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AMENDMENT TWELVE (12) RFP-017-C-2021(P) – Design-Build Services for Arthur Richards PK-8 New Build, St. Croix, U.S. Virgin Islands

INSERT

Specification Section 284621.90 attached to this Amendment.

INSERT QUESTIONS AND ANSWERS

- Q1 Can you provide information about the capacity, scope, equipment details for surveillance cameras, access control, intercom and intrusion detection systems for a proper design and quote?
- A1 The locations of the intrusion devices are indicated locationally on the drawings. Please refer to Specification Sections 281300, 281600 and 282300 for technical specifications. The final design of the intrusion and access control systems is the responsibility of the Design-Build Contractor.
- Q2 Will the doors need to have the interior facilities for access control, or an exposed infrastructure will be required?
- A2 All new installations shall be concealed construction.
- Q3 Will the surveillance camera, access control and intrusion detection be an all-integrated system or individual systems?
- A3 All security functions shall be consolidated into an interconnected system.
- Q4 Will the system at each site be monitored individually or in one site?
- A4 The security systems will be monitored locally and report to a remote location to be determined by VIDE. Design-Build Contractor to coordinate.

ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.

BIDDERS MUST ACKNOWLEDGE RECEIPT OF THIS AMENDMENT WITH THEIR BID
PROPOSAL.

Q5 How many monitoring, badging, control center areas will be considered for the whole project?

A5 One badge control center per site, with badge entry (door control) as indicated on the drawings.

Q6 Will a cable tray be required for the telecommunication room? What will be the size? Can you provide details?

A6 Yes, a cable tray is required in the telecommunication room. It is to be adequately sized for cables installed plus 40% growth. Final design is the responsibility of the Design-Build Contractor.

Q7 Will the fire rated panel to cover all telecommunication RM need to be factory fire retardant treated with the NFPA stamp, or can be a regular panel painted both at sides with fire retardant paint?

A7 Factory fire rated plywood with a fire rating stamp is to be used.

Q8 We need details for the intrusion detection equipment and locations in the drawings.

A8 Intrusion detection is comprised principally of door contacts at exterior doors and high value rooms in accordance with Specification Section 281600.

Q9 We did not find any details for fire alarm system installation, or detailed drawings with the locations for the equipment. Also, we do not have any specifications.

A9 Please refer to Specification Section 284621.90 attached to this amendment.

Q10 Do we need to consider RCDD for telecommunication design and supervision as part of our quotation?

A10 Yes, RCDD is required.

Q11 Do we need to consider NICED for certifications of the fire alarm design and installation?

A11 Either a NICET or PE is required.

ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.

BIDDERS MUST ACKNOWLEDGE RECEIPT OF THIS AMENDMENT WITH THEIR BID PROPOSAL.

SECTION 284621.90 - FIRE-ALARM SYSTEM -- DESIGN BUILD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Addressable fire-alarm system.
 - 2. Fire-alarm control unit (FACU).
 - 3. Manual fire-alarm boxes.
 - 4. System smoke detectors.
 - 5. Duct smoke detectors.
 - 6. Projected beam smoke detectors.
 - 7. Carbon monoxide detectors.
 - 8. Heat detectors.
 - 9. Continuous linear heat detectors.
 - 10. Air-sampling smoke detectors.
 - 11. Fire-alarm notification appliances.
 - 12. Exit-marking audible notification appliances.
 - 13. Firefighters' two-way telephone communication service.
 - 14. Firefighters' smoke-control system.
 - 15. Fire-alarm graphic annunciators.
 - 16. Fire-alarm remote annunciators.
 - 17. Fire-alarm addressable interface devices.
 - 18. Digital alarm communicator transmitters (DACTs).
 - 19. Fire-alarm radio transmitters.
 - 20. Video smoke detection.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for magnetic door holders that release in response to fire-alarm outputs.
 - 2. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" or Section 260523 "Control Voltage Electrical Power Cables" for cables and conductors for fire-alarm systems.

1.3 DEFINITIONS

- A. DACT: Digital alarm communicator transmitter.

