Preparing Activity: USACE

Superseding
UFGS-28 31 00.00 10 (November 2008)
UFGS-28 31 49 (April 2006)
UFGS-28 31 63.00 20 (October 2007)
UFGS-28 31 64.00 10 (August 2009)
UFGS-28 31 74.00 20 (February 2010)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
****

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SECTION 28 31 70

INTERIOR FIRE ALARM SYSTEM, ADDRESSABLE

08/20

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USACE / NAVFAC / AFCEC / NASA	**UFGS-28 31 70 (August 2020)**

Preparing Activity: USACE	**Superseding** **UFGS-28 31 00.00 10 (November 2008)** **UFGS-28 31 49 (April 2006)** **UFGS-28 31 63.00 20 (October 2007)** **UFGS-28 31 64.00 10 (August 2009)** **UFGS-28 31 74.00 20 (February 2010)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 28 31 70

INTERIOR FIRE ALARM SYSTEM, ADDRESSABLE
08/20

****
NOTE: This specification covers the requirements for an addressable integrated fire detection, fire alarm system.

Adhere to UFC 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 Designated Fire Protection Engineer (DFPE).
****

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NOTE: For Family Housing projects at NAVFAC NE use regional guide specification section 28 31 46.00 22 (N-13854N) HOUSEHOLD FIRE WARNING EQUIPMENT to specify residential fire warning systems in lieu of this section.

****

****

NOTE: This specification section includes requirements from UFC 3-600-01 (change 43, 7 February 2020)

****

****

NOTE: This guide specification covers carbon monoxide alarm detectors for protection in indoor locations where fuel-burning appliances/equipment are used.

****

PART 1 GENERAL

****

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 fire alarm systems riser diagram. Each device on the riser should be identified by type. Indicate connection of equipment.

3. A fire alarm 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 Fire Alarm 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 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 A17.1/CSA B44	(2019) Safety Code for Elevators and Escalators

ASTM INTERNATIONAL (ASTM)

ASTM F402	(2005; R 2012) 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 http://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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 4	(2018) Standard for Integrated Fire Protection and Life Safety System Testing

NFPA 70	(2023) National Electrical Code
NFPA 72	(2022; ERTA 22-1) National Fire Alarm and Signaling Code
NFPA 90A	(2024) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 170	(2021) Standard for Fire Safety and Emergency Symbols

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-601-02	(2021) Fire Protection Systems Inspection, Testing, and Maintenance
UFC 4-010-06	(2016; with Change 1, 2017) Cybersecurity of Facility-Related Control Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices
47 CFR 90	Private Land Mobile Radio Services

UNDERWRITERS LABORATORIES (UL)

UL 228	(2006; Reprint Mar 2022) UL Standard for Safety Door Closers-Holders, With or Without Integral Smoke Detectors
UL 268	(2023) UL Standard for Safety Smoke Detectors for Fire Alarm Systems
UL 268A	(2008; Reprint Oct 2014) 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 521	(1999; Reprint Feb 2023) UL Standard for Safety Heat Detectors for Fire Protective Signaling Systems
UL 864	(2014; Reprint May 2020) UL Standard for Safety Control Units and Accessories for Fire Alarm Systems
UL 1283	(2017) UL Standard for Safety Electromagnetic Interference Filters

UL 1449	(2021; Reprint Dec 2022) 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 Oct 2008) Signaling Devices for the Hearing Impaired
UL 2034	(2017; Reprint Oct 2022) UL Standard for Safety Single and Multiple Station Carbon Monoxide Alarms
UL 2075	(2013; Bul. 2019) UL Standard for Safety Gas and Vapor Detectors and Sensors
UL Fire Prot Dir	(2012) Fire Protection Equipment Directory

1.2 RELATED SECTIONS

Section 25 05 11Cybersecurity for Facility-Related Control Systems, applies to this section, with the additions and modifications specified herein. In addition, refer to the following sections for related work and coordination:

[Section 21 13 13 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION]
[Section 21 30 00 FIRE PUMPS]
[Section 21 23 00.00 20 WET CHEMICAL FIRE EXTINGUISHING for KITCHEN CABINET]
[Section 21 13 16 DRY PIPE FIRE SPRINKLER SYSTEMS]
[Section 21 13 18 PREACTION FIRE SPRINKLER SYSTEMS]
[Section 21 13 19 DELUGE FIRE SPRINKLER SYSTEMS]
[Section 23 30 00 HVAC AIR DISTRIBUTION]
[Section 21 13 24.00 10 AQUEOUS FILM-FORMING FOAM (AFFF) FIRE PROTECTION SYSTEM]
[Section 21 13 25 HIGH-EXPANSION FOAM SYSTEM, FIRE PROTECTION]
[Section 21 13 20.00 20 FOAM FIRE EXTINGUISHING FOR AIRCRAFT HANGARS]
[Section 21 13 21.00 20 FOAM FIRE EXTINGUISHING FOR FUEL TANK PROTECTION]
[Section 21 13 22.00 20 FOAM FIRE EXTINGUISHING FOR HAZ/FLAM MATERIAL FACILITY]
[Section 21 21 01.00 20 CARBON DIOXIDE FIRE EXTINGUISHING (HIGH PRESSURE)]
[Section 21 21 02.00 20 CARBON DIOXIDE FIRE EXTINGUISHING (LOW PRESSURE)]
[Section 21 21 03.00 10 WET CHEMICAL FIRE EXTINGUISHING SYSTEM]
[Section 08 71 00 DOOR HARDWARE for [door release][door unlocking] and additional work related to finish hardware.]
[Section[s] [14 21 13 ELECTRIC TRACTION FREIGHT ELEVATORS] [14 21 23 ELECTRIC TRACTION PASSENGER ELEVATORS] [and] [14 24 13 HYDRAULIC FREIGHT ELEVATORS] [14 24 23 HYDRAULIC PASSENGER ELEVATORS] for additional work related to elevators.]
[Section 07 84 00 FIRESTOPPING for additional work related to firestopping.]

1.3 SUMMARY

1.3.1 Scope

a. This work includes designing and [providing a new, complete,][modifying the existing] fire alarm system as described herein and on the contract drawings[for the _____]. Include system wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, initiating devices, notification appliances, supervising station fire alarm transmitters, and other accessories and miscellaneous items required for a complete operational system even though each item is not specifically mentioned or described. Provide system[s] complete and ready for operation.[Existing interior fire alarm system was manufactured by [_____].] Design and installation must comply with UFGS 25 05 11, UFC 4-010-06 and AFGM 2019-320-02.

b. Provide equipment, materials, installation, workmanship, inspection, and testing in strict accordance with NFPA 72, except as modified herein. [The system layout on the drawings show the intent of coverage and suggested locations. Final quantity, system layout, and coordination are the responsibility of the Contractor.]

[c. Each remote fire alarm control unit must be powered from a wiring riser specifically for that use or from a local emergency power panel located on the same floor as the remote fire alarm control unit. Where remote fire control units are provided, equipment for notification appliances may be located in the remote fire alarm control units.]

[d. Where a fire pump is provided, the fire alarm system must monitor and transmit the fire pump controller signals in accordance with the provisions of NFPA 72.]

[e. Where an emergency generator provides standby power supply for life safety system circuits, the generator must be monitored by the Fire Alarm Control Unit (FACU) and transmit emergency generator signals in accordance with NFPA 72.]

f. The fire alarm system must be independent of the building security, building management, and energy/utility monitoring systems other than for control functions.

1.3.2 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.
****

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. Construction (shop) drawings and calculations must be prepared by, or prepared under the immediate supervision of, the QFPE. The QFPE must affix their professional engineering stamp with signature to the shop drawings, calculations, and material data sheets, indicating approval prior to submitting the shop drawings to the DFPE.

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.

1.4 DEFINITIONS

Wherever mentioned in this specification or on the drawings, the equipment, devices, and functions must be defined as follows:

1.4.1 Interface Device

An addressable device that interconnects hard wired systems or devices to an analog/addressable system.

1.4.2 Fire Alarm Control Unit (FACU)

A master control unit having the features of a fire alarm control unit (FACU).

1.4.3 Remote Fire Alarm Control Unit

A control unit, physically remote from the fire alarm control unit, that receives inputs from automatic and manual fire alarm devices; may supply power to detection devices and interface devices; may provide transfer of power to the notification appliances; may provide transfer of condition to relays or devices connected to the control unit; and reports to and receives signals from the fire alarm and mass notification control unit.

1.4.4 Terminal Cabinet

A steel cabinet with locking, hinge-mounted door where terminal strips are securely mounted inside the cabinet.

1.4.5 Control Module and Relay Module

Terms utilized to describe emergency control function interface devices as defined by NFPA 72.

