A circular professional engineer seal for the State of South Carolina. The outer ring contains the text "SOUTH CAROLINA" at the top and "LICENSED PROFESSIONAL ENGINEER" at the bottom, separated by small vertical lines. In the center, the text "No. 31913" is printed. Below the number, there is a blue ink signature that reads "Charles Thane Joyce". At the very bottom of the seal, the name "CHARLES THANE JOYCE" is printed in a semi-circle.

20 Jan 2020

SECTION 21 13 13

WET PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Provide labor, material (including hardware), equipment and supervision to design and install automatic water-based wet pipe fire sprinkler systems.
 - 2. Include joining, cutting, patching, freight, engineering, fees, and appurtenances for a fully automatic system.
- B. Prepare sprinkler system shop drawings in accordance with the design documents and applicable codes and standards.
- C. System Description: The wet pipe system includes, but is not limited to:
 - 1. Water supply
 - 2. Wet pipe system valve(s)
 - 3. Hydraulically designed piping system
 - 4. Automatic sprinklers
 - 5. Piping supports and bracing
 - 6. Pipe identification systems

1.2 DEFINITIONS AND ABBREVIATIONS

AHJ	Authority Having Jurisdiction
AWWA	American Water Works Association
FM	Factory Mutual/ FM Global
FPE	Fire Protection Engineer
IAW	In Accordance With
IBC	International Building Code
IFC	International Fire Code
NFPA	National Fire Protection Association
NICET	National Institute for Certification in Engineering Technologies

PIV	Post Indicator Valve
UL	Underwriters Laboratories Inc.

1.3 QUALITY ASSURANCE

- A. Comply with the adopted Codes and Standards as listed on the drawings.
- B. Ensure layout drawings for fire protection systems are prepared by or under the supervision of a NICET Fire Protection Engineering Technician, Level 3 or 4, subfield of Water Based System Layout in accordance with State licensing laws.
- C. Pay for and obtain approvals, permits, and required inspections.
- D. Provide UL listed and FM Approved materials and equipment in compliance with applicable NFPA standards, owner and AHJ requirements. Submit documentation that the specific items furnished under this section for this Project conform to such requirements.

1.4 DESIGN CRITERIA

- A. Design and install fire protection systems in accordance with the applicable Codes and Standards referenced in the project documents. See Fire Protection drawing J-FP001.
- B. Submit hydraulic calculations to verify the design criteria can be met for the hydraulically designed system(s).
- C. Base hydraulic calculations upon water flow tests conducted and recorded at a point close to the tie-in point for the proposed system or as noted on the design drawings.
- D. Design drawings are provided by JACOBS to assist in conveying the fire protection scope of work. Layout of the fire protection system(s) is the Contractor's responsibility and requires verifying existing conditions, obtaining dimensions and discipline design information in order to develop the system layouts. The contractor shall notify the engineer of any serious omissions in the drawings or specifications.
- E. Seismic Design Category (SDC) is D. Seismic bracing is required for this project.

1.5 SUBMITTALS

- A. Refer to the Submittal Schedule at the end of Part 3 for a list of submittal requirements for this Section.
- B. For new or modified systems, working (shop) drawings and calculations must be prepared by an individual that has obtained National Institute for Certification in Engineering Technologies, Automatic Sprinkler Systems, Level III certification.
- C. Shop drawing packages are expected to be legible and shall include design drawings, electrical diagrams, battery calculations, pump data, water supply data, hydraulic

calculations, product data, details and calculations as necessary to convey and represent the system being installed IAW 2016 NFPA 13 CH 22.

- D. Product data sheets need to clearly and specifically indicate which model number of the component is being proposed.
- E. The contractor is expected to review his own shop drawings for completion and clarity before submitting to the engineer. Illegible and/or incomplete packages will be rejected.
- F. Shop Drawings shall include plan and elevation views demonstrating that the system will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:
 - 1. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.
 - 2. Floor plans drawn to a scale not less than 1/8" = 1'-0" which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement.
 - 3. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.
 - 4. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.
 - 5. Details of each type of riser assembly; pipe hanger, restraint of underground water main at point-of-entry into the building, and electrical devices.

PART 2 PRODUCTS

All components listed are referenced as an example for their particular category. Components deemed Equal To those listed may be submitted for approval.

2.1 ALARM SYSTEM

- A. Water flow alarm bell shown on drawings is to be provided, installed and wired by fire alarm vendor.
- B. Valve Tamper or Supervisory Switch:
 - 1. Provide for each manually operated valve single unit comprised of dual SPDT switches, 10 amps at 125/250 VAC, 2.5 amps at 24 VDC, in tamper-proof cover with mounting and required hardware for attachment to indicated valves.
 - 2. UL listed, FM approved.

3. System Sensor (Pittway) OSY2 for gate valve, PIBV2 for butterfly valves, or approved equals by ADT, United Electric, or Victaulic conforming to recommendations of valve manufacturer.
- C. Alarm Flow/Pressure Device:
1. Provide electrical alarm flow device as an accessory to each alarm check valve of the sprinkler system to detect water flow in the system. When water flow is detected, an electric audible alarm will be initiated via the fire alarm panel. Provide one flow device for each system riser. Wiring for devices will be by others.
Provide Potter Electric Type PS-10 electrical alarm flow device or approved equal. Provide device with two electrically independent, snap-acting switches, one capable of being wired “normally closed” and one capable of being “normally open”. Adjust both switches to actuate at the same time, on rising water pressure. Provide switch electrical rating of 15 amps, or greater, at 120V/240 Volts alternating current (VAC).

2.2 ABOVEGROUND PIPING SYSTEM MATERIALS AND VALVES

All components listed are referenced as an example for their particular category. Components deemed Equal To those listed may be submitted for approval.

- A. Pipe:
1. Listed and Approved for use in fire protection systems.
 2. Piping 2 inches and less in diameter; Schedule 40 black carbon steel, welded seam or seamless, ASTM A 53 or A135, threaded ends.
 3. Piping 2-1/2 inches and larger; Schedule 10 black carbon steel, welded seam or seamless, ASTM A 53 or A135, grooved ends.
 4. Do not use lightwall pipe, or Schedule 5 pipe.
- B. Pipe Fittings:
1. 2 Inches and Smaller: Listed and Approved, 150-psig malleable iron, ASTM A197, threaded, ASTM B16.3.
 2. 2-1/2 Inches and Larger: Listed and Approved, malleable iron grooved end fittings, Victaulic 10/11/12/18/19/25/29/100/110 or equal.
 3. Welded or segmented fittings are not acceptable.
 4. Plain-end fittings with mechanical couplings and fittings that use steel gripping devices to bite into the pipe shall not be used.
 5. Saddle tees using rubber gasket fittings are only permitted when connecting to existing piping for additions or modifications. Saddle tees must use a connection method that completely wraps around the pipe.
 6. Changes in pipe sizes must be made through tapered reducing fittings.
- C. Grooved Joint Couplings and Fittings:
1. Ductile or malleable iron conforming to ASTM A47/A47M, Grade 32510 or ASTM A536, Grade 65-45-12
 2. UL listed for fire protection service, with standard EPDM gaskets.
 3. Designed for not less than 175 psi.
 4. Galvanized if exposed outdoors.

5. Nuts and bolts shall be heat-treated steel conforming to ASTM A183 and shall be cadmium plated or zinc electroplated.
- D. Flanges:
1. Cast iron, NFPA 13 and AWWA C110, C111, C115, flat faced, flat faced.
 2. 250 psi water service rating, Class 125 dimensions and bolt pattern.
 3. Threaded or grooved as compatible with connecting pipe or fittings.
 4. Galvanized.
 5. For grooved type provide Victaulic 741 or equal.
- E. Bolts: ASTM A307 Grade B, galvanized, with galvanized nuts in accordance with ASTM A563 Grade A.
- F. Unions: 150 psig malleable iron, ASTM A197, threaded, ground joint, integral seat. Galvanized if exposed outdoors.
- G. Flange Gaskets: 1/8-inch full face synthetic rubber gaskets, Garlock 22 or PTFE/silica gaskets, Garlock 3500.
- H. Valves:
1. Wet Pipe Automatic System Valves: Alarm check valves, vertical variable pressure type, complete with water motor gong, trim, and drain fittings, by Viking, Tyco, or Reliable. Minimum working pressure rating of 175 psig. UL Listed, FM approved for fire protection service.
 2. Flanged end and wafer type valves shall be compatible for installation with flanges as specified.
 3. 2 Inches and Smaller:

