UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

SECTION 28 31 13.00 40

FIRE DETECTION AND ALARM CONTROL, GUI, AND LOGIC SYSTEMS

02/17

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FIRE DETECTION AND ALARM CONTROL, GUI, AND LOGIC SYSTEMS
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NOTE: This guide specification covers the requirements for analogor addressable interior fire alarm systems in single or multiple buildings, requirements for fire detection and alarm systems, and addressable systems.

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).

PART 1 GENERAL

Section 01 78 23 OPERATION AND MAINTENANCE DATA AND METHODS, and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM apply to work specified in this section with the additions and modifications specified herein.

1.1 SCOPE

NOTE: Indicate the location of fire alarm system devices and riser locations on floor plans. Provide a fire alarm system riser diagram indicating circuits and risers.

This work includes designing and providing [a new, complete,] [and] [modifying the existing] analog or addressable fire alarm system as

described herein and on the Contract drawings for the [building name]. The system includes wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, alarms, supervisory signal-initiating devices, alarm notification appliances, supervising station fire alarm system transmitter, and other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described. Provide system[s] complete and ready for operation. Provide equipment, materials, installation, workmanship, inspection, and testing in strict accordance with the required and advisory provisions of NFPA 72 [and] [_____], except as modified herein. [The system layout on the drawings shows the intent of coverage and the in suggested locations. Determine the final quantity and layout, and coordinate all necessary activity.][A single fire alarm control panel (FACP) is indicated, with terminal cabinets at each floor at each riser location. Where needed, provide remote fire alarm control units at a terminal cabinet location.]Power each remote fire alarm control unit 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, it is permissible to locate equipment for notification appliances in the remote fire alarm control units.

1.2 REFERENCES

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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.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S3.41	(2015) Audible Emergency Evacuation Signal (ASA 96)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A17.1/CSA B44	(2019) Safety Code for Elevators and Escalators

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 AERONAUTICS AND SPACE ADMINISTRATION (NASA)

RCBEA GUIDE	(2004) NASA Reliability Centered Building and Equipment Acceptance Guide

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 72	(2019; TIA 19-1; ERTA 1 2019) National Fire Alarm and Signaling Code
NFPA 90A	(2021) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 101	(2021) Life Safety Code
NFPA 241	(2019) Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 1221	(2019) Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems

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

47 CFR 90	Private Land Mobile Radio Services

UNDERWRITERS LABORATORIES (UL)

UL 6	(2007; Reprint Sep 2019) UL Standard for Safety Electrical Rigid Metal Conduit-Steel
UL 38	(2008; Reprint Nov 2013) Manual Signaling Boxes for Fire Alarm Systems
UL 228	(2006; Reprint Nov 2008) Door Closers-Holders, With or Without Integral Smoke Detectors
UL 268	(2016; Reprint Oct 2019) UL Standard for

	Safety Smoke Detectors for Fire Alarm Systems
UL 268A	(2008; Reprint Oct 2014) Smoke Detectors for Duct Application
UL 464	(2016; Reprint Sep 2017) UL Standard for Safety Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories
UL 521	(1999; Reprint Dec 2017) UL Standard for Safety Heat Detectors for Fire Protective Signaling Systems
UL 797	(2007; Reprint Mar 2017) UL Standard for Safety Electrical Metallic Tubing -- Steel
UL 864	(2014; Reprint May 2020) UL Standard for Safety Control Units and Accessories for Fire Alarm Systems
UL 1242	(2006; Reprint Aug 2020) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 1971	(2002; Reprint Oct 2008) Signaling Devices for the Hearing Impaired
UL Electrical Construction	(2012) Electrical Construction Equipment Directory
UL Fire Prot Dir	(2012) Fire Protection Equipment Directory

1.3 DEFINITIONS

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

a. Analog or Addressable System: A system in which multiple signals are transmitted via the same conduction path to a remote fire alarm control unit and fire alarm control panel, decoded, and separated so that each signal initiates the specified response.

b. Hard-Wired System: A system in which alarm- and supervisory-initiating devices are directly connected, through individual dedicated conductors, to a central control panel, without the use of analog or addressable circuits or devices.

c. Interface Device: An addressable device that interconnects hard-wired systems or devices to an analog or addressable system.

d. Fire Alarm Control Unit: A control panel, remote from the fire alarm control panel, 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 control panel.

e. Fire Alarm Control Panel (FACP): A master control panel having the features of a fire alarm control unit and to which fire alarm control units are interconnected. The panel has central processing, memory, input and output terminals, [video display units (VDUs),] [and] [printers].

f. Terminal Cabinet: A steel cabinet with a locking, hinge-mounted door in which terminal strips are mounted.

1.4 SUBMITTALS

****

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

A “G” following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a “G”. Only delete an existing “G” if the submittal item is not complex and can be reviewed through the Contractor’s Quality Control system. Only add a “G” 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.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G[, [____]]

SD-03 Product Data

Fire Alarm Control Panel (FACP); G[, [____]]

Printers; G[, [____]]

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

Terminal Cabinets; G[, [____]]

Manual Stations; G[, [____]]

Automatic Transmitters; G[, [____]]

Battery Chargers; G[, [____]]

Wiring; G[, [____]]

Notification Appliances; G[, [____]]

Fire Detecting Devices; G[, [____]]

Addressable Interface Devices; G[, [____]]

[Graphic Annunciator; G[, [____]]

][Amplifiers; G[, [____]]

][Tone Generators; G[, [____]]

][Digitized Voice Generators; G[, [____]]

][Firefighter Telephone; G[, [____]]

] Waterflow Detectors; G[, [____]]

Tamper Switches; G[, [____]]

[Electromagnetic Door Holders; G[, [____]]

][Remote Fire Alarm Control Units; G[, [____]]

] Storage Batteries; G[, [____]]

Special Tools and Spare Parts; G[, [____]]

Nameplates; G[, [____]]

SD-04 Samples

Typewritten Instruction Card

SD-05 Design Data

Battery Power Calculations; G[, [____]]

SD-07 Certificates

Qualifications of Installer

Qualifications

Equipment

Training Materials

Request for Formal Inspection and Tests

NFPA 72, Certificate of Completion

NFPA 72, Inspection and Testing Form

Parts List

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions

Data Package 5

SD-11 Closeout Submittals

Record of Installer'S Training History For The Employees

As-Built Drawings

1.5 MAINTENANCE MATERIAL SUBMITTALS

1.5.1 Special Tools and Spare Parts

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NOTE: Remove last sentence of the first paragraph when not required.
****

Furnish software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment to the Contracting Officer. Furnish two spare fuses of each type and size required. Furnish 2 percent of the total number of each different type of detector, but no less than two each.[Mount spare fuses in the fire alarm panel.]

Provide spare parts data for each different item of material and equipment specified, not later than [3] [_____] months before the date of beneficial occupancy. Include a complete list of parts and supplies, with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after [1] [_____] year[s] of service.

1.5.2 Spare Parts and Tools

Provide spare parts data for each different item of material and equipment specified, not later than [3] [_____] months before the date of beneficial occupancy. Include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after [1] [_____] year of service.

1.5.2.1 Interchangeable Parts

Ensure that spare parts furnished are directly interchangeable with the corresponding components of the installed system. Package and identify spare parts by nameplate, tagging, or stamping. Deliver spare parts to the Contracting Officer at the time of the final acceptance testing.

1.5.2.2 Spare Parts

Furnish the following spare parts and accessories:

a. [4][_____]audiovisual devices of each type installed

b. [4] [_____] fuses for each fused circuit

c. [1] [_____] electromagnetic door holders

d. [1] [_____] manual stations

e. [9] [_____] spare reams of paper for the system printer, plus sufficient paper for fire alarm acceptance tests

f. [2] [_____] smoke sensors and bases of each type installed

g. [2] [_____] heat sensors and bases of each type installed

h. [3] [_____] test magnets or devices for each type of sensor installed

i. [3] [_____] break rods for manual stations

1.5.2.3 Parts List

Furnish a list, in duplicate, of all other parts and accessories that the manufacturer of the system recommends to be stocked for maintenance.

1.6 QUALITY CONTROL

Ensure that equipment and devices are compatible and operable with existing station fire alarm system and do not impair reliability or operational functions of existing supervising-station fire alarm systems. [Existing supervising-station fire alarm system is [_____].]

1.6.1 Regulatory Requirements

Provide devices and equipment for fire alarm service listed by UL Fire Prot Dir or approved by FM APP GUIDE.

1.6.1.1 Compliance

Configure the fire detection and alarm system and the central reporting

system in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer. Ensure that the furnished equipment is compatible. Ensure that the equipment is UL-listed, FM approved, or approved or listed by a nationally recognized testing laboratory in accordance with the NFPA standards.

1.6.1.2 Requirements for Fire Protection Service

Provide equipment and material tested by UL and listed in UL Fire Prot Dir or approved by FM and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, the terms mean listed in UL Fire Prot Dir or FM APP GUIDE. Do not construe omission of these terms under the description of any item of equipment described as waiving this requirement.

1.6.1.3 Testing Services or Laboratories

Construct fire alarm and fire detection equipment in accordance with UL Fire Prot Dir, UL Electrical Construction, or FM APP GUIDE.

1.6.2 Qualifications

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NOTE: Since some states require that persons installing fire alarm systems be National Institute for Certification in Engineering Technologies (NICET) certified, the number of NICET-certified fire alarm technicians varies from state to state. The actual number of NICET-certified technicians should be checked with the state fire marshal. If the availability of NICET-technicians is a problem, delete all references to NICET.

NICET level 4 fire alarm technicians should be required for hospitals and large complex systems.

****

1.6.2.1 Engineer and Technician

Provide proof of qualifications for required personnel. Submit proof of experience for the professional engineer (PE), the fire alarm technician, and the installing company.

a. Registered PE with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.

b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems programming with verification of experience and current NICET certificate.

c. The Registered PE is permitted to perform all required actions under this specification. The NICET Fire Alarm Technician is permitted to perform only the actions allowed by the specific category of certification held.

1.6.2.2 Design Services

For design or modification of the fire detection, fire alarm, or fire suppression systems, ensure the services and review of a qualified fire protection engineer. For the purposes of meeting this requirement, a qualified fire protection engineer meeting one of the following conditions:

a. An engineer having a Bachelor of Science or Masters of Science in fire protection engineering from an accredited university engineering program, plus a minimum of 2 years' work experience in fire protection engineering.

b. A registered PE in fire protection engineering.

c. A registered PE in a related engineering discipline and member in the National Society of Fire Protection Engineers.

d. An engineer with a minimum of 10 years' experience in fire protection engineering and member of the National Society of Fire Protection Engineers.

1.6.2.3 Qualifications of Installer

[Ensure that the design is by a NICET Level III or Level IV technician.] Installer has been in existence for at least 3 years[, within a [_____] mile radius of the job site]. Submit record of installer's training history for the employees to the Contracting Officer. Accomplish installation by an electrical contractor with a minimum of 5 years' experience in the installation of fire alarm systems. The Contracting Officer may reject any proposed installer who cannot show evidence of such qualifications. Provide the services of a technician furnished by the control equipment manufacturer, to supervise installation, adjustments, and tests of the system. Furnish evidence that the fire alarm equipment supplier has an experienced and effective service organization that carries a stock of repair parts for the system to be furnished. Guarantee labor, materials, and equipment provided under this Contract against defects for one year after the date of final acceptance of this work by the Contracting Officer and the receipt of detailed as-built drawings and schematics of all equipment. Before installation, submit data for approval by the [[_____] Division] [EFA [_____]], Naval Facilities Engineering Command, Fire Protection Engineer, showing that the Contractor has successfully installed analog or addressable, analog intelligent interior fire alarm systems of the same type as specified herein, or that the Contractor has a firm contractual agreement with a subcontractor having such required experience. Include the names and locations of at least three installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months. Submit names and phone numbers of points of contact at each site.