1.4.6 Designated Fire Protection Engineer (DFPE)

The DoD fire protection engineer that oversees that Area of Responsibility for that project. This is sometimes referred to as the "cognizant" fire protection engineer. Interpret reference to "authority having jurisdiction" and/or AHJ in referenced standards to mean the Designated Fire Protection Engineer (DFPE). The DFPE may be responsible for review of the contractor submittals having a "G" designation, and for witnessing final inspection and testing.

1.4.7 Qualified Fire Protection Engineer (QFPE)

A QFPE is 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.

1.5 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES (or the particular specification section for submittal procedures in this project) 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, Air Force, and NASA 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.

Choose the first bracketed item for Navy, Air Force

and NASA projects, or choose the second bracketed item for Army projects.
****

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.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.]

Shop drawings (SD-02), product data (SD-03) and calculations (SD-05) must be prepared by the fire alarm 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 will be returned by the Government disapproved without review.

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

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

Fire alarm system designer; G[, [_____]]

Supervisor; G[, [_____]]

Technician; G[, [_____]]

Installer; G[, [_____]]

Test Technician; G[, [_____]]

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

SD-02 Shop Drawings

Nameplates; G[, [_____]]

Instructions; G[, [_____]]

Wiring Diagrams; G[, [_____]]

System Layout; G[, [_____]]

Notification Appliances; G[, [_____]]

Initiating devices; G[, [_____]]

Battery Power; G[, [_____]]

Voltage Drop Calculations; G[, [_____]]

SD-03 Product Data

Fire Alarm Control Unit (FACU); G[, [_____]]

[Video Display Unit (VDU); G[, [_____]]]

LCD Annunciator; G[, [_____]]

Manual Stations; G[, [_____]]

Smoke Detectors; G[, [_____]]

Duct Smoke Detectors; G[, [_____]]

[Projected Beam Smoke Detector; G[, [_____]]]

[Air sampling smoke detectors; G[, [_____]]]

Heat Detectors; G[, [_____]]

[Flame Detectors; G[, [_____]]
]
[Multi-Criteria Detectors; G[, [_____]]]

Carbon monoxide detector; G[, [_____]]

Addressable Interface Devices; G[, [_____]]

Addressable Control Modules; G[, [_____]]

Isolation Modules; G[, [_____]]

Notification Appliances; G[, [_____]]

Batteries; G[, [_____]]

Battery Chargers; G[, [_____]]

[Supplemental Notification Appliance Circuit Panels; G[, [_____]]]

[Auxiliary Power Supply Panels; G[, [_____]]]

Surge Protective Devices; G[, [_____]]

Alarm Wiring; G[, [_____]]

[Back Boxes and Conduit; G[, [_____]]]

[Ceiling Bridges for Ceiling-Mounted Appliances; G[, [_____]]]

Terminal Cabinets; G[, [_____]]

Digital Alarm Communicator Transmitter (DACT); G[, [_____]]

[Automatic Fire Alarm Transmitters (including housing); G[, [_____]]
]

[Radio Transmitter and Interface Panels; G[, [_____]]]

Electromagnetic Door Holders; G[, [_____]]

Environmental Enclosures or Guards; G[, [_____]]

[Firefighter Telephone; G[, [_____]]]

[Printer; G[, [_____]]]

Document Storage Cabinet; G[, [_____]]

SD-05 Design Data

[Air Sampling Smoke Detection System Calculations; G[, [_____]]
]

SD-06 Test Reports

Test Procedures; G[, [_____]]

SD-07 Certificates

Verification of Compliant Installation; G[, [_____]]

Request for Government Final Test; G[, [_____]]

SD-10 Operation and Maintenance Data

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

Instruction of Government Employees; G[, [_____]]

SD-11 Closeout Submittals

As-Built Drawings

Spare Parts

1.6 SYSTEM OPERATION

****
NOTE: Circuit wiring must be Class "B" unless Class "A" or "X" is required by the local installation and as permitted by NFPA 72 (SLC: "A", "B", or "X"; IDC and NAC: "A" or "B").

Circuits and pathways must have survivability levels as defined by NFPA 72.
****

Fire alarm system components requiring power, except for the FACU(s) power supply, must operate on 24 volts DC unless noted otherwise in this section.

The interior fire alarm system must be a complete, supervised, noncoded, analog/addressable fire alarm system conforming to NFPA 72, and UL 864. Systems meeting UL 2017 only are not acceptable. The system must be activated into the alarm mode by actuation of an alarm initiating device. The system must remain in the alarm mode until the initiating device is reset and the control unit is reset and restored to normal.

[Provide the system with an interconnected riser loop or network having

Class [A][X] supervision. Ensure that the return portion of the loop is remote from the supply portion of the loop.][Where the building has two stairs for egress from floors above grade or floors below grade, ensure that a single impairment cannot adversely affect more than one floor. Where three or more stairs are provided for egress from floors above grade or below grade, ensure that a single impairment cannot adversely affect more than one-half of any floor.][Ensure that any single impairment of the system does not affect the system on more than [one][one-half] of any floor.]

1.6.1 Alarm Initiating Devices and Notification Appliances (Visual, Audible)

a. Connect alarm initiating devices to initiating device circuits (IDC) [Class "A"][Class "B"], or to signaling line circuits (SLC) Class ["A"]["B"]["X"] and installed in accordance with NFPA 72.

b. Connect notification appliances to notification appliance circuits (NAC) [Class "A][Class "B"].

1.6.2 Functions and Operating Features

The system must provide the following functions and operating features:

a. Power, annunciation, supervision, and control for the system. Addressable systems must be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits with sufficient memory to perform as specified.

b. Visual alarm notification appliances must be synchronized as required by NFPA 72.

c. Electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control unit.

d. An audible and visual trouble signal to activate upon a single break or open condition, or ground fault[(or short circuit for Class "X")]. The trouble signal must also operate upon loss of primary power (AC) supply, absence of a battery supply, low battery voltage, or removal of alarm or supervisory control unit modules. After the system returns to normal operating conditions, the trouble signal must again sound until the trouble is acknowledged. A smoke detector in the process of being verified for the actual presence of smoke must not initiate a trouble condition.

e. A trouble signal silence feature that must silence the audible trouble signal, without affecting the visual indicator.

f. Program capability via switches in a locked portion of the FACU to bypass the automatic notification appliance circuits, [fire reporting system][air handler shutdown][smoke control operation][elevator recall][door release][door unlocking] features. Operation of this programmed action must indicate on the FACU display[and printer output] as a supervisory or trouble condition.[Notification appliance bypass must be selectable by floor.]

g. Alarm functions must override trouble or supervisory functions. Supervisory functions must override trouble functions.

h. The system must be capable of being programmed from the control unit keyboard. Programmed information must be stored in non-volatile memory.

i. The system must be capable of operating, supervising, and/or monitoring non-addressable alarm and supervisory devices.

j. There must be no limit, other than maximum system capacity, as to the number of addressable devices that may be in alarm simultaneously.

k. Where the fire alarm system is responsible for initiating an action in another emergency control device or system, such as [HVAC,][atrium exhaust,][smoke control,][elevator recall,][releasing service,]the addressable fire alarm relay must be located in the vicinity of the emergency control device.

l. An alarm signal must automatically initiate the following functions:

(1) Transmission of an alarm signal to [the fire department][a remote supervising station].

(2) Visual indication of the device operated on the FACU, [Video Display unit (VDU),] [and on the [graphic][remote]annunciator].[Indication on the graphic annunciator must be by floor, zone or circuit, and type of device.]

[(3) Record the event on the system printer.]

(4) Actuation of alarm notification appliances.

(5) Recording of the event electronically in the history log of the FACU.

[(6) Release of doors held open by electromagnetic devices.]

[(7) Operation of the [smoke control system][atrium exhaust system].]

[(8) Release of power to electric locks (delayed egress locks) on doors that are part of the means of egress.]

[(9) Elevator recall as described in this section.]

****

NOTE: Use this paragraph only where a detector or detection system is to release a special fire extinguishing system.

****

[(10) Operation of [_____] must release the [_____] fire extinguishing system after a [_____] second time delay.]

[(11) Operation of a sprinkler waterflow switch serving an elevator machinery room or elevator shaft must operate shunt trip circuit breaker(s) to shut down power to the elevators in accordance with ASME A17.1/CSA B44.]

[(12) Operation of an interface that operates vibrating pagers worn by hearing-impaired occupants.]

m. A supervisory signal must automatically initiate the following functions:

(1) Visual indication of the device operated on the FACU, [Video Display unit (VDU),] [and on the [graphic][remote]annunciator].[Indication on the graphic annunciator must be by floor, zone or circuit, and type of device.]

[(2) Record the event on the system printer.]