<u>Gate</u> Kennedy 8067SS Nibco T-104-0	<u>Ball</u> Nibco KT-585-70-UL, KT-580-70-UL Victaulic 722
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Drain, Test
 ½”– Potter-Roemer 4119 with capped nipple on outlet
 1 ½”– Potter-Roemer 4120 with capped nipple on outlet
Hose, male hose thread outlet
 Angle pattern - Potter-Roemer 4060 with Potter Roemer 4615 chained outlet cap
 Straight pattern - Potter-Roemer 4110 with Potter Roemer 4615 chained outlet cap
 4. 2-1/2 Inches and Larger:

<u>OS&Y Gate</u> Kennedy 8068A Mueller R- 2360-6 Nibco F-607-RW Crane 467	<u>Swing Check</u> Kennedy 1126A Mueller A-2122-6 Nibco 908W Victaulic 717
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NRS Gate (for wall indicator post)

Kennedy 8561ASS
Mueller P-2360-6

Wafer Check

Marlin U12-HMP

Butterfly

Nibco LD-3510-4 (lug mounted)
Nibco GD-4765-A
Grinnell LD-8282-3-FP (lug mounted)
Victaulic 705,705W

Drain, Test

2 ½" - Potter-Roemer 4125 with capped nipple on outlet

Hose, male hose thread outlet

Angle pattern - Potter-Roemer 4065 with Potter Roemer 4625 chained outlet cap
Straight pattern - Potter-Roemer 4115 with Potter Roemer 4625 chained outlet cap

- I. Wall Indicator Post: Mueller A-20814, Kennedy 641, Nibco NIP-2AJ, or approved equal, UL listed, FM approved.
- J. Pipeline Strainer: Mueller Steam Specialty (Muessco) 911-U, or approved equal, UL listed, with 0.25 inch perforated stainless steel screen.

2.3 SPRINKLERS

- A. Provide style as noted on Drawings. Recessed chrome style pendent sprinklers: Tyco TY-FRB, QR, standard coverage with Style 15 chrome escutcheon or approved equal. Extended coverage sprinklers are permissible when installed according to their listing. For exposed construction utilize TYCO TY-FRB, QR, standard coverage upright or pendent to suit conditions or approved equal. Sprinklers installed below 7 ft. AFF shall be provided with cage style sprinkler guards. All sprinklers are rated for 155°F except as noted. Electrical rooms, IT rooms and HVAC mechanical room sprinklers are to be rated for 200°F.
- B. Spares:
 - 1. Furnish the minimum supply of required spare automatic sprinklers in accordance with NFPA 13.
 - 2. Provide sprinkler head box with spare sprinklers representative of and in proportion of the number of each type and temperature rating of the sprinklers installed.
 - 3. Furnish no fewer than two special sprinkler head wrenches, or at least one head wrench for each container or sprinkler box, whichever is greater.
- C. Provide sprinklers by Reliable, Viking, Tyco, or Globe.
- D. General:
 - 1. Install sprinklers on concealed piping above suspended ceiling with sprinklers installed in the pendent position, except in areas having no suspended ceiling

where sprinklers are to be installed on exposed piping. Provide upright or pendant sprinklers on exposed piping to suit conditions.

2. Verify clearances to obstructions such as lights, equipment, ductwork, piping and provide separation as required by Chapter 8 of NFPA 13. Coordination with other trades during the system layout/design phase is critical.

2.4 FIRE DEPARTMENT CONNECTIONS

- A. 2 1/2 inch fire hose stations (or connections) shall be 2 1/2 inch - 7 1/2 (male) National Hose (N.H.) with cap and chain on each connection.
- B. Wall-Mounted Fire Department Inlet Connection: Potter-Roemer 5751-D or approved equal, 4 x 2 1/2 x 2 1/2 , with double clappers and caps with retaining chains on inlets. Include plate lettered "AUTO. SPKR."

2.5 BACKFLOW PREVENTER

- A. Provide system backflow preventer IAW requirements of SCDHEC as referenced by Monks Corner Public Works.

PART 3 EXECUTION

3.1 PREPARATION

- A. Take possession of material and debris resulting from the excavation and removal work and remove such material from the site IAW owner requirements.
- B. Perform excavation, removal, and disposal in a workmanlike manner.

3.2 INSTALLATION

- A. Install system components as indicated on Drawings and in accordance with NFPA 13.
- B. Support, isolate, and brace sprinkler piping in accordance with NFPA 13.
- C. Electrical connections for devices specified in this Article and for other required devices, will be made in accordance with Division 26 of the Specifications.
- D. Clean and pressure test water piping systems in accordance with NFPA 13
- E. Install, test, and commission equipment and systems provided under this Section; execute such installation, testing, and commissioning within the Project schedule to allow Owner sufficient time to obtain required occupancy permits.
- F. Conduct tests upon completion of work in the presence of and for the approval of the Owner and Fire Department Inspector. Provide Owner minimum 24 hours advance notice.

- G. Coordinate installation and operation of equipment and piping systems to avoid interferences.
- H. Coordinate with other trades to ensure proper operational interfaces with other building systems.
- I. Install supervisory switches on manual valves as indicated on Drawings and as required by applicable codes and AHJ.
- J. Install inspector's test connection in accordance with NFPA 13.
- K. Provide sprinkler system pressure relief valve IAW NFPA 13.
- L. Low Point Drains:
 - 1. Install connection with valve having capped nipple on outlet at each aboveground low point in piping.
 - 2. Size of drain connection and drain valve shall be $\frac{3}{4}$ inch for line sizes $\frac{3}{4}$ inch through 2 inches, 1-1/2 inches for line sizes 2-1/2 inches through 4 inches, and 2 inch for line sizes 6 inches and larger unless noted otherwise.
 - 3. Coordinate locations of low point drains needing special access with general contractor and architect.
- M. Pipe Identification Systems:
 - 1. Provide pipe labels IAW ASME A13.1.
 - 2. Acceptable Manufacturers: Seton Name Plate Corp., W.H. Brady Co., or approved equal.
 - 3. Pipe labels shall read "Fire Protection" with white lettering on safety red background.
 - 4. Valve tags shall be 1-1/2 inches in diameter, 18-gauge brass or copper, complete with short brass attachment chain. Tags shall be stamped or engraved with an appropriate alphanumeric code (prefixed with the letter(s) "H," "P," or "FP," as appropriate).
 - 5. Valve charts shall be typewritten on white bond paper and shall be mounted in glass front frames. Valve charts shall be mounted in the fire riser room.
 - 6. Valve charts shall show the location and function of every tagged valve.

3.3 FIELD QUALITY CONTROL

- A. Installation: By an automatic sprinkler company licensed by the State or agency having jurisdiction over the location of this portion of Work, regularly engaged in the business and familiar with this type of work.
- B. Construct in a workmanlike manner as shown on the Drawings and as stated in the specifications. It is the intent to include the necessary details whether or not those are shown on the Drawings or included in the specifications.

- C. Owner or engineer will witness tests on the system (such as piping and operational tests) and inspect installed systems
- D. Determine exact locations of sprinkler system piping and components during the development of the working plans to avoid interference with other trades.
- E. Locate sprinklers in ceiling spaces in accordance with hazard requirements and additionally locate symmetrical with respect to lighting fixtures. For lay-in or tiled ceilings, locate sprinklers in center of tile.
- F. At completion of Work under this Section, furnish to Owner an original version (not photocopied) of NFPA 25. Receipt of this document by Owner is indicated on the Material and Test Certificate.
- G. At completion of Work under this Section and before turnover of completed systems to Owner, prepare and install design information placards for each water supply riser for each system in accordance with requirements of NFPA 13.
- H. Provide updated drawings (As-Builts) of the installed systems to the owner at turnover of system.
- I. Prior to final acceptance by Owner, demonstrate to Owner that complete sprinkler system is complete and operable.
- J. Post 1 copy of complete operator's instructions at each alarm-check valve.

3.4 FIELD SUPPORT

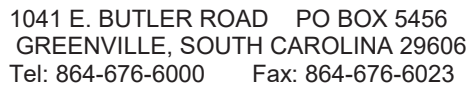
- A. Provide services of Contractor's technicians to train Owner's personnel at Project site in proper operation and maintenance of wet pipe systems and system components. Provide this training for not less than 4 hours per system (not including travel time) and at a time as stipulated by Owner.