- B. Design Build: The provision of a complete system with the calculation, product data and additional drawings in accordance with the requirements of the Authority Having Jurisdiction.
- C. EMT: Electrical metallic tubing.
- D. FACU: Fire-alarm control unit.
- E. High-Performance Building: A building that integrates and optimizes on a life-cycle basis all major high-performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations.
- F. Mode: The terms "Active Mode," "Off Mode," and "Standby Mode" are used as defined in the 2007 Energy Independence and Security Act (EISA).
- G. NICET: National Institute for Certification in Engineering Technologies.
- H. PC: Personal computer.
- I. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
 - 1. Control Voltage: Listed and labeled for use in remote-control, signaling, and power-limited circuits supplied by a Class 2 or Class 3 power supply having rated output not greater than 150 V and 5 A, allowing use of alternate wiring methods complying with NFPA 70, Article 725.
 - 2. Low Voltage: Listed and labeled for use in circuits supplied by a Class 1 or other power supply having rated output not greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Part I.

1.4 SEQUENCING AND SCHEDULING

- A. Provide a complete and fully functioning fire alarm system and design as specified herein.
- B. Prepare Action Submittals noted below.
- C. Submit complete fire alarm documentation package to plans review authority.
- D. Respond to reviewer's comments and resubmit until AHJ authority has been approved for installation.

1.5 ACTION SUBMITTALS

- A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction prior to submitting them to Architect.
- B. Product Data: For each type of product, including furnished options and accessories.
 - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
 - 2. Include rated capacities, operating characteristics, and electrical characteristics.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, and details, including details of attachments to other Work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Annunciator panel details as required by authorities having jurisdiction.
5. Detail assembly and support requirements.
6. Include voltage drop calculations for notification-appliance circuits.
7. Include battery-size calculations.
8. Include input/output matrix.
9. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.
10. Include performance parameters and installation details for each detector.
11. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
12. Provide program report showing that air-sampling detector pipe layout balances pneumatically within airflow range of air-sampling detector.
13. Provide control wiring diagrams for fire-alarm interface to HVAC; coordinate location of duct smoke detectors and access to them.
 - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system (if/as required by code).
 - c. Locate detectors in accordance with manufacturer's written instructions.
 - d. Show air-sampling detector pipe routing.
14. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
15. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

D. Delegated Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1. Drawings showing location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of device.
2. Design Calculations: Calculate requirements for selecting spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.6 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Seismic Performance Certificates: For FACU, accessories, and components, from manufacturer. Include the following information:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.

B. Field quality-control reports.

C. Qualification Statements: For Installer.

D. Sample Warranty: Submittal must include line-item pricing for replacement parts and labor.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction (as/if required by code):
 - a. Comply with "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - b. Provide "Fire-Alarm and Emergency Communications System Record of Completion Documents" in accordance with "Completion Documents" Article in "Documentation" section of "Fundamentals" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
 - d. Riser diagram.
 - e. Device addresses.
 - f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
 - g. Record copy of site-specific software.
 - h. Provide "Inspection and Testing Form" in accordance with "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.
 - 3) Frequency of inspection of installed components.
 - 4) Requirements and recommendations related to results of maintenance.

5) Manufacturer's user training manuals.

- i. Manufacturer's required maintenance related to system warranty requirements.
- j. Abbreviated operating instructions for mounting at FACU and each annunciator unit.

B. Software and Firmware Operational Documentation:

- 1. Software operating and upgrade manuals.
- 2. Program Software Backup: On USB media and approved online or cloud solution.
- 3. Device address list.
- 4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
- 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
- 3. Smoke Detectors, Fire Detectors, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
- 4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
- 5. Keys and Tools: One extra set for access to locked or tamperproofed components.
- 6. Audible and Visual Notification Appliances: One of each type installed.
- 7. Fuses: Two of each type installed in system. Provide in box or cabinet with compartments marked with fuse types and sizes.
- 8. Filters for Air-Sampling Detectors: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
- 9. Air-Sampling Fan: Quantity equal to one for every five detectors, but no fewer than one unit of each type.