(3) Transmission of a supervisory signal to [the fire department][a remote supervising station].

(4) Operation of a duct smoke detector must shut down the appropriate air handler in accordance with NFPA 90A in addition to other requirements of this paragraph and as allowed by NFPA 72.

(5) Recording of the event electronically in the history log of the FACU.

n. A trouble condition must automatically initiate the following functions:

(1) Visual indication of the device operated on the FACU, [Video Display unit (VDU),] [and on the [graphic][remote]annunciator].[Indication on the graphic annunciator must be by floor, zone or circuit, and type of device.]

[(2) Record the event on the system printer.]

(3) Transmission of a trouble signal to [the fire department][a remote supervising station].

(4) Recording of the event electronically in the history log of the FACU.

[o. Activation of a carbon monoxide alarm initiating device must automatically initiate the following functions:

(1) Visual indication of the device operated on the ,[LCD, LED Display unit (VDU),][and on the [graphic][remote]annunciator].[Indication on the graphic annunciator must be by floor and room number, device address, and device type.]

(2) Transmission of a carbon monoxide alarm signal to [the fire department][a remote supervising station].

(3) Activation of all strobes and the carbon monoxide alarm signal throughout the building.

(4) Recording of the event electronically in the history log of the FACU.]

p. System control equipment must be programmed to provide a 60-minute to 180-minute delay in transmission of trouble signals resulting from primary power failure.

[1.6.3 Elevator Recall

****
NOTE: Delete this paragraph if no elevator work is included in the project.
****

Provide elevator recall in accordance with ASME A17.1/CSA B44, Section [14 21 13 ELECTRIC TRACTION FREIGHT ELEVATORS][14 21 23 ELECTRIC TRACTION PASSENGER ELEVATORS][14 24 13 HYDRAULIC FREIGHT ELEVATORS][14 24 23 HYDRAULIC PASSENGER ELEVATORS], and as specified herein. Activation of any smoke detector in an elevator shaft, machine room, or lobby (except at designated recall level) must cause all elevators associated with that shaft, machine room, or lobby to return nonstop to the designated level. Activation of a smoke detector in the lobby or machine room at the designated level must cause all elevators associated with that lobby to return nonstop to the assigned alternate level. Activation of a detector in an elevator shaft, machine room, or lobby must also cause illumination of elevator cab warning signal (fire hat) and complete operation of fire alarm system as specified in paragraph titled "Functions and Operating Features".

]1.7 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 fire alarm system manufacturer must submit written confirmation of this contract provision as "Fire Alarm 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 fire alarm .

e. Description of Fire Alarm Control Unit equipment operation.

f. Description of auxiliary and remote equipment operations.

g. Library of application software.

h. Operation and maintenance manuals.

[1.8 EXISTING EQUIPMENT

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NOTE: If an addition to an existing fire alarm system is required, the contract drawings or this section must include the make, model number, and other pertinent information of existing components that are to operate with the new equipment. Since new interfaces will have to be compatible with the existing system or to the central fire alarm reporting system, it may be necessary to edit major items out of this specification. If a new FACU is required, it has to be compatible with the existing central fire alarm reporting system. When an existing system is to be expanded, show the following information on the contract drawings:

1. Manufacturer and model of existing control unit.

2. Number of existing initiating circuits (zones), notification appliance circuits, and control circuits served by the control unit.

3. Number of existing alarm notification appliances on the system.

4. Total calculated current draw of all devices served by each existing standby battery under both supervisory (standby) and alarm conditions, including NAC/extender control units and subcontrol units.

5. Ampere-hour rating and type of each existing battery.

****

a. Equipment and devices must be compatible and operable with the existing fire alarmmass notification system and must not impair reliability or operational functions of existing supervising station fire alarm system.[The proprietary type supervising station (PSS) is located [in Building [_____].][_____].][The supervising equipment is existing and consists of the following brands and models: [supervising station control unit [_____].][_____][signal reporting components [_____]], [annunciator [_____]][_____]].

[b. Equipment and devices must be compatible and operable with the existing building fire alarm system. Equipment must not impair reliability or operational functions of the existing system. The existing building system control unit is [_____].]

]1.9 QUALITY ASSURANCE

1.9.1 Submittal Documents

1.9.1.1 Preconstruction Submittals

Within 36 days of contract award but not less than [14 days][_____] prior to commencing any work on site, the Contractor must submit the following for review and approval. SD-02, SD-03 and SD-05 submittals received prior to the review and approval of the qualifications of the fire alarm subcontractor and QFPE must be returned disapproved without review. All resultant delays must be the sole responsibility of the Contractor.

1.9.1.2 Shop Drawings

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. Minimum scale for floor plans must be 1/8"=1'.

1.9.1.3 Nameplates

Nameplate illustrations and data to obtain approval by the Contracting Officer before installation.

1.9.1.4 Wiring Diagrams

[_____] 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 FACU and remote FACU, 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.

1.9.1.5 System Layout

[_____] 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. Indicate candela rating of each visual notification appliance. Clearly identify the locations of isolation modules. Indicate the addresses of all devices, modules, relays, and similar. Indicate if the environment for the FACU is within its environmental listing (e.g. temperature/humidity).

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.

[For air sampling smoke detection systems, provide floor plan layouts indicating location of fire alarm control unit, 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.]

1.9.1.6 Notification Appliances

Calculations and supporting data on each circuit to indicate that there is at least 25 percent spare capacity for notification appliances. Annotate data for each circuit on the drawings.

1.9.1.7 Initiating Devices

Calculations and supporting data on each circuit to indicate that there is at least [25][_____] percent spare capacity for initiating devices. Annotate data for each circuit on the drawings.

1.9.1.8 Battery Power

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 control unit component, and the battery recharging period, must be included on the drawings.

1.9.1.9 Voltage Drop Calculations

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.

1.9.1.10 Product Data

[_____] copies of annotated descriptive 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, and options 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.

[1.9.1.11 Air Sampling Smoke Detection System Calculations

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.

]1.9.1.12 Operation and Maintenance (O&M) Instructions

[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 Interior Fire Alarm System Operation and Maintenance Instructions must include the following:

a. "Manufacturer Data Package [five][_____]" 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 submitted for this project on 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 (devices, testing frequencies, and similar) must comply with UFC 3-601-02.

h. A final Equipment List must be submitted with the Operating and Maintenance (O&M) manual.

1.9.1.13 As-Built Drawings

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 two weeks after the final Government test of the system. At least one set of the as-built (marked-up) drawings must be provided at the time of, or prior to the final Government test.

1.9.2 Qualifications

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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.
****

1.9.2.1 Fire Alarm System Designer

The fire alarm 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 or meet the qualifications for a QFPE.

1.9.2.2 Supervisor

[A NICET Level [III][or][IV] fire alarm technician must supervise the installation of the fire alarm system[, including the air sampling smoke detection system].][A fire alarm technician with a minimum of eight years of experience must supervise the installation of the fire alarm 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.

1.9.2.3 Technician

Fire alarm technicians with a minimum of four years of experience must be utilized to install and terminate fire alarm devices, cabinets and control units. 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 installation of air sampling detection systems].

1.9.2.4 Installer

[Fire alarm installer with a minimum of two years of experience utilized to assist in the installation of fire alarm devices, cabinets and control units] [NICET Level II technician to assist in the installation of fire alarm devices, cabinets and control units]. A licensed electrician must be allowed to install wire, cable, conduit and backboxes for the fire alarm system 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.

1.9.2.5 Test Technician

Fire alarm technicians with a minimum of eight years of experience and NICET Level [III][or][IV]utilized in testing and certification of the installation of the fire alarm devices, cabinets and control units. 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.

1.9.2.6 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, except as specified herein.

1.9.3 Regulatory Requirements

Equipment and material must be listed or approved. Listed or approved, as used in this Section, means 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 approvals 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.

1.10 DELIVERY, STORAGE, AND HANDLING

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

1.11 MAINTENANCE

1.11.1 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 smoke detector manufacturer's test screen, card or magnet for each ten beam smoke detectors, or fraction thereof, installed in the system.]

[h. Two air sampling smoke detection system filter assemblies.]

i. [Two][_____] of each type of audible and visual alarm device installed.

j. [Two][_____] of each type of addressable monitor module installed.

k. [Two][_____] of each type of addressable control module installed.

l. [Two][_____] low voltage, [one][_____] [telephone][internet][ethernet], and [one][____] 120 VAC surge protective device.

[m. [Two][_____] spare reams of paper for the system printer, plus sufficient paper for testing.]

[n. [Two][_____] spare printer ribbons.]

1.11.2 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.

PART 2 PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENT

All fire alarm equipment must be listed for use under the applicable reference standards.

2.2 MATERIALS AND EQUIPMENT

2.2.1 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 72 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.