3.5 SUBMITTAL SCHEDULE

ITEM NO.	SUBMITTAL REQUIREMENT	WITH BID	AS INDICATED
21 13 13-01	Schedule covering design and installation of entire fire protection system		Prior to delivery Per construction schedule
21 13 13-02	It shall be the responsibility of the fire protection contractor to deliver to Owner all design drawings, calculations, and specification for approval by Owner's insurance underwriter and the fire marshal prior to the start of any construction. One (1) copy of all "working drawings" for the installation must be reviewed and approved by insurance underwriter and fire marshal before any fabrication of materials is begun.		Prior to delivery Per construction schedule
21 13 13-03	Product data for pipe, system valves, pipe fittings, gaskets, valves, sprinkler heads, alarm devices, hydrants, indicator posts, and limit switches		Prior to delivery Per construction schedule
21 13 13-04	Design drawings, hydraulic calculations and component data sheets for system.		Prior to delivery Per construction schedule
21 13 13-05	Field Test Reports: Indicate and interpret test results for compliance with performance requirements.		Per construction schedule
21 13 13-06	Record Drawings: Indicate actual routing, fitting details, elevations, and installed accessories and devices.		With record documents
21 13 13-07	Written certification that systems are correctly installed and that all components of such systems are fully functional in accordance with the applicable governing NFPA standard and recommendations of manufacturers		Per construction schedule

ITEM NO.	SUBMITTAL REQUIREMENT	WITH BID	AS INDICATED
21 13 13-08	“Contractor’s Material and Test Certificate for Aboveground Piping” signed by witnessing parties, from and in accordance with NFPA 13		Per construction schedule
21 13 13-09	<p>Instructions, including catalog cuts, diagrams, drawings, and other descriptive data, covering proper testing, operation, and maintenance of system installed, and necessary information for ordering replacement parts.</p> <p>Include detailed instructions covering necessary and recommended testing, operating, and maintenance procedures to be followed by the using service maintenance personnel as directed by the Owner.</p> <p>Furnish NFPA 25 document to Owner.</p>		<p>With record documents</p> <p>With operations and maintenance manuals</p>

END OF SECTION

A circular professional engineer seal for the State of South Carolina. The outer ring contains the text "SOUTH CAROLINA" at the top and "LICENSED PROFESSIONAL ENGINEER" at the bottom, separated by small dots. In the center, the text "No. 31913" is displayed. Below the number is a blue ink signature that reads "Charles Thane Joyce". At the very bottom of the seal, the name "CHARLES THANE JOYCE" is printed in capital letters.

20 Jan 2020

SECTION 21 13 19

PREACTION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Provide labor, material (including hardware), equipment and supervision to design and install automatic water-based wet pipe fire sprinkler systems.
 - 2. Include joining, cutting, patching, freight, engineering, fees, and appurtenances for a fully automatic system.
- B. Prepare sprinkler system shop drawings in accordance with the design documents and applicable codes and standards.
- C. System Description: The preaction sprinkler system includes, but is not limited to:
 - 1. Water supply
 - 2. Preacton system valve(s)
 - 3. Hydraulically designed piping system
 - 4. Automatic sprinklers
 - 5. Piping supports and bracing
 - 6. Pipe identification systems
 - 7. Supervisory air compressor
 - 8. Smoke detection system, notification/annunciation devices and releasing panel is provided under the fire alarm scope of work.

1.2 DEFINITIONS AND ABBREVIATIONS

AHJ	Authority Having Jurisdiction
AWWA	American Water Works Association
FM	Factory Mutual/ FM Global
FPE	Fire Protection Engineer
IAW	In Accordance With
IBC	International Building Code
IFC	International Fire Code

NFPA	National Fire Protection Association
NICET	National Institute for Certification in Engineering Technologies
PIV	Post Indicator Valve
UL	Underwriters Laboratories Inc.

1.3 QUALITY ASSURANCE

- A. Comply with the adopted Codes and Standards as listed on the drawings.
- B. Ensure layout drawings for fire protection systems are prepared by or under the supervision of a NICET Fire Protection Engineering Technician, Level 3 or 4, subfield of Water Based System Layout in accordance with State licensing laws.
- C. Pay for and obtain approvals, permits, and required inspections.
- D. Provide UL listed and FM Approved materials and equipment in compliance with applicable NFPA standards, owner and AHJ requirements. Submit documentation that the specific items furnished under this section for this Project conform to such requirements.

1.4 DESIGN CRITERIA

- A. Design and install fire protection systems in accordance with the applicable Codes and Standards referenced in the project documents. See Fire Protection drawing J-FP001.
- B. Submit hydraulic calculations to verify the design criteria can be met for the hydraulically designed system(s).
- C. Base hydraulic calculations upon water flow tests conducted and recorded at a point close to the tie-in point for the proposed system or as noted on the design drawings.
- D. Design drawings are provided by JACOBS to assist in conveying the fire protection scope of work. Layout of the fire protection system(s) is the Contractor's responsibility and requires verifying existing conditions, obtaining dimensions and discipline design information in order to develop the system layouts. The contractor shall notify the engineer of any serious omissions in the drawings or specifications.
- E. Seismic Design Category (SDC) is D. Seismic bracing is required for this project.

1.5 SUBMITTALS

- A. Refer to the Submittal Schedule at the end of Part 3 for a list of submittal requirements for this Section.

- B. For new or modified systems, working (shop) drawings and calculations must be prepared by an individual that has obtained National Institute for Certification in Engineering Technologies, Automatic Sprinkler Systems, Level III certification.
- C. Shop drawing packages are expected to be legible and shall include design drawings, electrical diagrams, battery calculations, pump data, water supply data, hydraulic calculations, product data, details and calculations as necessary to convey and represent the system being installed IAW 2016 NFPA 13 CH 22.
- D. Product data sheets need to clearly and specifically indicate which model number of the component is being proposed.
- E. The contractor is expected to review his own shop drawings for completion and clarity before submitting to the engineer. Illegible and/or incomplete packages will be rejected.
- F. Shop Drawings shall include plan and elevation views demonstrating that the system will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:
 - 1. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.
 - 2. Floor plans drawn to a scale not less than $1/8" = 1'-0"$ which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement.
 - 3. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.
 - 4. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.
 - 5. Details of each type of riser assembly; pipe hanger, restraint of underground water main at point-of-entry into the building, and electrical devices.

PART 2 PRODUCTS

2.1 ALARM SYSTEM

- A. Water flow alarm bell shown on drawings is to be provided, installed and wired by fire alarm vendor.
- B. Valve Tamper or Supervisory Switch:
 - 1. Provide for each manually operated valve single unit comprised of dual SPDT switches, 10 amps at 125/250 VAC, 2.5 amps at 24 VDC, in tamper-proof cover with mounting and required hardware for attachment to indicated valves.
 - 2. UL listed, FM approved.

3. System Sensor (Pittway) OSY2 for gate valve, PIBV2 for butterfly valves, or approved equals by ADT, United Electric, or Victaulic conforming to recommendations of valve manufacturer.
- C. Alarm Flow/Pressure Device:
1. Provide electrical alarm flow device as an accessory to each alarm check valve of the sprinkler system to detect water flow in the system. When water flow is detected, an electric audible alarm will be initiated via the fire alarm panel. Provide one flow device for each system riser. Wiring for devices will be by others.
Provide Potter Electric Type PS-10 electrical alarm flow device or approved equal. Provide device with two electrically independent, snap-acting switches, one capable of being wired “normally closed” and one capable of being “normally open”. Adjust both switches to actuate at the same time, on rising water pressure. Provide switch electrical rating of 15 amps, or greater, at 120V/240 Volts alternating current (VAC).
- D. System Releasing Panel:
1. The system releasing panel is provided under the fire alarm scope of work.
- E. Smoke Detection System:
1. The smoke detection components, wiring, conduit and system programming are provided under the fire alarm scope of work.

2.2 ABOVEGROUND PIPING SYSTEM MATERIALS AND VALVES

- A. Pipe:
1. Listed and Approved for use in fire protection systems.
 2. Piping 2 inches and less in diameter; Schedule 40 black carbon steel, welded seam or seamless, ASTM A 53 or A135, threaded ends.
 3. Piping 2-1/2 inches and larger; Schedule 10 black carbon steel, welded seam or seamless, ASTM A 53 or A135, grooved ends.
 4. Do not use lightwall pipe, or Schedule 5 pipe.
 - 5.
- B. Pipe Fittings:
1. 2 Inches and Smaller: Listed and Approved, 150-psig malleable iron, ASTM A197, threaded, ASTM B16.3.
 2. 2-1/2 Inches and Larger: Listed and Approved, malleable iron grooved end fittings, Victaulic 10/11/12/18/19/25/29/100/110 or equal.
 3. Welded or segmented fittings are not acceptable.
 4. Plain-end fittings with mechanical couplings and fittings that use steel gripping devices to bite into the pipe shall not be used.
 5. Saddle tees using rubber gasket fittings are only permitted when connecting to existing piping for additions or modifications. Saddle tees must use a connection method that completely wraps around the pipe.
 6. Changes in pipe sizes must be made through tapered reducing fittings.
- C. Grooved Joint Couplings and Fittings:

1. Ductile or malleable iron conforming to ASTM A47/A47M, Grade 32510 or ASTM A536, Grade 65-45-12
 2. UL listed for fire protection service, with standard EPDM gaskets.
 3. Designed for not less than 175 psi.
 4. Galvanized if exposed outdoors.
 5. Nuts and bolts shall be heat-treated steel conforming to ASTM A183 and shall be cadmium plated or zinc electroplated.
- D. Flanges:
1. Cast iron, NFPA 13 and AWWA C110, C111, C115, flat faced, flat faced.
 2. 250 psi water service rating, Class 125 dimensions and bolt pattern.
 3. Threaded or grooved as compatible with connecting pipe or fittings.
 4. Galvanized.
 5. For grooved type provide Victaulic 741 or equal.
- E. Bolts: ASTM A307 grade B, galvanized, with galvanized nuts in accordance with ASTM A563 grade A.
- F. Unions: 150 psig galvanized malleable iron, ASTM A197, threaded, ground joint, integral seat.
- G. Flange Gaskets: 1/8-inch full face synthetic rubber gaskets, Garlock 22 or PTFE/silica gaskets, Garlock 3500.
- H. Valves:
1. Preaction System Valves:
 - a. Listed and Approved for preaction service, automatic quick opening diaphragm type with spring loaded floating clapper, complete with electric/pneumatic trim and drain fittings, by Viking, Tyco, or Reliable.
 - b. Provide each preaction valve with a manual operating means that is independent of electronic detectors and independent of sprinklers.
 - c. Furnish each preaction valve with two pressure gauges, one on the upstream side of the preaction valve and one on the downstream side. Range of each gauge shall be 0 pounds per square inch (psi) to 200 psi.
 - d. Select and include accessories and devices for double interlock operation, as required and specified.
 - e. Minimum working pressure of 200 psig. FM-approved for fire protection service. Flanged end and wafer type valves shall be compatible for installation with flanges as specified.
 2. Flanged end and wafer type valves shall be compatible for installation with flanges as specified.
 3. 2 Inches and Smaller:

<u>Gate</u> Kennedy 8067SS Nibco T-104-0	<u>Ball</u> Nibco KT-585-70-UL, KT-580-70-UL Victaulic 722
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Drain, Test
 ½"– Potter-Roemer 4119 with capped nipple on outlet

1 ½”– Potter-Roemer 4120 with capped nipple on outlet

Hose, male hose thread outlet

Angle pattern - Potter-Roemer 4060 with Potter Roemer 4615 chained outlet cap

Straight pattern - Potter-Roemer 4110 with Potter Roemer 4615 chained outlet cap

4. 2-1/2 Inches and Larger:

OS&Y Gate

Kennedy 8068A

Mueller R- 2360-6

Nibco F-607-RW

Crane 467

Swing Check

Kennedy 1126A

Mueller A-2122-6

Nibco 908W

Victaulic 717

NRS Gate (for wall indicator post)

Kennedy 8561ASS

Mueller P-2360-6

Wafer Check

Marlin U12-HMP

Butterfly

Nibco LD-3510-4 (lug mounted)

Nibco GD-4765-A

Grinnell LD-8282-3-FP (lug mounted)

Victaulic 705,705W

Drain, Test

2 ½”- Potter-Roemer 4125 with capped nipple on outlet

Hose, male hose thread outlet

Angle pattern - Potter-Roemer 4065 with Potter Roemer 4625 chained outlet cap

Straight pattern - Potter-Roemer 4115 with Potter Roemer 4625 chained outlet cap

- I. Wall Indicator Post: Mueller A-20814, Kennedy 641, Nibco NIP-2AJ, or approved equal, UL listed, FM approved.
- J. Pipeline Strainer: Mueller Steam Specialty (Muessco) 911-U, or approved equal, UL listed, with 0.25 inch perforated stainless steel screen.
- K. Air Compressor and Accessories for Each Preaction System:
 - 1. Air Compressor: Automatically controlled air compressor, 115/208/1/60, with prewired motor starter with overload protection and integral UL-listed control package, for maintaining supervisory air pressure in dry pipe systems. Verify required compressor capacity during system design and before procurement.
 - 2. Provide air compressor of sufficient capacity to restore proper air pressure in system within 30 minutes.
 - 3. Provide integral safety relief valve to prevent over-pressurizing of system piping.
 - 4. Provide trim, connections, gauges, and switches for proper operation with the system served by the air compressor.
 - 5. For each air compressor include UL-listed air maintenance device with unloader valve and low air pressure switch.
- L. Preaction System Supervision – Double Interlock System:

1. Provide automatic pneumatic supervision of sprinkler piping to ensure overall integrity of the system.
2. Configure supervision of the sprinkler piping to ensure that a closed piping system exists. "Normal" status will indicate that the system is leak-tight.
3. Design supervisory system so that preaction valve does not open until both of the following occur:
 - a. Low air pressure or drop in air pressure (sprinkler opening).
 - b. Two photoelectric detectors agree to fire condition.
4. Provide sensors to alarm and monitor the system air pressure and provide audible annunciation if a drop in air pressure is detected via the fire alarm system.

2.3 COMPRESSED AIR PIPING SYSTEM

- A. Piping: Type K copper tubing, ASTM B88.
- B. Fittings: Copper, ASME B16.22.
 Joints: Silver brazed, made with cadmium-free brazing material, Handy and Harman Sil-Fos 5, J.W. Harris Stay Silv 5, or Engelhard Silvaloy 5.

2.4 SPRINKLERS

- A. Provide style as noted on Drawings. Recessed chrome style pendent sprinklers: For exposed construction utilize TYCO TY-FRB, QR, standard coverage upright or approved equal. Sprinklers installed below 7 ft. AFF shall be provided with cage style sprinkler guards. All sprinklers are rated for 155°F).
- B. Spares:
 1. Furnish the minimum supply of required spare automatic sprinklers in accordance with NFPA 13.
 2. Provide sprinkler head box with spare sprinklers representative of and in proportion of the number of each type and temperature rating of the sprinklers installed.
 3. Furnish no fewer than two special sprinkler head wrenches, or at least one head wrench for each container or sprinkler box, whichever is greater.
- C. Provide sprinklers by Reliable, Viking, Tyco, or Globe.
- D. General:
 1. Install sprinklers on concealed piping above suspended ceiling with sprinklers installed in the pendent position, except in areas having no suspended ceiling where sprinklers are to be installed on exposed piping. Provide upright or pendant sprinklers on exposed piping to suit conditions.
 2. Verify clearances to obstructions such as lights, equipment, ductwork, piping and provide separation as required by Chapter 8 of NFPA 13. Coordination with other trades during the system layout/design phase is critical.

2.5 FIRE DEPARTMENT CONNECTIONS

- A. 2 1/2 inch fire hose stations (or connections) shall be 2 1/2 inch - 7 1/2 (male) National Hose (N.H.) with cap and chain on each connection.

- B. Wall-Mounted Fire Department Inlet Connection: Potter-Roemer 5751-D or approved equal, 4 x 2 ½ x 2 ½ , with double clappers and caps with retaining chains on inlets. Include plate lettered “AUTO. SPKR.”

PART 3 EXECUTION

3.1 PREPARATION

- A. Take possession of material and debris resulting from the excavation and removal work and remove such material from the site IAW owner requirements.
- B. Perform excavation, removal, and disposal in a workmanlike manner.

3.2 INSTALLATION

- A. Install system components as indicated on Drawings and in accordance with NFPA 13.
- B. Support, isolate, and brace sprinkler piping in accordance with NFPA 13.
- C. Electrical connections for devices specified in this Article and for other required devices, will be made in accordance with Division 26 of the Specifications.
- D. Clean and pressure test water piping systems in accordance with NFPA 13
- E. Install, test, and commission equipment and systems provided under this Section; execute such installation, testing, and commissioning within the Project schedule to allow Owner sufficient time to obtain required occupancy permits.
- F. Conduct tests upon completion of work in the presence of and for the approval of the Owner and Fire Department Inspector. Provide Owner minimum 24 hours advance notice.
- G. Coordinate installation and operation of equipment and piping systems to avoid interferences.
- H. Coordinate with other trades to ensure proper operational interfaces with other building systems.
- I. Install supervisory switches on manual valves as indicated on Drawings and as required by applicable codes and AHJ.
- J. Install inspector’s test connection in accordance with NFPA 13.
- K. Provide sprinkler system pressure relief valve IAW NFPA 13.
- L. Low Point Drains:
 - 1. Install connection with valve having capped nipple on outlet at each aboveground low point in piping.