1.9 QUALITY ASSURANCE

A. Installer Qualifications:

- 1. Personnel must be trained and certified by manufacturer for installation of units required for this Project.
- 2. Design must be provided by personnel certified by NICET as fire-alarm Level IV or licensed as a Professional Engineer in accordance with local requirements.
- 3. Installation must be by personnel certified by NICET as fire-alarm Level II technician.
- 4. Obtain certification by NRTL in accordance with NFPA 72.
- 5. Licensed or certified by authorities having jurisdiction.

1.10 FIELD CONDITIONS

- A. Seismic Conditions: Unless otherwise indicated on Contract Documents, specified Work in this Section must withstand the seismic hazard design loads determined in accordance with ASCE/SEI 7 for installed elevation above or below grade.
 - 1. The term "withstand" means "unit must remain in place without separation of parts from unit when subjected to specified seismic design loads and unit must be fully operational after seismic event."

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail because of defects in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIRE-ALARM SYSTEM

- A. Description:
 - 1. Noncoded, UL-certified system, with multiplexed signal transmission and voice-and-strobe notification for evacuation.
- B. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Fire-Alarm Components, Devices, and Accessories: Listed and labeled by a NRTL in accordance with NFPA 70 for use with selected fire-alarm system and marked for intended location and application.
 - 2. General Characteristics (which may be required by code):
 - a. Automatic sensitivity control of certain smoke detectors.
 - b. Fire-alarm signal initiation must be by one or more of the following devices and systems:
 - 1) Manual stations.
 - 2) Heat detectors.
 - 3) Flame detectors.
 - 4) Smoke detectors.
 - 5) Duct smoke detectors.
 - 6) Air-sampling smoke-detection system.

- 7) Carbon monoxide detectors.
- 8) Combustible gas detectors.
- 9) Automatic sprinkler system water flow.
- 10) Preaction system.
- 11) Fire-extinguishing system operation.
- 12) Fire standpipe system.
- 13) Dry system pressure flow switch.
- 14) Fire pump running.

c. Fire-alarm signal must initiate the following actions:

- 1) Continuously operate alarm notification appliances and evacuation notices.
- 2) Identify alarm and specific initiating device at FACU, connected control panels, and remote annunciators.
- 3) Transmit alarm signal to remote alarm receiving station.
- 4) Unlock electric door locks in designated egress paths.
- 5) Release fire and smoke doors held open by magnetic door holders.
- 6) Activate voice/alarm communication system.
- 7) Switch HVAC equipment controls to fire-alarm mode.
- 8) Activate smoke-control system (smoke management) at firefighters' smoke-control system panel.
- 9) Activate stairwell and elevator-shaft pressurization systems.
- 10) Close smoke dampers in air ducts of designated air-conditioning duct systems.
- 11) Activate preaction system.
- 12) Recall elevators to primary or alternate recall floors.
- 13) Activate elevator power shunt trip.
- 14) Activate emergency lighting control.
- 15) Activate emergency shutoffs for gas and fuel supplies, except for shutoffs serving legally required life-safety systems such as emergency generators and fire pumps.
- 16) Record events in system memory.
- 17) Record events by system printer.
- 18) Indicate device in alarm on graphic annunciator.

d. Supervisory signal initiation must be by one or more of the following devices and actions:

- 1) Valve supervisory switch.
- 2) High- or low-air-pressure switch of dry-pipe or preaction sprinkler system.
- 3) Alert and Action signals of air-sampling detector system.
- 4) Elevator shunt-trip supervision.
- 5) Independent fire-detection and -suppression systems.
- 6) Fire pump is running.
- 7) Fire pump has lost power.
- 8) Power to fire pump has phase reversal.
- 9) Zones or individual devices have been disabled.
- 10) FACU has lost communication with network.