2.2.2 Nameplates

Major components of equipment must have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new name plate permanently affixed to the item or equipment. Major components include, but are not limited to, the following:

a. FACU

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

2.2.3 Keys

Keys and locks for equipment, control units 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][_____].]

2.2.4 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 FACU.][Install the frame in a conspicuous location observable from the FACU.] 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.

2.3 FIRE ALARM CONTROL UNIT

****

NOTE: The control unit must be located in an air conditioned space where the ambient temperature is maintained between 15 and 27 degrees C 60 and 80 degrees F.

****

Provide a complete fire alarm control unit (FACU) fully enclosed in a lockable steel cabinet as specified herein. Operations required for testing or for normal care, maintenance, and use of the system must be performed from the front of the enclosure. If more than a single unit is required at a location to form a complete control unit, the unit cabinets must match exactly.[If more than a single unit is required, and is

located in the lobby/entrance, notify the Contracting Officer's Designated Representative (COR), prior to installing the equipment.] The system must be capable of defining any module as an alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling such as waterflow switches, valve supervisory switches, fire pump monitoring, independent smoke detection systems, relays for output function actuation.

a. Each control unit must provide power, supervision, control, and logic for the entire system, utilizing solid state, modular components, internally mounted and arranged for easy access. Each control unit must be suitable for operation on a 120 volt, 60 hertz, normal building power supply. Provide each control unit with supervisory functions for power failure, internal component placement, and operation.

b. Visual indication of alarm, supervisory, or trouble initiation on the FACU must be by liquid crystal display or similar means with a minimum of 80 characters.

2.3.1 Cabinet

Install control unit components in cabinets large enough to accommodate all components and also to allow ample gutter space for interconnection of control units as well as field wiring. The cabinet must be a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and [surface][semi-recessed] mounting provisions. The enclosure must be identified by an engraved phenolic resin nameplate. Lettering on the nameplate must say "Fire Alarm control unit" and must not be less than 25 mm 1-inch high. Provide prominent rigid plastic or metal identification plates for lamps, circuits, meters, fuses, and switches.

2.3.2 Silencing Switches

2.3.2.1 Alarm Silencing Switch

Provide an alarm silencing switch at the FACU that must silence the audible and visual notification appliances. Subsequent activation of initiating devices must cause the notification appliances to re-activate.

2.3.2.2 Supervisory/Trouble Silencing Switch

Provide supervisory and trouble silencing switch(es) that must silence the audible trouble and supervisory signal(s), but not extinguish the visual indicator. This switch must be overridden upon activation of a subsequent supervisory or trouble condition. Audible trouble indication must resound automatically every 24 hours after the silencing feature has been operated if the supervisory or trouble condition still exists.

2.3.3 Non-Interfering

Power and supervise each circuit such that a signal from one device does not prevent the receipt of signals from any other device. Initiating devices must be manually reset by switch from the FACU after the initiating device or devices have been restored to normal.

2.3.4 Memory

Provide each control unit with non-volatile memory and logic for all

functions. The use of long life batteries, capacitors, or other age-dependent devices must not be considered as equal to non-volatile processors, PROMS, or EPROMS.

2.3.5 Field Programmability

Provide control units and control units that are fully field programmable for both input and output of control, initiation, notification, supervisory, and trouble functions. The system program configuration must be menu driven. System changes must be password protected. Any proprietary equipment and proprietary software needed by qualified technicians to implement future changes to the fire alarm system must be provided as part of this contract.

2.3.6 Input/Output Modifications

The FACU must contain features that allow the bypassing of input devices from the system or the modification of system outputs. These control features must consist of a control unit mounted keypad[and a keyboard]. Any bypass or modification to the system must indicate a trouble condition on the FACU.

2.3.7 Resetting

Provide the necessary controls to prevent the resetting of any alarm, supervisory, or trouble signal while the alarm, supervisory or trouble condition on the system still exists.

2.3.8 Walk Test

The FACU must have a walk test feature. When using this feature, operation of initiating devices must result in limited system outputs, so that the notification appliances operate for only a few seconds and the event is indicated in the history log[and on the system printer], but no other outputs occur.

2.3.9 History Logging

The control unit must have the ability to store a minimum of 400 events in a log. These events must be stored in a battery-protected memory and must remain in the memory until the memory is downloaded or cleared manually. Resetting of the control unit must not clear the memory.

2.3.10 Manual Access

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.

a. Primary status.

b. Device type.

c. Present average value.

d. Present sensitivity selected.

e. Detector range (normal, dirty).

[2.3.11 Heat Detector Self-Test Routines

Automatic self-test routines must be performed on each detector that will functionally check detector sensitivity electronics and ensure the accuracy of the value being transmitted. Any detector that fails this test must indicate a trouble condition with the detector location at the control unit.

][2.4 VIDEO DISPLAY UNIT (VDU)

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NOTE: Contact the DFPE to determine if a VDU is to be provided.
****

a. The VDU must be the secondary operator-to-system interface for data retrieval, alarm annunciation, commands, and programming functions. The desk mounted VDU must consist of a LCD monitor and a keyboard. The VDU must have a [300][430][_____]-mm [12][17][_____]-inch minimum [touch]screen, capable of displaying 25 lines of 80 characters each. Communications with the FACU must be supervised. Faults must be recorded in the history log[and on the printer]. Power required must be 120 VAC, 60 Hz from the same source as the FACU.

b. To eliminate confusion during an alarm situation, the screen must have dedicated areas for the following functions:

(1) Alarm and return to normal.

(2) Commands, reports, and programming.

(3) Time, day, and date.

c. Use full English language throughout to describe system activity and instructions. Full English language descriptors defining system points must be 100 percent field programmable by factory trained personnel, alterable and user definable to accurately describe building areas.

d. Alarms and other changes of status must be displayed in the screen area reserved for this information. Upon receipt of alarm, an audible alarm must sound and the condition and point type must flash until acknowledged by the operator. Return to normal must also be annunciated and must require operator acknowledgment. The following information must be provided in full English:

(1) Condition of device (alarm, trouble, or supervisory).

(2) Type of device (for example, manual pull, waterflow)

(3) Location of device plus numerical system address.

e. The system must have multiple levels of priority for displaying alarms to conform with UL 864. Priority levels must be as follows:

(1) Level 1 - Fire Alarms Signals

(2) Level 2 - Supervisory Signals

(3) Level 3 - Carbon Monoxide Alarm Signals

(4) Level 4 - Trouble Signals

f. Provide the system with memory so that no alarm is lost. A highlighted message must advise the operator when unacknowledged alarms are in the system.

g. Multiple levels of access must be provided for operators and supervisors via user-defined passwords. Provide the following functions for each level:

(1) Operator level access functions:

(a) Display system directory, definable by device.

(b) Display status of an individual device.

(c) Manual command (alarm device with an associated command must use the same system address for both functions).

(d) Report generation, definable by device, output on the VDU[or printer], as desired by the operator.

(e) Activate building notification appliances.

(2) Supervisor level access functions:

(a) Reset time and date.

(b) Enable or disable event initiated programs[, printouts,] and initiators.

(c) Enable or disable individual devices and system components.

h. The above supervisor level functions must not require computer programming skills. Changes to system programs must be [recorded on the printer and]maintained in the control unit as a trouble condition.

]2.5 REMOTE ANNUNCIATOR

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NOTE: Provide the annunciator at a location in accordance with NFPA 72. A suggested location should be near the door through which the first responders will enter the building as indicated in their pre-fire plan, typically the main entrance.

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[2.5.1 LCD Annunciator

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].

A building floor plan must be provided and mounted (behind Plexiglass or similar protective material) at the annunciator location. The floor plan must indicate all rooms by name and number including the locations of

stairs and elevators. The floor plan must show all devices and their programmed address to facilitate identification of their physical location from the LCD display information.

][2.5.2 Graphic Annunciator

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

****

Graphic annunciator must be of the [interior][weatherproof] type, [flush][surface][pedestal]-mounted. Annunciator 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]. Annunciator graphic must also show the locations of the annunciator and control unit, 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. Annunciator must have a lamp test switch.

2.5.2.1 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.

2.5.2.2 Programming

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

][2.5.3 Printer

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NOTE: If the printer will be located in a SCIF or similar area, specify "no stored memory".

