
USACE / NAVFAC / AFCEC

UFGS-21 22 00 (August 2026)

Preparing Activity: NAVFAC

New

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2026

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DIVISION 21 - FIRE SUPPRESSION

SECTION 21 22 00

CLEAN AGENT FIRE EXTINGUISHING SYSTEMS

08/26

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SECTION 21 22 00

CLEAN AGENT FIRE EXTINGUISHING SYSTEMS 08/26

NOTE: This guide specification covers the requirements for clean agent fire extinguishing systems.

Adhere to [UFS 1-300-02](#) Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a [Criteria Change Request \(CCR\)](#).

NOTE: For OCONUS projects, this specification section should be edited for specific Host Nation requirements. Coordinate compliance with Host Nation requirements with the DFPE.

NOTE: This specification section includes requirements from UFC 3-600-01, Fire Protection Engineering for Facilities.

PART 1 GENERAL

1.1 SUMMARY

NOTE: A manually activated exhaust system is required to be provided in accordance with UFC 3-600-01 to facilitate the extraction of any remaining clean agent after the required hold time of the clean agent system. The exhaust system can be integrated into the HVAC system for the enclosure, but in no case is it allowed to be designed for less than six air changes per hour. The manual activation switch must be located outside of the protected area. Permanent signage must be provided indicating "Fire Extinguishing Exhaust System - Fire Department Use Only". Coordinate with mechanical.

1. On the drawings, show location of control unit, batteries and charger (if remotely mounted), supervising station transmitter, annunciator, primary power supply, remote annunciator, detectors, notification appliances (unless performance requirements are specified), and each alarm initiating device including fire extinguishing system switches.

2. Show single-line releasing systems riser diagram. Each device on the riser should be identified by type. Indicate connection of equipment.

3. A releasing operating matrix must be placed on the drawings. Show actions of input devices such as detectors, manual stations, waterflow switches, initiating devices, etc. on one axis and output functions such as door releases, smoke control fans, elevator relays, indicating/notification appliances etc. on the other. Entries which require descriptions, explanation of processes, sequences, interfaces, etc. can be flagged by symbols keyed to supplementary notes. Alternately provide a zone-by-zone sequence of operation or a schedule identifying all initiators, outputs, and interfaces.

4. Addressable Releasing Systems generally utilize Signal Line Circuits (SLC) for communication between devices. Normally all devices are addressable or will have an addressable interface device installed integrally with the device. Initiating Device Circuits (IDC) should be provided for interfacing to existing IDC loops or connection between non-addressable devices and the SLC.

1.1.1.1 Scope

- a. Design and[provide a new][and][modify an existing][local][total flooding] type **clean agent** fire extinguishing system conforming to **NFPA 2001** and[**UL 2127**][**UL 2166**]. Pipe sizes which are not indicated on the Contract drawings must be determined by agent **discharge calculations**. The system must be complete in all ways and include all mechanical and electrical installation, all detection and control equipment, agent storage containers, agent, discharge nozzles, pipe and fittings, manual release and abort stations, audible and visual alarm devices, auxiliary devices and controls, shutdowns, alarm interface, caution/advisory signs, functional checkout and testing, training and all other operations necessary for a functional system. Design discharge nozzles to uniformly distribute the clean agent throughout the hazard area. Arrange system for fully automatic and manually operated electronic control operation, with operating controls of the enclosed release type to prevent accidental operation. Provide discharge nozzles in accordance with the manufacturer's guidelines and the system listing to distribute the clean agent unobstructed throughout the protected space. The installed nozzles must be designed to provide the proper clean agent quantity and distribution. Provide manual release stations, dead-man style abort stations and keyed override as indicated on the drawings. Provide material and equipment that are listed. Each protected area must have audible and visible notification appliances located where shown. Electrically supervise all circuits. Provide separate and distinct audible and visual pre-discharge and discharge signals. The discharge signals must be distinct from those used by the building fire alarm system. Design the clean agent fire extinguishing system to a concentration (by volume) as specified by **NFPA 2001** and the manufacturer. Final quantity, **system layout** and coordination are the responsibility of the Contractor.
- b. The control system must meet the requirements of **NFPA 72**. The control unit must be listed for "Releasing Device Service".

1.1.2 Qualified Fire Protection Engineer (QFPE)

NOTE: UFC 3-600-01 requires that shop drawings must bear the Review Stamp and professional engineering stamp of the QFPE prior to submission to the Government for approval.

NOTE: The term Qualified Fire Protection Engineer (QFPE) should be considered interchangeable with the terms "Fire Protection Designer of Record (FPDOR)" and/or "Fire Protection QC Specialist" where referred to in other applicable contract documents. The intent of defining the QFPE roles and responsibilities here is NOT to require personnel in addition to the QFPE, FPDOR, and/or FPQC specialist referenced elsewhere in the applicable contract documents.

An individual who is a licensed professional engineer (P.E.) who has

passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveying (NCEES) and has relevant fire protection engineering experience. Services of the QFPE must include:

- a. Reviewing SD-02, SD-03, and SD-05 submittal packages for completeness and compliance with the provisions of this specification. Prepare working (shop) drawings and calculations by, or under the immediate supervision of the QFPE.
- b. Providing a letter documenting that the SD-02, SD-03, and SD-05 submittal package has been reviewed and noting any outstanding comments.
- c. Performing in-progress construction surveillance prior to installation of ceilings (rough-in inspection).
- d. Witnessing pre-Government [and final Government]functional performance testing and performing a final installation review.
- e. Signing applicable certificates under SD-07.

1.2 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME BPVC (2025) Boiler and Pressure Vessels Code

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M (2024) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM B88/B88M (2020) Standard Specification for Seamless Copper Water Tube

ASTM F402 (2018) Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide
<https://www.approvalguide.com/>

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1 (2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits

IEEE C62.41.2 (2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

INTELLIGENCE COMMUNITY STANDARD (ICS)

ICS 705-1 (2010) Physical and Technical Security Standard for Sensitive Compartmented Information Facilities

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 4 (2024) Standard for Integrated Fire Protection and Life Safety System Testing

NFPA 70 (2026; TIA 26-1; ERTA 26-1; TIA 26-2; TIA 26-3; TIA 26-4; TIA 26-5; TIA 26-6; TIA 26-7; ERTA 26-2; ERTA 26-3) National Electrical Code

NFPA 72 (2025; TIA 25-1; TIA 25-2; TIA 25-3; TIA 25-4; ERTA 25-1; ERTA 25-2) National Fire Alarm and Signaling Code

NFPA 90A (2024) Standard for the Installation of Air Conditioning and Ventilating Systems

NFPA 170 (2024; ERTA 1 2023) Standard for Fire Safety and Emergency Symbols

NFPA 2001 (2025) Standard on Clean Agent Fire Extinguishing Systems

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7 (2012) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler

System Layout

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-601-02

(2026) Fire Protection Systems Inspection, Testing, and Maintenance

UL SOLUTIONS (UL)

UL 228

(2006; Reprint Mar 2022) UL Standard for Safety Door Closers-Holders, With or Without Integral Smoke Detectors

UL 268

(2023; Reprint Oct 2025) UL Standard for Safety Smoke Detectors for Fire Alarm Systems

UL 268A

(2008; Reprint Aug 2025) Smoke Detectors for Duct Application

UL 464

(2023) UL Standard for Safety Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

UL 497A

(2001; Bul. 2019) UL Standard for Safety Secondary Protectors for Communications Circuits

UL 497B

(2004; Reprint Feb 2022) UL Standard for Safety Protectors for Data Communications and Fire Alarm Circuits

UL 536

(2021; Reprint Mar 2026) UL Standard for Flexible Metallic Hose

UL 864

(2023; Reprint Oct 2024) UL Standard for Safety Control Units and Accessories for Fire Alarm Systems

UL 1283

(2025) UL Standard for Safety Electromagnetic Interference Filters

UL 1449

(2021; Reprint Oct 2025) UL Standard for Safety Surge Protective Devices

UL 1638

(2023) UL Standard for Safety Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

UL 1971

(2002; Reprint Feb 2024) UL Standard for Safety Signaling Devices for the Deaf and Hard of Hearing

UL 2127

(2024) UL Standard for Safety Inert Gas Clean Agent Extinguishing System Units

UL 2166

(2017; Reprint Dec 2021) UL Standard for Safety Halocarbon Clean Agent Extinguishing System Units

1.3 SUBMITTALS

NOTE: NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy and Air Force projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Partial submittals and submittals not fully complying with NFPA 2001 and this specification section will be returned disapproved without review. SD-02, SD-03 and SD-05 must be submitted simultaneously.

Shop drawings (SD-02), product data (SD-03) and calculations (SD-05) must be prepared by the designer and combined and submitted as one complete package. The QFPE must review the SD-02/SD-03/SD-05 submittal package for completeness and compliance with the Contract provisions prior to submission to the Government. The QFPE must provide a Letter of Confirmation that they have reviewed the submittal package for compliance with the contract provisions. This letter must include their registered professional engineer stamp and signature. Partial submittals and

submittals not reviewed by the QFPE may be returned disapproved without review. Shop drawings must not be smaller than [ISO A1][ANSI D][the Contract Drawings]. Drawings must comply with the requirements of NFPA 72 and NFPA 170. Floor plans may not have a smaller scale than 1:100 1/8" = 1'-0".