- e. System trouble signal initiation must be by one or more of the following devices and actions:
 - 1) Open circuits, shorts, and grounds in designated circuits.
 - 2) Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - 3) Loss of communication with addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
 - 4) Loss of primary power at FACU.
 - 5) Ground or single break in internal circuits of FACU.
 - 6) Abnormal ac voltage at FACU.
 - 7) Break in standby battery circuitry.
 - 8) Failure of battery charging.
 - 9) Abnormal position of switch at FACU or annunciator.
 - 10) Voice signal amplifier failure.
 - 11) Hose cabinet door open.
 - 12) Insert trouble signal-initiating devices and actions.
- f. System Supervisory Signal Actions:
 - 1) Initiate notification appliances.
 - 2) Identify specific device initiating event at FACU, connected control panels, and remote annunciators.
 - 3) Record event on system printer.
 - 4) After time delay of 200 seconds, transmit trouble or supervisory signal to remote alarm receiving station.
 - 5) Transmit system status to building management system.
 - 6) Display system status on graphic annunciator.
- g. Network Communications:
 - 1) Provide network communications for fire-alarm system in accordance with fire-alarm manufacturer's written instructions.
 - 2) Provide network communications pathway per manufacturer's written instructions and requirements in NFPA 72 and NFPA 70.
 - 3) Provide integration gateway using BACnet for connection to building automation system.
- h. System Printer:
 - 1) Printer must be listed and labeled as integral part of fire-alarm system.
- i. Device Guards:
 - 1) Description: Welded wire mesh of size and shape for manual station, smoke detector, gong, or other device requiring protection.
 - a) Factory fabricated and furnished by device manufacturer.
 - b) Finish: Paint of color to match protected device.

j. Document Storage Box:

- 1) Description: Enclosure to accommodate standard 8-1/2-by-11 inch (216-by-279 mm) manuals and loose document records. Legend sheet will be permanently attached to door for system required documentation, key contacts, and system information. Provide two key ring holders with location to mount standard business cards for key contact personnel.
- 2) Material and Finish: 18-gauge cold-rolled steel; four mounting holes.
- 3) Color: Red powder-coat epoxy finish.
- 4) Labeling: Permanently screened with 1 inch (25 mm) high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.
- 5) Security: Locked with 3/4 inch (19 mm) barrel lock. Provide solid 12 inch (304 mm) stainless steel piano hinge.

2.2 FIRE-ALARM CONTROL UNIT (FACU)

A. Manufacturers:

1. Gamewell
2. Honeywell
3. Simplex (JCI)
4. Or Approved Alternate, having local support.

B. Description: Field-programmable, microprocessor-based, modular, power-limited design with electronic modules.

C. Performance Criteria:

1. Regulatory Requirements: Comply with NFPA 72 and UL 864.
2. General Characteristics:
 - a. System software and programs must be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining information through failure of primary and secondary power supplies.
 - b. Include real-time clock for time annotation of events on event recorder and printer.
 - c. Provide communication between FACU and remote circuit interface panels, annunciators, and displays.
 - d. FACU must be listed for connection to central-station signaling system service.
 - e. Provide nonvolatile memory for system database, logic, and operating system and event history. System must require no manual input to initialize in the event of complete power down condition. FACU must provide minimum 500-event history log.
 - f. Addressable Initiation Device Circuits: FACU must indicate which communication zones have been silenced and must provide selective silencing of alarm notification appliance by building communication zone.
 - 1) Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: FACU must be listed for releasing service.

- g. Fire-Alarm Annunciator: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.
 - 1) Annunciator and Display: LCD, 80 characters, minimum.
 - 2) Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- h. Alphanumeric Display and System Controls: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.
 - 1) Annunciator and Display: LCD, [**two**] [**three**] line(s) of 80 characters, minimum.
 - 2) Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into system for control of smoke-detector sensitivity and other parameters.
- i. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
 - 1) Pathway Class Designations: NFPA 72, Class B.
 - 2) Pathway Survivability: Level 0.
 - 3) Install no more than 50 addressable devices on each signaling-line circuit.
 - 4) Install fault circuit isolators to comply with circuit performance requirements of NFPA 72 or with manufacturer's written instructions, whichever is more conservative.
- j. Serial Interfaces:
 - 1) Connection for remote station operation.
- k. Smoke-Alarm Verification:
 - 1) Initiate audible and visible indication of "alarm-verification" signal at FACU.
 - 2) Activate approved "alarm-verification" sequence at FACU and detector.
 - 3) Record events by system printer.
 - 4) Sound general alarm if alarm is verified.
 - 5) Cancel FACU indication and system reset if alarm is not verified.
- l. Notification-Appliance Circuit:
 - 1) Audible appliances must sound in three-pulse temporal pattern, as defined in NFPA 72.
 - 2) Where notification appliances provide signals to sleeping areas, alarm signal must be 520 Hz square wave with intensity 15 dB above average ambient