1.6.3 Manufacturer Qualifications

Provide components of current design and in regular and recurrent production at the time of installation. Provide design, materials, and devices for a protected-premises fire alarm systems that are complete, and that conform to NFPA 72, except as otherwise or additionally specified herein.

1.6.4 Standard Products

Provide materials, equipment, and devices that have been tested by a nationally recognized testing laboratory, such as UL or FM, and listed or approved for fire protection service when so required by NFPA 72 or this specification. Select material from one manufacturer, where possible, and not from a combination of manufacturers, for each particular classification of materials.

Submit certified copies of current approvals or listings issued by an independent testing laboratory if not listed by UL, FM, or another nationally recognized testing laboratory, showing compliance with NFPA standards.

1.6.5 Modification of References

In NFPA publications referred to herein, consider advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; interpret references to "authority having jurisdiction" to mean the [[_____] Division] [EFA [_____]], Naval Facilities Engineering Command, Fire Protection Engineer.

[Consider the recommended practices stated in the manufacturer's literature or documentation as mandatory requirements.

]1.6.6 Predictive Testing and Inspection Technology (PT&I) Requirements

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NOTE: The Predictive Testing and Inspection (PT&I) tests prescribed in Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS are MANDATORY for all [NASA] [_____] assets and systems identified as Critical, Configured, or Mission Essential. If the system is not critical, and not configured, and not mission essential, assess the value of adding these additional test and acceptance requirements. See Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS for additional information regarding cost feasibility of PT&I.

****

This section contains systems and equipment components regulated by NASA's Reliability Centered Building and Equipment Acceptance Program (RCBEA). This program requires the use of PT&I technologies in conformance with RCBEA GUIDE to ensure that the building equipment and systems installed by the Contractor have been installed properly and contain no identifiable defects that shorten the design life of a system or its components. Satisfactory completion of all acceptance requirements is required in order for the Government to approve and accept the Contractor's work.

Perform PT&I and provide submittals as specified in Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 PROJECT CONDITIONS

1.8.1 Verification of Dimensions

Verify dimensions in the field and advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

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NOTE: Provide 25-percent spare capacity where buildings are protected by sprinklers throughout or where such protection is being provided under this design. Where automatic sprinkler protection will be provided later, use 50-percent spare capacity.

****

2.1.1 Operation

****

NOTE: If a small fire alarm system is required, the specification writer should consider using Section 28 31 00.00 10 FIRE DETECTION AND ALARM SYSTEM, DIRECT CURRENT LOOP.

If an addition to an existing system is required, provide the make, model number, and other pertinent information on existing components that are to operate with the new equipment. Since new interfaces are compatible with the existing system or with the central fire alarm reporting system, the designer may need to delete major items from this specification. A new fire alarm panel must be compatible with the existing central fire alarm reporting system.

****

Provide a complete, supervised fire alarm reporting and detection system. Activate the system into the alarm mode by actuation of any alarm-initiating device. Ensure that the system remains in the alarm mode until the initiating device is reset and the FACP is reset and restored to normal. Connect alarm-initiating devices [to initiating-device circuits (IDCs)], [Style B] [or] [Style D], to signal line circuits (SLCs), Style [5] [6], in accordance with NFPA 72. Connect alarm notification appliances to notification appliance circuits (NACs), Style Z, in accordance with NFPA 72. Provide a looped conduit system so that if the conduit and all conductors within are severed at any point, all IDCs, NACs and SLCs remain functional. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the supervising-station (fire station, fire alarm central communication center). Ensure that textual, audible, and visual appliances and systems comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, operate on 24 V dc. Provide an addressable system with the following features:

a. Sufficient memory to perform as specified and as shown for the addressable system.

b. Individual identity of each addressable device for the following conditions: alarm, trouble, open, short, and appliances missing/failed remote detector - sensitivity adjustment from the panel for smoke detectors.

c. Capability of each addressable device being individually disabled or enabled from the panel.

d. Capability of each SLC to provide 40-percent addressable expansion without hardware modifications to the panel.

2.1.2 Operational Features

****

NOTE: For zoned fire alarm and detection systems, the systems should be zoned by type of device and by floor.

List zones, and indicate the exact wording of the descriptive zone labeling.

Remove item j. below when elevators are not involved.

****

Provide the system with the following operating features:

a. Monitoring of electrical supervision of [IDC,] [SLC,] [and] [NAC]. [Smoke detectors [do not] have combined alarm-initiating and power circuits.]

b. Monitoring of electrical supervision of the primary power ac supply, battery voltage, placement of alarm zone module within the control panel, and the integrity of the transmitter's tripping circuit.

c. A trouble buzzer and light-emitting diode (LED)or liquid crystal diode (LCD) to activate upon a single break, open, or ground fault condition that prevents the required normal operation of the system. Ensure that the trouble signal also operates upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module and disconnection of the circuit used for transmitting alarm signals off-premises. Provide a trouble alarm silence switch that silences the trouble buzzer, but does not extinguish the trouble indicator LED or LCD. Ensure the subsequent trouble and supervisory alarms sound the trouble signal until silenced. Ensure that, after the system returns to the normal operating conditions, the trouble buzzer sounds again until the silencing switch returns to the normal position, unless an automatic trouble reset is provided.

d. A one-person test mode. Ensure that activating an initiating device in this mode activates an alarm for a short time, and then automatically resets the alarm, without activating the transmitter during the entire process.

e. A transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but providing a trouble signal when disconnected and a restoration signal when reconnected.

f. A switch to silence the evacuation alarm, which, when activated,

silences alarm devices, but does not affect the zone-indicating LED or LCD or the operation of the transmitter. Over-ride this switch upon activation of a subsequent alarm from an unalarmed device and the NAC devices are activated.

g. Electrical supervision for circuits used for supervisory signal services, such as sprinkler systems, and valves. Ensure that supervision detects any open, short, or ground.

h. Confirmation or verification of all smoke detectors. Ensure that the he control panel interrupts the transmission of an alarm signal to the system control panel for a factory-preset period. Ensure that this interruption period is adjustable from 1 to 60 seconds and can be factory-set at [20] [_____] seconds. Ensure that immediately following the interruption period, a confirmation period is in effect during which an alarm signal, if present, is sent immediately to the control panel. Program fire alarm devices, other than smoke detectors without confirmation or verification.

i. An FACP provides supervised addressable relays for HVAC shutdown. Do not provide an override at the HVAC panel.

[j. An FACP that provides the monitoring and supervised control outputs needed to accomplish elevator recall.

] k. An FACP that monitors [and controls] the fire sprinkler system, or other fire protection extinguishing systems.

l. An FACP and field panels that are software-reprogrammable to enable expansion or modification of the system without replacement of hardware or firmware. Examples of required changes are adding or deleting devices or zones, changing system responses to particular input signals, and programming certain input signals to activate auxiliary devices.

m. Zones for [IDCs] [and] [NACs] are [arranged as indicated on the Contract drawings] [as follows: [_____]].

2.1.3 Alarm Functions

****

NOTE: Check with the local fire department to determine which signal or signals are to be transmitted. For zoned fire alarm reporting, the transmitter should be zoned as required by the Authority Having Jurisdiction (AHJ).

List the zones, and indicate the exact wording of the descriptive zone labeling.

Functions e., g., and h. below are optional depending on the job conditions.

****

An alarm condition on a circuit automatically initiates the following functions:

a. Transmission of [a signal] [signals] over the station [telephonic] [telegraphic] [radio] fire reporting system.[The signal is common

for any device][The signals are as follows: [_____]].

b. Visual indications of the alarmed devices on the FACP display [and on the remote audible or visual display].

c. Continuous sounding or operation of alarm notification appliances [only in designated areas] [throughout the building] as required by ASA S3.41.

d. Closure of doors held open by electromagnetic devices.

e. Operation of the smoke control system.

f. Deactivation of the air-handling units [serving the alarmed area] [throughout the building].

g. Shutdown of power to the data processing equipment in the alarmed area.

h. Automatic discharge of the designated fire suppression systems. Provide a [_____] [15]-second maximum delay for the deluge system, a [_____] [30]-second delay for the wet-pipe system.

2.1.4 Primary Power

Provide operating power as required by Paragraph "Power Supply For The System." Ensure that transfer from normal to emergency power or restoration from emergency to normal power is fully automatic and does not cause a transmission of a false alarm. Ensure the loss of ac power does not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

2.1.5 Battery Backup Power

Provide battery backup power through the use of rechargeable, sealed-type storage batteries and battery charger.

2.1.6 Interface with Existing Fire Alarm Equipment

****

NOTE: If an addition to an existing system is required, provide the make, model number, and other pertinent information on existing components that are to operate with the new equipment. Since new interfaces will have to be compatible with the existing system or with the central fire alarm reporting system, the specification writer may need to delete major items from of this specification. A new fire alarm panel must be compatible with the existing central fire alarm reporting system.

Clearly identify the existing Fire Alarm equipment by the fire alarm system designer in the specification and on the drawings.

****

Operate the equipment specified herein as an extension to an existing configuration. Connect the new equipment to [an existing control panel in the existing part of the building] [existing monitoring equipment at the supervising station (Building [_____])]. Expand, modify, or supplement

existing [control] [monitoring] equipment to extend the existing [control] [monitoring] functions to the new points or zones. Ensure that the new components are capable of merging with the existing configuration without degrading the performance of either system. The scope of the acceptance tests of the paragraph TESTING includes aspects of operation that involve combined use of both new and existing portions of the final configuration.

2.1.7 Interface with Other Equipment

Furnish interfacing components to connect to subsystems or devices that interact with the fire alarm system, such as supervisory or alarm contacts in suppression systems, operating interfaces for smoke control systems, door releases, and [_____].

2.1.8 System Operation

Furnish a complete description of the system operation [in matrix format] on the drawings.

****

NOTE: To ensure system reliability, locate the supply and return portions of the Style 6 loop in separate rooms or shafts, with enough separation that a single fire does not involve both the supply and return portions of the loop.

****

Ensure that the system is a complete, supervised, noncoded, analog or addressable fire alarm system conforming to NFPA 72. Provide the system with an interconnected riser loop or network having Style [6] [_____] supervision that is not located in the same room or shaft. 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, 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, 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.] Operate the system in the alarm mode upon actuation of any alarm initiating device. Ensure that the system remains in the alarm mode until initiating device(s) are reset and the FACP is manually reset and restored to normal. Ensure that the system provides the following functions and operating features:

a. Power, annunciation, supervision, and control for the system.

b. Style [B] [_____] IDCs [for conductor lengths of 3050 mm 10 feet or less].

c. Style [4] [_____] SLCs for each floor.

d. Style [6] [_____] SLCs for the network.

e. Style [Z] [_____] NACs that synchronize the flash rates with the visual alarm notification appliances.

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

g. An audible and visual trouble signal to activate upon a single break or open condition, or ground fault. Ensure that the trouble signal also operates upon loss of primary power (AC) supply, absence of a battery supply, low battery voltage, or removal of alarm or supervisory panel modules. Provide a trouble alarm silence feature that silences the audible trouble signal, without affecting the visual indicator. After the system returns to normal operating conditions, ensure that the trouble signal again sounds until the trouble is acknowledged. Provide a smoke sensor that does not initiate a trouble condition while its ability to detect smoke is being verified.

h. A notification appliance silencing switch that, when activated, silences the audible signal appliance, but does not affect the visual alarm indicator, the LCD, or the automatic notification of the [fire department] [central station service]. Override this switch upon activation of a subsequent alarm.

i. Alarm verification capability for smoke sensors. Ensure the alarm verification is initially set for [30] [_____] seconds.

j. Programming capability via switches in a locked portion of the FACP to bypass the automatic NACs, [fire reporting system] [air handler shutdown] [smoke control operation] [elevator recall] [door release] [door unlocking] features. Ensure the operation of this programming indicates this action on the FACP display and printer output.

k. Automatic transmission of alarm, supervisory, and trouble signals to [the fire department] [a UL-listed central station].

l. Alarm functions that override trouble or supervisory functions and supervisory functions that override trouble functions.

m. Ability to be programmed from the panel's keyboard and to store programmed information in nonvolatile memory.

n. Ability to operate, supervise, and monitor both addressable and nonaddressable alarms and supervisory devices.

o. Ability for all addressable devices to be in alarm simultaneously.

p. An addressable fire alarm relay that is within 915 mm 3 feet of each corresponding emergency control device, where the fire alarm system is responsible for initiating an action in another emergency control device or system, such as [an HVAC system] [an atrium exhaust system] [a smoke control system] [an elevator system].