SD-01 Preconstruction Submittals

Qualified Fire Protection Engineer (QFPE); G, [_____]

Clean Agent System Designer; G, [_____]

Releasing System Designer; G, [_____]

Releasing System Installer; G, [_____]

Releasing System Supervisor; G, [_____]

Releasing System Technician; G, [_____]

Clean Agent System Installer; G, [_____]

Test Technician; G, [_____]

Releasing System Site-Specific Software Acknowledgement; G, [_____]

SD-02 Shop Drawings

Nameplates; G, [_____]

Instructions; G, [_____]

Wiring Diagrams; G, [_____]

System Layout; G, [_____]

System Operation; G, [_____]

Notification Appliances; G, [_____]

Initiating Devices; G, [_____]

Battery Power; G, [_____]

Voltage Drop Calculations; G, [_____]

SD-03 Product Data

Clean Agent; G, [_____]

High-Pressure Containers; G, [_____]

Piping and Fittings; G, [_____]

Pipe Hangers and Supports; G, [_____]

Low-Pressure Switch; G, [_____]

Discharge Nozzles; G, [_____]

	Escutcheons; G, [_____]
	Releasing Control Unit; G, [_____]
[	Remote Annunciator Panel; G, [_____]
][	Graphic Annunciator Panel; G, [_____]
]	Smoke Detectors; G, [_____]
[	Air Sampling Smoke Detectors; G, [_____]
]	Manual Release Stations; G, [_____]
	Abort Stations; G, [_____]
	Notification Appliances; G, [_____]
	Batteries; G, [_____]
	Battery Charger; G, [_____]
	Surge Protective Devices; G, [_____]
[	Electromagnetic Door Holder Release; G
]	Wire; G, [_____]
	Back Boxes and Conduit; G, [_____]
	Ceiling Bridges; G, [_____]
	Document Storage Cabinet; G, [_____]
	Warning Signs; G, [_____]
	Supplemental Notification Appliance Circuit Panels; G, [_____]
	Auxiliary Power Supply Panels; G, [_____]
	Addressable Interface Devices; G
	Addressable Control Modules; G, [_____]
	Isolation Modules; G, [_____]
	Terminal Cabinets; G, [_____]
	SD-05 Design Data
	Discharge Calculations; G, [_____]
[	Air Sampling Smoke Detection System Calculations
]	SD-06 Test Reports
	Test Procedures; G, [_____]

SD-07 Certificates

Verification of Compliant Installation; G, [____]

Request for Government Final Test; G, [____]

SD-09 Manufacturer's Field Reports

System Operation; G, [____]

SD-10 Operation and Maintenance Data

Operation and Maintenance (O&M) Instructions; G, [____]

Instruction of Government Employees; G, [____]

SD-11 Closeout Submittals

Spare Parts

As-built Drawings

1.4 SYSTEM OPERATION

As part of the SD-02 package, submit [____] copies of point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems that are supervised or controlled by the system. Diagrams must show connections from field devices to the releasing control unit and remote control units, initiating circuits, switches, relays and terminals, including pathway diagrams between the control unit and shared communications equipment within the protected premises. Point-to-point wiring diagrams must be job specific and must not indicate connections or circuits not being utilized. Provide complete riser diagrams indicating the wiring sequence of all devices and their connections to the control equipment. Include a color-code schedule for the wiring.

- a. Submit [____] copies of plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, conduit sizes, wire counts, conduit fill calculations, wire color-coding, circuit identification in each conduit, and circuit layouts for all floors. Annotate clean agent fire extinguishing system piping layout with reference points for design. Show isometric details of agent storage containers, mounting details and proposed pipe runs and sizes. Drawings must include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Indicate candela rating of each visual notification appliance. Clearly identify the locations of isolation modules. Indicate the addresses of all devices, modules, relays, etc. Show/identify all acoustically similar spaces.
- b. Provide a complete description of the system operation in matrix format similar to the "Typical Input/Output Matrix" included in the Annex of [NFPA 72](#).
- [c. For air sampling smoke detection systems, provide floor plan layouts indicating location of air aspirating system, air sampling piping

(lengths of pipe) and sampling ports (sizes and locations). Floor plan must also indicate geographic monitor zone boundaries, location of display control unit, bar level annunciation panels if separate, and all other associated equipment that is required to provide a complete operational system.

-] d. Submit a complete list of device addresses and corresponding messages.
- e. Submit calculations and supporting data on each notification circuit to indicate that there is at least [25][____] percent spare capacity for notification appliances. Annotate data for each circuit on the drawings. Submit calculations as part of SD-05 package as well.
- f. Submit calculations and supporting data on each initiating circuit to indicate that there is at least [25][____] percent spare capacity for initiating devices. Annotate data for each circuit on the drawings.
- g. Submit calculations and supporting data as required in paragraph BATTERY POWER CALCULATIONS for alarm, alert, and supervisory power requirements. Calculations including ampere-hour requirements for each system component and each panel component, and the battery recharging period, must be included on the drawings. Submit calculations as part of SD-05 package as well.
- h. Submit voltage drop calculations for each notification circuit indicating that sufficient voltage is available for proper operation of the system and all components, at a minimum rated voltage of the system operating on batteries. Include the calculations on the system layout drawings. Submit calculations as part of SD-05 package as well.
- i. As part of the SD-05 package, submit clean agent discharge calculations verifying total storage requirements, flooding concentrations, discharge times, flow through the piping network, pipe sizes, and nozzle orifice sizes, in accordance with the manufacturer's listed design manual and NFPA 2001. Inert gas calculations must include the total required venting area, in square millimeters square inches for each protected enclosure.
- [j. Submit air sampling detection system design analysis calculations consisting of battery capacity, loading calculations, and fan speed and air flow/transport calculations. Include schematic diagrams showing pipe segments, pipe diameters, lengths of pipe, node numbers, and sample port diameters to verify the requirements are met.

]1.4.1 System Sequence

NOTE: Designer must review the method of cooling the IT/Electronic equipment and discuss with the DFPE to determine the appropriate method of detection and suppression.

Automatic operation of each protected area must be as follows:

NOTE: Use the sequence below when using standard spot type detectors for actuation.

- [a. Actuation of one detector, within the system, must:
 - (1) Activate the "ALARM" indicator lamp on the releasing control unit (RCU).
 - (2) Energize the alarm audible and visible notification device located in the hazard area for evacuation of the protected area.
 - (3) Operate door holder/closures on access doors.
 - (4) Transmit an alarm signal to the main fire alarm control unit (FACU).
 - (5) Activate the building fire alarm system.
- [(6) Activate an individual visible indicator for that device on the graphic annunciator.
-] b. Actuation of a second detector, within the system, must:
 - (1) Activate the "PRE-DISCHARGE" indicator on the RCU.
 - (2) Energize the pre-discharge audible and visible notification device located in the hazard area.
 - (3) Shut down the HVAC system and close smoke dampers.
 - (4) Start time-delay sequence (not to exceed 60 seconds).
 - (5) System abort sequence is enabled at this time.
- [(6) Shunt power to protected equipment
-][(7) Light an individual lamp for that device on the graphic annunciator.

] *****
] **NOTE: Use the sequence below when using Very Early Warning Smoke Detection**

- [a. Actuation of Alarm Level 1 (Alert) within the system must:
 - (1) Activate the "ALERT" indicator lamp on the air aspirating smoke detection control unit.
 - (2) Transmit a supervisory signal to the[main fire alarm control unit (FACU)][releasing control unit (RCU)].
- b. Actuation of Alarm Level 2 (Action) within the system must:
 - (1) Activate the "ALARM" indicator lamp on the releasing control unit (RCU).
 - (2) Energize the alarm audible and visible notification device located in the hazard area for evacuation of the protected area.
 - (3) Operate door holder/closures on access doors.

- (4) Transmit an alarm signal to the main fire alarm control unit (FACU).
- (5) Activate the building fire alarm system.
- [(6) Activate an individual visible indicator for that device on the graphic annunciator.
-] c. Actuation of Alarm Level 3 (Fire 1) within the system must:
 - (1) Activate the "PRE-DISCHARGE" indicator on the RCU.
 - (2) Energize the pre-discharge audible and visible notification device located in the hazard area.
 - (3) Shut down the HVAC system and/or close dampers.
 - [(4) Start time-delay sequence (not to exceed 60 seconds).
 -][(5) System abort sequence is enabled at this time.
 -][(6) Shunt power to protected equipment
 -][(7) Light an individual lamp for that device on the graphic annunciator.
-] d. After completion of the time-delay sequence, the clean agent fire extinguishing system must activate and the following must occur:
 - (1) Activate the "RELEASE" indicator on the RCU.
 - [(2) Shutdown power to all equipment in hazard area.
 -] (3) Energize the visible notification device(s) outside the hazard area in which the discharge occurred.
 - [(4) Energize the "System Release" audible device.
 -] (5) Transmit a system release signal to the FACU.
- e. The system must be capable of being actuated by manual release stations located at each hazard exit. Operation of a manual release station must duplicate the sequence description[above except that the time delay and abort functions must be bypassed].

]1.4.2 Circuit Requirements

Connect alarm [initiating devices](#) to initiating device circuits (IDC), Class [B][_____] or to signal line circuits (SLC), Class [B][_____] in accordance with [NFPA 72](#). Alarm notification or indicating appliances must be connected to notification appliance circuit (NAC), Class [B][_____] in accordance with [NFPA 72](#). Provide a separate circuit for actuation of each clean agent system. Fully supervise the circuits that actuate the water control valves so that the occurrence of a single open or a single ground fault condition in the interconnecting conductors will be indicated at the control unit.

1.5 TECHNICAL DATA AND SITE-SPECIFIC SOFTWARE

Technical data and site-specific software (meaning technical data that relates to computer software) that are specifically identified in this project, and may be required in other specifications, must be delivered, strictly in accordance with the CONTRACT CLAUSES. The releasing system manufacturer must submit written confirmation of this contract provision as "[Releasing System Site-Specific Software Acknowledgement](#)". Identify data delivered by reference to the specification paragraph against which it is furnished. Data to be submitted must include complete system, equipment, and software descriptions. Descriptions must show how the equipment will operate as a system to meet the performance requirements of this contract. The site-specific software data package must also include the following:

- a. Items identified in [NFPA 72](#), titled "Site-Specific Software".
- b. Identification of programmable portions of the system equipment and capabilities.
- c. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.
- d. Provision of operational software data on all modes of programmable portions for the releasing control system.
- e. Description of releasing control system equipment operation.
- f. Description of auxiliary and remote equipment operations.
- g. Library of application software.
- h. Operation and maintenance manuals.

1.6 QUALITY ASSURANCE

Submit SD-01 Preconstruction Submittals within 36 days of contract award but not less than [14 days][____] prior to commencing any work on site. SD-02, SD-03 and SD-05 submittals received prior to the review and approval of the qualifications of the subcontractor and QFPE will be returned disapproved without review. All resultant delays must be the sole responsibility of the Contractor.

1.6.1 Qualifications

NOTE: NICET (National Institute for Certification in Engineering Technologies) establishes the qualifications of an individual as an Engineering Technologist with verification of experience by having a current NICET certification.

1.6.1.1 [Releasing System Designer](#)

The system designer must be certified as a Level [III][IV] (minimum) Technician by National Institute for Certification in Engineering Technologies (NICET) in the Fire Alarm Systems subfield of Fire Protection Engineering Technology in accordance with [NICET 1014-7](#), or meet the

qualifications for a QFPE.

