharge shall be performed in accordance with the manufacturer's established procedures and shall not require replacement components for normal service.

## 2.15 VALVE ACTUATORS

A. Electric valve actuators shall be of brass construction and stackable design with swivel connections to allow removal of actuators for maintenance or testing.

B. Operation of actuators shall not require replacement of components. No electro-explosive devices may be used to actuate the valve assembly.

C. Electric actuators shall be the magnetic latch, continuous duty type for 24 VDC operation.

D. Actuation devices shall be UL listed and/or FM approved for use with the system.

## 2.16 DISCHARGE HOSE AND CHECK VALVE

A. When manifolding, all cylinder assemblies shall include a flexible discharge hose and check valve for connection to the manifold inlet.

B. All hose/check valves shall be UL listed and/or FM approved.

## 2.17 DISCHARGE NOZZLES

A. Discharge nozzles shall be of two-piece construction and sized to provide flow rates in accordance with system design flow calculations.

B. A nozzle inlet orifice plate shall be included. The orifice size shall be determined by the computerized UL listed flow calculation program.

C. Orifice(s) shall be machined in the nozzle body to provide a horizontal discharge pattern based upon the approved coverage arrangements.

D. Nozzles shall be permanently marked with the manufacturer's part number. The nozzles shall be threaded directly to the discharge piping without the use of special adapters.

E. Nozzles shall be UL listed and/or FM approved.

## 2.18 ORIFICE UNION/NIPPLE ASSEMBLIES

A. An orifice union/nipple shall be included in the manifold to reduce pressure in the downstream pipe network.

B. Orifice union/nipple assemblies shall be rated at 2000 lb. Class minimum.

C. Orifice union/nipple assemblies shall be permanently marked with the manufacturer's orifice code. The union orifice/nipple shall be threaded directly to the manifold piping without the use of special adapters.

D. Orifice union/nipple assemblies shall be UL Listed and/or FM approved.

## 2.19 WARRANTY

A. All system components furnished under this contract shall be guaranteed against defect in design, material and workmanship for the full warranty time which is standard with the manufacturer and/or supplier, but not less than one (1) year from the date of the system acceptance. In addition, the installing Contractor must guarantee the systems against false actuation or leakage due to faulty equipment, design or workmanship for a period of one (1) year from final acceptance. In the event of agent leakage or system discharge from any of the above condition, the installing Contractor shall completely recharge and recondition the system at no cost to OWNER.

## 2.20 EMERGENCY SERVICE

A. CONTRACTOR shall provide emergency repair service for the system at no cost to OWNER, within four hours of a request for such service by OWNER during the installation and guarantee periods. This service shall be provided on a 24-hours per day seven days per week basis.

B. CONTRACTOR shall respond to an emergency within 2 hours of receiving an emergency trouble call.

# PART 3 - EXECUTION

## 3.1 GENERAL

A. This installation shall be made in strict accordance with the specifications and applicable Codes and Standards, including all local requirements.

B. CONTRACTOR shall examine daily all areas in which the work will be performed on the day prior to beginning work. CONTRACTOR shall immediately report unsatisfactory working conditions to OWNER for resolution. CONTRACTOR shall not proceed with the work until all unsatisfactory working conditions have been corrected.

C. It shall be CONTRACTOR's responsibility to inspect the job site and become familiar with the conditions under which the work will be performed.

D. CONTRACTOR shall be responsible for prior coordination of all work.

## 3.2 INSTALLATION

A. All holes made by CONTRACTOR in any wall, ceiling or floor shall be patched by CONTRACTOR, restoring the walls, ceilings, and floors to their original condition, fire resistance and integrity. All work shall be done in accordance with the requirements of the specifications.

B. All piping and conduit shall be installed at a height so as not to obstruct any portion of a window, doorway, stairway or passageway and shall not interfere with the operation of any existing mechanical or electrical equipment.

C. Locations of all equipment, controls and system components are subject to the approval of OWNER.

D. CONTRACTOR is responsible for protecting smoke detectors during construction. These detectors shall be covered during construction. All such covers shall be removed upon completion of work.

E. Exposed conduit, raceways, junction boxes, and other associated items related to the conduit and piping network shall be provided with red bands every ten feet with junction box covers painted red and labeled as "FA" in white letters.