****

NOTE: Show the following in matrix format either in this specification or on the drawings. If a matrix is provided, omit subparagraphs q, r, and s.

****

q. An alarm signal that automatically initiates the following functions:

(1) Transmission of an alarm signal to [the fire department] [a UL-listed central station].

(2) Visual indication of the device operated on the fire alarm control

panel (FACP), [VDU,] [and graphic annunciator]. [Indication on the graphic annunciator is by floor, zone, or circuit, and by type of device.]

****

NOTE: In high-rise buildings whose fire alarm systems provided full sprinkler protection, the fire alarm notification appliances should operate only on the fire floor, on the one or two floors above and on the floor below. In buildings that have some fire protection or life safety concerns but the building can be evacuated quickly, the fire alarm system should operate all notification appliances in the building upon a fire alarm. In those buildings designed for total evacuation due to fire protection or life safety concerns, the system should be designed so that it can easily be modified when the fire protection or life safety improvements have been made.

****

(3) [Continuous actuation of all alarm notification appliances, except those in stairs or in elevator cabs.][Continuous actuation of alarm notification appliances on the floor of fire alarm origin, the floor above the floor of fire alarm origin, and the floor below the floor of fire alarm origin, except those in stairs or in elevator cabs.]

[(4) Recording of the event via the system printer.

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

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

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

][(8) Operation of a smoke sensor that automatically recalls elevators.

][(9) Operation of a duct smoke sensor that shuts down the appropriate air handler in accordance with NFPA 90A.

****

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

****

][(10) Operation of [_____] that releases the [_____] fire extinguishing system after a [_____]-second delay.

][(11) In an elevator machinery room, operation of a sprinkler waterflow switch that operates 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.

] r. A supervisory signal that automatically initiates the following

functions:

(1) Visual indication of the device operated on the FACP [VDU,] and on the graphic annunciator, and sound the audible alarm at the respective panel.

(2) Transmission of a supervisory signal to [the fire department] [a UL-listed central station].

[(3) Recording of the event via the system printer.

] s. A trouble condition that automatically initiates the following functions:

(1) Visual indication of the system trouble on the FACP [VDU,] and graphic annunciator, and actuation of the audible alarm at the respective panel.

(2) Transmission of a trouble signal to [the fire department] [a UL-listed central station].

[(3) Recording of the event via the system printer.

] t. Maximum permissible elapsed time of 15 seconds between the actuation of an initiating device and its indication at the FACP.

u. The maximum elapsed time of 200 seconds between the occurrence of the trouble condition and its indication at the FACP.

2.1.9 System Monitoring

2.1.9.1 Valves

Electrically monitor 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, and valves at backflow preventers, whether existing or supplied under this Contract, to verify its proper position. Except where a maximum of [5] [_____] tamper switches within the same room can use the same address, provide each tamper switch with a separate address.

[2.1.9.2 Independent Fire Detection System

Monitor each existing independent smoke detection subsystem and kitchen fire extinguishing system for the presence of an alarm condition and a trouble condition. Provide each monitored condition with a separate address.

]2.1.10 Detail Drawings

Submit detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the Contract drawings show layouts based on typical detectors. Check the layout based on the actual detectors to be installed and make any necessary revisions in the detail drawings. Note that the detail drawings also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and functions properly as a unit. Prepare a

detailed point-to-point wiring diagram signed by a registered PE or a NICET-certified Level [3] [4] fire alarm technician showing points of connection. In the diagram include connections between system devices, appliances, control panels, supervised devices, and equipment that is activated or controlled by the panel.

Furnish 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. In the diagrams show connections from field devices to the FACP and remote fire alarm control units, initiating circuits, switches, relays, and terminals.

Furnish a plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, wire counts, circuit identification in each conduit, and circuit layouts for all floors.

Furnish 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.

Include annotated catalog data, in table format on the drawings, showing manufacturer's name, model, voltage, and catalog numbers for equipment and components.

2.2 EQUIPMENT

2.2.1 Addressable Interface Devices

Provide an addressable input interface to the FACP for monitoring normally open or normally closed contact devices, such as waterflow switches, valve supervisory switches, fire pump monitoring, independent smoke detection systems, and relays for output function actuation.

2.2.2 Fire-Detecting Devices

****
NOTE: Remove last sentence when not applicable.
****

****
NOTE: Provide smoke sensors only in spaces where MIL-HDBK-1008 specifically requires smoke sensors.
****

Ensure that fire-detecting devices comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. Provide the detectors as indicated. Ensure the detector bases have screw terminals for making connections and no soldered connections. Provide a remotely visible indicator LED or LCD for concealed detectors such as those above ceilings or in raised floors. Ensure that addressable fire-detecting devices, except flame detectors, are dynamically supervised and uniquely identified in the control panel. Ensure that all fire-alarm-initiating devices are individually addressable, except where indicated. Ensure the installed devices conform to NFPA 70 hazard classification of the area where the devices are installed.

2.2.2.1 Heat Detectors

****

NOTE: Heat detectors provided in elevator machinery rooms are strictly for the warning sign in the elevator cab and are not connected to the FACP. Coordinate with Section 14 21 13 ELECTRIC TRACTION FREIGHT ELEVATORS, 14 21 23 ELECTRIC TRACTION PASSENGER ELEVATORS, Section 14 24 13 HYDRAULIC FREIGHT ELEVATORS and 14 24 23 HYDRAULIC PASSENGER ELEVATORS.

****

Provide heat detectors for detection of fire by [fixed temperature] [combination fixed-temperature and rate-of-rise principle] [rate-compensating principle]. Rate heat detector spacing in accordance with UL 521. For detectors located in areas subject to moisture, exterior atmospheric conditions, or hazardous locations [as defined by NFPA 70] [and] [as shown on drawings], provide types approved for such locations. Ensure that heat detectors located in attic spaces or in similar concealed spaces below the roof are rated for intermediate temperature.

a. Combination Fixed-Temperature and Rate-of-Rise Detectors

Provide detectors for [surface] [semiflush] outlet box mounting that are supported independently of wiring connections. Provide contacts that are self-resetting after response to rate-of-rise principle. For detectors under fixed temperature actuation, provide a permanent external indication that is readily visible. For detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes, provide units operating on fixed-temperature principles only. The UL 521 test rating for the fixed-temperature portion is [[57.2] [_____] degrees C [135] [_____] degrees F] [as shown]. The UL 521 test rating for the rate-of-rise detectors is rated for 15 by 15 m 50 by 50 ft.

b. Rate Compensating Detectors

Provide [surface] [flush]-mounted [vertical] [horizontal]-type detectors, with outlet boxes supported independently of wiring connections. Ensure that detectors are hermetically sealed and automatically resetting. Rate-compensated detectors are rated for 15 by 15 m 50 ft by 50 ft.

c. Fixed Temperature Detectors

Design detectors for [surface] [semiflush] outlet box mounting and supported independently of wiring connections. Design detectors to detect high heat. Provide detectors with a specific temperature setting of [[57.2] [_____] degrees C [135] [_____] degrees F] [as shown]. The UL 521 test rating for the fixed-temperature detectors is 15 ft by 15 ft.

2.2.2.2 Photoelectric Smoke Sensors

Provide addressable photoelectric smoke sensors as follows:

a. Provide analog or addressable photoelectric smoke sensors using the photoelectric-light scattering principle for operation in accordance with UL 268. List smoke sensors for use with the FACP.

b. Provide self-restoring-type sensors that do not require any

readjustment after actuation at the FACP to restore them to normal operation. Use sensors that are UL-listed as smoke-automatic fire sensors.

c. Install rust-resistant and corrosion-resistant components. Ensure that vibration has no effect on the sensor's operation. Protect the detection chamber with a fine-mesh metallic screen that prevents the entrance of insects or airborne materials. Ensure that the screen does not inhibit the movement of smoke particles into the chamber.

d. Provide twist-lock bases for the sensors. Ensure that the sensors maintain contact with their bases without the use of springs. Provide a companion mounting base with screw terminals for each conductor. Terminate field wiring on the screw terminals. Provide sensors with a visual indicator to show actuation.

e. Ensure that the sensor address identifies the particular unit, its location within the system, and its sensitivity setting. Provide low voltage sensors rated for use on a 24 V dc system.

f. For each initiating device, ensure that a control panel operator with a proper access level, can manually access the following information.

(1) Primary status

(2) Device type

(3) Present average value

(4) Present sensitivity selected

(5) Sensor range (such as normal, dirty)

2.2.2.3 Combination Smoke-and-Heat Detectors

Provide combination smoke-and heat-detectors with an audible (self-contained) device designed for detection of abnormal smoke densities by the photoelectric principle and abnormal heat by a fixed-temperature sensor. Provide smoke detectors with an LED light source. Ensure that LED failure does not cause an alarm condition and that the sensitivity is factory-set at a nominal [3] [_____] percent and requires no field adjustments of any kind. Ensure that the heat detector portion is a fixed-temperature sensor rated at 57 degrees C 135 degrees F. Provide audible appliances that have a minimum sound output of at least [85] [_____] dBA at 3.05 m 10 feet. Provide detectors that contain a visible indicator LED that shows when the unit is in alarm condition. Provide detectors that are not adversely affected by vibration or pressure. Provide heat detectors that connect to a control panel [SLC] [IDC] and that are [non-restorable] [self-restorable].

2.2.2.4 Flame Detectors

****

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

****

Ensure that detectors comply with FM APP GUIDE. Provide detectors sensitive to the micron range best suited for their intended use. Ensure that detectors operate over electrically supervised wiring circuits and that the loss of power to the detector results in a trouble signal. Provide a self-test feature for each detector to be individually tested.

a. 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.

****

Provide a detector sensitive in the range of [_____] to [_____] micrometers only.

b. IR Dual-Frequency Flame Detector

****

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

****

Provide an IR detector that consists of two or more IR sensors, each selected for a different IR frequency. Ensure that the primary sensor is sensitive in the range of [_____] to [_____] micrometers only. Ensure that the secondary sensors are tuned to different IR wavelengths to null out the effect of blackbody radiation to the primary sensor.

c. 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 Earth.

Solid-state UV detectors are available, but their spectral response extends into the Sun's UV range and they 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 extreme temperature or pressure. UV units produce false alarms if exposed to arc welding or X-ray and gamma radiation. UV units 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 buildup of contaminants.
****

Provide a UV flame detector that operates on radiated UV energy and is sensitive in the range of [_____] to [_____] micrometers only. Ensure that the cone of vision is 80 degrees or greater. Ensure that each detector is completely insensitive to light sources in the visible frequency range.

d. 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.
****

Provide a flame detector that requires both UV and IR flame detection before an alarm is sent. Ensure that the UV sensor is sensitive in the range of 0.185 to 0.265 micrometers only. Ensure that the IR sensor is sensitive in the range of [_____] to [_____] micrometers only. Ensure that the detectors are completely insensitive to light sources in the visible frequency range.

[2.2.2.5 Duct Smoke Sensors

Duct smoke sensors are analog or addressable photoelectric type smoke sensors as described in paragraph "photoelectric Smoke Sensors" in ductwork in accordance with NFPA 90A and in accordance with manufacturer's recommendations.