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a. Provide a system printer [with no stored memory] to record alarm, supervisory, and trouble conditions without loss of any signal or signals. Printout must be by circuit, device, and function as

provided in the FACU. Printer must operate on a 120 VAC, 60 Hz power supply.

b. The printer must have at least 80 characters per line and have a 96 ASCII character set. The printer must have a microprocessor-controlled, bi-directional, logic seeking head capable of printing 120 characters per second utilizing a 9 by 7 dot matrix print head. Printer must not contain internal software which is essential for proper operation.

c. When the FACU receives a signal, the alarm, supervisory, and trouble condition must be printed. The printout must include the type of signal, the circuit or device reporting, the date, and the time of the occurrence. The printer must differentiate alarm signals from other printed indications. When the system is reset, this condition must also be printed including the same information concerning device, location, date, and time. Provide a means to automatically print a list of existing alarm, supervisory, and trouble conditions in the system. If a printer is off-line when an alarm is received, the system must have a buffer to retain the data and it must be printed when the printer is restored to service. The printer must have an indicator to alert the operator that the paper has run out.

]2.6 MANUAL 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][flush][surface] 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 red with molded raised lettering operating instructions of contrasting color. The use of a key must be required to reset the station.

2.7 SMOKE DETECTORS

****
NOTE: Provide smoke detectors only in spaces where they are specifically required by UFC 3-600-01, DESIGN: FIRE PROTECTION ENGINEERING FOR FACILITIES.

Smoke detectors provided in elevator machinery rooms are to be provided per requirements of UFC 3-600-01. Coordinate with Section 14 21 13 ELECTRIC TRACTION FREIGHT ELEVATORS, Section 14 21 23 ELECTRIC TRACTION PASSENGER ELEVATORS and/or Section 14 24 13 HYDRAULIC FREIGHT ELEVATORS, Section 14 24 23 HYDRAULIC PASSENGER ELEVATORS.
****

2.7.1 Spot Type Detectors

Provide addressable [photoelectric][ionization][laser] smoke detectors as

follows:

a. Provide analog/addressable [photoelectric smoke detectors utilizing the photoelectric light scattering principle for operation in accordance with UL 268][smoke detectors that operate on the ionization principle and are actuated by the presence of visible or invisible products of combustion][laser smoke detectors utilizing laser diode and patented smoke sensing chamber, designed to amplify signals from smoke but diminish stray internal reflections and must, on command from the FACU, send data to the control unit representing the analog level of smoke density]. Smoke detectors must be listed for use with the FACU.

b. Provide self-restoring type detectors that do not require any readjustment after actuation at the FACU to restore them to normal operation. The detector must have a visual indicator to show actuation.

c. 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.

d. Provide twist lock bases [with sounder that produces a minimum of 90 dBA at 3 m 10 feet] with screw terminals for each conductor. The detectors must maintain contact with their bases without the use of springs.

e. 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.

[f. Laser smoke detector must be listed for use with the FACU. Detector must be able to achieve sensitivities from 0.02 percent-per-foot to 2 percent-per-foot obscuration.

g. 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.]

[2.7.2 Projected Beam Smoke Detector

Detectors must consist of [combined transmitter and receiver unit] [separate transmitter and receiver units]. The transmitter unit must emit an infrared beam to the receiver unit [the use of a supplied reflector is required for the combined unit]. When the signal at the receiver falls below a preset threshold, the detector must initiate an alarm. The receiver must contain an LED status indicator that illuminates when an alarm condition exists. Long-term changes to the received signal caused by environmental variations must be automatically compensated. Detectors must incorporate features to assure that they are operational; a trouble signal must be initiated if the beam is obstructed for more than 3 seconds, the limits of the compensation circuit are reached, or the housing cover is removed. Detectors must have multiple sensitivity settings in order to meet UL listings for the different distances covered by the beam.

]2.7.3 Duct Smoke Detectors

****

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

****

Duct-mounted addressable photoelectric smoke detectors must consist of a smoke detector, as specified in paragraph Spot Type 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 listed for operation over the complete range of air velocities, temperature and humidity expected at the detector when the air-handling system is operating. Detectors must be powered from the FACU.

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 FACU.

b. Lights to indicate the operation and alarm condition must be visible and accessible with the unit installed and the cover in place. Remote indicators must be provided where required by NFPA 72. Remote indicators as well as the affected fan units must be properly identified in etched plastic placards.

c. 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 m 3 feet of the controlled circuit or appliance. The auxiliary contacts must be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

[2.8 AIR SAMPLING SMOKE DETECTION SYSTEM

The [addressable]air sampling smoke system must consist of a detector assembly housing an integral aspiration fan, filter, laser-based detection chamber and control, 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 pre-Government system 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 Government 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 obscuration/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 (for example, dust and dirt) 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 unit 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.

]2.9 HEAT DETECTORS

****
NOTE: Heat detectors provided in elevator machinery rooms are strictly for the warning sign in the elevator cab and must not alarm the FACU. Coordinate with Section 14 21 13 ELECTRIC TRACTION FREIGHT ELEVATORS, Section 14 21 23 ELECTRIC TRACTION PASSENGER ELEVATORS and/or Section 14 24 13 HYDRAULIC FREIGHT ELEVATORS, Section 14 24 23 HYDRAULIC PASSENGER ELEVATORS.
****

2.9.1 Heat Detectors

Heat detectors must be analog/addressable and designed for detection of fire by [fixed temperature][combination fixed temperature and rate-of-rise principle][rate-compensating principle] in accordance with UL 521. The alarm condition must be determined by comparing detector value with the stored values.. Detectors located in areas subject to moisture, exterior atmospheric conditions, or hazardous locations [as defined by NFPA 70][and][as indicated], must be types approved for such locations.

[2.9.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors must be [surface][semi-flush] mounted in the [vertical][horizontal] orientation and supported independently of wiring connections. Detectors must be self-resetting. Detector must operate at [57.2][90] degrees C[135][194] degrees F. Detector must feature rate compensation. [Detectors rated to operate at 57.2 degrees C135 degrees F must not respond to momentary temperature fluctuations less than 16.7 degrees C30 degrees F per minute between 16 and 38 degrees C60 and 100 degrees F].[Detectors rated to operate at 90 degrees C194 degrees F must not respond to momentary temperature fluctuations less than 27.8 degrees C 50 degrees F per minute between 16 and 66 degrees C60 and 150 degrees F.][The detector assembly must be [weatherproof][and][explosionproof].]

][2.9.1.2 Rate Compensating Detectors

Detector backbox must be [surface][flush] mounted in the [vertical][horizontal] orientation and supported independently of wiring connections. Detectors must be self-restoring and hermetically sealed.[The detector assembly must be [weatherproof][and][explosionproof].]

][2.9.1.3 Line-Type Fixed Temperature Detectors

****
NOTE: Specify line-type heat detectors only with

approval of the EFD/EFA Fire Protection Engineer.
****

Provide [thermostatic][or][thermistor] line-type heat detection cable [with weather-resistant outer covering] where indicated. Cable must be nominally rated for a temperature of [68][88][138] degrees C [155][190][280] degrees F and must operate on fixed temperature principle only.

][2.9.1.4 Fixed Temperature Detectors

Detectors must be [surface][semi-flush] mounted in the [vertical][horizontal] orientation and supported independently of wiring connections. Detectors must be self-restoring. The detectors must have a specific temperature setting [of [57.2][_____] degrees C [135][_____] degrees F][as shown].[The detector assembly must be [weatherproof][and][explosionproof].]

][2.10 FLAME DETECTORS

****
NOTE: Modify these paragraphs as necessary to indicate that detectors placed in an explosive environment will be approved for use in the appropriate class, division, and group environment as defined in NFPA 70 and as shown on drawings.
****

Detectors must be sensitive to the micron range best suited for their intended use. Detectors must operate over electrically supervised wiring circuits and the loss of power to the detector must result in a trouble signal. A self-test feature must be provided for each detector to be individually tested.

[2.10.1 Infrared (IR) Single Frequency Flame Detector

****
NOTE: The single frequency IR flame detector has the advantage of a fast response and is moderately sensitive. Its disadvantages are being affected by temperature extremes and being subject to false alarms from a myriad of IR sources.
****

The detector must be sensitive in the range of [_____] to [_____] micrometers only.

][2.10.2 Infrared (IR) Multi Frequency Flame Detector

****
NOTE: The IR multi frequency flame detector has the advantages of a moderately fast response, moderate sensitivity, and a lower false alarm rate. Its disadvantage is being affected by temperature extremes.
****

The IR detector must consist of three or more IR sensors, each selected for a different IR frequency. The primary sensor must be sensitive in the

range of [_____] to [_____] micrometers only. Secondary sensors are tuned to different IR wavelengths to null out the effect of black body radiation to the primary sensor.

][2.10.3 Ultraviolet (UV) Flame Detectors

****

NOTE: Ultraviolet (UV) flame detectors can be set to respond accurately to UV wavelength light produced by flame from both indoors and outdoors. UV flame detectors operate on the Geiger-Muller principle. These gas-filled vacuum tubes respond in the UV portion of the spectrum but can ignore UV radiation from the sun because the upper response range of the detector falls below the range of UV radiation that reaches the earth.