2. Size of drain connection and drain valve shall be $\frac{3}{4}$ inch for line sizes $\frac{3}{4}$ inch through 2 inches, 1-1/2 inches for line sizes 2-1/2 inches through 4 inches, and 2 inch for line sizes 6 inches and larger unless noted otherwise.
3. Coordinate locations of low point drains needing special access with general contractor and architect.

M. Pipe Identification Systems:

1. Provide pipe labels IAW ASME A13.1.
2. Acceptable Manufacturers: Seton Name Plate Corp., W.H. Brady Co., or approved equal.
3. Pipe labels shall read "Fire Protection" with white lettering on safety red background.
4. Valve tags shall be 1-1/2 inches in diameter, 18-gauge brass or copper, complete with short brass attachment chain. Tags shall be stamped or engraved with an appropriate alphanumeric code (prefixed with the letter(s) "H," "P," or "FP," as appropriate).
5. Valve charts shall be typewritten on white bond paper and shall be mounted in glass front frames. Valve charts shall be mounted in the fire riser room.
6. Valve charts shall show the location and function of every tagged valve.

3.3 FIELD QUALITY CONTROL

- A. Installation: By an automatic sprinkler company licensed by the State or agency having jurisdiction over the location of this portion of Work, regularly engaged in the business and familiar with this type of work.
- B. Construct in a workmanlike manner as shown on the Drawings and as stated in the specifications. It is the intent to include the necessary details whether or not those are shown on the Drawings or included in the specifications.
- C. Owner or engineer will witness tests on the system (such as piping and operational tests) and inspect installed systems
- D. Determine exact locations of sprinkler system piping and components during the development of the working plans to avoid interference with other trades.
- E. Locate sprinklers in ceiling spaces in accordance with hazard requirements and additionally locate symmetrical with respect to lighting fixtures. For lay-in or tiled ceilings, locate sprinklers in center of tile.
- F. At completion of Work under this Section, furnish to Owner an original version (not photocopied) of NFPA 25. Receipt of this document by Owner is indicated on the Material and Test Certificate.

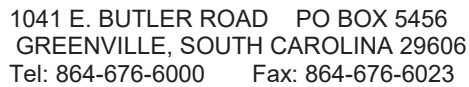
- G. At completion of Work under this Section and before turnover of completed systems to Owner, prepare and install design information placards for each water supply riser for each system in accordance with requirements of NFPA 13.
 - H. Provide updated drawings (As-Built) of the installed systems to the owner at turnover of system.
 - I. Prior to final acceptance by Owner, demonstrate to Owner that complete sprinkler system is complete and operable.
 - J. Post 1 copy of complete operator's instructions at each alarm-check valve.
- 3.4 FIELD SUPPORT
- A. Provide services of Contractor's technicians to train Owner's personnel at Project site in proper operation and maintenance of wet pipe systems and system components. Provide this training for not less than 4 hours per system (not including travel time) and at a time as stipulated by Owner.

3.5 SUBMITTAL SCHEDULE

ITEM NO.	SUBMITTAL REQUIREMENT	WITH BID	AS INDICATED
23 13 19-01	Schedule covering design and installation of entire fire protection system.		Prior to delivery Per construction schedule
23 13 19-02	It shall be the responsibility of the fire protection contractor to deliver to Owner all design drawings, calculations, and specification for approval by Owner's insurance underwriter and the fire marshal prior to the start of any construction. One (1) copy of all "working drawings" for the installation must be reviewed and approved by insurance underwriter and fire marshal before any fabrication of materials is begun.		Prior to delivery Per construction schedule
23 13 19-03	Product data for pipe, system valves, pipe fittings, gaskets, valves, sprinkler heads, alarm devices, air compressors, hydrants, indicator posts, and limit switches.		Prior to delivery Per construction schedule
23 13 19-04	Design drawings, hydraulic calculations and component data sheets for system.		Prior to delivery Per construction schedule
23 13 19-05	Field Test Reports: Indicate and interpret test results for compliance with performance requirements.		Per construction schedule
23 13 19-06	Record Drawings: Indicate actual routing, fitting details, elevations, and installed accessories and devices.		With record documents
23 13 19-07	Written certification that systems are correctly installed and that components of such systems are fully functional in accordance with the applicable governing NFPA standard and recommendations of manufacturers.		Per construction schedule
23 13 19-08	"Contractor's Material and Test Certificate for Aboveground Piping" signed by witnessing parties, from and in accordance with NFPA 13.		Per construction schedule

ITEM NO.	SUBMITTAL REQUIREMENT	WITH BID	AS INDICATED
23 13 19-9	<p>Instructions, including catalog cuts, diagrams, drawings, and other descriptive data, covering proper testing, operation, and maintenance of system installed, and necessary information for ordering replacement parts.</p> <p>Include detailed instructions covering necessary and recommended testing, operating, and maintenance procedures to be followed by the using service maintenance personnel as directed by the Owner.</p> <p>Furnish NFPA 25 document to Owner</p>		<p>With record documents</p> <p>With operations and maintenance manuals</p>

END OF SECTION

A circular professional engineer seal for the State of South Carolina. The outer ring contains the text "SOUTH CAROLINA" at the top and "LICENSED PROFESSIONAL ENGINEER" at the bottom. In the center, the number "No. 31913" is printed. Below the number, the name "CHARLES THANE JOYCE" is written in a stylized, cursive blue ink signature. The seal is surrounded by a border of small, evenly spaced vertical lines.

20 Jan 2020

SECTION 21 22 00

CLEAN AGENT FIRE SUPPRESSION SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. Design and install an engineered NOVEC 1230 total flooding, clean agent, fire suppression system for the 911 Call Center Rm. S107 including sub-floor and the Server Rm. S121.
- B. The scope of work is divided between the suppression contractor and fire alarm contractor. The suppression contractor will be responsible for the suppression side of the system which will include but not be limited to providing the suppression agent, agent storage cylinder, distribution piping, nozzles, hangers, supports, control valves, suppression system installation drawings, system calculations,
- C. Provide the services of a Certified Special Hazards Design Specialist (CSHDS) thoroughly experienced in Clean Agent Suppression System installations on site, to perform or directly supervise the installation, make all necessary adjustments, and perform all tests.
- D. A CSHDS is considered certified when the specialist holds a valid System Layout Certification, Level III Certification from the National Institute for Certification in Engineering Technologies (NICET) or is licensed by the State of South Carolina as a Contractor in accordance with state laws and statutes and/or holds a current Certificate of Competency where required by State law.
- E. Certification by other recognized agencies with equivalent requirements may be considered.
- F. Drawings: The contract drawings indicate the general arrangements of the areas designated as being protected by the clean agent system. Review all drawings so that all items affecting the operation of the fire detection/fire suppression system (such as equipment location, air diffusers, damper closures, and door openings) are considered in the design of the engineered system.
- G. Room detection, annunciation devices, abort switches and the releasing panel are being provided a part of the fire alarm scope of work. Coordinate system design, installation, testing and certification with the fire alarm contractor.

1.2 APPLICABLE STANDARDS AND PUBLICATIONS

- A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto (current adopted edition):
 - 1. National Fire Protection Association (NFPA) Standards:

NFPA 2001: Standard on Clean Agent Fire Extinguishing Systems
NFPA 70: National Electrical Code
NFPA 72: National Fire Alarm and Signaling Code

2. National Electrical Manufacturers Association (NEMA) Publication
3. Requirements of the Authority Having Jurisdiction (AHJ)
4. Manufacturer's Design, Installation, Operation and Maintenance Manual
5. The system components shall have the following applicable listings and approvals
 - a. Underwriters Laboratories Inc. (or equivalent)
 - b. FM Global

1.3 REQUIREMENTS

- A. The installation shall be in accordance with the drawings, specifications and applicable NFPA and other referenced Standards. All equipment and devices used shall be listed by the standardizing agencies (UL and/or FM).
- B. Design and installation of the fire detection/fire suppression system will be in accordance with the following guidelines and regulatory agencies:
 1. NFPA 2001 Standard on Clean Agent Fire Extinguishing Systems
 2. NFPA 72 National Fire Alarm and Signaling Code
 3. NFPA 70 National Electrical Code

1.4 GENERAL

- A. Furnish all engineering design and materials for a complete fire detection/fire suppression system including charged agent storage tank(s), nozzles, control panel, detection system, wiring, annunciators, alarm and all other equipment necessary for a complete operational system.
- B. Major System components shall be installed by a licensed contractor certified for the design, installation, and service of NOVEC 1230 fire suppression systems.
- C. Contractor shall, as a minimum, provide 24-hour emergency service, 7 days a week and shall be able to respond to an emergency situation within 2 hours of receiving an emergency trouble call.