]2.2.3 Electric Power

2.2.3.1 Primary Power

Provide primary power for the FACP from the normal ac service to the building [where shown on the drawings] [or] [_____]. Ensure that power is 120 V ac service. Make the service connection for the FACP at the [main service switchgear] [emergency distribution panel where shown] [a main distribution panel where shown]. Provide equipment to protect against power surges. Provide a separate NEMA 1 "general purpose enclosure" for the circuit breaker. Paint the circuit breaker enclosure red, and permanently affix a red and white engraved plastic sign reading "FIRE ALARM SYSTEM" to the face of the switch. Provide an enclosure with a lockable handle or cover.

[2.2.3.2 Generator

Where an emergency generator provides a standby power supply for life safety system circuits, provide a connection from one of the circuits for the fire alarm system.

]2.2.4 Emergency Power Supply

Provide for system operation in the event of primary power source failure. Ensure that transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power is automatic and does not cause transmission of a false alarm.

2.2.4.1 Storage Batteries

Provide sealed, maintenance-free, [lead-calcium] [sealed lead acid] [gel cell] [nickel-cadmium] [lithium] batteries as the source for emergency power to the FACP. Ensure that batteries contain suspended electrolyte. Maintain the battery system in a fully charged condition by means of a solid-state battery charger. Provide batteries with overcurrent protection in accordance with NFPA 72. Provide separate battery cabinets that have a lockable, hinged cover similar to the fire alarm panel. Key the lock the same as the FACP. Paint cabinets to match the FACP.

Locate batteries [at the bottom of the panel] [in a separate battery cabinet]

2.2.4.2 Capacity

****

NOTE: The fire alarm system may interface with auxiliary systems or subsystems; ensure that adequate battery backup is available, if the fire alarm system provides the power.

NOTE: Use 48 hours if the building has no generator providing standby power to the fire alarm system. If such a generator exists, use 4 hours.

****

Ensure that the batteries have the capacity, with primary power disconnected, to operate the fire alarm system for [48][_____] hours and, after this period, to operate all components of the system, including all alarm signaling devices in the total alarm mode, for a at least [10][15] minutes.

2.2.4.3 Battery Chargers

Provide a solid-state, fully automatic, variable-charging rate battery charger capable of providing 150 percent of the connected system load and maintaining the batteries at full charge. Ensure that when the batteries are fully discharged, the charger recharges the batteries back to 95 percent of full charge within 48 hours. Provide a 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.

2.2.4.4 Battery Power Calculations

Verify that battery capacity exceeds supervisory and alarm power requirements by furnishing the following:

a. Complete battery calculations for both the alarm and supervisory power requirements. Submit ampere hour requirements for each system component with the calculations.

b. Data on each circuit to indicate that there is sufficient spare capacity for notification appliances and [25] [50]-percent spare capacity for initiating devices. Note data for each circuit on the drawings.

[c. Data to indicate that the amplifiers have sufficient capacity to simultaneously drive fire alarm speakers at their 1/2 watt tap plus 50-percent spare capacity. Note data for each circuit on the drawings.

] d. Voltage drop calculations for NACs to indicate that sufficient voltage is available for required appliance operation.

2.2.5 System Field Wiring

2.2.5.1 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 200 mm by 200 mm least 8 inches by 8 inches at the base of any circuit riser, on each floor at each riser, and where indicated on the drawings. Select a terminal size appropriate for the size of the wiring to be connected. Label conductor terminations and permanently mount a drawing showing conductors, their labels, their circuits, and their interconnection in the terminal cabinet.

2.2.5.2 Alarm Wiring

****
NOTE: Do not penetrate the perimeters of sensitive compartmented information facilities (SCIFs) with copper signal line circuits. SCIF penetrations should be either fiber-optic cable or IDCs. IDCs that penetrate the SCIF are filtered.
****

Provide wiring that conforms with NFPA 70.

Provide [fiber-optic] [or] [copper] cable for field wiring of SLCs and IDCs in accordance with the manufacturers requirements. for NACs, that contain audible alarm devices, [other than speakers,] provide solid copper No. 14 AWG size conductors at a minimum. [For speaker circuits provide copper No. [16] [_____] AWG size conductors at a minimum.] [For firefighter telephone circuits provide No. [16] [18] [_____] AWG size conductors at a minimum.] Select a wire size sufficient to prevent voltage drop problems. For power wiring operating at 120 V ac minimum, provide No. 12 AWG solid copper having similar insulation. Use shielded wiring where recommended by the manufacturer. For shielded wiring, ground the shield at only one point, which is in or adjacent to the FACP. T-taps are permitted in Style 4 circuits with interconnections occurring on terminal strips or using screw terminal blocks for Style 5 addressable systems.

Color-code circuits, and maintain coding throughout the circuit. Similarly color-code conductors used for the same functions so that code colors remain uniform throughout the circuit.

2.2.5.3 Conduit

Provide conduit and fittings that comply with NFPA 70, UL 6, UL 1242, and UL 797.

Provide all wiring in rigid metal conduit or intermediate metal conduit. Electrical metallic tubing conduit is acceptable in dry locations not enclosed in concrete or in locations not subject to mechanical damage. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. The use of flexible conduit not exceeding a 1830 mm [6] [_____]-foot length is permitted in IDCs. Conceal conduit or tubing unless specifically shown otherwise on the drawings.

2.2.5.4 Conductor Terminations

Label conductors at terminal blocks in terminal cabinets, FACP, and remote fire alarm control units at each conductor connection. Provide a shrink-wrap label for each conductor or cable for a unique and specific designation. In each terminal cabinet, FACP, and fire alarm control unit mount a laminated drawing in at least 12 point lettering, that indicates each conductor, its label, its circuit, and its terminal, so that the drawing does not interfere with the wiring or terminals. Maintain the existing color code scheme where connecting to existing equipment.

2.2.5.5 Wiring to Station Telegraphic Fire Alarm Circuit

Provide wiring from the master fire alarm box to the station telegraphic fire alarm circuit with a two-conductor No. [12] [10] [_____] AWG-type UF cable [in conduit].

2.2.6 Fire Alarm Control Panel (FACP)

****

NOTE: For high-rise buildings, locate the FACP in an emergency control center having one door opening to the outside.

****

Provide a control panel that complies with the applicable requirements of UL 864.

Provide a complete control panel fully enclosed in a lockable steel enclosure. If more than a single unit is required at a location to form a complete control panel, match the unit enclosures exactly. [If more than a single unit is required, and is located in the lobby or entrance, notify the [_____] Division] [EFA [_____] Fire Protection Engineer, via the Contracting Officer, before installing the equipment.] Ensure that each control unit provides power, supervision, control, and logic for the entire system, using solid-state, modular components, internally mounted and arranged for easy access. Provide visual annunciation for a LED or LCD visual display as an integral part of the control panel and identify with a word description and ID number each device. Ensure that each control unit is suitable for operation on a 120 V, 60 hz, building power supply. Provide each panel with supervisory functions for power failure, internal component placement, and operation. Provide visual indication of alarm, supervisory, or trouble initiation on the FACP is by LED or LCD.

2.2.6.1 Cabinet

Install control panel components in cabinets large enough to accommodate all components. If more than one modular unit is required to form a control panel, install the units in a single cabinet large enough to accommodate the units. Allow ample gutter space for interconnection of panels, as well as field wiring. Locate the LED or LCD displays on the exterior of the cabinet door or make them visible through the cabinet door. Place the cabinet in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions.

2.2.6.2 Control Modules

Provide power and control modules to perform all functions of the FACP. Provide audible signals to indicate any alarm, supervisory, or trouble condition. Ensure that the alarm signals are different from the trouble signal. Connect circuit conductors entering or leaving the panel to screw-type terminals, and mark each terminal for identification. Locate diodes and relays, if any, on screw terminals in the FACP.

[2.2.6.3 Addressable Control Module

****
NOTE: Remove this paragraph when not required.
****

Ensure that the control module is capable of operating as a relay (dry-contact form C) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. Ensure that the module is UL-listed as compatible with the control panel. Configure the indicating device or the external load being controlled as a Style Y NAC. Ensure that the system is capable of supervising the audible, visual and dry-contact circuits. Ensure that the control module has both an input and output address. Ensure the system can detect a short on the supervised circuit and prevent power from being applied to the circuit. Ensure that the control module's means of address setting is compatible with the control panel's SLC supervision and the control module stores an internal identifying code. Ensure that the control module contains an integral LED that flashes each time the control module is polled. [Connect the existing fire alarm system NACs to a single module to power and supervise the circuit.]

][2.2.6.4 Addressable IDC Module

****
NOTE: Remove this paragraph when not required.
****

Configure the initiating device being monitored as a [Style D] [Style B] IDCs. The system is 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. Ensure that the module is UL-listed as compatible with the control panel. Ensure that the monitor module's means of address setting is compatible with the control panel's SLC supervision and that the monitor module stores an internal identifying code. Ensure that the monitor module contains an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED. [Connect the existing fire alarm system IDCs to a single

module to power and supervise the circuit.]

]2.2.6.5 Silencing Switches

At the FACP, provide an alarm-silencing switch that silences the audible signal but does not affect the visual alarm indicator. Override this switch upon activation of a subsequent alarm.

Provide trouble- and supervisory-silencing switch that silences the audible trouble and supervisory signals but does not extinguish the visual indicator. Override this switch upon activation of a subsequent alarm, supervision, or trouble condition.

2.2.6.6 Noninterference

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

[2.2.6.7 Fire Alarm Voice Message

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NOTE: Use the proper bracketed item depending upon whether the fire alarm system is to cause total evacuation upon an alarm.
****

Ensure that a fire alarm activates the NACs. Ensure that textual audible appliances produce a slow whoop tone for three cycles, followed by a voice message that is repeated until the control panel is reset or silenced. Broadcast automatic messages through speakers on appropriate floors, but not in stairs or elevator cabs. Automatically activate the visual strobes, and broadcast audible messages on the floor of fire alarm origin, [the floor] [two floors] immediately above the floor of fire alarm origin, and the floor immediately below the floor of fire alarm origin. Ensure the ability to override the automatic audible output through use of a microphone input at the control panel for a live broadcast message. Ensure that the ability to broadcast live messages from a microphone through speakers in stairs, in elevator cabs, and throughout a selected floor or floors. Ensure the system is capable of operating all speakers at the same time. Ensure that the digitized voice message consists of a nonvolatile (EPROM) microprocessor-based input to the amplifiers. Ensure that the microprocessor actively interrogates the circuitry, field wiring, and digital coding necessary for the immediate and accurate rebroadcasting of the stored voice data into the appropriate amplifier input. Ensure that loss of operating power, loss of supervisory power, or any other malfunction that could render the digitized voice module inoperative automatically causes the slow whoop tone to take over all functions assigned to the failed unit.

Use a [male] [female] voice for messages as follows:

["May I have your attention, please. May I have your attention, please. A fire has been reported that may affect your floor. Please walk to the nearest exit and evacuate the building." (Provide a [2] [_____]-second pause.) "May I have your attention, please (repeat the message)."

]["May I have your attention, please. May I have your attention please. A

fire emergency has been reported in the building. Please leave the building by the nearest exit or exit stairway. Do not use the elevators." (Provide a [2] [_____]-second pause.) "May I have your attention please (repeat the message)."

]][2.2.6.8 Fire Alarm Signal

Ensure that a fire alarm activates notification appliances throughout the building. Audible devices are fire alarm horns that produce a [three-pulse temporal pattern] [continuous slow whoop tone] [_____]. Visual devices are strobes operating in accordance with NFPA 72.

]2.2.6.9 Memory

Provide each control unit with nonvolatile memory and logic for all functions. Do not consider the use of long-life batteries, capacitors, or other age-dependent devices as equal to nonvolatile processors, PROMS, or EPROMS.