1.6.1.2 Releasing System Supervisor

[A NICET Level [III][or][IV] fire alarm technician must supervise the installation of the releasing system[, including the air sampling smoke detection system].][A fire alarm technician with a minimum of 8 years of experience must supervise the installation of the releasing system.]The fire alarm technicians supervising the installation of equipment must be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.6.1.3 Releasing System Technician

Releasing system technicians with a minimum of 4 years of experience must be utilized to install and terminate devices, cabinets and panels. The fire alarm technicians installing the equipment must be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings[, and must be thoroughly experienced in the design and installation of air sampling detection systems].

1.6.1.4 Releasing System Installer

[Releasing system installer with a minimum of 2 years of experience utilized to assist in the installation of devices, cabinets and panels.][NICET Level II technician to assist in the installation of devices, cabinets and panels.]A licensed electrician may install wire, cable, conduit and backboxes for the system. The fire alarm installer must be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.6.1.5 Clean Agent System Designer

The designer must be certified as a Level [III][IV] (minimum) Technician by National Institute for Certification in Engineering Technologies (NICET) in the Special Hazards subfield of Fire Protection Engineering Technology in accordance with **NICET 1014-7**, or meet the qualifications for a QFPE.

1.6.1.6 Clean Agent System Installer

The installing contractor must be trained by the supplier to install, test and maintain a clean agent system. The installing contractor must be an experienced firm regularly engaged in the installation of automatic clean agent, or similar, fire extinguishing systems in strict accordance with all applicable standards. The installing contractor must have a minimum of 5 years experience in the design, installation and testing of clean agent, or similar, fire extinguishing systems.

1.6.1.7 Clean Agent Recharging Service

The installing contractor must maintain, or have access to, a clean agent recharging service. The installing contractor must provide proof of ability to recharge the system with clean agent within 24 hours of notification during the warranty period of the system.

1.6.1.8 Test Technician

Releasing system technicians with a minimum of 8 years of experience and

NICET Level[III][or][IV] utilized in testing and certification of the installation of the devices, cabinets and panels. The fire alarm technicians testing the equipment must be factory trained in the installation, adjustment, testing, and operation of the equipment installed as part of this project.

1.6.1.9 Manufacturer

Components must be of current design and must be in regular and recurrent production at the time of installation. Provide design, materials, and devices for a protected premises fire alarm system, complete, conforming to NFPA 72 and NFPA 2001, except as specified herein.

1.6.2 Regulatory Requirements

Equipment and material must be listed or approved. Listed or approved, as used in this Section, must be interpreted to mean listed, labeled, or approved by a Nationally Recognized Testing Laboratory (NRTL) such as UL Fire Prot Dir or FM APP GUIDE. The omission of these terms under the description of any item of equipment described must not be construed as waiving this requirement. All listings or approval by testing laboratories must be from an existing ANSI or UL published standard. The recommended practices stated in the manufacturer's literature or documentation must be considered as mandatory requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity, and temperature variation, dirt and dust, and other contaminants.

1.8 EXTRA MATERIALS

1.8.1 Spare Parts

Furnish the following spare parts in the manufacturers original unopened containers:

- a. [Five][_____] complete sets of system keys.
- b. [Two][_____] of each type of fuse required by the system.
- c. [One][_____] manual stations.
- [d. [Two][_____] of each type of detector installed.
-] e. [Two][_____] of each type of detector base and head installed.
- [f. [One][_____] electromagnetic door holders.
-] g. One of each type of abort station.
- [h. Two air sampling smoke detection system filter assemblies.
-] i. [Two][_____] of each type of audible and visual alarm device installed.
- j. [One][_____] textual visual notification appliance.
- k. [Two][_____] low voltage, [one][_____] [telephone][internet][ethernet], and [one][_____] 120 VAC surge protective devices.

- [1. [Two][_____] spare reams of paper for the system printer, plus sufficient paper for releasing system acceptance tests.
-]m. [Two][_____] spare printer ribbons.
-] n. [_____] spare zone modules for modular type control units in addition to those installed in the panel.

1.8.2 Special Tools

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment must be furnished to the Contracting Officer, prior to the instruction of Government employees.

1.9 EXCLUSIONS

The work listed below will be provided by others:

- a. 120 VAC or 240 VAC power supply to the RCU.
- [b. Interlock wiring and conduit for shutdown of the HVAC, dampers, and/or electric power supplies.
-]c. Connection to local/remote fire alarm system(s) and listed central station(s).
-]d. Mechanical ventilation, including overpressure relief.
-]e. Structural review of floor assembly to verify adequate support for cylinders.

]PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Submit as part of SD-03 package [_____] copies of annotated catalog data to show the specific model, type, and size of each item. Catalog cuts must also indicate the NRTL listing. The data must be highlighted to show model, size, options, etc., that are intended for consideration. Data must be adequate to demonstrate compliance with all contract requirements. Product data for all equipment must be combined into a single submittal.

Provide an equipment list identifying the type, quantity, make, and model number of each piece of equipment to be provided under this submittal. The equipment list must include the type, quantity, make and model of spare equipment. Types and quantities of equipment submitted must coincide with the types and quantities of equipment used in the battery calculations and those shown on the shop drawings.

2.1.1 Standard Products

Provide materials, equipment, and devices that have been tested by a nationally recognized testing laboratory and listed for fire protection service when so required by **NFPA 2001** or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for any particular classification of materials. Material

and equipment must be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least [2][_____] years prior to bid opening.

2.1.2 Nameplates

Submit SD-02 Nameplate Illustrations and data to obtain approval by the Contracting Officer before installation.

Include the manufacturer's name, address, type or style, model or serial number, and catalog number, with the date of installation, installing Contractor's name and address, and the Contract number for all major components on a new name plate permanently affixed to each item or piece of equipment. Major components include, but are not limited to, the following:

- a. Releasing control unit.
- b. Clean agent tank.

Nameplates must be etched metal or plastic, permanently attached by screws to panels or adjacent walls.

2.1.3 Identification and Marking

Mark all pipe and fittings with name or identifying symbol of manufacturer and nominal size, and with with ASTM designation. Valves and equipment markings must have name or identifying symbol of manufacturer, specific model number, nominal size, name of device, arrow indicating direction of flow, and position of installation (horizontal or vertical), except if valve can be installed in either position. Markings must be included on the body casting or on an etched or stamped metal nameplate permanently on the valve or cover plate.

2.1.4 Keys

Keys and locks for equipment, panels and devices must be identical.[Master all keys and locks to a single key as required by the[Installation Fire Department] [____].][Keys must be CAT [60][____].]

2.1.5 Instructions

Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame.[Install the instructions on the interior of the RCU.][Install the frame in a conspicuous location observable from the RCU.] The card must show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory, and trouble. The instructions and their mounting location must be approved by the Contracting Officer before being posted.

2.2 PIPING COMPONENTS

2.2.1 Piping and Fittings

Pipe and fittings must be steel conforming to ASTM A53/A53M, nonferrous drawn seamless copper tubing conforming to ASTM B88/B88M or flexible metallic hose conforming to UL 536.

Use fittings for changes in direction of piping and for all connections. Reduce pipe sizes in the fitting. Do not use flush bushings. Fuse brazed joints, when used, with an alloy with a melting point above 537 degrees C 1,000 degrees F.

For 13-mm 1/2-inch and 19-mm 3/4-inch iron pipe size (ips), provide Schedule 40. For 19.25-mm 1-inch or greater, use only Schedule 90 pipe. Standard malleable iron banded fittings or ductile-iron fittings are to be used up through 19-mm 3/4-inch ips. Use extra heavy malleable-iron or ductile-iron fittings through 50-mm 2-inch ips. Use forged steel fittings in all sizes over 50 mm 2 inches.

2.2.2 Valves

Use the class and style of flanges required to match the valve's flanged connections. All gaskets, o-rings, sealants and other valve components must be constructed of materials that are compatible with the agent. Protect valves against mechanical, chemical, or other damage.

2.2.3 Pipe Hangers and Supports

Provide pipe hangers and supports conforming to NFPA 2001 and manufacturer's recommendations.

2.2.4 Escutcheons

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

2.2.5 Discharge Nozzle

Permanently mark discharge nozzles to identify the nozzle and to show the equivalent single orifice diameter regardless of shape and number of orifices. Nozzles must be available in NPT sizes 8 mm to 50 mm 1/4-inch to 2.0-inch and must be available in 180-degree and 360-degree distribution patterns.

2.2.6 High-Pressure Containers

Each container must meet the following:

- a. Provide a pressure gauge to allow for visual and electrical supervision of the container pressure. The pressure gauge must be color-coded to provide an easy, visual indication of container pressure.
- b. Include a pressure relief provision that automatically operates when the internal temperature exceeds 54 degrees C 130 degrees F. Each container must have a safety device to relieve excess pressure safely, in advance of the rated cylinder test pressure.
- c. Provide container complying with requirements of U.S. Department of Transportation specifications if container is to be used as shipping container. If not used as a shipping container, each container must be designed, fabricated, inspected, certified, and stamped in

accordance with Section VIII of ASME BPVC.

- d. Provided with support racks that anchor to walls[and floors].
- e. On each container, include a permanent nameplate or other permanent marking that indicates the following:
 - (1) For halocarbon agent containers, the agent, tare and gross weights and super-pressurization level (where applicable) of the container.
 - (2) For inert gas agent containers, the agent, pressurization level of the container, and nominal agent volume.

2.2.7 Low-Pressure Switch

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

2.3 RELEASING CONTROL UNIT (RCU)

The RCU must be listed, analog-addressable and compatible with the system, devices and functions specified.[Route all supervision of the RCU through the main FACU.] The RCU must perform all functions necessary to operate the system detection, actuation, and auxiliary functions independent of the FACU. The control system must be microprocessor-based utilizing distributed processing concept. A single microprocessor failure must not impact operation of additional modules on the system. The control system must be capable of supporting an air aspirating smoke detection system. The control system's initiating circuits must be capable of Class A or Class B operation. The solenoid must be listed for use with the releasing unit and extinguishing equipment. Each circuit must be capable of monitoring contact devices configured for manual release, system abort, trouble input or auxiliary (non-fire) input. The RCU must contain release circuits for activation of an extinguishing system[s]. Each release circuit must be capable of Class B operation. The RCU must contain at least two notification appliance circuits for annunciation. Each notification circuit must be capable of Class A or Class B operation. Provide alarm/trouble reset switches to reset a cleared device in alarm or trouble. Alarm or trouble signals are not to be self-restoring without activating the switch. The system must be capable of providing a "PRE-ALARM" feature that can give advanced warning of a possible alarm condition.