F. Devices, equipment and wiring installed in exterior locations shall be suitable for weatherproof applications.

## 3.3 SYSTEM TESTS

A. CONTRACTOR shall perform the following:
   1. Arrange for system inspection and testing by a manufacturer's certified representative.
   2. Ensure the system is installed in accordance with the manufacturer's recommendations, UL listings and Clark County requirements.
   3. Is in proper working order.

B. System Inspection.
   1. The completed installation shall be inspected by factory authorized and trained personnel. The inspection shall include a full operational test of all components per the equipment manufacturer's recommendations (including agent discharge).
   2. Inspection shall be performed in the presence of OWNER or the local authority having jurisdiction.
   3. All mechanical and electrical components shall be tested according to the manufacturer's recommended procedure to verify system integrity.
   4. Inspection shall include a complete checkout of the detection/control system and certification of cylinder pressure. A written report shall be filed with OWNER.

C. Acceptance Tests Control System.
   1. Upon completion of the installation phase, CONTRACTOR shall perform and document system tests as required by Clark County Fire Department, NFPA 72 and 2001, and OWNER. All acceptance tests shall be performed in the presence of OWNER.
      a. All conductors, including shielding conductors, shall be tested for continuity, shorts to ground and shorts between pairs.
      b. All indicating devices have been functionally tested.
      c. All supervisory functions of each indicating device circuit shall be functionally tested.
      d. Receipt of all alarm and trouble signals, initiated during the course of the testing, shall be verified at the control panel.
      e. Correct labeling of all annunciation devices LED’s shall be verified.
   2. A functional test shall be completed prior to the concentration test consisting of detection, release, alarm, accessories related to the system, control unit and a review of the cylinders, piping, fittings, hangers and cylinder pressure.

D. Concentration Testing to the Actual Design Concentration of the agent.
   1. Concentration testing shall be performed under the supervision of CONTRACTOR's authorized personnel in the presence of OWNER, local authorities and any other insuring authority.
   2. Test procedures shall be as required by the equipment manufacturer.
   3. CONTRACTOR shall provide a gas analyzer capable of automatically recording sampling points. Concentration recording shall continue until authorities are satisfied with hazard integrity or until 10 minutes have elapsed.
   4. The sampling point(s) shall be located at a strategic area(s) but no higher than the highest combustible contents.
   5. If the test results indicate that the design concentration was not achieved and/or held, CONTRACTOR shall determine the cause of the failure. After determination of the cause, the system shall be recharged and again placed in operation. CONTRACTOR shall be responsible for re-testing.

E. Any additional tests required by the referenced codes, standards and criteria, and by OWNER, and authorities shall be performed.

F. Final Inspection and Tests.

1. CONTRACTOR shall make arrangements with OWNER and Clark County authorities for final inspection and witnessing of the final acceptance tests. OWNER along with the authorities will witness the final acceptance test. Separate tests for OWNER and authorities may be required and shall be arranged and provided by CONTRACTOR at no additional cost.
2. CONTRACTOR shall provide at least five (5) working days notice for all tests.

## 3.4 SPURIOUS ALARMS

A. If the system experiences spurious, or unexplained false alarms during the guarantee periods, CONTRACTOR shall be responsible for providing the necessary labor, material and technical expertise to correct the problem to the satisfaction of OWNER.

## 3.5 PROGRAMMING

A. CONTRACTOR shall provide all system programming, at no additional cost, required for the system. This shall include, but not be limited to, all necessary programming for proper operation in accordance with the specifications. Prior to final acceptance of the system, OWNER may require modifications to the system program for message descriptors. These changes shall be made at no additional cost.

## 3.6 TRAINING

A. Train not less than three OWNER staff, with personal on the job instruction provided by competent engineers representing the manufacturer.

B. CONTRACTOR shall provide three distinct training sessions, with minimum training time of 4 hours each. Sessions scheduled to suit requirements, shall be scheduled at the time of the final acceptance test and during the first six months of operations.

C. Certification of successful completion of training. If in the opinion of the training instructor, any personnel assigned are not qualified to be certified, the training instructor shall notify OWNER.

D. Training shall include all system operational functions needed. This shall include, but will not be limited to:
   1. Alarm acknowledgment.
   2. Interpretation of the scheme used to provide identifiers.
   3. System reset.
   4. Basic troubleshooting.
   5. Control system operation
   6. Trouble procedures
   7. Abort procedures
   8. Emergency procedures
   9. Safety requirements
   10. Demonstration of the system (excluding agent release)

E. The quantity of agent shall reflect the actual design quantity of suppression agent.

**END OF SECTION 13967**

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