2.2.6.10 Field Programmability

Provide control units and control panels that are fully field-programmable for control, initiation, notification, supervisory, and trouble functions of both input and output. Ensure that the system program configuration is menu-driven and the system changes are password-protected.

2.2.6.11 Input/Output Modifications

Ensure that the FACP features allow the bypassing of input devices from the system or the modification of system outputs. Provide a panel-mounted keypad [and a keyboard]. Ensure that any bypass of or modification to the system indicates a trouble condition on the FACP,[and on the VDU] [and a produces a printed output of the trouble condition].

2.2.6.12 Resetting

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

2.2.6.13 Instructions

Provide a typeset 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 FACP.] [Install the frame in a conspicuous location observable from the FACP.] On the card, 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. Ensure that the instructions are approved by the Contracting Officer before being posted.

[2.2.6.14 Walk Test

Ensure that the FACP has a walk test feature. When this feature is used, ensure that operation of initiating devices results in limited system outputs, so that the notification appliances operate for only a few seconds, that the event is indicated on the system printer, but that no other outputs occur.

]2.2.6.15 History Logging

Ensure that the control panel has the ability to store a minimum of 400 events in a log. Ensure that these events are stored in a battery-protected memory and remain in the memory until the memory is downloaded or cleared manually. Ensure that resetting of the control panel does not clear the memory.

2.2.7 Remote Fire Alarm Control Units

Provide complete remote control units fully enclosed in a lockable steel enclosure. Perform operations required for testing or for normal care and maintenance of the control units from the front of the enclosure. If more than a single unit is required at a location to form a complete control panel, match the unit enclosures exactly. Ensure that each control unit provides power, supervision, control, and logic for its portion of the entire system, using solid-state, modular components, internally mounted and arranged for easy access. Ensure that each control unit is suitable for operation on a 120 V, 60 Hz, normal building power supply. Provide each unit with supervisory functions for power failure, internal component placement, and operation.

2.2.7.1 Cabinet

Install remote control unit components in cabinets large enough to accommodate components and also to allow ample gutter space for interconnection of units as well as field wiring. Provide a rigid plastic phenolic resin, or metal identification sign that reads "Remote Fire Alarm Control Unit" in letters at least 2.5 cm 1 inch high. Provide prominent rigid plastic or metal identification plates for lamps, circuits, meters, fuses, and switches. Place the cabinet in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions.

2.2.7.2 Control Modules

Provide power and control modules to perform all functions of the remote control unit. Provide audible signals to indicate any alarm or trouble condition. Ensure that the alarm signals are different from the trouble signal. Connect circuit conductors entering or leaving the panel to screw-type terminals, and mark each terminal for identification. Locate diodes and relays, if any, on screw terminals in the remote control unit. Ensure that circuits operating at 24 V dc do not operate at less than 21.6 V. Ensure that circuits operating at any other voltage do not have a voltage drop exceeding 10 percent of nominal voltage. Arrange circuits so that there is 25-percent spare capacity for any circuit.

2.2.7.3 Remote System Audible or Visual Display

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NOTE: Provide a remote audible or visual display when the control panel is located in an area where the control panel's integral signaling normally cannot be heard or seen.

****

Provide audible appliances that have a minimum sound level output rating of [85] [_____] dBA at 3.05 m 10 feet and that operate in conjunction with the panel's integral display. Ensure that a system-silence switch on the

remote system can silence the audible device but does not extinguish the visual indication. Ensure that the remote visual appliance located with the audible appliance is not extinguished until the trouble or alarm has been cleared. Ensure that the remote LED or LCD visual display provides identification, consisting of the word description and ID number for each device as displayed on the control panel. Provide a rigid plastic, phenolic or metal identification sign that reads "Fire Alarm System Remote Display" at the remote audible or visual display.

2.2.7.4 Silencing Switches

At the remote control unit, provide an alarm-silencing switch that silences the audible signal but does not affect the visual alarm indicator. Override this switch upon activation of a subsequent alarm.

Provide a trouble- and supervisory-silencing switch that silences the audible trouble and supervisory signal but does not extinguish the visual indicator. Override this switch upon activation of a subsequent trouble or supervisory signal.

2.2.7.5 Noninterference

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

2.2.7.6 Memory

Provide each control unit with nonvolatile memory and logic for all functions. Do not consider the use of long-life batteries, capacitors, or other age-dependent devices as equal to nonvolatile processors, PROMs, or EPROMs.

2.2.7.7 Field Programmability

Provide control units that are fully field-programmable for control, initiation, supervisory, and trouble functions of both input and output. Ensure that the system program configuration is menu-driven, and that system changes are password protected. Accomplish changes using personal-computer based equipment.

2.2.7.8 Input/Output Modifications

Each remote control unit contains features that allow the elimination of input devices from the system or the modification of system outputs. Ensure that any such modification indicates a trouble condition on the remote control unit and on the FACP, and produces a printed output of the trouble condition.

2.2.7.9 Resetting

Prevent the resetting of any alarm, supervisory, or trouble signal while the alarm, supervisory, or trouble condition on the system still exists.

2.2.7.10 Instructions

Provide a typeset 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 remote fire alarm control unit.] On the card, 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. Ensure that the instructions are approved by the Contracting Officer before being posted.

[2.2.7.11 Walk Test

Provide each remote control unit with a walk test feature. When this feature is used, ensure that operation of initiating devices results in limited system outputs, so that the notification appliances operate for only a few seconds, that the event is indicated on the system printer, but that no other outputs occur.

]2.2.7.12 History Logging

Ensure that the control panel has the ability to store a minimum of 400 events in a log. Ensure that these events are stored in a battery-protected memory and remain in the memory until the memory is downloaded or cleared manually. Ensure that resetting of the control panel does not clear the memory.

[2.2.8 Amplifiers, Preamplifiers, Tone Generators

House any amplifiers, preamplifiers, tone generators, digitized voice generators, and other hardware necessary for a complete, operational, textual audible circuit conforming to NFPA 72 in a fire alarm control unit, in a terminal cabinet, or in the FACP. Ensure that the system automatically operates and controls all building fire alarm speakers except those installed in the stairs and within elevator cabs. Operate the speakers in the stairs and elevator cabs only when the microphone is used to deliver live messages. Provide each amplifier with two channels: one for broadcasting a message and the other for paging.

[2.2.8.1 Construction

Use computer-grade solid state components for amplifiers. Provide output protection devices sufficient to protect the amplifier against any transient up to 10 times the highest rated voltage in the system.

][2.2.8.2 Inputs

Equip each system with separate inputs from the tone generator, digitized voice driver and panel-mounted microphone. Use low-impedance, balanced line microphone. Ensure that both the microphone input and the tone generator input are operational on any amplifier.

][2.2.8.3 Tone Generator

Provide a tone generator of the modular, plug-in type, with attached labels to identify the component as a tone generator and to identify the specific tone that the generator produces. Ensure that the tone generator produces a slow whoop tone, which slowly ascends from low (500 Hz) to high (1200 Hz), and constantly repeats until interrupted by the digitized voice message, the microphone input, or the alarm silence mode. Ensure that each slow whoop cycle lasts approximately 4 seconds. Ensure that the tone generator is single-channel with one automatic backup generator per channel such that failure of the primary tone generator causes the backup

generator to automatically take over the functions of the failed unit and also causes transfer of the common trouble relay.

][2.2.8.4 Protection Circuits

Constantly supervise each amplifier for any condition that could render the amplifier inoperable at its maximum output. Ensure that failure of any component causes automatic transfer to a designated backup amplifier, illumination of a visual "amplifier trouble" indicator on the control panel, logging of the condition on the system printer.

]][2.2.9 Video Display Unit (VDU)

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NOTE: Contact the EFD or Engineering Field Activity (EFA) Fire Protection Engineer to determine if a VDU is to be provided.
****

Provide a VDU as the secondary operator-to-system interface for data retrieval, alarm annunciation, commands,and programming functions. Ensure that the desk mounted VDU consists of a keyboard and a monitor with a [300] [430] [_____] mm [12] [17] [_____]-inch minimum [touch] screen, capable of displaying 25 lines of 80 characters each. Supervise communications with the FACP. Record faults on the printer. Ensure that power is 120 V ac, 60 Hz from the same source as the FACP.

To eliminate confusion during an alarm situation, provide dedicated areas on the screen for the following functions:

a. Alarms and returns to normal

b. Commands, reports, and programming

c. Time, day, and date

Use English language throughout to describe system activity and instructions. Provide English language descriptors that define system points and that are 100-percent field-programmable by factory-trained personnel and are alterable and user-definable to accurately describe building areas.

Display alarms and other changes of status in the screen area reserved for this information. Provide the follow information in English:

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

b. Type of device (such as manual pull or waterflow)

c. Location of device plus numerical system address

Upon receipt of an alarm, ensure that an audible alarm sounds and the condition and point type flash until they are acknowledged by the operator. Ensure that returns-to-normal is also annunciated and require operator acknowledgment.

Ensure that the system has multiple levels of priority for displaying alarms to conform with UL 864. Priority levels are as follows:

a. Level 1 - Fire Alarms

b. Level 2 - Supervisory Alarms

c. Level 3 - Trouble Signals

Provide the system with sufficient memory to retain all alarms. Ensure that a highlighted message advises the operator when unacknowledged alarms are in the system.

Provide multiple levels of access for operators and supervisors via user-defined passwords. Provide the following functions in each level:

a. Operator-level access functions:

(1) Display system directory, definable by device.

(2) Display status of an individual device.

(3) Manual command (alarm device with an associated command uses the same system address for both functions).

(4) Report generation, definable by device, and output the report on either the VDU or the printer, as desired by the operator.

(5) Activate building notification appliances.

b. Supervisory-level access functions:

(1) Reset time and date.

(2) Enable or disable event-initiated programs, printouts, and initiators.

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

Ensure that the above supervisory-level functions do not require computer programming skills. Record changes to system programs on the printer and maintain the changes in the control panel as a trouble condition.

][2.2.10 Graphic Annunciator

****

NOTE: Provide the graphic annunciator at a location convenient for fire department. The annunciator should be near the door through which the firefighters enter the building as indicated in the prefire plan.

****

Provide detailed drawings of the graphic annunciator.

[2.2.10.1 Annunciator Panel

Provide a graphic annunciator that indicates the building floor plan, including the locations of stairs and elevators. Identify stairs and elevators by [letter] [number]. Clearly mark alarm circuit boundaries on the floor plan. Ensure that the graphic annunciator includes a north arrow, [location of the FACP,] and a "you are here" indicator and is [a

minimum size of 915 by 915 mm 3 feet by 3 feet] [as indicated on the Contract drawings].

][2.2.10.2 Indicating Lights

Provide the graphic annunciator with individual LEDs indicating each type of alarm and supervisory device. Provide an amber LED for indicating a system trouble condition and a separate amber LED for indicating a supervisory condition. Provide a green LED to indicate the presence of power and a red LED to indicate an alarm condition. Ensure that the actuation of any alarm signal causes the illumination of a boundary LED, a floor LED, and a device LED. Ensure that supervisory or trouble initiates the illumination of a trouble LED. Also provide LEDs indicating normal power and emergency power. Provide a push-button LED test switch. The test switch does not require key operation. Extinguish annunciator LEDs by operation of the system reset switch on the FACP.

][2.2.10.3 Material

Construct the graphic annunciator faceplate of [smoked Plexiglas] [bronze]. Backlight the LEDs. House control equipment and wiring in a [recessed] [semirecessed] [surface-mounted] back box. [Chrome-plate] [Bronze-plate] exposed portions of the back box with knockouts.

][2.2.10.4 Programming

Where programming for the operation of the required LEDs is accomplished by a software program separate from the software for the FACP, ensure that the software program does not require reprogramming after loss of power. Ensure that the software is reprogrammable in the field.