Annunciator must be integral with the RCU. Annunciation must be by an indicator lamp, alphanumeric display, or other equivalent means in which each indication provides status information about a circuit, condition, or location and visible through the cabinet door. Supervision is not required provided that a fault in the annunciator circuits results only in loss of annunciation and does not affect the normal functional operation of the remainder of the system. Ensure each visible indicator provides specific identification of the[zone][area][device]. Do not use generic nondescript wording such as "Zone 1", or "Zone 2", for the label identification.

An operator at the RCU, having the proper access level must have the capability to manually access the following information for each

initiating device:

- a. Primary status.
- b. Device type.
- c. Present average value.
- d. Present sensitivity selected.
- e. Sensor range (normal, dirty, etc).

2.4 ANNUNCIATOR

[2.4.1 Remote Annunciator Panel

NOTE: Provide a remote annunciator only for very large spaces with 10 or more smoke detectors.

Provide a[semi-recessed][flush] mounted annunciator that includes an LCD display. The display must indicate the device in trouble/alarm or any supervisory device. Display the device name, address[, and actual building location]. The remote annunciator must duplicate functions of the RCU for message display, alarm, supervisory, and trouble conditions, visual and audible notification, and system reset functions. Remote annunciator must require the use of a key for accessing the reset, control and other functions.

]2.4.2 Graphic Annunciator Panel

NOTE: Graphic annunciator panels should be provided only when a large number of concealed devices are installed. Normally, exposed devices will be annunciated by zone only on the releasing control panel zone annunciator and remote zone annunciator. Edit accordingly. Locate panel(s) at or near building entrance to allow fire department quick access to panel.

Provide panel that is of the[interior][weatherproof] type,[flush][surface][pedestal]-mounted. Panel must be provided with the[building][room] floor plan, drawn to scale, with alarm lamps mounted to represent the location of[each concealed detector][each initiating device]. Panel graphic must also show the locations of the annunciator panel and control panel, and must have a "you are here" arrow showing its location. Orient building floor plan on graphic to location of person viewing the graphic, i.e., the direction the viewer is facing must be toward the top of the graphic display. Provide a North arrow.[Principal rooms and areas shown must be labeled with room numbers or titles.] Detectors mounted above ceilings[, on ceilings,] and beneath raised floors and different types of initiating devices must have different symbols or lamps of different colors for identification. Lamps must illuminate upon activation of corresponding device and must remain illuminated until the system is reset. Panel must have a lamp test switch.

2.4.2.1 Materials

Construct the graphic annunciator face plate of[smoked Plexiglas][non-glare matte finish][anodized bronze][anodized aluminum]. The face plate must be backlit with LEDs. Control equipment and wiring must be housed in a[recessed][semi-recessed][surface mounted] back box. The exposed portions of the back box must be[chrome plated][anodized bronze][anodized aluminum] without knockouts.

2.4.2.2 Programming

Where programming for the operation of the graphic annunciator is accomplished by a separate software program other than the software for the RCU, the software program must not require reprogramming after loss of power. The software must be reprogrammable in the field.

]2.5 SMOKE DETECTORS

NOTE: Detector selection and spacing should be based on the applicable cooling system in the hazard area. Detection should be listed for the anticipated temperature and airflow in the hazard area.

[2.5.1 Photoelectric Smoke Detectors

- a. Smoke detector must be photoelectric type and listed for use with the RCU.
- b. Provide analog/addressable photoelectric smoke detectors utilizing the photoelectric light scattering principle for operation in accordance with [UL 268](#). Smoke detectors must be listed for use with the RCU.
- c. Provide self-restoring type detectors, listed as smoke-automatic fire detectors, that do not require any readjustment after actuation at the RCU to restore them to normal operation.
- d. Components must be rust and corrosion resistant. Vibration must have no effect on the detector's operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen must not inhibit the movement of smoke particles into the chamber.
- e. Provide twist lock bases for the detectors. The detectors must maintain contact with their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on the screw terminals. The detector must have a visual indicator to show actuation.
- f. The detector address must identify the particular unit, its location within the system, and its sensitivity setting. Detectors must be of the low voltage type rated for use on a 24 VDC system.
- g. An operator at the control unit having a proper access level, must have the capability to manually access the following information for each initiating device.

- (1) Primary status.
- (2) Device type.
- (3) Present average value.
- (4) Present sensitivity selected.
- (5) Sensor range (normal, dirty, etc.).

]2.5.2 Laser Smoke Detectors

- a. Addressable laser smoke detectors must utilize laser diode and smoke sensing chamber, designed to amplify signals from smoke but diminish stray internal reflections and must, on command from the RCP, send data to the panel representing the analog level of smoke density.
- b. Smoke detector must be listed for use with the RCU. Detector must be able to achieve sensitivities from 0.02 percent-per-foot to 2 percent-per-foot obscuration.
- c. Laser smoke detector must provide point identification of the fire location through addressability, must experience no delay in response time due to smoke dilution or smoke transportation time, and must offer complete supervision of wiring and detector.

]2.5.3 Duct Smoke Detectors

NOTE: The requirements for duct detectors must be coordinated with the HVAC requirements and Sections 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC. All required duct detectors must be shown on the contract drawings.

Duct-mounted addressable[photoelectric][laser] smoke detectors must be provided where indicated and in accordance with NFPA 90A. Units must consist of a smoke detector, as specified in paragraphs PHOTOELECTRIC SMOKE DETECTORS or LASER SMOKE DETECTORS, mounted in a special housing fitted with duct sampling tubes. Detector circuitry must be mounted in a metallic or plastic enclosure exterior to the duct.[It is not permitted to cut the duct insulation to install the duct detector directly on the duct.] Detectors must be rated for air velocities that include air flows between [2.5 and 20][_____] and [_____] m/s [500 and 4000][_____] and [_____] fpm. Detectors must be powered from the RCU.

- a. Sampling tubes must run the full width of the duct. The duct detector package must conform to the requirements of NFPA 90A, UL 268A, and must be listed for use in air-handling systems. The control functions, operation, reset, and bypass must be controlled from the RCU.
- b. Lights to indicate the operation and alarm condition; and the test and reset buttons must be visible and accessible with the unit installed and the cover in place. Remote indicators must be provided where required by NFPA 72 and these must be provided with test and reset switches.

- c. Remote lamps and switches as well as the affected fan units must be properly identified in etched plastic placards. Detectors must provide for control of auxiliary contacts that provide control, interlock, and shutdown functions specified in Section 23 09 00 to INSTRUMENTATION AND CONTROL FOR HVAC. Auxiliary contacts provide for this function must be located within 1-meter 3 feet of the controlled circuit or appliance. The detectors must be supplied by the releasing system manufacturer to ensure complete system compatibility.

[2.5.4 Air Sampling Smoke Detectors

NOTE: Detector selection and spacing should be based on the applicable cooling system in the hazard area. Detection should be listed for the anticipated temperature and airflow in the hazard area.

Provide[addressable] air sampling smoke system consisting of a detector assembly housing an integral aspiration fan, filter, laser-based detection chamber and control, and output and supervision circuitry.[Each sampling point must be capable of being independently addressable.] The system must consist of a piping or tubing distribution network that runs from the detector assembly(s) to the protected area(s) and is supported by air sampling smoke detection system calculations from a computer-based design modeling tool. The system must include configurable alarm and trouble relay outputs for interface to other systems where required.

- a. System must be complete in all ways. It must include all engineering, and electrical installation, all detection and control equipment, auxiliary devices and controls, alarm interface, functional checkout and testing, training and all other operations necessary for a functional system.
- b. System base detectors and modules must each accommodate up to [40 addressable][_____] microbore sampling tubes where each tube has a sampling point at the end. Additional modules may be used to provide up to [20 addressable][_____] sampling holes per system.
- c. Program alarm thresholds to the following values unless the results of the system acceptance tests indicate a clear need to change them. In the event that such a need is indicated, notify the Contracting Officer and provide complete documentation concerning the need to deviate from these values. Include within the deviation documentation request, information that complies with the paragraph entitled "Sensitivity Verification Test". Ensure initial threshold levels are approved prior to the final acceptance test.
 - (1) Alarm Level 1: set ALERT at [_____] [0.0250] percent obscuration/foot
 - (2) Alarm Level 2: set PRE-ALARM at [_____] [0.0500] percent obscuration/foot
 - (3) Alarm Level 3: set FIRE 1 at [_____] [0.1000] percent obscuration/foot
 - (4) Alarm Level 4: set FIRE 2 at [_____] [0.2000] percent

obscurations/foot

- d. All air sampling smoke detection devices and associated components must be new, standard products or the manufacturer's latest design and suitable to perform the functions intended.
- e. The laser detection chamber must be of the mass light scattering type and capable of detecting a wide range of smoke particle types of varying size. A particle counting method must be employed for the purposes of:
 - (1) Preventing large particles from affecting the true smoke reading.
 - (2) Monitoring contamination of the filter (dust and dirt, etc.) to automatically notify when maintenance is required. The particle counting method must not be used for the purpose of smoke density measurement.
- f. Detector(s) must be self-monitoring for filter contamination and provide indication through system fault when replacement is necessary. Detectors which allow automatic reset of filter status upon removal and re-insertion are not permitted.
- g. Detector(s) must contain relays for alarm and fault conditions. The relays must be software programmable to the required functions.
- h. Detector(s) must permit configuration by programmers that are either integral to the system, portable or PC based.
- i. Detector(s) must allow programming of:
 - (1) Smoke threshold alarm levels; ALERT, PRE-ALARM, FIRE 1 and FIRE 2.
 - (2) Time delays. Ensure the display control panel contains individual adjustable alarm time delay features for each of the alarm threshold levels. Provide an adjustment range between 0 and 60 seconds. Program the alarm threshold time delays to 30 seconds for alarm levels 1 and 2, and 15 seconds for alarm levels 3 and 4.
 - (3) Faults, including airflow, detector, power, filter and network, as well as an indication of the urgency of the fault.
 - (4) Configuration of relay outputs for remote indication of alarm and fault conditions.
 - (5) General purpose input functionality.

]2.6 MANUAL RELEASE STATIONS

**NOTE: Architectural Barriers Act (ABA) requires
that manual alarm stations be mounted at a maximum of
1.1 m 44 inches above finished floor (AFF).**

Provide metal or plastic, semi-flush mounted, [single][double]-action, addressable manual stations, that are not subject to operation by jarring or vibration. Stations must be equipped with screw terminals for each

conductor. Stations that require the replacement of any portion of the device after activation are not permitted. Stations must be finished in yellow with molded raised lettering operating instructions of contrasting color. The use of a key must be required to reset the station. Stations must have a separate screw terminal for each conductor. Manual release stations must be a different color from building fire alarm pull stations.