Solid-state UV detectors are available, but their spectral response extends into the sun's UV range and are not recommended for external use.

UV detectors have an 80 to 90 degree cone of vision. The UV detector has a fast response time and usually is not affected by rain, wind, snow, high humidity, or temperature and pressure extremes. UV units will produce false alarms if they are exposed to arc welding or X-ray and gamma radiation. They can also be blinded by oil film or smoke. UV flame detectors that are used in dirty and dusty environments should be equipped with automatic self-test and self-cleaning devices. The cleaning device uses a stream of clean air across the lens surface to minimize the build-up of contaminants.

****

UV flame detector must be of the narrow band response type which operates on radiated ultraviolet energy and must be sensitive in the range of [_____] to [_____] micrometers only. The cone of vision must be 80 degrees or greater. Each detector must be completely insensitive to light sources in the visible frequency range.

][2.10.4 Combination UV/IR Flame Detector

****

NOTE: Combination UV/IR flame detectors have been used both inside and outside to detect fires, but are slower to react than individual units.

****

The UV/IR detector must provide discrimination against false alarms by requiring both UV and IR flame detection before an alarm is sent. The UV sensor must be sensitive in the range of 0.185 to 0.265 micrometers only. The IR sensor must be sensitive in the range of [_____] to [_____] micrometers only. Detectors must be completely insensitive to light sources in the visible frequency range.

]][2.11 MULTI-CRITERIA DETECTORS

****
The designer must select the sensor required to initiate a fire alarm condition.
****

Multi-criteria detectors must contain [fixed temperature [_____] degrees C F heat sensor], [rate-of-rise heat sensor], [photoelectric smoke detector], [_____] elements in a single housing.

]2.12 CARBON MONOXIDE DETECTOR

Analog/addressable carbon monoxide (CO) detectors must be listed to UL 2075 and set to respond to the sensitivity limits of UL 2034. Carbon monoxide detectors must be listed for use with fire alarm control units. Detectors must be [surface] [semi-flush] mounted in the [vertical][horizontal] orientation and supported independently of wiring connections. Detectors must be self-restoring. For FACU with no listed compatible addressable CO detectors, provide listed 4-wire detectors.[Do not provide CO detectors with local alarms.] Detector must be provided with an LED status indicator.

a. Where 4-wire CO detectors are necessary, each 4-wire CO detector must be individually monitored via addressable interface modules for alarm and off normal/trouble conditions (including loss of power to the individual detector). Power circuits for 4-wire CO detectors must be dedicated to powering the CO detectors only. Battery powered and 120 VAC powered detectors are prohibited.

b. Wiring connections must be made by means of screw terminals and detectors must be equipped with trouble relays. Detectors must be able to mount a single-gang electrical box.

c. A trouble condition at an individual CO detector must not affect any other CO detectors. CO detectors must be powered by the FACU.

d. Detectors must be provided with a means to test CO gas entry into the CO sensing cell.

2.13 ADDRESSABLE INTERFACE DEVICES

The initiating device being monitored must be configured as a [Class "A"][Class "B"] initiating device circuits. 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.

2.14 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 or initiate elevator fire service. The module must

be listed as compatible with the control unit. The indicating device or the external load being controlled must be configured as [Class B][Class A] 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.

[2.15 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 FACU.

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

]2.16 NOTIFICATION APPLIANCES

2.16.1 Audible Notification Appliances

****

NOTE: The designer must layout speakers to achieve both the required dBA levels requires by NFPA 72.

NOTE: Where horns or bells are used for fire alarm notification, calculate the proper locations for these devices as detailed in "Designing Fire Alarm Audibility," which is contained in the Society of Fire Protection Engineers (SFPE) Handbook of Fire Protection Engineering. Submit the calculations at the 35-percent design review.

****

Audible appliances must conform to the applicable requirements of UL 464. Appliances must be connected into notification appliance circuits. Surface mounted audible appliances must be painted [red][white][_____]. Recessed audible appliances must be installed with a grill that is painted [red][white][_____][with a factory finish to match the surface to which it is mounted].

2.16.1.1 Horns

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 3.1 meters10 feet. Horns used in exterior locations must be specifically listed or approved for outdoor use and be provided with

metal housing and protective grilles.[Horns must be [weatherproof][explosionproof].]

[2.16.1.2 Bells

Bells must be surface mounted with the matching mounting backbox [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 m 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.

][2.16.1.3 Chimes

****

NOTE: Chimes are normally only used in hospitals and child development centers to alert the staff about a fire emergency without arousing the patients. Sound output is low and prevents them from being used in areas having even moderately low noise levels.

****

Chimes must be electrically operated, supervised, electronic type, with an adjustable frequency of 800 to 1200 Hertz. Chimes must have a minimum sound rating of [80][_____] dBA at 3 m 10 feet. Chimes must ring the bell codes, as indicated.

]2.16.2 Visual Notification Appliances

****

NOTE:
1. ABA requires that Visual Notification Appliances be provided in buildings and facilities in each of the following areas: restrooms, and any general usage area (e.g., meeting rooms), hallways, lobbies, and any other area for common use and other areas stated at www.access-board.gov. The Visual Notification Appliance must be mounted as required by ABA that directs compliance with NFPA 72. In addition, alarms in guest rooms required to provide communication features must comply with sections 18.5.5.7 of 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 Fire Alarm Notification. NFPA 72 requires the strobe must be marked "Fire" to clear 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, or light emitting diode (LED) and be marked "Alert" in

letters of contrasting color. 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.

2.17 ELECTRIC POWER

2.17.1 Primary Power

Power must be [120][_____] VAC [50][60] Hz service for the FACU from the AC service to the building in accordance with NFPA 72.

2.18 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.

2.18.1 Batteries

Provide sealed, maintenance-free, [sealed lead acid][lead-calcium][gel cell] batteries as the source for emergency power to the FACU. Batteries must contain suspended electrolyte. The battery system must be maintained in a fully charged condition by means of a solid state battery charger. Provide an automatic transfer switch to transfer the load to the batteries in the event of the failure of primary power.

2.18.1.1 Capacity

Battery size must be the following capacity. This capacity applies to every control unit associated with this system, including supplemental notification appliance circuit panels, auxiliary power supply panels, and fire alarm transmitters.

a. Sufficient capacity to operate the fire alarm system under supervisory and trouble conditions, including audible trouble signal devices for 48 hours and audible and visual signal devices under alarm conditions for an additional 15 minutes.

2.18.1.2 Battery Power Calculations

a. Verify that battery capacity exceeds supervisory and alarm power requirements for the criteria noted in the paragraph "Capacity" above.

   (1) Substantiate the battery calculations for alarm and supervisory power requirements. Include ampere-hour requirements for each system component and each control unit 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. 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.

2.18.2 Battery Chargers

Provide a solid state, fully automatic, variable charging rate battery charger. The charger must be capable of providing 120 percent of the connected system load and must maintain 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.

2.19 SURGE PROTECTIVE DEVICES

Surge protective devices must be provided to suppress all voltage transients which might damage fire alarm control unit components. Systems having circuits located outdoors, 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 FACU 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 fire alarm 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.

2.20 WIRING

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

2.20.1 Alarm Wiring

IDC and SLC wiring must be [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.

2.21 AUTOMATIC FIRE ALARM TRANSMITTERS

****

NOTE: State the make and model number of existing proprietary supervising station receiving equipment. The choice of code transmitter, or radio transmitter depends upon the type of existing fire reporting system at the activity. Determine the type of activity reporting system (e.g., positive non interfering or shunt). In most cases a local energy-tripping device will be required. The facility Fire Dept. or Engineering office should be contacted to determine the type and amount of data to be supervised (monitored), e.g., -type: separate or common transmission of alarm, supervisory, and trouble type signals; -amount: all points, all zones, or the combined premises. Verify that existing monitoring equipment has sufficient capacity to support the additional premises or that it can be expanded as necessary to accommodate the new fire alarm system. Identify existing components.

****

[2.21.1 Radio Transmitter and Interface Panels

Transmitters must be compatible with proprietary supervising station

receiving equipment. Each radio alarm transmitter must be the manufacturer's recognized commercial product, completely assembled, wired, factory tested, and delivered ready for installation and operation. Transmitters must be provided in accordance with applicable portions of NFPA 72, Federal Communications Commission (FCC) 47 CFR 90 and Federal Communications Commission (FCC) 47 CFR 15. Transmitter electronics module must be contained within the physical housing as an integral, removable assembly. The proprietary supervising station receiving equipment is [_____] and the transmitter must be fully compatible with this equipment. At the contractors option, and if listed, the transmitter may be housed in the same control unit as the FAC. The transmitter must be narrowband radio, with FCC certification for narrowband operation and meets the requirements of the NTIA (National Telecommunications and Information Administration) Manual of Regulations and Procedures for Federal Frequency Management.