]][2.2.11 System Printers

Provide a system printer to record alarm, supervisory, and trouble conditions without loss of any signal or signals. Ensure that the printer has at least 80 characters per line, has a 96 ASCII character set, and operates on a 120 VAC, 60 Hz power supply. Ensure the the printout is by the circuit, device, and function specified in the FACP.

When the FACP receives a signal, print the alarm, supervisory, and trouble condition. Ensure that the printout includes the type of signal, the circuit or device reporting, the date, and the time of the occurrence. Differentiate alarm signals from other printed indications. When the system is reset, ensure that this condition is also 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, ensure that the system buffer retains and prints the data when the printer is restored to service. Provide the printer with an indicator to alert the operator that the paper has run out.

][2.2.12 Firefighter Telephone Communication System

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NOTE: Provide a master control station at the FACP 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 in the fire pump room and outside the emergency generator room.
****

Provide a firefighter telephone system as follows:

a. Provide a firefighter telephone communication system with complete, common-talk, closed circuits. Ensure that the system includes, but not be limited to, a master control station mounted in the FACP, a power supply and standby battery system, and remote telephone stations.

b. Provide a master control station that provides power, supervision, and control for wiring, components, and circuits.

   (1) Provide a master control station hand set that is red in color and equipped with a 5-foot, strain-relieved coiled cord. Ensure that the act of lifting any remote telephone hand set from its cradle causes both a visual and audible signal to annunciate at the master control station. Ensure that the act of removing the hand set at the master control station and depressing a button at the remote telephone hand set causes the automatic silencing of the audible signal. Ensure that communication between the master control station hand set and all remote hand sets requires the pressing of a push-to-talk switch located on remote hand sets. Ensure that while the master control hand set is removed from its cradle, communication between five remote hand sets and the master control station is possible. Ensure that sets are able to monitor any conversation in progress and join the conversation by pressing the push-to-talk button.

   (2) Equip the master control station with a silencing switch and ring-back feature such that any audible trouble signal can be silenced and is so indicated by the lighting of an amber LED. Ensure that once any trouble condition has been corrected, the amber LED is extinguished and the silencing switch sounds again until the switch is restored to its original position. Equip the master control station with a separate, LED-annunciated switch for each telephone circuit. In addition, ensure that LEDs provide for the annunciation of operating and supervisory power. Ensure that the loss of operating or supervisory power causes an audible and visual indication at the master control station and also causes the fire alarm trouble signal to sound on the FACP.

   (3) Fully label switches, LEDs, and controls.

c. Provide [surface] [flush]-mounted remote telephone stations. Equip each station with a hinged door that is magnetically locked. Permanently wire each hand set in place with a coiled cord. Ensure that each hand set is red, equipped with a push-to-talk switch and a switch-equipped, storage cradle that, when operated, signals the master control station.

d. Provide operating and supervising power from the same supply circuit or circuits used for the FACP.

]2.2.13 Manual Stations

Ensure that addressable manual fire alarm stations conform to the applicable requirements of UL 38. Provide metal or plastic, [semiflush

mounted][surface-mounted], addressable manual stations, that are not subject to operation by jarring or vibration. Ensure that stations are [single] [double] action type. Ensure that stations to latch upon operation and remain latched until manually reset. Equip stations with screw terminals for each conductor. Do not use stations that require the replacement of any portion of the device after activation. Finish stations in fire-engine red with molded raised lettering operating instructions of contrasting color. Require the use of a key or wrench to reset the station. Match and paint surface-mounted boxes the same color as the [fire alarm manual stations] [mounting surface].

2.2.14 Notification Appliances

[2.2.14.1 Fire Alarm Speakers

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NOTE: Locate speakers throughout the building with a maximum spacing of 92.9 square meters 1000 square feet per speaker. Where sound has to pass through more than one partition or wall to be heard in a space, provide an additional speaker.

****

Provide fire alarm speakers conforming to UL 464 with a minimum of three tap settings and separate terminations for each in and out connection. Ensure that tap settings include taps of 1/4, 1/2, and 1 watt. Ensure that speakers use the 1/2-watt tap in the system. Ensure that speakers have an output rating of 84 dBA at 3050 mm 10 feet as determined by the reverberant room test and do not have data on peak output as determined in an anechoic chamber. Ensure speakers can be installed on standard 100 mm 4 inch-square electrical boxes. Where speakers and strobes are provided in the same location, they may be combined into a single wall-mounted unit.

Provide speaker mounting plates constructed of cold-rolled steel having a minimum thickness of 16 gage and equipped for a complete installation. Grind and finish fabrication marks and holes to provide a smooth and neat appearance for each plate. Prime and paint each plate.

]2.2.14.2 Visual Alarm Signals

****

NOTE: Wall mount strobes in corridors no more than 4570 mm 15 feet from the end of a corridor with 30.48 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 wall-mounted strobes in rooms accessible to the public, such as conference rooms, restrooms, courtrooms, cafeterias, and auditoriums in accordance with NFPA 72.

****

Provide strobe light visual alarm signals that operate on a supervised 24 V dc circuit. Provide strobe lenses that comply with UL 1971 and conform to the Americans With Disabilities Act. Disburse the light pattern so that the light is visible above and below the strobe and from a 90-degree angle on both sides of the strobe. Ensure that the strobe flash output is a minimum of [15] [_____] candela based on the UL 1971 test. Ensure that

the strobe has a xenon flash tube. Visible appliances may be part of an audiovisual assembly.[Where more than two appliances are located in the same room or corridor, provide synchronized operation.]

[2.2.14.3 Fire Alarm Horns

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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.

****

Provide [surface] [semiflush]-mounted electronic, multitone horns that produce a minimum of four distinct sounds, suitable for use in an electrically supervised circuit. Ensure that horns have a rating of 90 dBA at 3050 mm 10 feet when tested in accordance with UL 464 while emitting a slow whoop tone. Ensure that the output from the horn is a [three-pulse temporal pattern] [the slow whoop tone] [_____]. Where horns and strobes are provided in the same location, they may be combined into a single unit.

][2.2.14.4 Fire Alarm Bells

****

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.

****

Provide [surface] [flush]-mounted bells suitable for use in an electrically supervised circuit. Provide 250 mm 10 inch vibrating bells with a sound output rating of at least 90 dBA at 3050 mm 10 feet when tested in accordance with UL 464.

]2.2.14.5 Connections

Provide screw terminals for each notification appliance. Design terminals to accept the size conductors used in this project without modification.

2.2.14.6 Chimes

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NOTE: Chimes are normally used only in hospitals 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.

****

Provide electrically operated, supervised, electronic, chimes, with an adjustable frequency of 800 to 1200 Hz. Ensure that chimes have a minimum

sound rating of [80] [_____] dBA at 3.05 m 10 feet.

2.2.14.7 Combination Audible/Visual Notification Appliances

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NOTE: Combination audible-visual notification appliances satisfy the same requirements as individual units except that the combination appliances mount as a unit in standard backboxes.
****

Provide factory-assembled units. Any other audible notification appliance employed in the fire alarm systems requires approval by the Contracting Officer.

2.2.14.8 Voice Evacuation System

Provide a voice evacuation system for [one-way] [two-way] voice communications, routing and preamplification of digital alarm tones and voice (digital and analog) messages. Zone the system for messages (custom and prerecorded) and tones as indicated on the drawings. Ensure that the following electronic tones are available from the amplifier: Slow whoop, high/low, horn, chime, beep, stutter, wail and bell. Permit either manual operation from a control switch or automatic operation from the FACP. Accomplish reset by the FACP during a panel reset.

[2.2.15 Valve Monitor Switches (Tamper Switches)

Provide a tamper switch for each fire protection system control valve. Ensure that tamper switches are UL-listed as "Extinguishing System Attachment" for the location and type of valve supervised. Ensure that the tamper switch contains double-pole, double-throw contacts. Ensure that operation of the switch causes a supervisory signal to be transmitted to the FACP upon not more than two complete turns of the valve wheel or a closure of 10 percent, whichever is less. Equip tamper switches with screw terminals for each conductor.

][2.2.16 Waterflow Detectors

[Provide vane-type waterflow detectors for wet-pipe sprinkler systems containing double-pole, double-throw contacts. Equip each detector with a pneumatic time delay, field-adjustable from 0 to 90 seconds. Set the time delay initially to [30] [45] [_____] seconds. Ensure that each detector is a UL-listed extinguishing system attachment rated for the particular pressure and location at which the detector is installed. Equip flow switches with screw terminals for each conductor.

] Provide pressure-type waterflow detectors for dry-pipe sprinkler systems containing double-pole, double-throw contacts. Ensure that each detector is a UL-listed extinguishing system attachment rated for the particular pressure and location at which the detector is installed. Equip flow switches with screw terminals for each conductor.

][2.2.17 Electromagnetic Door Holders

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NOTE: Provide electromagnetic door holders only for cross-corridor doors and for doors likely to be propped open once construction is complete.

****

Where indicated on the drawings, provide electromagnetic devices to hold fire doors open. Design the electromagnetic holding devices to operate on 120 V ac, and require not more than 3 watts of power to develop 172.4 kPa 25 psi of holding force. Ensure that the initiation of any fire alarm causes the release of the electromagnetic door-holding device and permits the door to be closed by the door closer. Ensure that the device is UL-listed based on UL 228 tests.

]2.2.18 Automatic 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. When telegraphic systems exist, use code transmitters. Determine the type of activity reporting system (such as positive noninterfering or shunt). In most cases, a local energy-tripping device is required.

Contact the facility Fire Department or Engineering office to determine the type and amount of data to be supervised (monitored), that is, 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 the monitoring equipment can be expanded to accommodate the new fire alarm system. Identify existing components.

****

[2.2.18.1 Telegraphic Transmitter

Submit data and include UL or FM listing cards for equipment provided.

Provide electric-motor-driven or prewound spring transmitters that transmit not less than four rounds of code. When motor-driven transmitters are provided, connect the motor to a supervised circuit in a control panel. Provide metallic or rigid plastic code number plates on the exterior face of transmitters. Design transmitters to provide the same features as the fire alarm boxes for electrically supervised, coded, positive, noninterfering transmissions and to transmit signals on grounded or open circuits. Ensure that when a single open fault on an exterior fire alarm circuit activates the box,the box is idle for only one complete round, and then immediately transmits four complete code rounds via the box earth ground connection. Ensure the transmitters have local-energy-type auxiliary tripping devices. Ensure that the wheel is metallic and that the box code is as directed by the Contracting Officer.

][2.2.18.2 Radio Transmitter and Interface Panels

Provide a radio transmitter with antenna that is compatible with the existing supervising-station fire alarm system. Ensure that alarm,

supervisory, and trouble conditions can be transmitted via a single transmitter. Provide transmitters in accordance with applicable portions of [NFPA 72,] [NFPA 1221,] and Federal Communications Commission (FCC) 47 CFR 90. Contain the transmitter electronics module within the physical housing as an integral, removable assembly. UL-listed transmitter may be housed in the same panel as the FACP. Provide transmitters capable of initiating a test signal daily at any selected time.

]2.2.18.3 Transmitter Power Supply

Power each radio alarm transmitter by a combination of locally available 120 V ac power and a sealed, lead-calcium battery.

Operate each transmitter from 120 V ac power. Ensure that if 120 V ac power is lost, the transmitter automatically switches to battery operation. Accomplish switchover with no interruption of protective service, and automatically transmit a trouble message. Upon restoration of ac power, automatically transfer back to the normal ac power supply.

Ensure the transmitter's standby battery capacity provides sufficient power to operate the transmitter in a normal standby status for a minimum of [72][_____] hours and to transmit alarms during that period.

2.2.18.4 Radio Alarm Transmitter Housing

Provide NEMA Type 1 transmitter housing with a lock that is keyed [identical to the fire alarm system for the building.] [identically to radio alarm transmitter housings on the base.] Ensure that the radio alarm transmitter housing is Factory-painted with a suitable priming coat and not less than two coats of a hard, durable, weatherproof enamel.