- sound level or 5 dB above maximum sound level, or at least 75 dB(A-weighted), whichever is greater, measured at pillow.
- 3) Visual alarm appliances must flash in synchronization where multiple appliances are in same field of view, as defined in NFPA 72.
- m. Elevator Recall: Initiate by one of the following alarm-initiating devices:
- 1) Elevator lobby detectors except lobby detector on designated floor.
 - 2) Smoke detectors in elevator machine room.
 - 3) Smoke detectors in elevator hoistway.
- n. Elevator controller must be programmed to move cars to alternate recall floor if lobby detectors located on designated recall floors are activated.
- o. Water-flow alarm connected to sprinkler in elevator shaft and elevator machine room must shut down elevators associated with location without time delay.
- 1) Water-flow switch associated with sprinkler in elevator pit may have delay to allow elevators to move to designated floor.
- p. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls must be connected to fire-alarm system.
- q. Remote Smoke-Detector Sensitivity Adjustment: Controls must select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out final adjusted values on system printer.
- r. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to remote alarm station.
- s. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in separate cabinet located in fire command center.
- t. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of central-control microphone. Amplifiers must comply with UL 1711.
- u. Allow application of, and evacuation signal to, indicated number of zones and simultaneously allow voice paging to other zones selectively or in combination.
- v. Programmable tone and message sequence selection.
- w. Standard digitally recorded messages for "Evacuation" and "All Clear."
- x. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of FACU.

- y. Status Annunciator: Indicate status of various voice/alarm speaker zones and status of firefighters' two-way telephone communication zones.
- z. Preamplifiers, amplifiers, and tone generators must automatically transfer to backup units, on primary equipment failure.
- aa. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from other printed indications. Also, print system reset event, including same information for device, location, date, and time. Commands initiate printing of list of existing alarm, supervisory, and trouble conditions in system and historical log of events.
- bb. Primary Power: 24 V(dc) obtained from 120 V(ac) service and power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and supervisory signals and digital alarm radio transmitters must be powered by 24 V(dc) source.
- cc. Alarm current draw of entire fire-alarm system must not exceed 80 percent of power-supply module rating.
- dd. Secondary Power: 24 V(dc) supply system with batteries, automatic battery charger, and automatic transfer switch.
- ee. Batteries: Sealed lead calcium.

D. Accessories:

- 1. Instructions: Computer printout or typewritten instruction card mounted behind plastic or glass cover in stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe functional operation of system under normal, alarm, and trouble conditions.
- 2. Preaction System Functionality:
 - a. Initiate Presignal Alarm: This function must cause audible and visual alarm and indication to be provided at FACU. Activation of initiation device connected as part of preaction system must be annunciated at FACU only, without activation of general evacuation alarm.

2.3 MANUAL FIRE-ALARM BOXES

- A. Manual fire alarm boxes/stations shall be listed for use with the system.
- B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes must be finished in red with molded, raised-letter operating instructions in contrasting color; must show visible indication of operation; and must be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1.
 - 2. Double-action mechanism requiring two actions to initiate alarm; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to FACU.

3. Station Reset: Key- or wrench-operated switch.
4. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at top to permit lifting for access to initiate alarm. Lifting cover actuates integral battery-powered audible horn intended to discourage false-alarm operation.
5. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at top to permit lifting for access to initiate alarm.
6. Able to perform at up to 90 percent relative humidity at 90 deg F (32 deg C).
7. Able to be used in indoor and/or outdoor areas as required by code.