1.5 SUBMITTAL

- A. Construction shop drawings and calculations must be prepared IAW NFPA 2001.
- B. The following shall be submitted for review and approval prior to delivery of materials:
 1. Material and equipment information shall include manufacturer's catalog cut sheet and technical data for each component or device used in the system with specific model number and other relevant data highlighted. This shall include, but not be limited to, the following:

- a. System release/control panel (by fire alarm contractor)
 - b. Detection system (by fire alarm contractor)
 - c. Manual actuation stations (by fire alarm contractor)
 - d. Release devices (by fire alarm contractor)
 - e. Alarm devices (by fire alarm contractor)
 - f. Agent storage cylinders
 - g. Mounting brackets
 - h. Discharge nozzles
 - i. Abort stations (by fire alarm contractor)
 - j. Piping isometrics, installation drawings
 - k. Flow calculations
- C. Provide information outlining the warranty of each component or device used in the system.
 - D. Provide information outlining the operation and maintenance procedures that will be required of the owner. This information shall explain any special knowledge or tools the owner will be required to employ and all spare parts that should be readily available.
 - E. Drawings shall indicate locations, installation details and operation details of all equipment associated with the clean agent 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 in. = 1 ft-0 in. 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.
 - F. Show a complete Riser Diagram with specific detail on connections to all monitor and control functions.
 - G. Testing plan that includes means, methods and schedules for interface testing with systems that will be interfaced to via monitor or control modules.
 - H. Sequence of operation, electrical schematics and connection diagrams shall be provided to completely describe the operation of the clean agent system controls.
 - I. Provide flow calculations per Section 4.2.

1.6 EXCLUSIONS

- A. The work listed below shall be provided by others, or under other sections of this specification:
 - 1. 120 VAC or 220 VAC power supply to the system control panel.
 - 2. Interlock components, wiring and conduit for shutdown of HVAC, dampers and/or electric power supplies, relays or shunt trip breakers
 - 3. Smoke detection system
 - 4. Abort Switches, Keyed override, notification and annunciation devices
 - 5. Releasing panel

- B. The contractor will coordinate needs with the other associated trades and will be responsible for providing a complete, compliant and functional system to the owner.

PART 2 – PRODUCTS

2.1 SYSTEM DESCRIPTION AND OPERATION

- A. The system shall be a total flood NOVEC 1230 Fire Suppression System.
- B. The system shall provide an agent minimum design concentration of 4.5% by volume for Class A hazards and a minimum of 5.85% by volume for Class B hazards in all areas and/or protected spaces, at the minimum anticipated temperature within the protected area. System design shall not exceed 10% for occupied spaces, adjusted for maximum space temperature anticipated, with provisions for room evacuation before agent release. Include volume of HVAC ductwork open to the rooms.
- C. HVAC INTERFACE:
For 911 Operator's Rm. S107, the HVAC unit will continue to operate. Dampers on the supply and return ductwork serving the room will close upon signal from the system releasing panel.
For Server Rm. S121, the HVAC unit will continue to run. The HVAC unit is a recirculating unit dedicated only to the Server Rm. A signal from the releasing panel will close the damper in the outside air duct.
- D. The system shall include all detection and control equipment, agent storage containers, NOVEC 1230 agent, discharge nozzles, pipe and fittings, manual release and abort stations, audible and visual alarm devices, auxiliary devices and controls, shutdowns, alarm interface, advisory signs, functional checkout and testing, training, and any other operations necessary for a functional UL listed Clean Agent suppression system.
- E. Provide two inspections during the first year of service: Inspections shall be made at 6-month intervals commencing when the system is first placed into normal service.
- F. Coordinate with the general contractor for sealing and securing the protected spaces against agent loss and/or leakage during the 10-minute "hold" period.
- G. The system(s) shall be actuated by local spot smoke detection.
- H. Room conditions are listed on drawing J-FP-001 under DESIGN CRITERIA.

2.2 SEQUENCE OF OPERATION

- A. Activation of first level (Pre-Alarm) smoke detection system shall:
 - 1. Illuminate the "ALARM" lamp on the releasing panel.
 - 2. Transmit a Supervisory signal to a fire alarm system panel.
 - 3. Energize a lamp on the activated detector and identify detector on the display of the control panel (and remote annunciator, if included).

Note:

The shutdown of HVAC equipment is not required for either room.

- B. Activation of a second smoke detection stage (Alarm Level 2) shall:
 - 1. Transmit an “ALARM” signal to the building fire alarm panel.
 - 2. Cause a second-stage (pre-discharge) Audio/Visual alarm to operate.
 - 3. Operate auxiliary contacts for HVAC system damper shutdown and closure of exhaust and/or outside air dampers.
 - 4. Initiate a programmable agent release time delay.
- C. Upon completion of the time delay the clean agent system shall:
 - 1. Cause a discharge alarm to be activated.
 - 2. Activate visual alarms (strobe) at protected area entrance.
 - 3. Energize control solenoid for agent cylinders releasing gaseous agent into the protected area.

2.3 AUXILIARY COMPONENTS

- A. Double action manual actuation stations shall be provided at each exit of the protected area and shall, when activated, immediately release the agent and cause all audible/visual alarms to activate. In addition, activation of the manual actuation stations shall cause immediate shutdown and closure of HVAC dampers.
- B. Abort stations shall be provided at each exit of the protected area and shall, when operated, interrupt the discharge of agent and emergency power-off functions. The abort stations shall be momentary devices (dead-man) requiring constant pressure to maintain contact closure.

Note: Manual actuation station activation shall override any abort station. Abort station operation shall be per NFPA 2001.

PART 3 – MATERIAL AND EQUIPMENT

3.1 GENERAL REQUIREMENTS

- A. Materials and equipment are preferred to be of a single manufacturer when possible and UL Listed and FM Approved for their intended function.
- B. The name of the manufacturer and the part/serial numbers shall appear on all major components.

3.2 GENERAL MATERIALS – ELECTRICAL

- A. All electrical enclosures, raceways and conduits shall be employed 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 steel conduit, rigid or thin wall 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/or drying shall be employed.
- D. NEMA rating and/or 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. Splicing of circuits shall be kept to a minimum and are only to be found in an electrical device suited for the purpose.
- G. Wire spliced together shall have the same color insulation.
- H. Wire splices shall be made with appropriate devices suited for the purpose.
- I. All wire terminations shall be made with crimp terminals unless the device at the termination is designed for bare wire terminations.
- J. 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.
- K. The use of colored wires is encouraged but not required unless dictated by state or local authorities.
- L. White-colored wire shall be used exclusively for the identification of the neutral conductor of an alternating current circuit.
- M. Green-colored wire shall be used exclusively for the identification of the earth ground conductor of an AC or DC circuit.

3.3 CONTROL SYSTEMS – GENERAL

- A. All control systems shall be UL Listed and FM approved and be utilized with listed or approved compatible operating devices and shall be capable of 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 pull circuit (if applicable)
 - 6. Supervised primary power circuit
 - 7. Battery backup
 - 8. LCD operator interface and LED indicating lamps
 - 9. Key lock steel enclosure
 - 10. Programmable time delay
 - 11. Programmable detection logic
 - 12. Microprocessor based logic

13. History buffer

3.4 CONTROL PANEL (by Fire Alarm contractor)

- A. The system control panel shall be Listed for use and suitable for supervising, annunciating and controlling the release of the clean agent. The panel shall contain a Central Processing Unit (CPU) with integral power supply which is suitably rated for “Special Application” appliances including suppression release peripherals such as horns, strobes and horn/strobes and rated to 6 amp for “regulated 24 VDC” appliance power. The CPU shall communicate with and control the following types of equipment used to make up the system: addressable and conventional initiating devices, addressable modules, annunciators, and other system-controlled devices. The releasing function may be incorporated into a Listed combined fire alarm control/releasing panel.
1. The control panel shall include battery standby power to support 24 hours in standby and 5 minutes in alarm.
 2. The control panel shall be microprocessor based, utilizing a distributed processing concept. A single microprocessor failure shall not impact operation of additional modules in the system.
 3. The control panel shall supply integrated power supply circuitry.
 4. Each control panel shall contain initiating circuits:
 - a. Each circuit shall be capable of Class A (Style D) or Class B (Style A) operation.
 - b. Each circuit shall be capable of operating up to 30 approved detectors per system.
 - c. Each circuit shall be capable of monitoring contact devices configured for manual release, manual alarm, system abort, trouble input or auxiliary (non-fire) input.
 5. Each control system shall contain release circuits for activation of a fire suppression system(s):
 - a. Each circuit shall be capable of Class B (Style Y) operation.
 - b. Each circuit shall be rated for a minimum of 1.5 amp @ 24 VDC.
 6. Each control system shall contain two indicating appliance circuits for annunciation:
 - a. Each circuit shall be capable of Class A (Style B) or Class B (Style Y) operation.
 - b. Each circuit shall be rated for a minimum of 1.5 amp @ 24 VDC.
 7. Each control panel shall be provided with an auxiliary power supply suitably rated per NFPA 2001/NFPA 72.
 8. Each control panel shall provide a suitable quantity of SPST relays for common alarm and for common trouble. Provide additional programmable relays for auxiliary equipment or system activations.
- B. 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.