2.7 ABORT STATIONS

Provide guarded, spring-loaded, "dead-man" type which operates only when pressure is manually applied to the switch. Upon release of manual pressure, switch de-activates allowing delayed functions to resume. After start of agent, abort switch has no effect. Activation of the abort switch during normal (non-alarm) conditions causes activation of system supervisory signal.

2.8 ADDRESSABLE INTERFACE DEVICES

The initiating device being monitored must be configured to operate on a [Class "A"] [Class "B"] initiating device circuit. The module must be listed as compatible with the control unit. The module must provide address setting means compatible with the control unit's SLC supervision and store an internal identifying code. Monitor module must contain an integral LED that flashes each time the monitor module is polled and is visible through the device cover plate. Pull stations with a monitor module in a common backbox are not required to have an LED. [Existing fire alarm system initiating device circuits must be connected to a single module to supervise the circuit.] Modules must be listed for the environmental conditions in which they will be installed.

2.9 ADDRESSABLE CONTROL MODULES

The control module must be capable of operating as a relay (dry contact form C) for interfacing the control unit with other systems, and to control door holders. The module must be listed as compatible with the control unit. The indicating device or the external load being controlled must be configured as a Class "B" notification appliance circuits. The system must be capable of supervising, audible, visual and dry contact circuits. The control module must have both an input and output address. The supervision must detect a short on the supervised circuit and must prevent power from being applied to the circuit. The control model must provide address setting means compatible with the control unit's SLC supervision and store an internal identifying code. The control module must contain an integral LED that flashes each time the control module is polled and is visible through the device cover plate. Control Modules must be listed for the environmental conditions in which they will be installed.

2.10 ISOLATION MODULES

- a. Provide isolation modules to subdivide each signaling line circuit [into groups of not more than [20 addressable devices] [_____] [each floor] [in accordance with NFPA 72] between adjacent isolation modules.
- b. Isolation modules must provide short circuit isolation for signaling line circuit wiring.
- c. Power and communications must be supplied by the SLC and must report faults to the RCU.

- d. After the wiring fault is repaired, the fault isolation modules must test the lines and automatically restore the connection.

2.11 NOTIFICATION APPLIANCES

NOTE: The notification appliances are for providing local notification of a clean agent system operation. These devices are not intended to provide general building fire alarm evacuation.

Provide notification appliances suitable for connection to supervised notification appliance circuits. Each appliance must have a separate screw terminal for each conductor. The surface of the appliance must be red in color. Each signal device must have a rigid plastic or metal identification sign with lettering a minimum of 40 millimeters 1.5 inches high. Label the pre-discharge alarm "FIRE" and the discharge alarm "Clean Agent Fire Extinguishing System DISCHARGE".[Locate post-discharge visual alarms outside all entrances to the protected areas, and provide signs reading "Clean Agent DISCHARGED WHEN FLASHING - DO NOT ENTER".]

2.11.1 Horns

Horns must conform to the applicable requirements of UL 464. Horns must be[semi-flush mounted][surface mounted], with the matching mounting backbox surface mounted vibrating type suitable for use in an electrically supervised circuit. Horns must produce a sound rating of at least 85 dBA at 3 meters 10 feet. Horns used in exterior locations must be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles.

[2.11.2 Bells

Bells must be surface mounted with the matching mounting back box[surface mounted][recessed]. Bells must be suitable for use in an electrically supervised circuit. Bells must be the underdome type producing a minimum output rating of [85][_____] dBA at 3.1 meters 10 feet. Bells used in exterior locations must be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles. Single stroke, electrically operated, supervised, solenoid bells must be used for coded applications.

]2.11.3 Visual Notification Appliances

NOTE: 1. The Visual Notification Appliance must be mounted as required by ABA that directs compliance with NFPA 72. Shop drawings must indicate location, dimensions, content, details, and other required information to indicate extent of complying with ABA requirements.
2. Currently NFPA 72 requires "clear color" strobes for notification. NFPA 72 requires the strobe must be marked "Fire" to clearly identify the function.

Visual notification appliances must conform to the applicable requirements of [UL 1638](#), [UL 1971](#) and conform to the Architectural Barriers Act (ABA). Visual Notification Appliances must have clear high intensity optic lens, xenon flash tubes, light emitting diode (LED), or rotating beacon. The light pattern must be disbursed so that it is visible above and below the strobe and from a 90 degree angle on both sides of the strobe. Strobe flash rate must be 1 flash per second and a minimum of [15][30][75][_____] candela (based on the [UL 1971](#) test. Strobe must be[surface][semi-flush] mounted. Strobes must be synchronized with the building fire alarm strobes per [NFPA 72](#).

2.12 ELECTRIC POWER

2.12.1 Primary Power

Provide [120][_____] VAC [50][60] Hz service power to the RCU from the AC service to the building in accordance with [NFPA 72](#).

2.13 SECONDARY POWER SUPPLY

Provide for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power must be automatic and must not cause transmission of a false alarm.

2.13.1 Batteries

Provide sealed, maintenance-free, [valve regulated lead acid] batteries as the source for emergency power to the RCU. Batteries must contain suspended electrolyte. Provide solid state battery charger to maintain the battery system in a fully charged condition at all times when primary power is available. Provide an automatic transfer switch to transfer the load to the batteries in the event of the failure of primary power.

2.13.1.1 Capacity

Battery size must apply to every panel associated with this system, including [supplemental notification appliance circuit panels](#), [auxiliary power supply panels](#), and fire alarm transmitters.

- a. Sufficient capacity to operate the releasing system under supervisory and trouble conditions, including audible trouble signal devices for 48 hours and (in addition)
- b. audible and visual signal devices under alarm conditions for an additional 15 minutes (or minimum required time for clean agent discharge), whichever is greater.

2.13.1.2 Battery Power Calculations

- a. Verify that battery capacity exceeds supervisory and alarm power requirements for the criteria noted in paragraph CAPACITY above.
 - (1) Substantiate the battery calculations for alarm and supervisory power requirements. Include ampere-hour requirements for each system component and each panel component, and compliance with [UL 864](#).
 - (2) Provide complete battery calculations for both the alarm and

supervisory power requirements. Submit ampere-hour requirements for each system component with the calculations.

- (3) Provide [voltage drop calculations](#) to indicate that sufficient voltage is available for proper operation of the system and all components, at the minimum rated voltage of the system operating on batteries. Calculations must be performed using the minimum rated voltage of each component.

- b. For battery calculations assume a starting voltage of 24 VDC for starting the calculations to size the batteries. Calculate the required Amp-Hours for the specified standby time, and then calculate the required Amp-Hours for the specified alarm time. Using 20.4 VDC as starting voltage, perform a voltage drop calculation for circuits containing device and/or appliances remote from the power sources.

2.13.2 Battery Chargers

Provide a solid state, fully automatic, variable charging rate [battery charger](#) capable of providing 120 percent of the connected system load and maintaining the batteries at full charge. In the event the batteries are fully discharged (20.4 Volts dc), the charger must recharge the batteries back to 95 percent of full charge within 48 hours after a single discharge cycle as described in paragraph CAPACITY above. Provide pilot light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided.

2.14 SURGE PROTECTIVE DEVICES

Provide [surge protective devices](#) to suppress all voltage transients which might damage RCU components. Systems having circuits located outdoors and communications equipment must be protected against surges induced on any signaling line circuit. Cables and conductors, that serve as communications links, must have surge protection circuits installed at each end. The surge protective device must wire in series to the power supply of the protected equipment with screw terminations. Line voltage surge arrestor must be installed directly adjacent to the power panel where the releasing control unit breaker is located.

- a. Surge protective devices for nominal 120 VAC must be [UL 1449](#) listed with a maximum 500 volt suppression level and have a maximum response time of 5 nanoseconds. The surge protective device must also meet [IEEE C62.41.1](#) and [IEEE C62.41.2](#) category B tests for surge capacity. The surge protective device must feature multi-stage construction and be provided with a long-life indicator lamp (either light emitting diode or neon) which extinguishes upon failure of protected components. Any unit fusing must be externally accessible.
- b. Surge protective devices for nominal 24 VAC, fire alarm telephone dialer, or ethernet connection must be [UL 497B](#) listed, meet [IEEE C62.41.1](#), and have a maximum response time of 1-nanosecond. The surge protective device must feature multi-stage construction and be self-resetting. The surge protective device must be a base and plug style. The base assembly must have screw terminals for releasing system wiring. The base assembly must accept "plug-in" surge protective module.
- c. All surge protective devices (SPD) must be the standard product of a single manufacturer and be equal or better than the following:

- (1) For 120 VAC nominal line voltage: **UL 1449** and **UL 1283** listed, series connected 120 VAC, 20A rated, surge protective device in a NEMA 4x enclosure. Minimum 50,000 amp surge current rating with EMI/RFI filtering and a dry contact circuit for remote monitoring of surge protection status.
- (2) For 24-volt nominal line voltage: **UL 497B** listed, series connected low voltage, 24-volt, 5A rated, loop circuit protector, base and replaceable module.
- (3) For alarm telephone dialers: **UL 497A** listed, series connected, 130-volt, 150 mA rated with self-resetting fuse, dialer circuit protector with modular plug and play.
- (4) For IP-DACTS: **UL 497B** listed, series connected, 6.4-volt, 1.5A rated with 20 kA/pair surge current, data network protector with modular plug and play.

2.15 ELECTRICAL

NOTE: Coordinate power and alarm requirements with the contract drawings and other specification sections.

2.15.1 Wire

Provide wiring materials under this section as specified in Section **26 20 00** INTERIOR DISTRIBUTION SYSTEM with the additions and modifications specified herein.

2.15.2 Alarm Wiring

Provide IDC and SLC wiring consisting of [fiber optic][or][solid copper] cable in accordance with the manufacturers requirements. Copper signaling line circuits and initiating device circuit field wiring must be No. [14][16][18][_____] AWG size conductors at a minimum. Visual notification appliance circuit conductors, that contain audible alarm appliances, must be copper No. 14 AWG size conductors at a minimum. Wire size must be sufficient to prevent voltage drop problems. Circuits operating at 24 VDC must not operate at less than the listed voltages for the detectors and/or appliances. Power wiring, operating at 120 VAC minimum, must be a minimum No. 12 AWG solid copper having similar insulation. Acceptable power-limited cables are FPL, FPLR or FPLP as appropriate with red colored covering. Nonpower-limited cables must comply with **NFPA 70**.

