

**SECTION 21 2200**  
**CLEAN-AGENT FIRE EXTINGUISHING SYSTEM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Total flooding extinguishing system for enclosed spaces.
- B. Fire detection system.
- C. Control and supervision systems.
- D. Extinguishing agent, containers, distribution and discharge system.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.
- B. Section 08 7100 - Door Hardware: Release hardware for automatic closing doors.
- C. Section 09 9123 - Interior Painting.
- D. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.
- E. Section 21 1300 - Fire Suppression Sprinklers.
- F. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- G. Section 23 0913 - Instrumentation and Control Devices for HVAC: Dampers.
- H. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.
- I. Section 28 3100 - Fire Detection and Alarm: Building fire alarm system and devices.

**1.03 REFERENCE STANDARDS**

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.
- B. ASME B31.1 - Power Piping; 2014.
- C. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.
- D. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.
- E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- F. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2014.
- G. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2009 (Reapproved 2014).
- H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.
- I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- J. FM (AG) - FM Approval Guide; current edition.
- K. ISO 9000 - ISO Standards Compendium: ISO 9000 - Quality management; 2005.
- L. ITS (DIR) - Directory of Listed Products; current edition.
- M. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (R2011).
- N. NFPA 72 - National Fire Alarm and Signaling Code; 2016.
- O. NFPA 2001 - Standard on Clean Agent Fire Extinguishing Systems; 2015.
- P. UL (DIR) - Online Certifications Directory; current listings at [database.ul.com](http://database.ul.com).
- Q. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

- R. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.
- S. UL 1076 - Proprietary Burglar Alarm Units and Systems; Current Edition, Including All Revisions.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week before starting work of this section.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: To bear stamp of approval of Authority Having Jurisdiction. Provide for each piece of equipment comprising the system including detectors, release devices, discharge nozzles, manual controls, alarm devices, annunciators, extinguishing agent containers, manifolds, and control panel.
- C. Shop Drawings: To bear stamp of approval of Authority Having Jurisdiction. Indicate detailed layout of system, including piping and location of each component. Include control diagrams, wiring diagrams, and written sequence of operation.
  - 1. Drawing Scale: 1/8 inch to 1 foot, minimum; use larger scale for details.
- D. Design Data: Submit design calculations bearing stamp of approval of Authority Having Jurisdiction. Include calculations that verify system pressures, nozzle flow rate, orifice code numbers, piping pressure losses, component flow data, and pipe sizes.
- E. Installer's Qualification Statement.
- F. Certificates: Certify that products meet or exceed specified requirements.
  - 1. Manufacturer: Certify that system meets or exceeds specified requirements.
  - 2. Welders: Submit certificate indicating compliance with ASME BPVC-IX and AWS D1.1/D1.1M.
- G. Manufacturer's Instructions: Include recommended equipment installation and system components.
- H. Test Reports: Indicate successful completion of tests; include certification of extinguishing agent container pressure and extinguishing agent quantity.
- I. Code Authority Approval: Submit copy of inspection approval of fire protection system by Authority Having Jurisdiction.
- J. Project Record Documents: Record actual locations of components and equipment, equipment identification markings, conduit and piping routing details, and agent container positions.
- K. Operation and Maintenance Data:
  - 1. Include electrical schematic written description of system design, drawings illustrating control logic and equipment locations, and technical brochures describing equipment.
  - 2. Include list of recommended spare parts.
  - 3. Include checklists and procedures for emergency situations, trouble shooting techniques, abort functions, system control panel operation, trouble procedures, and safety requirements.
- L. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### **1.06 QUALITY ASSURANCE**

- A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Michigan.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
  - 1. ISO 9000 registered.
- C. Welding Materials and Procedures: Conform to ASME BPVC-IX.

- D. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store equipment in shipping containers with labeling in place. Deliver fire extinguishing agent in approved containers.