- C. 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.
- D. The control panel shall have the ability to meet the latest requirements of UL 864 for delayed AC fail reporting.
- E. Power Supply:
 - 1. The power supply shall operate on 120 or 240 VAC, 50/60 Hz, and shall provide all necessary power for the control panel. The power supply shall have a 6 A output rating which provides current for special application devices, module currents and auxiliary output currents. When NACs are controlling regulated 24 DC appliances, total NAC current available shall be 3 A.
 - 2. Provide a battery charger using dual-rate charging techniques for fast battery recharge.
 - 3. Provide an earth detection circuit capable of detecting earth faults on I/O modules field wired circuits connected to power supply.
 - 4. The power supply shall be power-limited using Positive Temperature Coefficient (PTC) resistors and solid-state circuits.
- F. Field Wiring Terminal Blocks:
 - 1. For ease of service, all panel I/O wiring terminal blocks shall have sufficient capacity for 18 to 12 AWG wire.
- G. Field Programming:
 - 1. All programming shall be accomplished through a standard PC laptop.
 - 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. Three 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 third level (higher-level) is used for actual change of program information.
 - 4. A special program check function shall be provided to detect common operator errors.
 - 5. For flexibility, an off-line programming function with batch upload/download shall also be available.
- H. Specific System Operations:
 - 1. Smoke Detector Sensitivity Adjust: Means shall be provided for 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: Verification is implemented using zones with 512 zones available. The alarm verification delay shall be programmable from 5 to 30 seconds and each zone shall be able to be selected for verification. The control panel shall keep a count of the number of times that each zone 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. Point Read: The system shall be able to display or print the following point status diagnostic functions:
 - a. Device status.
 - b. Device type.
 - c. Custom device label.
 - d. View analog detector values.
 - e. Device zone assignments.
 - f. All program parameters.
 5. System Status Reports: Upon command from a system operator, a status report will be generated and printed listing all system status provided an optional RS232 card is installed. The report must also be exportable to a USB device on the Z-20 USB port
 6. System History Recording and Reporting: The control panel shall contain a history buffer that will be capable of storing up to 2000 events (1000 alarm and 1000 trouble). Each of these activations will be stored and time-and-date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, exported to a USB device or printed (if optional RS232 module is provided) in its entirety.
 7. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable.
 8. Automatic Detector Maintenance Alert: The control panel shall automatically interrogate each intelligent smoke detector and analyze the detector responses over a period of time.
 - a. If any intelligent smoke detector in the system responds with a reading that is below or above normal limits, the system will enter the trouble mode and the particular detector will be annunciated on the system display. This feature shall in no way inhibit the receipt of alarm conditions in the system nor shall it require any special hardware, special tools or computer expertise to perform.
 9. Pre-Alarm Function: The system shall provide 2 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. 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.
 10. Software Zones: The control panel shall provide 512 programmable software zones. All addressable devices may be field programmed to be grouped into these zones for control activation and annunciation purposes.
- I. Batteries:
1. Batteries shall be 12 volt (2 required).
 2. Batteries shall have sufficient capacity to power the system for not less than 24 hours upon 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.

3.5 PROGRAMMABLE ELECTRONIC SOUNDERS

- A. Electronic sounders shall be UL Listed or FM Approved and operate on 24 VDC nominal.

- B. Electronic sounders shall be field programmable without the use of special tools to choose 1 of 8 tones with an output sound level of at least 90 dBA measured at 10 ft (3.0 m) from the device.
- C. Electronic sounders shall be surface, flush or semi-flush mounted to suit conditions.

3.6 VISUAL NOTIFICATION APPLIANCES

- A. Strobe lights shall operate on 24 VDC nominal.
- B. Strobe lights shall meet the requirements of the ADA as defined in UL standard 1971 and shall meet the following criteria:
 - 1. The strobe intensity shall meet the requirements of UL 1971 and devices shall be multi-candela 15 cd – 110cd and higher intensity if required by the plans.
 - 2. The flash rate shall meet the requirements of UL 1971.
 - 3. The appliance shall be placed 80 in. (to the bottom of the appliance) to 96 in. (to the top of the appliance) above the finished floor within the space

3.7 AUDIBLE/VISUAL COMBINATION DEVICES

- A. Audible/visual combination devices shall meet the applicable requirements of Section 3.5 listed above for audibility.
- B. Audible/visual combination devices shall meet the requirements of Section 3.6 (listed above) for visibility.

3.8 ADDRESSABLE DEVICES – GENERAL

- A. Where used, addressable devices shall provide an address-setting means using dip switches.

3.9 ADDRESSABLE MANUAL ACTUATION STATION

- A. Where used, addressable manual actuation stations shall, on command from the control panel, send data to the panel representing the state of the manual switch. They 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 clearly visible operating instructions provided on the cover. The word AGENT shall appear on the front and both sides of the stations.
- D. Stations shall be suitable for surface mounting or semi-flush mounting and shall be installed not less than 42 in. (1.1 m), nor more than 48 in. (1.2 m) above the finished floor.
- E. Operation shall require 2 actions.

3.10 ADDRESSABLE DRY CONTACT MONITOR MODULE

- A. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the control panel SLC loops.
- B. The monitor module shall mount in a 4 in. (102 mm) square, 2 1/8 in. (54 mm) 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.
- D. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 in. x 1-1/4 in. x 1/2 in. (69.9 mm x 31.8 mm x 12.7 mm). This version need not include Style D or an LED.

3.11 ADDRESSABLE TWO-WIRE DETECTOR MONITOR MODULE

- A. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional two-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
- B. The two-wire monitor module shall mount in a 4 in. (102 mm) square, 2 1/8 in. (54 mm) deep electrical box or with an optional surface back box.
- C. The IDC zone may be wired for Class A or B (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.

3.12 ADDRESSABLE CONTROL MODULE

- A. Addressable control modules shall be provided to supervise and control the operation of one conventional Notification Appliance Circuit (NAC) of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.
- B. The control module shall mount in a standard 4 in. (102 mm) square, 2 1/8 in. (54 mm) deep electrical box, or to a surface mounted back box.
- C. The control module NAC circuit may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements and to ensure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
- D. Audio/visual power shall be provided by a separate supervised power loop from the main control panel or from a supervised, UL listed remote power supply.

- E. The control module shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. An LED shall be provided that shall flash under normal conditions indicating that the control module is operational and is in regular communication with the control panel.
- F. A magnetic test switch shall be provided to test the module without opening or shorting its NAC wiring.
- G. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

3.13 ISOLATOR MODULE

- A. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.
- B. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
- C. The isolator module shall not require any address-setting and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
- D. The isolator module shall mount in a standard 4 in. (102 mm) deep electrical box or in a surface mounted back box. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

3.14 ABORT SWITCH

- A. The abort switch shall be used where an investigative delay is desired between detection and actuation of the fire suppression system.
- B. 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.
- C. This switch shall be rated for 2 A resistive @ 30 VDC.
- D. The terminal connections shall be of the screw type.

3.15 SUPERVISORY SWITCH

- A. Low Pressure Alarm Switch: Provide the clean agent tanks with a low pressure alarm switch to warn of clean agent tank depressurization.

3.16 MAINTENANCE LOCK-OUT SWITCH

- A. The maintenance lock-out switch shall be used where it is desired to disable the fire suppression system during routine maintenance.
- B. This switch shall be key operated allowing removal of the key only in "Normal" 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 used to indicate a supervisory condition when in the "Lock-Out" position.
- C. The switch shall include 1 set of normally open and 1 set of normally closed control contacts rated for 2 A resistive @ 30 VDC.
- D. The terminal connections shall be of the screw type.

3.17 SELECTOR SWITCH

- A. The selector switch shall be used where a connected reserve is required.
- B. This switch shall be key operated allowing removal of the key in either the "Main" or "Reserve" position.
- C. This switch shall be rated at 28 VDC @ 1.1 amp make/break or 6-amp continuous carry.
- D. The terminal connections shall be of the screw type.

PART 4 – SYSTEM ARRANGEMENT

4.1 CLEAN AGENT FIRE SUPPRESSION SYSTEM

- A. The NOVEC 1230 fire suppression system shall be of the engineered, permanently piped, fixed nozzle type with all pertinent components.
- B. All agent storage tank(s) shall be vertical, free-standing with wall mounted retaining brackets. Where multiple cylinders are required for the same hazard, a common manifold shall be employed.
- C. On multiple cylinder arrangements (discharging into a common hazard), one cylinder shall be designated as the pilot cylinder and employ the restorable electric actuator, and mechanical manual actuator, or both. All remaining cylinders shall be pneumatically operated from the NOVEC 1230 agent.
- 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.