[2.16 ELECTROMAGNETIC DOOR HOLDER RELEASE

Provide electromagnetic holding devices which operate on[120 VAC][24 VDC], and require not more than [3][_____] watts of power to develop **6.9 kPa 25 psi** of holding force. Under normal conditions, the magnets must attract and hold the doors open. Operation must be fail safe with no moving parts. Electromagnetic door hold-open devices must not be required to be held open during building power failure. The device must be listed based on **UL 228** tests.

]2.17 WARNING SIGNS

Signs must be three-layer red-white-red micarta engraved to show white letters on a red background. Letters are to be uppercase. Warning signs are to be 0.3175 mm 1/8-inch thick with beveled edges. Make letters for "WARNING" 3.81 cm 1-1/2 inches tall, and all other lettering 2.54 cm 1-inch tall.

PART 3 EXECUTION

NOTE: Installer should give consideration to the possibility of compartment over-pressurization and must provide a manually activated exhaust system to facilitate the extraction of any remaining clean agent after the required hold time of the clean agent system.

3.1 VERIFYING ACTUAL FIELD CONDITIONS

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

3.2 INSTALLATION

Install the systems in accordance with the applicable provisions of NFPA 72 and NFPA 2001. Provide each system complete and ready for operation. Conceal piping to the maximum extent possible. Inspect and test pipe and receive Contracting Officer approval before pipe is concealed. Provide each system with a listed pressure-relief device designed to operate between 13.79 and 22.75 megapascals 2,000 and 3,300 pounds per square inch and located between the storage cylinder manifolds and any normally closed valve.

3.3 ELECTRICAL

NOTE: Coordinate power and alarm requirements with the contract drawings and other specification sections.

Except as modified herein, electric equipment and wiring must be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.[Alarm signal wiring connected to the building fire alarm control system must be by the fire alarm installer.]

3.3.1 Overcurrent and Surge Protection

All equipment connected to alternating current circuits must be protected from surges. Cables and conductors that serve as communications links, except fiber optics, must have surge protection circuits installed at each end. Fuses must not be used for surge protection.

3.3.2 Grounding

Grounding must be provided to building ground.

3.3.3 System Field Wiring

3.3.3.1 Wiring within Cabinets, Enclosures, and Boxes

Provide wiring installed in a neat and workmanlike manner and installed parallel with or at right angles to the sides and back of any box, enclosure, or cabinet. Conductors that are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting, or junction box must be connected to screw-type terminal blocks. Mark each terminal in accordance with the [wiring diagrams](#) of the system. The use of wire nuts or similar devices is prohibited. Wiring to conform with [NFPA 70](#).

Indicate the following in the wiring diagrams:

- a. Point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems that are supervised or controlled by the system. Diagrams must show connections from field devices to the RCU and remote RCU, initiating circuits, switches, relays and terminals.
- b. Complete riser diagrams indicating the wiring sequence of devices and their connections to the control equipment. Include a color code schedule for the wiring. Include floor plans showing the locations of devices and equipment.

3.3.3.2 Terminal Cabinets

NOTE: Provide terminal cabinets on each floor where the releasing system supply riser is located and where the releasing return riser is located.

Provide a terminal cabinet at the base of any circuit riser, on each floor at each riser, and where indicated on the drawings. Terminal size must be appropriate for the size of the wiring to be connected. Conductor terminations must be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection must be permanently mounted in the terminal cabinet. Minimum size is [200 mm by 200 mm 8 inches by 8 inches](#). Only screw-type terminals are permitted. Provide an identification label, that displays "RELEASING SYSTEM TERMINAL CABINET" with [50-mm 2-inch](#) lettering, on the front of the terminal cabinet.

3.3.3.3 Alarm Wiring

NOTE: Do not penetrate SCIF perimeters with copper signal line circuits. SCIF penetrations should be either fiber optic cable or IDC. IDC circuits penetrating the SCIF must be filtered.

- a. Do not install wiring for more than one nominal voltage in any

junction box, housing or device, except those containing power supplies and control relays.

- b. Utilize shielded wiring where recommended by the manufacturer. For shielded wiring, ground the shield at only one point, in or adjacent to the RCU.
- c. [Pigtail or T-tap connections to [signal line circuits](#), initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited.] [T-tapping using screw terminal blocks is allowed for Class "B" [initiating device circuits signaling line circuits](#).]
- d. Color coding is required for circuits and must be maintained throughout the circuit. Conductors used for the same functions must be similarly color coded. Conform wiring to [NFPA 70](#).
- e. Pull all conductors splice free. The use of wire nuts, crimped connectors, or twisting of conductors is prohibited. Where splices are unavoidable, the location of the junction box or pull box where they occur must be identified on the as-built drawings. The number and location of splices must be subject to approval by the [_____] Designated Fire Protection Engineer (DFPE).

3.3.3.4 Back Boxes and Conduit

In addition to the requirements of Section [26 20 00](#) INTERIOR DISTRIBUTION SYSTEM, provide all wiring in rigid metal conduit or intermediate metal conduit unless specifically indicated otherwise. Minimum conduit size must be [19 mm 3/4-inch](#) in diameter. Do not use electrical non-metallic tubing (ENT) or flexible non-metallic tubing and associated fittings.

- a. Galvanized rigid steel (GRS) conduit must be utilized where exposed to weather, where subject to physical damage, and where exposed on exterior of buildings. Intermediate metal conduit (IMC) may be used in lieu of GRS as allowed by [NFPA 70](#).
- b. Electrical metallic tubing (EMT) is permitted above suspended ceilings or exposed where not subject to physical damage. Do not use EMT underground, encased in concrete, mortar, or grout, in hazardous locations, where exposed to physical damage, outdoors or in fire pump rooms. Use die-cast compression connectors.
- c. For rigid metallic conduit (RMC), only threaded type fitting are permitted for wet or damp locations.
- d. Flexible metal conduit is permitted for initiating device circuits [2 meters 6 feet](#) in length or less. Flexible metal conduit is prohibited for notification appliance circuits and signaling line circuits. Use liquid tight flexible metal conduit in damp and wet locations.
- e. Schedule 40 (minimum) polyvinyl chloride (PVC) is permitted where conduit is routed underground or underground below floor slabs. Convert non-metallic conduit, other than PVC Schedule 40 or 80, to plastic-coated rigid, or IMC, steel conduit before turning up through floor slab.
- f. Exterior wall penetrations must be weathertight. Conduit must be sealed to prevent the infiltration of moisture.

- [g. For Class "A" or "X" circuits with conductor lengths of 3 meters 10 feet or less, the conductors must be permitted to be installed in the same raceway in accordance with NFPA 72.

]3.3.3.5 Conductor Terminations

Labeling of conductors at terminal blocks in terminal cabinets, and RCU must be provided at each conductor connection. Each conductor or cable must have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet and RCU must contain a laminated drawing that indicates each conductor, its label, circuit, and terminal. The laminated drawing must be neat, using 12-point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

3.4 RELEASING CONTROL SYSTEM

3.4.1 Releasing Control Unit (RCU)

The RCU must be located in a year round environmentally conditioned space and not in the hazard area served but adjacent to it. Locate the RCU[where indicated on the drawings] [____]. [Recess][Semi-recess][Surface mount]the enclosure with the top of the cabinet 2 meters 6 feet above the finished floor or center the cabinet at [1.5][____] meters [5][____] feet, whichever is lower. Conductor terminations must be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection must be permanently mounted in the RCU. Locate the document storage cabinet adjacent to the RCU unless the Contracting Officer directs otherwise.

3.4.2 Smoke Detectors

Locate detectors[as required by NFPA 72 and their listing][as indicated on the drawings] on a 100-mm 4-inch mounting box. Smoke detectors are permitted to be on the wall no lower than 300 mm 12 inches from the ceiling with no minimum distance from the ceiling.[In raised floor spaces, install the smoke detectors to protect[21 square meters 225 square feet per detector] [____].] Install smoke detectors no closer than 1-meter 3 feet from air handling supply diffusers.[Detectors mounted in acoustical ceiling tiles must be centered in the tiles plus or minus 50 mm 2 inches.]

3.4.3 Air Sampling Smoke Detector

Locate air sampling smoke detectors in accordance with the manufacturer's instructions. Air sampling smoke detectors must be installed as follows:

a. Air Sampling Smoke Detector Assembly:

- (1) Mount detector assembly to a wall at a height between 1200 to 1800 mm 48 to 60 inches to top of detector measured above the finished floor.
- (2) Mounting must be in a fully accessible and visible location.
- (3) Mounting or attachment to site equipment, cable trays, movable walls, other equipment or equipment supports is not permitted.

- (4) Piping network insertion into the detector inlet must not be glued.
- (5) Air sampling smoke detector assembly must be installed in accordance with this specification section and the manufacturer's installation and instruction manuals.
- (6) Flexible tubing for termination of the sampling pipe network into detector inlet is not permitted unless allowed by its listing.
- (7) Provide red background with white lettering labels that are plastic or phenolic type with a minimum of 6.4 mm 0.25-inch block lettering to indicate detector and zone. For example: "AIR SAMPLING SMOKE DETECTOR No. 1-1 No. 5".
- (8) Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the ASD panel. The card must show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory, and trouble. The instructions must be approved by the Contracting Officer before being posted.

b. Pipe and Sampling Tube Mounting:

- (1) The pipe and sampling tubing detection network must be mounted as per the design and manufacturer's specification. The hardware used for mounting will depend upon the design and site requirements.
- (2) To minimize flexing, pipes must be secured every 1.5 meters 5 feet.
- (3) Pipes must be suspended between 25 and 100 mm 1 and 4 inches below the ceiling. In areas with a suspended ceiling, the pipe network must be installed above the ceiling utilizing the manufacturer's capillary sample port supported by the ceiling.
- (4) The sampling tubes must be of the same length or use the manufacturer's guidelines to run tubes of the required lengths.
- (5) When installing a pipe network in areas subject to high temperature fluctuations allow for the contraction and expansion of pipes.
- (6) Where expansion or contraction of pipes is likely either after installation or on a continuous basis, do not place pipe clips adjacent to couplings and socket unions as these may interfere with the movement of the pipe.
- (7) No bends are permitted within the first 450 mm 18 inches from the detector inlet.
- (8) The routing of the piping and sample tube network must be coordinated with potential obstructions, including cable trays, grounding bars, and HVAC ductwork.
- (9) All changes in direction must be made with standard elbows or

tees.