2.2.18.5 Antenna

Provide [omnidirectional, coaxial, halfwave dipole antennas] [_____] for radio alarm transmitters with a driving point impedance to match transmitter output. Ensure that the antenna and antenna mounts are corrosion-resistant and designed to withstand wind velocities of 161 km/h 100 mph. Do not mount antennas to any portion of the building roofing system.

[2.2.18.6 Digital Alarm Communicator Transmitter (DACT)

Provide a DACT that is compatible with the existing supervising-station fire alarm system. Ensure that alarm, supervisory, and trouble conditions can be transmitted via a single transmitter. Provide a power source for operation conforming to NFPA 72. Ensure that the transmitter is capable of initiating a test signal daily at any selected time. Arrange the transmitter to seize telephone circuits in accordance with NFPA 72.

][2.2.18.7 Telephonic Reporting System

Provide transmitters compatible with existing receiving equipment at the supervising-station. Design transmitters to provide the same features as the fire alarm boxes for electrically supervised, coded, [positive,] [shunt,] noninterfering transmissions and to transmit signals on grounded or open circuits. Ensure that the transmitters respond to the actuation of the FACP. Provide electric-motor-driven or pre-wound spring transmitters that transmit not less than four rounds of code. When motor-driven transmitters are provided, connect the motor to a supervised

circuit in a control panel. Provide metallic or rigid plastic code number plates on the exterior face of transmitters. Ensure that when a single open fault on an exterior fire alarm circuit activates the box, the box is idle for only one complete round and then immediately transmits four complete code rounds via the box earth ground connection.

Provide a transmitter with a [shunt-] [local-energy-] type auxiliary tripping device. Ensure that the code wheel is metallic and that the box code is as directed. Extend wiring to the indicated telephone terminating location [for future connection by other] [and connected to specific twisted-pair cable identified by the Contracting Officer in the field]. Extend [one new [_____]-pair [shielded] [nonshielded] twisted-pair cable to the supervising-station and connect to the existing terminating equipment.]

][2.2.18.8 Signals to be Transmitted to the Base Receiving Station

Send the following signals 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. Heat detectors

][g. Sprinkler valve supervision

][h. Fire pump running

][i. Fire pump loss of power/phase reversal

]]2.2.19 Nameplates

Permanently affix a new nameplate showing the following information to each major component: the manufacturer's name and address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the Contract number. Major components include the following:

a. FACPs

Provide a rigid plastic, phenolic-resin or metal nameplate that reads "Fire Alarm Control Panel" in letters at least 25 mm 1 inch high. Ensure that nameplates for fuses also include ampere rating. Provide prominent rigid plastic or metal identification plates for lamps, circuits, meters, fuses, and switches.

b. Automatic transmitter

c. Printer

Obtain approval of the nameplates by the Contracting Officer before installation. Obtain approval by the Contracting Officer for installation

locations. Ensure that nameplates are either etched metal or plastic and are permanently attached by screws to panels or adjacent walls.

2.2.20 Addressable Manual Fire Alarm Stations

Provide addressable manual fire alarm stations that conform to the applicable requirements of UL 38. Ensure that stations are [single] [double]-action type. Finish stations in red, with raised-letter operating instructions of contrasting color. Do not provide stations that require the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods [are] [are not] acceptable. The use of a key or wrench is required to reset the station. Gravity or mercury switches are not acceptable. Rate switches and contacts for the voltage and current upon which they operate. Provide addressable pull stations capable of being field programmed. Stations to latch upon operation and remain latched until manually reset. Stations have a separate screw terminal for each conductor. Match and paint surface mounted boxes the same color as the [fire alarm manual stations] [mounting surface].

2.2.21 Transmitters

2.2.21.1 Master Fire Alarm Boxes

Ensure that master fire alarm boxes are of the coded, [shunt] [positive] noninterfering type with succession features having a [shunt-] [local energy-] type auxiliary tripping device. [Design boxes for operation at 100 mA dc, but with capability of full operation between 70 to 120 mA.]Ensure that the boxes are the prewound, open-door, pull-lever type. Install the mechanism in a weatherproof cottage shell housing with a metallic or rigid plastic code number plate mounted on the exterior face of the cottage shell. Ensure that operation of the actuating pull-lever causes the box to transmit four complete rounds of code to gongs, recorders, and other devices on the same circuit. Ensure that driving springs have the capability to transmit not less than eight complete four-round groups of code before being rewound.

Ensure that when a single open fault on an exterior fire alarm circuit activates the box, the the box is idle for only one complete round and then immediately transmits four complete code rounds via the box earth ground connection. Equip each box with a manual signaling key, telephone jack, silent test device, and box shunt device. Ensure that each box is [[wall-] [pole-] [pedestal-] mounted] [as indicated], with the center of the box 1525 mm 61 inches above grade, and provide each box with a lighting fixture.

Use copper alloy, cadmium, or zinc-coated steel bolts, brackets, fastenings, and conduit. Ensure that the code wheel is metallic and that the box code is as directed.

2.2.22 Keys

Furnish identical keys and locks for equipment. Provide not less than six keys of each type required. Ensure that keys are CAT [60] [_____].

Furnish tags with stamped identification number for keys and locks.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 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 the new equipment "NOT IN SERVICE" until the new equipment is accepted. Once the new system is completed, tested, and accepted by the Government, place the new equipment in service and connect the new equipment to the station fire alarm system. Remove tags from the new equipment, and tag the existing equipment "NOT IN SERVICE" until removed from the building.

[3.1.2 Disconnection and Removal of Existing System

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

Turn over disconnected and removed FACPs and fire alarm devices to the Contracting Officer.

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

]3.1.3 Supervising-Station Provisions

[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 panel [_____]] [_____], [signal reporting components [_____]], [annunciator [_____]] [_____]].

3.1.3.1 Revisions to Existing Facilities

Modify existing supervising components as indicated on the drawings, and update programming if required to accommodate the revised configuration. Ensure that acceptance testing includes procedures that would demonstrate that operation of existing equipment has not been degraded and that the revised configuration, plus interfacing components, operates compatibly with the new fire alarm system at the protected premises. Perform work on existing equipment in accordance with the manufacturer's instructions or under supervision of the manufacturer's representative.

3.1.3.2 Additions to Existing Facilities

Add supplemental components to the existing supervising equipment [as required to accommodate the new fire alarm system installed at the protected premises] [as indicated on the drawings]. Extend all present functions, including recording and storage in memory, and update programming if required to accommodate the revised configuration. Ensure that acceptance testing includes procedures that would demonstrate that operation of existing equipment has not been degraded and that the expanded configuration operates compatibly with the new fire alarm system.

3.2 INSTALLATION

3.2.1 Grounding

Provide grounding by connecting to building ground system.

3.2.2 Overvoltage And Surge Protection

3.2.2.1 Power Line Surge Protection

Protect all equipment connected to ac circuits from surges in accordance with IEEE C62.41.1 IEEE C62.41.2 for a B3 combination waveform and NFPA 70. Do not use fuses for surge protection. Rate the surge protector for a maximum let-through voltage of 350 V ac (line-to-neutral) and 350 V ac (neutral-to-ground).

3.2.2.2 Low-Voltage DC Circuit Surge Protection

For all [IDCs] [IDCs, NACs, and communication cables or conductors], except fiber-optics, install surge protection at each point where the cables or conductors exit or enter a building. Protect equipment from surges in accordance with IEEE C62.41.1 IEEE C62.41.2 for a B3 combination waveform and NFPA 70. Rate the surge protector to protect the 24 Volt dc equipment. The maximum dc clamping voltages is 36 V (line-to-ground) and 72 V dc (line-to-line).

3.2.2.3 Signal Line Circuit Surge Protection

For all SLC cables/conductors, except fiber optics, install surge protection/isolation circuits at each point where it exits or enters a building. Protect the circuit from surges per IEEE C62.41.1/IEEE C62.41.2 for a B3 combination waveform and NFPA 70. Rate the surge protector or isolator to protect the equipment.

3.2.3 Fire-Alarm-Initiating and -Indicating Devices

****

NOTE: The Americans with Disabilities Act (ADA) requires that manual alarm stations be mounted at a maximum of 1.2 m 48 inches above finished floor (AFF) for forward reach and 1.4 m 54 inches AFF for side reach.

****

Mount manual stations at [1220] [1370] [_____] mm [48] [54] [_____] inches into SLCs. Install stations on [surface] [semiflush] [flush]-mounted outlet boxes.

Install all work as shown, and in accordance with NFPA 70 and NFPA 72, and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Do not install smoke detectors until construction is complete and the building has been thoroughly cleaned.

Locate the FACP [where indicated on the drawings] [_____]. [Recess] [Semirecess] [Surface-mount] the enclosure, with the top of the cabinet 1830 mm 6 feet above the finished floor (AFF) or center the cabinet at [1525] [_____] mm [5] [_____] feet, whichever is lower.

Locate manual stations [as required by NFPA 101 and NFPA 72] [where shown

on the drawings] [_____]. Mount stations so that each station's operating handles are 1220 mm 4 feet AFF. Mount stations no farther than [1525] [_____] mm [5] [_____] feet from the exit doors that the stations serve, measured horizontally.

Locate notification appliance devices [as required by NFPA 72] [where shown on the drawings]. Mount assemblies on walls, 2030 mm 80 inches AFF or 150 mm 6 inches below the ceiling, whichever is lower.[Conform ceiling-mounted speakers to NFPA 72.]

[Locate sensors [as required by NFPA 72 and their listings] [as shown on the drawings] on a 100 mm 4 inch mounting box. Install sensors located on the ceiling not less than 100 mm 4 inches from a side wall to the near edge. Ensure that those located on the wall have the top of the sensor at least 100 mm 4 inches below the ceiling, but not more than 300 mm 12 inches below the ceiling. In raised-floor spaces, install the smoke sensors to protect 20.9 square meters 225 square feet per sensor. Install smoke sensors no closer than 1525 mm 5 feet from air-handling supply outlets.

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

][Locate waterflow detectors and tamper switches [where shown on the drawings] [at each supervised sprinkler valve station].

][Locate wall-mounted items in each stair at each floor landing, in each elevator lobby, and in each elevator cab 1220 mm 4 feet AFF.

][Comply with the requirements of NFPA 241 for the modification of any fire alarm system.

][3.2.4 Connection Of New System

Make the following new-system connections during the last phase of construction, at the beginning of the preliminary tests:

[a. Connection of new control modules to existing magnetically held smoke door (hold-open) devices.

][b. Connection of new elevator recall smoke sensors to existing wiring and conduit.

][c. Connection of new-system transmitter to the existing base fire reporting system.

] Once these connections are made, leave the system energized and the new audio or visual devices deactivated. Report immediately to the Contracting Officer the coordination problems and field problems resulting from the connection of the above components.

]3.2.5 Power Supply for the System

****
NOTE: Show the power source for the fire alarm system on the drawings.
****

Provide a single dedicated circuit connection for supplying power from a

branch circuit to each building fire alarm system. Supply the power as shown on the drawings. Equip the power supply with a locking mechanism and mark the locking mechanism in red with the words "FIRE ALARM CIRCUIT CONTROL."

3.2.6 Wiring

Ensure that the conduit size for wiring is in accordance with NFPA 70. Do not install wiring for the fire alarm system in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Install no more than two conductors under any device screw terminal. Ensure that wires under the screw terminal are straight when placed under the terminal, and then clamp them in place under the screw terminal. Break the wires, and do not twist them around the terminal. Connect circuit conductors entering or leaving any mounting box, outlet box enclosure, or cabinet to screw terminals, with each terminal and conductor marked in accordance with the wiring diagram. Make connections and splices using screw terminal blocks. Do not use wire nut connectors. Ensure that wiring within control equipment is accessible without removing component parts. Ensure that the fire alarm equipment manufacturer's representative is present for the connection of wiring to the control panel.