2.21.1.1 Operation

Operate each transmitter from 120-volt ac power. In the event of 120-volt ac power loss, the transmitter must automatically switch to battery operation. Switchover must be accomplished with no interruption of protective service, and must automatically transmit a trouble message. Upon restoration of ac power, transfer back to normal ac power supply must also be automatic.

2.21.1.2 Battery Power

Transmitter standby battery capacity must provide sufficient power to operate the transmitter in a normal standby status for a minimum of 72 hours and be capable of transmitting alarms during that period.

2.21.1.3 Transmitter Housing

Use NEMA Type 1 for housing. The housing must contain a lock that is keyed [identical to the fire alarm system for the building][identical to radio alarm transmitter housings on the Installation]. Radio alarm transmitter housing must be factory painted with a suitable priming coat and not less than two coats of a hard, durable weatherproof enamel.

2.21.1.4 Antenna

Antenna must be [omnidirectional, coaxial, halfwave dipole antennas][_____] for radio alarm transmitters with a driving point impedance to match transmitter output. The antenna and antenna mounts must be corrosion resistant and designed to withstand wind velocities of 161 km/hour 100 mph. Do not mount antennas to any portion of the building roofing system. Protect the antenna from physical damage.

][2.21.2 Digital Alarm Communicator Transmitter (DACT)

Provide DACT that is compatible with the existing supervising station fire alarm system. Transmitter must have a means to transmit alarm, supervisory, and trouble conditions via a single transmitter. Transmitter must have a source of power for operation that conforms to NFPA 72. Transmitter must be capable of initiating a test signal daily at any selected time. Transmitter must be arranged to seize telephone circuits in accordance with NFPA 72.

]2.21.3 Signals to Be Transmitted to the Base Receiving Station

****
NOTE: The following paragraph is applicable only to existing installations for connections to an auxiliary (public) alarm system. Edit this for the installation specific criteria.
****

The following signals must be sent to the base receiving station:

[a. Sprinkler waterflow]

[b. Manual pull stations]

[c. Smoke detectors]

[d. Duct smoke detectors]

[e. Sleeping room smoke detectors]

[f. Carbon monoxide detectors]

[g. Heat detectors]

[h. Fire extinguishing system]

[i. Sprinkler valve supervision]

[j. Fire pump running]

[k. Fire pump supervision]

[l. Water supply level and temperature]

[m. Combustion engine drive fire pump running

(1) Selector switch in position than automatic

(2) Engine over-speed

(3) Low fuel

(4) Low battery

(5) Engine trouble (for example, low oil, over temp)]

2.22 SYSTEM MONITORING

2.22.1 Valves

Each valve affecting the proper operation of a fire protection system, including automatic sprinkler control valves,[standpipe control valves,] sprinkler service entrance valve,[valves at fire pumps,] isolating valves for pressure type waterflow or supervision switches, and valves at backflow preventers, whether supplied under this contract or existing, must be electrically monitored to ensure its proper position. Provide each tamper switch with a separate address[, unless they are within the same room, then a maximum of five can use the same address].

[2.22.2 High/Low [Air][Nitrogen] Supervisory Switches

Provide monitoring of high and low supervisory [air][nitrogen] for [dry pipe][and][preaction] systems. Each air supervisory switch must have a separate address. Switches must be listed extinguishing system attachments. The device must contain double pole, double throw contacts. Operation of the switch must cause a supervisory signal to be transmitted to the FACU when [air][nitrogen] pressure in the system monitored sprinkler system increases more than 34.5 kPa5 psi above the normal system pressure or drops halfway from the normal pressure to the tripping point.

][2.22.3 Room Low Temperature Supervisory Switch

Provide [monitoring of the]listed supervisory air temperature switch for the [fire pump][sprinkler riser] room[s]. Switch must cause a supervisory signal to be transmitted to the FACU whenever the temperature in the room drops to below 4.4 degrees C40 degrees F. Device must reset when temperature rises above 4.4 degrees C40 degrees F.

][2.22.4 Electromagnetic Door Holders

Electromagnetic holding devices must operate on [120 VAC][24 VDC], and require not more than [3][_____] watts of power to develop 6.9 kPa25 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.

]2.23 ENVIRONMENTAL ENCLOSURES OR GUARDS

Environmental enclosures must be provided to permit fire alarm components to be used in areas that exceed the environmental limits of the listing. The enclosure must be listed for the device or appliance as either a manufactured part number or as a listed compatible accessory for the component is currently listed. Guards required to deter mechanical damage must be either a listed manufactured part or a listed accessory for the category of the initiating device or notification appliance.

[2.24 FIREFIGHTER TELEPHONE COMMUNICATION SYSTEM

****

NOTE: Provide a master control station at the FACU with remote telephone stations in each stair at each floor landing, in each elevator lobby on each floor, and in elevator cabs. In addition, provide them at specific locations containing essential fire protection equipment, such as the fire pump room and outside the emergency generator room.

NOTE: In lieu of firefighter telephones radio repeater equipment compatible with responding fire department may be used if approved by the responding fire department.

****

2.24.1 General

Provide a firefighter telephone communication system with complete, common talk, closed circuits. The system must include, but not be limited to, a master control station mounted in the fire alarm control unit, a power supply and standby battery system, and remote telephone stations.

2.24.2 Features

The system must include the following features:

a. A master control station which must provide power, supervision, and control for wiring, components, and circuits. The act of lifting any remote telephone hand set from its cradle must cause both a visual and audible signal to annunciate at the master control station. Removing the hand set at the master control station and depressing a button at the remote telephone hand set must cause the automatic silencing of the audible signal.

b. Communication between the master control station hand set and any/or all remote hand sets must require the depressing of a push-to-talk switch located on any/all remote hand sets. During the time that the master control hand set is removed from its cradle it must be possible to communicate between five remote hand sets and the master control station.

c. Hand sets must be able to monitor any conversation in progress and join the conversation by pressing the push-to-talk button. It must not be possible to communicate between two or more remote hand sets with the master control station hand set in its cradle.

d. The master control station hand set must be red in color and equipped with a 1.5 m5-foot long strain-relieved coiled cord.

e. The master control station must monitor wire and connections for any opens, shorts, or grounds which would render the system inoperable or unintelligible.

f. The master control station must be equipped with a silencing switch and ring-back feature such that any audible trouble signal can be silenced and must be so indicated by the lighting of an amber LED. Once any trouble condition has been corrected, the amber LED must be extinguished.

g. The master control station must be equipped with a separate, LED annunciated switch for each telephone circuit. In addition, LEDs must provide for the annunciation of operating and supervisory power.

h. The loss of operating or supervisory power must cause an audible and visual indication at the master control station and must also cause the fire alarm trouble signal to sound on the FACU.

i. Switches, LEDs, and controls must be fully labeled.

2.24.3 Handsets

Handsets must have the following features:

a. Provide [surface][flush] mounted remote telephone stations.

b. Each station must be equipped with a hinged door that is magnetically locked.

c. Each hand set must be permanently wired in place with a coiled cord.

d. Each hand set must be red high-impact cycolac and must be equipped with a push-to-talk switch which, when operated, must signal the master control station and a switch-equipped, storage cradle.

e. Provide operating and supervising power from the same supply circuit(s) utilized for the FACU.

]PART 3 EXECUTION

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

3.2.1 Fire Alarm Control Unit (FACU)

Locate the FACU [where indicated on the drawings][_____]. [Recess][Semi-recess][Surface mount] the enclosure with the top of the cabinet 2 m 6 feet above the finished floor or center the cabinet at [1.5][_____] m [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 FACU. Locate the document storage cabinet adjacent to the FACU unless the Contracting Officer directs otherwise.

3.2.2 Battery Cabinets

When batteries will not fit in the FACU, locate battery cabinets below or adjacent to the FACU. Battery cabinets must be installed at an accessible location when standing at floor level. Battery cabinets must not be installed lower than 300 mm12 inches above finished floor, measured to the bottom of the cabinet, nor higher than 900 mm36 inches above the floor, measured to the top of the cabinet. Installing batteries above drop ceilings or in inaccessible locations is prohibited. Battery cabinets must be large enough to accommodate batteries and also to allow ample gutter space for interconnection of control units as well as field wiring. The cabinet must be provided in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions.The cabinet must be identified by an engraved phenolic resin nameplate. Lettering on the nameplate must indicate the control unit(s) the batteries power and must not be less than 25 mm1-inch high.

3.2.3 Manual Stations

Locate manual stations as required by NFPA 72[and as indicated on the drawings]. Mount stations so they are located no farther than

[1.5][_____] m [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.