- (10) All joints must be air-tight and made by using solvent cement, except at the entry to the detector assembly. Refer to **ASTM F402**.
- (11) All pipes must be supported by mechanical hangers attached to the structure of the building. Not more than **300 mm 1-foot** of pipe must extend beyond the last hanger of each sampling pipe. The final installation must result in no noticeable deflection in the piping network.
- (12) Attachment of air sampling pipes to cable trays, "gray iron", and telecommunications equipment is prohibited.
- (13) Clearly label pipe network to distinguish the pipe from other facility pipe work or protective cabling enclosures. For example: "SMOKE DETECTION SAMPLING TUBE - DO NOT DISTURB". In open rooms and exposed areas, provide labels at no greater than **6.1-meter 20-foot** intervals. Provide labels every **3 meters 10 feet** where piping is installed above suspended ceilings and every **609 mm 2 feet**, centered in the floor panels, where piping is installed within the raised floor cavity.
- (14) Placement of the sampling tube must take into consideration appropriate sampling point locations and spacing.

c. Air Sampling Points:

- (1) Open area ceiling sampling points must be oriented downward and must be within **25 to 100 mm 1 to 4 inches** below the underside of the ceiling above where the ceiling is smooth.
- (2) Label all air sampling points with a round red label, each with a center hole to match the diameter of the drilled sampling point. For example: "AIR SAMPLING POINT DIA **3.2 MM 0.125 INCHES**". Indicate fractional dimensions in decimal format with a minimum of three decimal places.

3.4.4 Manual Stations

Locate manual stations as required by **NFPA 72** and **NFPA 2001**[and as indicated on the drawings]. Mount stations so they are located no farther than **[1.5][] meters [5][] feet** from the exit door they serve, measured horizontally. Manual stations must be mounted at **[1067][1117][] mm [42][44][] inches** measured to the operating handle.

3.4.5 Notification Appliances

NOTE: Locate strobes wall mounted in corridors no more than **4.5 meters 15 feet** from the end of a corridor with **30 meters 100 feet** maximum distance between strobes. Where there is an obstruction to the viewing path in the corridors, such as a cross-corridor door or ceiling elevation change, consider the obstruction as defining a new corridor. Provide ceiling mounted strobes in rooms accessible to the public, such as conference rooms,

**restrooms, courtrooms, cafeterias, and auditoriums
in accordance with NFPA 72.**

- a. Locate notification appliance devices[as required by NFPA 72 and NFPA 2001][where indicated]. Where more than two strobe appliances (releasing [and][or] building) are located in the same room or corridor or field of view, provide synchronized operation. Devices must use screw terminals for all field wiring.[Audible and visual notification appliances mounted in acoustical ceiling tiles must be centered in the tiles plus or minus 50 mm 2 inches.]
- b. Audible and visual notification appliances mounted on the exterior of the building, within unconditioned spaces, or in the vicinity of showers must be listed weatherproof appliances installed on weatherproof backboxes.

[3.4.6 Graphic Annunciator Panel]

Locate the graphic annunciator as shown on the drawings. Mount the panel, with the top of the panel 1830 mm 6 feet above the finished floor or center the panel at [1525][_____] mm [5][_____] feet, whichever is lower.
[Locate the graphic annunciator as shown on the drawings. Surface-mount the panel, with the top of the panel 1830 mm 6 feet AFF or center the panel at [1525][_____] mm [5][_____] feet, whichever is lower.]

]3.4.7 Remote LCD Annunciator

Locate the remote LCD annunciator as shown on the drawings. Mount the panel, with the top of the panel 2 meters 6 feet above the finished floor or center the panel at [1.5][_____] meters [5][_____] feet, whichever is lower.

3.4.8 Smoke or Fire/Smoke Dampers

NOTE: Automatic dampers are required in all ducts passing through walls, floors, and ceilings, to prevent the leakage of clean agent from the protected space, and to prevent the communication of fire and smoke. Locations of dampers should be shown on HVAC plans. Additional smoke dampers may be required in systems over 424,000 L/m 15,000 cfm by NFPA 90A. Coordinate with Section 23 09 53.00 20 SPACE TEMPERATURE CONTROL SYSTEMS. Provide access door in duct at each damper location. Connect duct detectors to clean agent system control unit only if no building fire alarm system is provided.

Activation of smoke or fire/smoke dampers must occur upon second zone detection, or upon activation of clean agent discharge by manual release station. Smoke or fire/smoke dampers are specified in Section 23 30 00 HVAC AIR DISTRIBUTION.

3.4.9 Electromagnetic Door Holder Release

Doors must be held open at a minimum of 90 degrees so as not to impede egress from the space. Mount the armature portion on the door and have an

adjusting screw for seating the angle of the contact plate. Wall-mount the electromagnetic release, with a total horizontal projection not exceeding 100 mm 4 inches. Ensure all doors release to close upon first stage (pre-discharge) alarm. Electrical supervision of wiring external of control unit for magnetic door holding circuits is not required.

3.4.10 Ceiling Bridges

Provide ceiling bridges for ceiling-mounted appliances. Ceiling bridges must be as recommended/required by the manufacturer of the ceiling-mounted notification appliance.

3.5 CLEAN AGENT EXTINGUISHING SYSTEM

3.5.1 Distribution Piping and Fittings

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

3.5.1.1 Pipe Penetrations

- a. Where pipes or conduits penetrate fire walls, fire partitions, or floors, pipes/conduits must be firestopped in accordance with Section 07 84 00 FIRESTOPPING.
- b. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe must be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.
- c. All penetrations through the boundary of rooms/areas identified as secure space area must meet ICS 705-1.

3.5.1.2 Escutcheons

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

3.5.2 Discharge Nozzle

Where clogging by external foreign materials is likely, discharge nozzles must be provided with frangible discs, blow-off caps, or other suitable devices.

3.6 WARNING SIGNS

Provide three-layer red-white-red micarta engraved to show white letters on a red background, warning signs. Letters are to be uppercase. Warning

signs are to be 0.3175 mm1 /8-inch thick with beveled edges. Make letters for "WARNING" 3.81 cm 1-1/2 inches tall, and all other lettering 2.54 cm 1-inch tall.

3.6.1 Protected Space

Permanently affix a sign adjacent to every audible/visual alarm activated due to agent discharge reading:

WARNING

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

3.6.2 Manual Release Station Activation

Place warning signs, ["Clean Agent Fire Extinguishing System"] manual release, at each station indicating that operation of the station initiates immediate fire extinguishing clean agent discharge. Where building fire alarm pull stations are also mounted at the exits from the protected areas, separate them from clean agent manual release stations by at least 1-meter 3 feet horizontally. [If 1-meter 3-foot separation is not possible, provide additional precautions to avoid accidental activation.] Provide labels to clearly distinguish building fire alarm stations from clean agent manual release stations. Ensure clean agent manual release stations are a different color (yellow or orange) from building fire alarm pull stations and are consistent throughout the facility. Place a sign at every location where manual operation of the system may occur reading:

WARNING

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

3.6.3 System Controls

Provide an electrical and mechanical actuating control system contained in a RCU as modified below.

3.6.3.1 Disconnect Switch

Connect the positive and negative conductors of the Class B solenoid/actuator/electric release head circuitry in series to a lock switch. Provide and install the switch in an enclosure inside the facility. A clearly visible sign on the enclosure, or immediately adjacent, is to explicitly indicate its purpose as "CLEAN AGENT FIRE EXTINGUISHING SYSTEM DISCONNECT SWITCH". The disconnect switch must be supervised by the RCU.

3.6.4 Operating Instructions

Provide operating instructions for clean agent fire protection systems consisting of raised or embossed white letter on red rigid plastic or enameled steel background and of adequate size to permit them to be easily read. Provide operating instructions at each RCU. Instruction are to clearly indicate necessary steps for the operating of the system.

3.7 FIRESTOPPING

Provide firestopping for holes at conduit and pipe penetrations through floor slabs, fire-rated walls, partitions with fire-rated doors, corridor walls, and vertical service shafts in accordance with Section 07 84 00 FIRESTOPPING.

3.8 PAINTING

- a. In unfinished areas (including areas above drop ceilings), paint all exposed electrical conduit (serving releasing system equipment), releasing system conduit, surface metal raceway, junction boxes and covers red. In lieu of painting conduit, the contractor may utilize red conduit with a factory applied finish.
- b. In finished areas, paint exposed electrical conduit (serving releasing system equipment), releasing system conduit, surface metal raceways, junction boxes, and electrical boxes to match adjacent finishes. The inside cover of the junction box must be identified as "Releasing System" and the conduit must have painted red bands 19 mm 3/4-inch wide at 3-meter 10-foot centers and at each side of a floor, wall, or ceiling penetration.
- c. Painting must comply with Section 09 90 00 PAINTS AND COATINGS.

3.9 FIELD QUALITY CONTROL

**NOTE: Listed tests are minimum required.
Coordinate with the local Authority Having
Jurisdiction (AHJ) for minimum requirements in
excess of the NFPA 72 minimums or those recommend
below. If additional tests are required, such tests
must be added to the list.**

3.9.1 Test Procedures

Submit detailed test procedures, prepared and signed by the NICET Level[III][or][IV] Fire Alarm Technician, and the representative of the installing company[, and reviewed by the QFPE] [60][_____] days prior to performing system tests. Detailed test procedures must list all components of the installed system such as initiating devices and circuits, notification appliances and circuits, signaling line devices and circuits, control devices/equipment, batteries, power sources/supply, annunciators, special hazard equipment, and interface equipment. Test procedures must include sequence of testing, time estimate for each test, and sample test data forms. The test data forms must be in a check-off format (pass/fail with space to add applicable test data; similar to the forms in NFPA 72 and NFPA 4.) The test procedures and accompanying test data forms must be used for the pre-Government testing and the final Government testing. The test data forms must record the test results and must:

- a. Identify the NFPA Class of all initiating device circuits (IDC), notification appliance circuits (NAC, and signaling line circuits (SLC)).
- b. Identify each test required by NFPA 72 Test Methods and NFPA 2001 and

required test herein on each component in compliance with the same.