### **1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

## **PART 2 PRODUCTS**

### **2.01 FIRE SUPPRESSION SYSTEM MANUFACTURERS**

- A. System Components Other Than Pipe, Piping Specialties, Conduit, Wiring, and Wiring Devices:
  - 1. ANSUL, a Tyco Business; using INERGEN extinguishing agent: [www.ansul.com](http://www.ansul.com).
  - 2. Chemetron Fire Systems, a UTC Company; FM-200: [www.chemetron.com](http://www.chemetron.com).
  - 3. Kidde Fire Systems, a UTC Company; ECS FM-200: [www.kiddefiresystems.com](http://www.kiddefiresystems.com).
  - 4. Pyro-Chem, a Tyco Fire Business; using FM 200 as extinguishing agent: [www.pyrochem.com](http://www.pyrochem.com).
- B. Controls and Control Panels:
  - 1. Chemetron Fire Systems, a UTC Company; Micro MLX: [www.chemetron.com](http://www.chemetron.com).
  - 2. Kidde Fire Systems, a UTC Company; ARIES NETLink: [www.kiddefiresystems.com](http://www.kiddefiresystems.com).
- C. Alarm and Detection Systems:
  - 1. Chemetron Fire Systems, a UTC Company; AIR-Intelligence: [www.chemetron.com](http://www.chemetron.com).
  - 2. Kidde Fire Systems, a UTC Company; AIR-Intelligence: [www.kiddefiresystems.com](http://www.kiddefiresystems.com).

### **2.02 APPLICATIONS**

- A. Computer Room: Location of devices:
  - 1. Smoke Detector: One at ceiling, and two below floor.
  - 2. Heat Detector: Two at ceiling.
  - 3. Abort Switch: Next to main entrance, left side.
  - 4. Manual Release: Next to main entrance, right side.
  - 5. Alarm Bell: Any suitable location.
  - 6. Alarm Horn: Not required.

### **2.03 FIRE SUPPRESSION SYSTEM**

- A. Fire Suppression System: Complete fire detection and suppression system that totally floods protected area with fire extinguishing agent to extinguish fire.
  - 1. Comply with NFPA 2001 and NFPA 72.
  - 2. Fire Extinguishing Agent: Any allowed by NFPA 2001.
  - 3. Locate extinguishing agent supply and backup supply in each protected area.
  - 4. Locate manual release stations at each exit from protected area.
  - 5. Locate abort stations at each exit from protected area.
  - 6. Provide all manufactured system components from a single source and by a single manufacturer.
  - 7. Provide components listed and labeled by ITS (DIR) or UL (DIR) for the type of system required and for use with the other components of the system.
- B. Design Criteria: Provide total flooding of fire extinguishing agent at manufacturer's recommended concentration by volume, in maximum discharge time of 10 seconds, for period of 10 minutes and with 10 percent allowance for room leakage.
  - 1. Direct discharge parallel to ceiling; use 360 degree pattern nozzles except where obstructions would make 360 distribution inefficient.
  - 2. Provide sufficient amount of fire extinguishing agent. Consider the following when computing volume:
    - a. Volume of protected area.
    - b. Specific volume of fire extinguishing agent.

- c. Additional quantities of fire extinguishing agent required to compensate for openings, pipe losses.
- d. Other special conditions affecting extinguishing agent concentration.

#### **2.04 PIPE AND PIPING SPECIALTIES**

- A. Steel Pipe: ASTM A53/A53M or ASTM A106/A106M Schedule 40, or ASTM A135/A135M Schedule 10, galvanized as specified in ASTM A53/A53M.
  - 1. Fittings: ASME B16.3 malleable iron class 300 for sizes 2 inch and smaller, or ASTM A234/A234M, wrought steel welding type fittings.
  - 2. Joints: Threaded, AWS D1.1/D1.1M welded, or grooved and shouldered pipe end couplings.
- B. Pipe Hangers: ASME B31.1, FM (AG) or UL (DIR) approved listing for sprinkler systems, split clamp up to 2-1/2 inch size, riser clamps over 2-1/2 inch size, adequate to offset discharge thrust.
- C. Escutcheons: Chrome plated pressed or stamped brass, one-piece or split pattern, minimum 2 inches larger than opening.
- D. Gages:
  - 1. ASME B40.100, UL 393, or UL 404 3-1/2 inch diameter cast aluminum case, phosphor bronze bourdon tube, rotary brass movement, brass socket, front re-calibration adjustment, black figures on white background, 1 percent mid-scale accuracy, scale calibrated in psi.