4.2 FLOW CALCULATIONS

- A. Computerized verification of flow calculations shall be submitted for each Clean Agent fire suppression system and include the following data as a minimum:
 - 1. Quantity of agent per nozzle
 - 2. Nozzle orifice diameters
 - 3. Pressure at nozzle (psi)
 - 4. Nozzle body nominal pipe size (inch)
 - 5. Number and size of cylinders
 - 6. Total agent
 - 7. Pipe size per pipe section
 - 8. Pipe schedule per pipe section
 - 9. Number, size and type of fitting per pipe section
 - 10. Actual length per pipe section (feet)
 - 11. Equivalent length per pipe section (feet)
 - 12. Discharge time (seconds)

PART 5 – EQUIPMENT AND MATERIAL (MECHANICAL)

5.1 PIPE MATERIAL – NOVEC 1230 SYSTEM

- A. System piping shall be in conformance with NFPA 2001. Provide only galvanized, ferrous piping, Schedule 40 manifolds and distribution piping materials conforming to ASTM A53/A53M, nonferrous drawn seamless copper tubing conforming to ASTM B88, and flexible metallic hose conforming to UL 536.
- B. Under no conditions shall ordinary cast iron pipe or fitting be utilized. Provide pipe and fittings having a minimum bursting pressure of 5,000 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 are to be used up through 3/4 inch ips. Use extra heavy malleable iron or ductile iron fittings through 2 inch ips. Use forged steel fittings in all sizes over 2 inches.
- C. As a minimum, fittings shall be black, 300 lb. class fittings conforming to ANSI B-16.3.
- D. Piping shall be installed in accordance with good commercial practice to the appropriate codes, 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.
- E. Piping shall be bracketed within 12 in. of all discharge nozzles.
- F. All piping shall be reamed, blown clear and swabbed with appropriate solvent to remove mill varnish and cutting oils before assembly.
- G. Pipe unions are acceptable.
- H. Reducing bushings are not permitted. Pipe size changes are to occur using reducing fittings only.

- I. Dead end pipe lines to be provided with a capped nipple, 2 in. long.
- J. Vertical drops on end of line are acceptable.
- K. Assembly of all joints shall conform to the appropriate standards. Threaded pipe joints shall utilize Teflon tape applied to the male threads only.
- L. The system shall be installed in accordance with requirements for Seismic Design Category "D".
- M. Piping shall be provided with a seismic separation assembly at the point where the pipe leaves the fire riser room and enters the Food Lion structure. An additional seismic separation assembly shall be provided where piping supported off the Food Lion structure enters the 911/EOC internal structural cap. Structural movement of 1" in any direction is anticipated during a seismic event. Provide adequate clearance around piping and fittings to accommodate potential movement.

5.2 EXTINGUISHING AGENT

- A. The fire suppression agent shall be Novec 1230 Fire Protection Fluid manufactured by 3M Company, St. Paul, MN or their approved supplier.
- B. Agent shall not contain any Hydrofluorocarbons (HFC).

5.3 AGENT STORAGE CYLINDERS

- A. The clean agent shall be stored in dedicated Clean Agent storage tanks. Tanks shall be super-pressurized with dry nitrogen to an operating pressure of 360 psi at 70 °F. Tanks shall be of high-strength low alloy steel construction and conforming to NFPA 2001.
- B. Tanks (master) shall be actuated by either a resettable electric actuator or by pneumatic means from a nitrogen cartridge located in the releasing device. Explosive devices shall not be permitted.
- C. Each tank shall have a pressure gauge and low-pressure switch (optional) to provide visual and electrical supervision of the container pressure. The low-pressure switch shall be wired to the control panel to provide audible and visual "Trouble/Supervisory" alarms in the event the container pressure drops below 290 psi. The pressure gauge shall be color coded to provide an easy, visual indication of container pressure.
- D. Tanks shall have a pressure relief provision that automatically operates when the internal nominal pressure is between 710 and 790 psi.
- E. Provide reserve supply of agent if supply cannot be replaced within 24 hours.
- F. 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.

5.4 TANK BRACKET

- A. Each tank assembly shall be furnished with at least one mounting bracket consisting of a nut, bolt and two bracket straps. The back channel must be supplied by others.
- B. Tank brackets shall be UL listed and/or FM approved for use with the clean agent fire suppression system.

5.5 VALVE ACTUATORS

- A. Electric valve actuators shall be of steel body, stainless steel actuation pin and brass 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 continuous duty type for 24 VDC operation.
- D. Actuation devices shall be UL listed and/or FM approved for use with the clean agent fire suppression system.

5.6 DISCHARGE HOSE/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 for use with the clean agent valve.

5.7 DISCHARGE NOZZLES

- A. Discharge nozzles shall be of one-piece construction and sized to provide flow rates in accordance with system design flow calculations.
- B. The orifice size shall be determined by a 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.

5.8 WARNING SIGNS

Provide signs manufactured of 3-layer red-white-red micarta, engraved to show white

uppercase letters on a red background, warning signs. Warning sign thickness is 0.3175 cm 1/8-inch thick with beveled edges.

A. Inside Protected Room

Permanently affix a sign adjacent to every audible/visual system alarm reading:

**WARNING
WHEN THIS STROBE IS LIT,
RELEASE OF FIRE SUPPRESSION AGENT
WILL OCCUR WITHIN 60 SECONDS**

Make letters for "WARNING" 1-1/2-inch (3.81 cm) tall, and all other lettering 1-inch tall.

B. Outside Protected Space at each door

Permanently affix a sign adjacent to every audible/visual system alarm reading:

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

Make letters for "WARNING" 3.81 cm 1-1/2-inch tall, and all other lettering 1-inch tall.

C. Manual Actuation or Release Stations

Place a sign at every location where manual operation of the system may occur, reading:

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

Make letters for "WARNING" 3/4-inch (1.905 cm) tall, and all other lettering 3/8-inch (0.9525 cm) tall.

5.9 SYSTEM CHECKOUT AND TESTING

- A. The completed installation shall be inspected by factory authorized and trained personnel. The entire system shall be checked out, inspected, and functionally tested by qualified, trained personnel, in accordance with the manufacturer's recommendation procedures and NFPA standards.

- B. Inspection shall be performed in the presence of the owner's representative, architect's or engineer's representative, insuring authority and/or the local AHJ.
- C. All mechanical and electrical components shall be tested according to the manufacturer's recommended procedure to verify system integrity.
- D. Inspection shall include a complete checkout of the detection/control system and certification of cylinder pressure. A written report shall be filed with the owner.
- E. As-built drawings including as-built circuit diagrams shall be provided by the contractor (2 hard copies and thumb drive with digital, Bound AutoCAD and PDF versions) indicating the installation details. All routing of piping, electrical conduit and accessories shall be noted.
- F. Equipment installation and maintenance manuals shall be provided in addition to the as-built drawings.
- G. Prior to final acceptance, the contractor shall provide operational training in all concepts of the system to the owner's key personnel. Training shall consist of:
 - 1. Control system operation
 - 2. Trouble procedures
 - 3. Abort procedures
 - 4. Emergency procedures
 - 5. Safety requirements
 - 6. Demonstration of the system (excluding clean agent release)
- H. The quantity of agent shall reflect the actual design quantity of NOVEC 1230 agent.

5.10 PIPE SLEEVES

- A. Provide sleeves where piping passes through masonry or concrete walls, floors, roofs and partitions. Use standard weight zinc coating for steel pipe sleeves in outside walls, below and above grade, in floor, and roof slabs. Zinc coat steel sleeves in partitions having a nominal weight of not less than 4.40 kg per sq meters 0.90 pounds per square foot. Ensure space between piping and the sleeve, is not less than that required for 1" of multi-directional movement due to a seismic event. Use sleeves of sufficient length to pass through the entire thickness of walls, partitions and slabs. Extend sleeves in floor slabs 50 mm 2-inches above the finished floor. Pack space between the pipe and sleeve with asbestos free insulation and caulk at both ends of the sleeve with plastic waterproof cement.

5.11 ESCUTCHEONS

- A. 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.

PART 6 – WARRANTY

6.1 WARRANTY

- A. Components/System: Limited one-year warranty shall be offered for defects in workmanship and material.

PART 7 TRAINING

7.1 Training

- A. Provide the Owner a minimum of 4 hours of instruction for two technicians in the operation and maintenance of the system and test equipment