- c. Identify each component and circuit as to type, location within the facility, and unique identity within the installed system. Provide necessary floor plan sheets showing each component location, test location, and alphanumeric identity.
- d. Identify all test equipment and personnel required to perform each test (including equipment necessary for smoke detector testing. The use of magnets is not permitted.
- e. Provide space to identify the date and time of each test. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

3.9.2 Pre-Government Testing

3.9.2.1 Verification of Compliant Installation

Conduct inspections and tests to ensure that devices and circuits are functioning properly. Releasing system tests must meet the requirements of paragraph MINIMUM SYSTEM TESTS as required by NFPA 72. The Contractor and an authorized representative from each supplier of equipment must be in attendance at the pre-Government testing to make necessary adjustments. After inspection and testing is complete, provide a signed Verification of Compliant Installation letter by the QFPE that the installation is complete, compliant with the specification and fully operable. The letter must include the names and titles of the witnesses to the pre-Government tests. Provide all completion documentation as required by NFPA 72 and NFPA 2001 and the test reports noted below.

- a. NFPA 72 Record of Completion
- b. NFPA 72 Record of Inspection and Testing
- c. NFPA 2001 Clean Agent System Acceptance Test Report.
- d. Audibility test results with marked-up test floor plans.
- e. Documentation that all tests identified in paragraph MINIMUM SYSTEM TESTS are complete.

3.9.2.2 Request for Government Final Test

When the verification of compliant installation has been completed, submit a formal request for Government final test to the [____][Designated Fire Protection Engineer (DFPE)][Contracting Offices Designated Representative (COR)]. Government final testing will not be scheduled until the DFPE has received copies of the request for Government final testing and Verification of Compliant Installation letter with all required reports. Government final testing will not be performed until after the connections to the installation-wide fire reporting system has been completed and tested to confirm communications are fully functional. Submit request for test at least [15][____] calendar days prior to the requested test date.

3.9.3 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, perform corrective actions and repeat the tests. Tests must

be conducted and repeated if necessary until the system has been demonstrated to comply with all contract requirements.

3.9.4 Government Final Tests

The tests must be performed in accordance with the approved test procedures in the presence of the DFPE. Furnish instruments and personnel required for the tests. The following must be provided at the job site for Government Final Testing:

- a. The manufacturer's technical representative.
- [b. The contractor's Qualified Fire Protection Engineer (QFPE).
-] c. Marked-up red line drawings of the system as actually installed.
- d. Loop resistance test results.
- e. Complete program printout including input/output addresses.
- f. Copy of pre-Government Test Certificate, test procedures and completed test data forms.
- g. Audibility test results with marked-up floor plans.

Government Final Tests will be witnessed by the [____][, Designated Fire Protection Engineer][, Contracting Officer's Representative (COR)][, Qualified Fire Protection Engineer (QFPE)]. At this time, any and all required tests noted in paragraph MINIMUM SYSTEM TESTS must be repeated at their discretion.

3.10 MINIMUM SYSTEM TESTS

3.10.1 System Tests

Test the system in accordance with the procedures outlined in NFPA 72. The required tests are as follows:

- a. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests must be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.
- b. Verify the absence of unwanted voltages between circuit conductors and ground. The tests must be accomplished at the preliminary test with results available at the final system test.
- c. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.
- d. Test each initiating device and notification appliance and circuit for proper operation and response at the control unit. Smoke detectors must be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors must comply with the requirements of NFPA 72 except disconnect at least 20 percent of devices. If there is a failure at these devices, then supervision must be tested at each device.

- e. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M manual.
- f. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.
- g. Determine that the system is operable under trouble conditions as specified.
- h. Visually inspect wiring.
- i. Test the battery charger and batteries.
- j. Verify that software control and data files have been entered or programmed into the releasing control unit. Hard copy records of the software must be provided to the Contracting Officer.
- k. Verify that red-line drawings are accurate.
- l. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.
- m. Measure voltage readings for circuits to ensure that voltage drop is not excessive.
- n. Disconnect the verification feature for smoke detectors during tests to minimize the amount of smoke needed to activate the sensor. Testing of smoke detectors must be conducted using real smoke or the use of canned smoke which is permitted.
- o. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.
- p. Verify the documentation cabinet is installed and contains all as-built shop drawings, product data sheets, design calculations, site-specific software data package, and all documentation required by paragraph titled "Test Reports".

3.10.2 Audibility Tests

Sound pressure levels from audible notification appliances must not exceed 110 dBa in any occupiable area. The provisions for audible notification (audibility) must be met with doors, fire shutters, movable partitions, and similar devices closed.

3.10.3 Room Pressurization Test

After all construction work is complete, conduct a room pressurization test in accordance with NFPA 2001 in each clean agent fire extinguishing system hazard area. Test must confirm enclosure's ability to retain the agent concentration level for the required hold time. If the test fails, the clean agent fire extinguishing system contractor must coordinate room sealing with the general contractor. Additional tests must be conducted until successful test results are achieved. Include final test results with the final record drawings.

- a. A room pressurization test must be conducted, in each protected space, to determine the presence of openings, which would affect the agent

system concentration levels. The test(s) must be conducted using the Retro-Tec Corp. Door Fan system, or equivalent, with integrated computer program. All testing must be in accordance with **NFPA 2001**.

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

3.10.4 Clean Agent Fire Extinguishing Systems Test

Using nitrogen or other inert gas, perform a flow test on the piping network to verify that flow is continuous and unobstructed through piping and nozzles and that the piping has been cleaned and swabbed.

3.10.5 Pressure/Leak Test

Pneumatically test the piping in a closed circuit for a period of 10 minutes at **276 kPa 40 psi**. At the end of 10 minutes, the pressure drop must not fall below 80 percent of the test pressure. Repair leaks and retest until no leaks exist.

3.11 SYSTEM ACCEPTANCE

- [a. Furnish one set of CDs or DVDs containing software back-up and CAD based drawings in latest version of[MicroStation][AutoCAD,] DXF and portable document formats of as-built drawings and schematics.
-] b. Include complete wiring diagrams showing connections between devices and equipment, both factory and field wired.
- c. Include a riser diagram and drawings showing the as-built location of devices and equipment.
- d. Provide **operation and maintenance (O&M) instructions**.
- [In existing buildings, the transfer of devices from the existing system to the new system and the permission to begin demolition of the old fire alarm system will not be permitted until the as-built drawings and O&M manuals are received.
-] Submit Operation and Maintenance (O&M) Manuals as part of the SD-10 package. O&M data must include[Six][_____] copies of the Operation and Maintenance Instructions. The O&M Instructions must be prepared in a

single volume or in multiple volumes, with each volume indexed, and may be submitted as a Technical Data Package. Manuals must be approved prior to training. The Releasing System Operation and Maintenance Instructions must include the following:

- a. "Manufacturer Data Package [5][____]" as specified in[Section 01 78 23 OPERATION AND MAINTENANCE DATA] [____].
- b. Operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual must include the manufacturer's name, model number, service manual, parts list, and preliminary equipment list complete with description of equipment and their basic operating features.
- c. Maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals must include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed.
- d. Complete procedures for system revision and expansion, detailing both equipment and software requirements.
- e. Software delivered for this project on each type of CD/DVD media utilized.
- f. Printouts of configuration settings for all devices.
- g. Routine maintenance checklist. The routine maintenance checklist must be arranged in a columnar format. The first column must list all installed devices, the second column must state the maintenance activity or state no maintenance required, the third column must state the frequency of the maintenance activity, and the fourth column provided for additional comments or reference. All data (such as devices and testing frequencies) must comply with UFC 3-601-02.
- h. A final Equipment List must be submitted with the Operating and Maintenance (O&M) manual.

Submit as-built drawings as part of the SD-11 package. The drawings must show the system as installed, including deviations from both the project drawings and the approved shop drawings. These drawings must be submitted within 2 weeks after the final Government test of the system. At least one set of as-built (marked-up) drawings must be provided at the time of, or prior to the final Government test.

[3.12 SYSTEM INSPECTION AND TESTING

The installing contractor must provide two inspections of the clean agent fire extinguishing system, one at 6 months and the second at 12 months after system acceptance. Inspections must be conducted in accordance with manufacturer's guidelines and NFPA 2001. Documents certifying satisfactory system operation must be submitted to the Contracting Officer or the Contracting Officer's Representative.

]3.13 INSTRUCTION OF GOVERNMENT EMPLOYEES

3.13.1 Instructor

Provide the services of an instructor, who has received specific training

from the manufacturer for the training of other persons regarding the operation, inspection, testing, and maintenance of the system provided. The instructor must train the Government employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the releasing system. The instructor must be thoroughly familiar with all parts of this installation. The instructor must be trained in operating theory as well as in practical O&M work. Submit the instructor's information and qualifications including the training history.

3.13.2 Required Instruction Time

Provide [8][16][____] hours of instruction after final acceptance of the system. Provide the instruction during regular working hours on such dates and times selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The on-site training must allow for rescheduling for unforeseen maintenance and/or fire department responses.

[3.13.2.1 Technical Training

Equipment manufacturer or a factory representative must provide [1][3][____] days of on-site[and 5 days of technical training to the Government at the manufacturing facility.] Training must allow for classroom instruction as well as individual hands on programming, troubleshooting and diagnostics exercises.[Factory training][Training] must occur within [6][12][____] months of system acceptance.

]3.13.3 Technical Training Manual

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

3.14 EXTRA MATERIALS

3.14.1 Repair Service/Replacement Parts

Repair services and replacement parts for the system must be available for a period of 10 years after the date of final acceptance of this work by the Contracting Officer. During the warranty period, the service technician must be on-site within 24 hours after notification. All repairs must be completed within 24 hours of arrival on-site.

During the warranty period, the installing releasing system contractor is responsible for conducting all required testing and maintenance in accordance with the requirements and recommended practices of NFPA 72, NFPA 2001 and the system manufacturer[s]. Installing releasing system contractor is NOT responsible for any damage resulting from abuse, misuse, or neglect of equipment by the end user.

3.14.2 Spare Parts

Provide spare parts which are directly interchangeable with the corresponding components of the installed system[s]. Spare parts must be suitably packaged and identified by nameplate, tagging, or stamping.

Deliver all spare parts directly to the Contracting Officer at the time of the final acceptance testing and provide an accompanying inventory list.

3.14.3 Document Storage Cabinet

Upon completion of the project, but prior to project close-out, place in the document storage cabinet copies of the following record documentation:

- a. As-built shop drawings
- b. Product data sheets
- c. Design calculations
- d. Site-specific software data package
- e. All documentation required by SD-06.

-- End of Section --