#### **2.05 EXTINGUISHING AGENT CONTAINERS**

- A. Containers:
  - 1. Where multiple, replaceable containers are used, provide only containers of the same size and holding the same amount of extinguishing agent.
- B. Contents: Fill with required fire extinguishing agent.
- C. Identification: Permanent plate or marking, specifying agent, tare and gross weight, pounds of fire extinguishing agent, and pressurization level; installed so plate or marking is visible and readable.
- D. Safety Release: Equip with frangible disc safety device that operates when internal pressure exceeds 730 pounds per square inch.
- E. Safety Release: Equip with frangible disc safety device.
- F. Valves: Heavy duty forged brass, with safety pressure relief device, manual control, discharge valve, and pressure gage.
  - 1. Pressure relief device activated at between 3000 to 3360 pounds per square inch.
  - 2. Provide a solenoid pilot valve for each container or each bank of containers.
- G. Actuator: Resettable electric or pneumatic with pressurized nitrogen cartridge. Explosive devices are NOT permitted.
- H. Pressure Gage: Visual indicator of internal pressure.
- I. Low Pressure Switch: Electronic sensor; reports to control panel and provides audible and visual alarms when container pressure drops below 230 pounds per square inch.
- J. Manifold: Provide for systems with more than one container, with rack to secure each and check valves between each discharge and manifold.
- K. Wall Bracket: Manufacturer's standard; UL (DIR) listed, welded steel construction, modular design with saddle bottom and front bracket.

#### **2.06 MANUAL STATIONS**

- A. Manual Release Station: Semi-flush housing fitted with double action control fitted with "push in" tab and "pull down" lever that locks in position after releasing spring-loaded contact switch, for mounting on electrical outlet box; addressable using manufacturer's standard monitor module.

1. Activate all audible and visual alarms.
  2. Override any abort station or time delay function.
  3. Activate all release and shutdown functions normally triggered by detectors or alarm system.
  4. Locate engraved label adjacent to each manual release station indicating area protected and that actuation will cause discharge of fire extinguishing agent.
- B. Manual System Abort Switch: Stainless steel plate with momentary contact push button, countdown timer, magnetic door holders manual release, for mounting on electrical outlet box; addressable using manufacturer's standard monitor module.
1. Locate engraved label adjacent to each manual abort station, indicating area protected and that actuation will prevent discharge of fire extinguishing agent after automatic system is activated.

## 2.07 DETECTORS

- A. Ionization Smoke Detectors: UL (DIR) listed, NFPA 72, adjustable sensitivity, operating on ionization principle, activated by combustion products, plug-in, twist-lock unit easily removed from base.
1. Ionization chambers: Dual, one for fire detection and second for reference, stabilizing detector for changes in temperature, humidity, and pressure.
  2. Amplifier-Switching Circuit and Indicator Lamp: Solid state, two-wire, 24 volts. On alarm, unit shall lock and be reset at control panel.
  3. Adjustment: Manual for normal or high sensitivity, with sensitivity setting visible and requiring no special tools.
  4. Base Assembly: Twist-lock type with screw terminals, lamp to indicate alarm, security base lock, and relay contactor.
- B. Photoelectric Smoke Detectors: UL (DIR) listed, NFPA 72, adjustable sensitivity, with LED light source including photocell, activated by smoke, plug-in, twist-lock unit easily removed from base.
1. Amplifier-Switching Circuit and Indicator Lamp: Solid state, two-wire operating on detector line voltage. On alarm, unit shall lock and be reset at control panel.
  2. Adjustment: Manual for normal or high sensitivity, with sensitivity setting visible and requiring no special tools.
  3. Base Assembly: Twist-lock type with screw terminals, lamp to indicate alarm, security base lock, and relay contactor.

## 2.08 DISCHARGE NOZZLES

- A. Nozzles: UL (DIR) listed; orifice size providing required rates of discharge and coverage and to distribute extinguishing agent uniformly throughout protected area.
- B. Construction: Two-piece chrome plated brass or aluminum nozzle with textured finish with female pipe thread integral on body; one-piece deflector plate.
- C. Orifice Union Nipple Assemblies:
1. Construction: Manufacturer's standard, UL (DIR) listed.
  2. Identification: Permanently marked with manufacturer's part number and UL (DIR) listing or FM (AG) approval.
  3. Rating: 2000 pounds.
- D. Identification: Permanently mark nozzles with manufacturer's part number, UL listing and equivalent single orifice diameter.

## 2.09 CONTROLS AND CONTROL PANEL

- A. Controls: Combination type approved as both alarm and releasing device, with solid state internal circuitry enclosed in NEMA ICS 6, Type 1 cabinet.
- B. Provide supervision to NFPA 72, Class A of following circuits for wire break or ground faults:
1. Zone detection loops.
  2. Suppression system solenoid valves.