3.2.4 Notification Appliances

****

NOTE: Locate strobes wall mounted in corridors no more than 4.5 m 15 feet from the end of a corridor with 30 m 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. In Child Development Centers only chimes must be used as the pre-alert tone prior to voice messages.

****

a. Locate notification appliance devices [as required by NFPA 72][where indicated] Where more than two visual notification appliances 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 mm2 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.

c. Speakers must not be located in close proximity to the FACU or LOC so as to cause feedback when the microphone is in use.

3.2.5 Smoke and Heat Detectors

Locate detectors [as required by NFPA 72 and their listing][as indicated on the drawings] on a 100 mm 4-inch mounting box. Install heat detectors not less than 100 mm 4 inches from a side wall to the near edge. Heat detectors located on the wall must have the top of the detector at least 100 mm 4 inches below the ceiling, but not more than 300 mm 12 inches below the ceiling. 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 m 3 feet from air handling supply diffusers. Detectors installed in acoustical ceiling tiles must be centered in the tiles plus or minus 50 mm2 inches.

3.2.6 Carbon Monoxide Detectors

Locate detectors [as required by NFPA 72 and their listings][as indicated on the drawings] on a 100-mm4-inch mounting box.[Carbon monoxide detectors must be installed separate from smoke and/or heat detectors.]

[3.2.7 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) Detector assembly must be mounted to a wall at a height between 48 to 60 inches1200 mm to 1800 mm 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 0.25-inch6.4 mm block lettering to indicate detector and zone. For example: "AIR SAMPLING SOME 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 m5 feet.

(3) Pipes must be suspended between 25 mm and 100 mm1 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 mm18 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 mm1-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-m20-foot intervals. Provide labels every 3 m10 feet where piping is installed above suspended ceilings and every 609 mm2 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 mm to 100 mm1 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 MM0.125 INCHES". Indicate fractional dimensions in decimal format with a minimum of three decimal places.

][3.2.8 Graphic Annunciator

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

]3.2.9 LCD REMOTE Annunciator

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

[3.2.10 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 mm4 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.

][3.2.11 Firefighter Telephones

Mount telephone[hand sets][jacks] on the wall in each stair at each floor landing, in each emergency generator room, in each fire pump room, in each elevator machine room, in each elevator lobby, and in each elevator cab 1200 mm 4 feet above the finished floor.

]3.2.12 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.

3.3 SYSTEM FIELD WIRING

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 FACU and remote fire alarm control units, 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.

3.3.2 Terminal Cabinets

****

NOTE: Provide terminal cabinets on each floor where

the fire alarm system supply riser is located and where the fire alarm 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 "FIRE ALARM TERMINAL CABINET" with 50 mm2-inch lettering, on the front of the terminal cabinet.

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. Voltages must not be mixed 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 FACU.

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" 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).

3.3.4 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 mm3/4-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 [_____]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 10 feet3 meters or less, the conductors must be permitted to be installed in the same raceway in accordance with NFPA 72.]

3.3.5 Conductor Terminations

Labeling of conductors at terminal blocks in terminal cabinets, FACU, and remote FACU 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, FACU, and remote FACU 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, control unit, 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 DISCONNECTION AND REMOVAL OF EXISTING SYSTEM

****

NOTE: Contact the Contracting Officer, Base Fire Prevention Office, and/or Base Maintenance Personnel to determine what action is appropriate for the salvaging of existing fire alarm equipment.

****

Maintain existing fire alarm equipment fully operational until the new equipment has been tested and accepted by the Contracting Officer. As new equipment is installed, label it "NOT IN SERVICE" until the new equipment is accepted. Once the new system is completed, tested, and accepted by the Government, it must be placed in service and connected to the supervising station. Remove tags from new equipment and tag the existing equipment "NOT IN SERVICE" until removed from the building.

a. After acceptance of the new system by the Contracting Officer, remove existing equipment not connected to the new system, remove unused exposed conduit, and restore damaged surfaces. Remove the material

from the site and dispose.

b. Disconnect and remove the existing fire alarm and smoke detection systems where indicated and elsewhere in the specification.

c. Control units and fire alarm devices and appliances disconnected and removed must be turned over to the Contracting Officer.

d. Properly dispose of fire alarm outlet and junction boxes, wiring, conduit, supports, and other such items.

3.5 CONNECTION OF NEW SYSTEM

The following new system connections must be made during the last phase of construction, at the beginning of the pre-Government tests. New system connections must include:

a. Connection of new relays to existing magnetic door hold-open devices.

b. Connection of new elevator recall relays to existing wiring and conduit.

c. Connection of new system transmitter to existing installation fire reporting system.

Once these connections are made, system must be left energized. Report immediately to the Contracting Officer, coordination and field problems resulting from the connection of the above components.

]3.6 FIRESTOPPING

Provide firestopping for holes at conduit 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.

3.7 PAINTING

a. In unfinished areas (including areas above drop ceilings), paint all exposed electrical conduit (serving fire alarm equipment), fire alarm 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 fire alarm equipment), fire alarm conduit, surface metal raceways, junction boxes, and electrical boxes to match adjacent finishes. The inside cover of the junction box must be identified as "Fire Alarm" and the conduit must have painted red bands 19 mm3/4-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.

3.8 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.
****

3.8.1 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, transmitting and receiving equipment, power sources/supply, annunciators, special hazard equipment, emergency communication equipment, interface equipment, and surge protective devices. 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 forma in NFPA 72 and NFPA 4.) The test procedures and accompanying test data forms must be used for the pre-Government testing and the Government testing. The test data forms must record the test results and must:

a. Identify the NFPA Class of all Initiating Device Circuits (IDC), and Notification Appliance Circuits (NAC), and Signaling Line Circuits (SLC).

b. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how these tests must be performed.

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.

3.8.2 Pre-Government Testing

3.8.2.1 Verification of Compliant Installation

Conduct inspections and tests to ensure that devices and circuits are functioning properly. Tests must meet the requirements of paragraph entitled "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 including all referenced annex sections and the test reports noted below.

a. NFPA 72 Record of Completion.

b. NFPA 72 Record of Inspection and Testing.

c. Fire Alarm and Emergency Communication System Inspection and Testing Form.

d. Audibility test results with marked-up test floor plans.

e. Documentation that all tests identified in the paragraph "Minimum System Tests" are complete.

3.8.2.2 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 Officer's 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 systemhas 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.

3.8.3 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.

3.8.4 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 the paragraph "Minimum System Tests" must be repeated at their discretion.

3.9 MINIMUM SYSTEM TESTS

3.9.1 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 Government test.

b. Verify the absence of unwanted voltages between circuit conductors and ground. The tests must be accomplished at the pre-Government 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. Carbon Monoxide Detector Tests: Carbon monoxide detectors must be tested in accordance with NFPA 72 and the manufacturer's recommended calibrated test method.

f. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M manual.

g. 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.

h. Determine that the system is operable under trouble conditions as specified.

i. Visually inspect wiring.

j. Test the battery charger and batteries.

k. Verify that software control and data files have been entered or programmed into the FACU. Hard copy records of the software must be provided to the Contracting Officer.

l. Verify that red-line drawings are accurate.

m. Measure the current in circuits to ensure there is the calculated

spare capacity for the circuits.

n. Measure voltage readings for circuits to ensure that voltage drop is not excessive.

o. 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.

p. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.

q. 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".

3.9.2 Audibility Tests

Sound pressure levels from audible notification appliances must be a minimum of 15 dBa over ambient with a maximum of 110 dBa in any occupiable area. The provisions for audible notification (audibility and intelligibility) must be met with doors, fire shutters, movable partitions, and similar devices closed.

3.10 SYSTEM ACCEPTANCE

Following acceptance of the system, as-built drawings and O&M manuals must be delivered to the Contracting Officer for review and acceptance. 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 two 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.

[a. The drawings must be prepared electronically and sized no less than the contract drawings.][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.]

3.11 INSTRUCTION OF GOVERNMENT EMPLOYEES

3.11.1 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 fire alarm 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 instructors information and qualifications including the training history.

3.11.2 Required Instruction Time

Provide [8][16][_____] hours of instruction after final acceptance of the system. The instruction must be given 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 training must allow for rescheduling for unforeseen maintenance and/or fire department responses.

[3.11.2.1 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 must occur within [6][12][_____] months of system acceptance.]

]3.11.3 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.

3.12 EXTRA MATERIALS

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

3.12.2 Spare Parts

Spare parts furnished must be directly interchangeable with the corresponding components of the installed system[s]. Spare parts must be suitably packaged and identified by nameplate, tagging, or stamping. Spare parts must be delivered to the Contracting Officer at the time of the Government testing and must be accompanied by an inventory list.

3.12.3 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 --