3.2.6.1 Wiring within Cabinets, Enclosures, Boxes, Junction Boxes, and Fittings

Install wiring parallel with or at right angles to the sides and back of any box, enclosure, or cabinet. Ensure that conductors that are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting, or junction box are connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make connections with approved mounted, pressure-type terminal blocks. Do not use wire nut connectors.

3.2.7 Control Panel

Mount the control panel and its assorted components so that no part of the enclosing cabinet is between 12 inches and 78 inches above the finished floor. Ensure that manually operable controls are between 900 and 1100 mm 36 and 42 inches AFF. Install the panel to comply with the requirements of UL 864.

3.2.8 Detectors

Locate and install detectors in accordance with NFPA 72. Connect detectors into SLCs or IDCs as indicated on the drawings. Install detectors at least 300 mm 12 inches from any part of any lighting fixture. Locate detectors at least 900 mm 3 feet from diffusers of air-handling systems. Provide each detector with the mounting hardware required by its mounting location. In open space, mount detectors directly to the end of the stubbed-down, rigid conduit drop. Secure conduit drops to minimize detector sway. Where the length of conduit drop from ceiling or wall surface exceeds 900 mm 3 feet, provide sway bracing. Ensure that detectors installed in concealed locations (such as above ceilings and in raised floors) have a remote visible indicator LED or LCD [in a finished, visible location] [as indicated] [_____].

3.2.9 Notification Appliances

Mount notification appliances 2003 mm 80 inches AFF or 150 mm 6 inches

below the ceiling, whichever is lower.

3.2.10 Annunciator Equipment

Mount annunciator equipment where indicated on the drawings.

3.2.11 Addressable IDCs Module

****
NOTE: Remove this paragraph when not required.
****

Use the IDCs module to connect supervised, conventional initiating devices (waterflow switches, water pressure switches, manual fire alarm stations, high/low air pressure switches, and tamper switches). Mount the module in an electrical box next to or connected to the device that the module is monitoring, and ensure that the module is capable of connecting Style B supervised wiring to the initiating device. Do not use T-taps on Style B lines. Ensure that addressable IDC modules monitor only one initiating device each.

3.2.12 Addressable Control Module

****
NOTE: Remove this paragraph when not required.
****

Install addressable control modules in the outlet box or next to the devices that the modules are controlling. If a supplementary suppression-releasing panel is provided, mount the monitor modules in a common enclosure next to the suppression-releasing panel. Ensure that this enclosure and the suppression-releasing panel are in the same room as the releasing devices. Supervise all interconnecting wires unless an abnormal open-circuit or short-circuit condition does not affect the required operation of the fire alarm system. If control modules are used as interfaces to other systems, such as HVAC or elevator control, ensure that the control modules are within the control panel or immediately next to it. Ensure the control modules that control a group of notification appliances are next to the first notification appliance in the NACs. Ensure the control modules that connect to devices supervise the NACs. Control modules that connect to auxiliary systems or that interface with other systems (non-life safety systems) and where not required by NFPA 72 do not require the secondary circuits to be supervised.

3.2.13 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.

3.2.14 Painting

Paint exposed electrical fire alarm conduit and surface metal raceway to match adjacent finishes in exposed areas. Paint fire cabinets [red] [beige]. Paint [junction boxes] [conduit] [and] [surface metal raceways] red in unfinished areas. Ensure that painting complies with Section 09 90 00 PAINTS AND COATINGS.

3.3 FIELD QUALITY CONTROL

3.3.1 Tests

Upon completion of the installation, subject the system to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Submit detailed test procedures, prepared and signed by a registered PE or a NICET-certified Level [3] [4] fire alarm technician, for the fire detection and alarm system [60] [_____] days before performing system tests.

Notify the Contracting Officer [10][_____] days before conducting tests. Conduct the following tests:

Ensure that the control panel manufacturer's representative is present to supervise tests. Furnish instruments and personnel required for the tests.

****
NOTE: If the specified system is identified as critical, configured, or mission-essential, use Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS to establish predictive and acceptance testing criteria, above and beyond that listed below.
****

Perform PT&I and submit documentation as specified in Section 01 86 26.07 40 RELIABILITY CENTERED ACCEPTANCE FOR ELECTRICAL SYSTEMS.

a. Megger Tests: After wiring has been installed, and connections to panels or devices, megger test wiring for insulation resistance, grounds, and/or shorts. Test conductors with 300 volt rated insulation at a minimum of 250 V dc. Test conductors with 600 volt rated insulation at a minimum of 500 V dc. Ensure that the tests are witnessed by the Contracting Officer and that test results are recorded for use at the final acceptance test.

b. 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. Ensure that the tests are witnessed by the Contracting Officer and that test results are recorded for use at the final acceptance test.

c. Preliminary Testing: Conduct preliminary tests to ensure that devices and circuits are functioning properly. Ensure that tests meet the requirements of paragraph MINIMUM SYSTEM TESTS.

After completing the preliminary testing, complete and submit the NFPA 72, Certificate of Completion. Ensure that the certificate addresses the control panel and the initiating and indicating devices and that the certificate cites a unique identifier for each device, with an indication of test results and signatures of the equipment installer and factory-trained technician of the control panel manufacturer.

Request for Formal Inspection and Tests: When preliminary tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the Contracting Officer.

Final Testing: Notify the Contracting Officer in writing when the system

is ready for final acceptance testing. Submit a request for test at least [15][_____] calendar days before the test date. A final acceptance test will not be scheduled until the operation and maintenance (O&M) manuals are furnished to the Contracting Officer and the following are present at the job site:

a. The system manufacturer's technical representative

b. Marked-up red-line drawings of the system as actually installed

c. Megger test results

d. Loop resistance test results

e. Complete program printout, including input/output addresses

The final tests are witnessed by the Contracting Officer[,] [and] Fire Protection Engineer, [and _____]. At this time, repeat any and all required tests at their discretion. Following acceptance of the system, deliver as-built drawings and O&M Manuals to the Contracting Officer for review and acceptance. 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 are not granted until the as-built drawings and O&M manuals are received.

3.3.2 Minimum System Tests

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

a. Verify the absence of unwanted voltages between circuit conductors and ground. Accomplish tests at the preliminary test, and make results available at the final system test.

b. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.

c. Test each initiating and indicating device and circuit for proper operation and response at the control unit. Test smoke sensors in accordance with the manufacturer's recommended calibrated test method. Ensure that testing of duct smoke detectors complies with the requirements of NFPA 72.

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

e. Test both primary power and secondary power. Verify, by test, that the secondary power system is capable of operating the system for the period and in the manner specified.

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

g. Visually inspect wiring.

h. Test the battery charger and batteries.

i. Verify that software control and data files have been entered or programmed into the FACP. Submit hard-copy records of the software to

the Contracting Officer.

j. Verify that red-line drawings are accurate.

k. Verify by measurement that the circuits have is the calculated spare capacity.

l. Verify by measurement that voltage drop is not excessive.

m. Disconnect the verification feature for smoke sensors during tests to minimize the amount of smoke needed to activate the sensor. Test smoke sensors with real smoke. Do not use canned smoke.

n. Measure the voltage drop at the most remote appliance on each NAC.

3.3.3 Testing

3.3.3.1 Preliminary Tests

Tests include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. Conduct the megger test before the installation of fire alarm equipment. If deficiencies are found, make corrections and retest the system.

3.3.3.2 Acceptance Test

****
NOTE: Listed tests are the minimum required. If additional tests are required, add such tests to the list.
****

Do not perform acceptance testing until after submitting the Certificate of Completion. Test in accordance with NFPA 72. The recommended tests in NFPA 72 are mandatory and verify that previous deficiencies have been corrected. Complete and submit the NFPA 72, Inspection and Testing Form. The test includes all requirements of NFPA 72 and the following:

a. Test of each function of the control panel

b. Test of each circuit in both trouble and normal modes

c. Tests of each alarm-initiating device, in both normal and trouble conditions

d. Tests of each control circuit and device

e. Tests of each alarm notification appliance

f. Tests of the battery charger and batteries

g. Complete operational tests under emergency power supply

h. Visual inspection of wiring connections

i. Opening of the circuit at each alarm-initiating device and notification appliance to test the wiring supervisory feature

j. Ground fault

k. Short-circuit faults

l. Stray voltage

m. Loop resistance

3.4 CLOSEOUT ACTIVITIES

3.4.1 Operation and Maintenance

Submit Data Package 5 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

Provide [six] [_____] copies of the operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. Include the manufacturer's name, model number, service manual, parts list, and complete description of equipment items and their basic operating features. Provide [six] [_____] copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. Ensure that the manuals include conduit layout, equipment layout, simplified wiring, and control diagrams of the system as installed. Ensure that the manuals include complete procedures for system revision and expansion, detailing both equipment and software requirements. Provide original and backup copies of all software delivered for this project, on each type of media used. Manuals are approved before training.

3.4.2 As-built Drawings

Prepare and submit to the Contracting Officer [six][_____] sets of detailed as-Built Drawings. Include complete wiring diagrams in the drawings showing connections between devices and equipment, both factory-wired and field-wired. Include a riser diagram and drawings, showing the as-built location of devices and equipment. Show the system as installed, including deviations from both the project drawings and the approved shop drawings. Prepare the drawings on uniform-sized mylar sheets not less than 760 by 1065 mm with 200 by 100 mm 30 by 42 inches, with 8 by 4 inch title block similar to Contract drawings. Submit these drawings within 2 weeks after the final acceptance test of the system. Provide at least one set of as-built (marked-up) drawings at the time of, or before the final acceptance test.

3.4.3 Training

3.4.3.1 Instruction

Ensure that the manufacturer provides 3 days of onsite training [and 5 days of technical training to the Government at the manufacturing facility.] [Include room-and-board costs for two Government employees.] [Factory] training occurs within [6] [12] [_____] months of system acceptance.

a. Instructor

Ensure that each instructor is thoroughly familiar with all parts of this installation. Ensure that each instructor is trained in operating theory, as well as in practical O&M work.

Include in the project the services of an instructor who has received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided. Ensure that this instructor trains the Government employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm [and fire detection] system.

b. Required Instruction Time

To accommodate rescheduling for unforeseen maintenance, Fire Department responses, or both, schedule instruction after final acceptance of the system. Give the instruction during regular working hours on dates and at times selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer.

3.4.3.2 Training Materials and Course

****
NOTE: The operations training familiarizes designated Government employees with proper operation of the fire alarm system. The maintenance training course provides the designated Government employees knowledge necessary to diagnose, repair, maintain, and expand functions inherent in the system.
****

Furnish lesson plans, operating instructions, maintenance procedures, and training data, all in manual format, for the training courses.

Conduct a training course for the operations and maintenance staff. Conduct the course in the building where the system is installed or as designated by the Contracting Officer. Design the training period for systems operation to consist of [1] [_____] training days (8 hours per day) and to start after the system is functionally completed but before final acceptance tests. Design the training period for systems maintenance to consist of [2] [_____] training days (8 hours per day) and to start after the system is functionally completed but before final acceptance tests. Ensure that the instructions cover items contained in the operating and maintenance instructions. In addition, Conduct training on performance of expansions or modifications to the fire detection and alarm system. Design the training period for system expansions and modifications to consist of at least [1] [_____] training days (8 hours per day) and to start after the system is functionally completed but before final acceptance tests.

[3.5 MAINTENANCE

3.5.1 Repair Service or Replacement Parts

Ensure that repair services and replacement parts for the system provided under this Contract are available for a period of 10 years after the date of final acceptance of this work by the Contracting Officer. Provide onsite service during the guarantee period within 24 hours after notification. Complete all repairs within 48 hours after notification.

] -- End of Section --