2.4 SYSTEM SMOKE DETECTORS

A. Photoelectric Smoke Detectors: shall be listed for use with the system.

1. Performance Criteria:
 - a. Regulatory Requirements:
 - 1) NFPA 72.
 - 2) UL 268.
 - b. General Characteristics:
 - 1) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
 - 2) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
 - 3) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 4) Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
 - 5) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
 - 6) Operator at FACU, having designated access level, must be able to manually access the following for each detector:
 - a) Primary status.
 - b) Device type.
 - c) Present average value.
 - d) Present sensitivity selected.
 - e) Sensor range (normal, dirty, etc.).
 - 7) Detector must have functional humidity range within 10 to 90 percent relative humidity.
 - 8) Color: White.
 - 9) Remote Control: Unless otherwise indicated, detectors must be digital-addressable type, individually monitored at FACU for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by FACU.

- 10) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units must be selectable at FACU for 15 or 20 deg F (8 or 11 deg C) per minute.
- 11) Fixed-temperature sensing characteristic of combination smoke- and heat-detection units must be independent of rate-of-rise sensing and must be settable at FACU to operate at 135 or 155 deg F (57 or 68 deg C).
- 12) Multiple levels of detection sensitivity for each sensor.
- 13) Sensitivity levels based on time of day.

B. Ionization Smoke Detectors: shall be listed for use with the system.

1. Performance Criteria:

a. Regulatory Requirements:

- 1) NFPA 72.
- 2) UL 268.

b. General Characteristics:

- 1) Detectors must be two-wire type.
- 2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
- 3) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
- 4) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
- 5) Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
- 6) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
- 7) Operator at FACU, having designated access level, must be able to manually access the following for each detector:
 - a) Primary status.
 - b) Device type.
 - c) Present average value.
 - d) Present sensitivity selected.
 - e) Sensor range (normal, dirty, etc.).
- 8) Detector must have functional humidity range within 10 to 90 percent relative humidity.
- 9) Color: White.
- 10) Remote Control: Unless otherwise indicated, detectors must be digital-addressable type, individually monitored at FACU for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by FACU.
- 11) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units must be selectable at FACU for 15 or 20 deg F (8 or 11 deg C) per minute.

- 12) Fixed-temperature sensing characteristic of combination smoke- and heat-detection units must be independent of rate-of-rise sensing and must be settable at FACU to operate at 135 or 155 deg F (57 or 68 deg C).
- 13) Multiple levels of detection sensitivity for each sensor.
- 14) Sensitivity levels based on time of day.

2.5 DUCT SMOKE DETECTORS

- A. Duct smoke detectors shall be listed for use with the system.
- B. Description: Photoelectric-type, duct-mounted smoke detector.
- C. Performance Criteria:
 1. Regulatory Requirements:
 - a. NFPA 72.
 - b. UL 268A.
 2. General Characteristics:
 - a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
 - b. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - c. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
 - d. Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
 - e. Operator at FACU, having designated access level, must be able to manually access the following for each detector:
 - 1) Primary status.
 - 2) Device type.
 - 3) Present average value.
 - 4) Present sensitivity selected.
 - 5) Sensor range (normal, dirty, etc.).
 - f. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with supplied detector for smoke detection in HVAC system ducts.
 - g. Each sensor must have multiple levels of detection sensitivity.
 - h. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 - i. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.6 PROJECTED BEAM SMOKE DETECTORS

- A. Detectors shall be listed for use with the system.

B. Performance Criteria:

1. Regulatory Requirements:
 - a. NFPA 72.
2. General Characteristics:
 - a. Projected Beam Light Source and Receiver: Designed to accommodate small angular movements and continue to operate and not cause nuisance alarms.
 - b. Detector Address: Accessible from FACU and able to identify detector's location within system and its sensitivity setting.
 - c. Operator at FACU, having designated access level, must be able to manually access the following for each detector:
 - 1) Primary status.
 - 2) Device type.
 - 3) Present average value.
 - 4) Present sensitivity selected.
 - 5) Sensor range (normal, dirty, etc.).