3. Power supply and circuit wiring and fuse.
  4. Battery interconnecting wires and fuse.
  5. Alarm in abort mode.
- C. Conceal control switches and indicators, with exception of Power On, Master Trouble, Supervisory Trouble, Circuit 1 Alarm, Circuit 2 Alarm and Release Indicators.
- D. Equip panel with following standard features:
1. Visual and audible annunciation of trouble or alarm signals.
  2. Panel reset switch.
  3. Trouble alarm silence switch with ring back feature.
  4. Battery test meter and switch.
  5. Manual discharge switch.
  6. Deadman abort switch.
  7. Programmable timers for pre-discharge and discharge, 0 to 60 second cycle.
  8. Isolated relay contactors for external alarm or equipment and ventilation shutdown.
  9. Relay contactors for general trouble signal.
  10. Relay contactor activated by detector zone board in alarm or trouble mode.
  11. Drift compensation.
  12. Sensitivity test complying with NFPA 72, Chapter 5.
  13. Maintenance alert feature.
  14. System status report to display or printer.
  15. Alarm verification with verification counter.
  16. Presignal complying with NFPA 72 3-8.3.
  17. Rapid (less than 2 seconds) manual station reporting.
  18. Non-alarm points for general control.
  19. Periodic, programmed detector self-test program software.
  20. Pre-alarm advanced fire warning feature.
  21. Detection: Capability of counting two detectors in alarm, two software zones in alarm or one smoke and one thermal detector in alarm.
  22. March time and temporal coding.
  23. Walk test with check for two detectors set to same address.
  24. UL 1076 Security Monitor Points.
  25. Control-by-time feature for non-fire operations with holiday schedule.
  26. Automatic day or night adjustment of detector sensitivity.
  27. Detector blink control for sleeping areas.
- E. Annunciation: Provide the following annunciation:
1. Power On: Green.
  2. System Trouble: Amber.
  3. Battery Trouble: Amber.
  4. Ground Fault: Amber.
  5. Release trouble: Amber.
  6. Agent Release: Red.
  7. Alarm Output Trouble: Amber.
  8. Supervisory Trouble: Amber.
- F. Batteries: Provide nickel cadmium batteries and charger for continuous operation of detection, alarm, actuation and supervision functions for 24 hours. Provide automatic battery switch-over upon failure of primary power supply.

## **2.10 MISCELLANEOUS EQUIPMENT**

- A. Mounting Height: Mount miscellaneous equipment listed above 80 inches above floor or 72 inches, whichever is lower.
- B. Alarm Bells: 24 volts, with supervision of circuit wiring, of modular design, red baked enamel finish, with minimum sound level of 84 dba at 10 feet, for mounting on 4 inch electrical outlet box.

- C. Alarm Horns: 24 volts, with supervision of circuit wiring, with minimum sound level of 90 dba at 10 feet, for mounting on 4 inch electrical outlet box.
- D. Strobe Beacon: Manufacturer's standard design, 24 volts, with system identification on strobe lens.

## **2.11 OPERATING SEQUENCE**

- A. Actuation of one detector in either zone circuit:
  - 1. Illuminate zone indicator.
  - 2. Energize alarm bell.
  - 3. Shut down air-conditioning system and close dampers.
  - 4. Close doors to area.
  - 5. Signal building fire alarm system.
- B. Actuation of second detector on second zone circuit:
  - 1. Illuminate zone indicator.
  - 2. Energize alarm horn.
  - 3. Shut down power to protected equipment.
  - 4. Actuate time delay for up to 30 seconds.
  - 5. Release extinguishing agent into protected area.
  - 6. If abort switch is engaged, delay release.
  - 7. Upon abort switch disengagement release extinguishing agent unless system cleared and reset.
- C. Discharge of Extinguishing Agent:
  - 1. Sounds alarm bells and horns.
  - 2. Operates strobes.
- D. Temperature Detection:
  - 1. Lower Temperature: Illuminate indicator and energize bell.
  - 2. Higher Temperature: Shut down power to protected equipment.
- E. High Temperature Detection: Close circuit to sprinkler pre-action valve.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that enclosing walls are continuous above ceilings and below raised floors to enable required concentration to be built up and maintained for required time to ensure fire is extinguished.

### **3.02 INSTALLATION**

- A. Install in accordance with standards referenced in PART 2 of this section (the referenced standards) and NFPA 2001.
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe. Remove scale and dirt on inside and outside before assembly. Blow out pipe before nozzles or discharge devices are installed.
- C. Route piping in orderly manner, concealed, plumb and parallel to building structure, and maintain gradient. Install piping to conserve building space, and not interfere with use of space and other work.
- D. Securely support piping in accordance with ASME B31.1 with allowance for fire extinguishing agent thrust forces, and thermal expansion and contraction.
- E. Use grooved mechanical couplings and fasteners only in accessible locations. Roll groove piping only.
- F. Install unions downstream of valves and at equipment or apparatus connections.
- G. Prepare pipe, fittings, supports, and accessories for finish painting, in accordance with Section 09 9123.

- H. Identify in accordance with requirements of referenced standard.
  1. Place directional arrows and system labels wherever piping changes direction and minimum 20 feet on straight runs.
  2. Refer to Section 21 0553.
- I. Containers: Mount and anchor as indicated on drawings.
- J. In rooms with suspended ceiling tiles, clip or retain tiles within 4 foot radius of the nozzles to prevent lifting during discharge.
- K. Install wiring in accordance with Section 26 2717 requirements.
- L. Make final connections between equipment and system wiring under direct supervision of factory trained representative of manufacturer.
- M. Install engraved plastic instruction plate, detailing emergency procedures, at control panel and at each manual discharge and abort switch location. At control panel identify control logic units, contacts, and major circuits with permanent nameplates.
- N. At hazard area walls pack space between pipe, pipe sleeve or surface penetration with mineral fiber with elastomer calk to depth of 1/2 inch. Provide escutcheons where exposed piping passes through walls, floors, and ceilings. Seal pipe penetrations of fire separations. Refer to Section 07 8400.
- O. Locate discharge nozzle approximately 6 inches above or below ceiling and 6 inches below raised floors. Avoid interference with other piping and equipment.
- P. Locate remote manual releases at one or more doors to protect area where indicated. Locate deadman abort switch adjacent.
- Q. Locate strobe units at all points of entrance to protected area.
- R. Locate abort station at all points of exit from protected area.

### **3.03 INTERFACE WITH OTHER PRODUCTS**

- A. Provide interlock with automatic closing door releases. Refer to Section 08 7100.
- B. Integrate system with pre-action sprinkler system. Refer to Section 21 1300.
- C. Provide signal to building fire alarm system. Refer to Section 28 3100.

### **3.04 FIELD QUALITY CONTROL**

- A. Manufacturer Services: Provide experienced manufacturer's field engineer to supervise installation and performance testing of the system.
- B. Perform field inspection and testing in accordance with Section 01 4000.
- C. Test distribution piping and valving, prior to nozzle installation, to 50 psi air pressure test. Inspect joints using soap water solution or halide torch or lamp. Repair leaks and retest. Maintain test pressure for four hours.
- D. Upon completion of installation provide final checkout inspection by factory trained representative of manufacturer to ascertain proper system operation. Leave system in a fully commissioned and automatic readiness state with circuitry energized and supervised.
- E. Test circuits including automatic discharge, manual discharge, equipment shut-down, alarm devices, and storage container pressure. Test supervision of each circuit.
- F. Check each ionization detector with a sensitivity meter, adjust. Record sensitivity, and include record in test report.
- G. Submit original copies of tests, indicating that factory trained technical representatives of the manufacturer have inspected and tested systems and are satisfied with methods of installation, connections and operation.
- H. Pressure test entire enclosure with test fan, pressurizing protected area both under positive and negative conditions. Confirm that leakage is within system design allowance.



### **3.05 DEMONSTRATION AND INSTRUCTIONS**

- A. Demonstrate that components, except discharge assemblies, are functioning properly and in conjunction with controls system.
- B. Submit integrated step-by-step test procedure for approval 30 days prior to start of demonstration.
  - 1. Arrange meeting prior to demonstration with representatives of Owner, Owner's underwriter, and the installer.
  - 2. Perform visual inspection and overall review of system installed.
  - 3. Place minimum of three UL-listed recording analyzers in space. Provide certification that testing devices have been checked by recognized testing authority within two weeks of date of demonstration.
  - 4. Certify that replacement charge can be provided within 24 hours of demonstration.
- C. Discharge system using manual-release switch mounted on control panel. Run discharge test with compressed nitrogen at 360 psi. After discharge, check for complete pressure release.
- D. After satisfactory completion of discharge test, fill agent containers with amount of fire extinguishing agent specified in design calculations.

**END OF SECTION 21 2200**