2.7 CARBON MONOXIDE DETECTORS

A. Detectors shall be listed for use with the system.

B. Description: Carbon monoxide detector listed for connection to fire-alarm system.

C. Performance Criteria:

1. Regulatory Requirements:
 - a. NFPA 72
 - b. NFPA 720.
 - c. UL 2075.
2. General Characteristics:
 - a. Mounting: Adapter plate for outlet box mounting.
 - b. Testable by introducing test carbon monoxide into sensing cell.
 - c. Detector must provide alarm contacts and trouble contacts.
 - d. Detector must send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
 - e. Locate, mount, and wire in accordance with manufacturer's written instructions.
 - f. Provide means for addressable connection to fire-alarm system.
 - g. Test button simulates alarm condition.

2.8 HEAT DETECTORS

- A. Combination-Type Heat Detectors:
- B. Detectors shall be listed for use with the system.
 - 1. Performance Criteria:
 - a. Regulatory Requirements:
 - 1) NFPA 72.
 - 2) UL 521.
 - b. General Characteristics:
 - 1) Temperature sensors must test for and communicate sensitivity range of device.
 - c. Actuated by fixed temperature of 135 deg F (57 deg C) or rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
 - d. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 - e. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
 - f. Detector must have functional humidity range of 10 to 90 percent relative humidity.
 - g. Color: White.
- C. Fixed-Temperature-Type Heat Detectors:
- D. Detectors shall be listed for use with the system.
 - 1. Performance Criteria:
 - a. Regulatory Requirements:
 - 1) NFPA 72.
 - 2) UL 521.
 - b. General Characteristics:
 - 1) Actuated by temperature that exceeds fixed temperature of 190 deg F (88 deg C).
 - 2) Mounting: Twist-lock base interchangeable with smoke-detector bases.
 - 3) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
 - 4) Detector must have functional humidity range of 10 to 90 percent..
 - 5) Color: White.

2.9 CONTINUOUS LINEAR HEAT-DETECTOR SYSTEM

- A. Detectors shall be listed for use with the system.

B. Performance Criteria:

1. Regulatory Requirements:
 - a. NFPA 72.
2. General Characteristics:
 - a. Detector Cable: Rated detection temperature of 155 deg F (68 deg C). Listed for "regular" service and standard environment. Cable includes two steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow cable twist pressure to short circuit wires at location of elevated temperature.
 - b. Control Unit: Two-zone or multizone unit as indicated. Provide same system power supply, supervision, and alarm features as specified for FACU.
 - c. Signals to FACU: Local system trouble must be reported to FACU as composite "trouble" signal. Alarms on each detection zone must be individually reported to central FACU as separately identified zones.
 - d. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.

2.10 AIR-SAMPLING SMOKE DETECTORS

A. Detectors shall be listed for use with the system.

B. Performance Criteria:

1. Regulatory Requirements:
 - a. NFPA 72.
 - b. UL 1887.
2. General Characteristics:
 - a. Air-sampling smoke detector must be laser based using piping system and fan to transport particles of combustion to detector.
 - b. Provide two levels of alarm from each zone covered by detector and two supervisory levels of alarm from each detector.
 - c. Air being sampled must pass through filters to remove dust particulates greater than 20 microns before entering detection chamber.
 - d. Detectors must have capability via RS 485 to connect up to 100 detectors in network.
 - e. Detectors must communicate with FACU via addressable, monitored dry contact closures, RS 485, and interface modules. Provide minimum of six relays, individually programmable remotely for any function.
 - f. Pipe airflow balancing calculations must be performed using approved calculation software.

- g. Detector, Filter, Aspirator, and Relays: Housed in mounting box and arranged such that air is drawn from detection area and sample passes through dual-stage filter and detector by aspirator.
- h. Obscuration Sensitivity Range: 0.005 to 6 percent obs/ft.
- i. Four independent, field-programmable, smoke-alarm thresholds per sensor pipe and programmable scan time delay. Threshold set points must be programmable.
 - 1) Four alarm thresholds may be used as follows:
 - a) Alarm Level 1 (Alert): Activate visual and audible supervisory alarm.
 - b) Alarm Level 2 (Action): Activate shutdown of electrical/HVAC equipment and activate visual and audible supervisory alarm.
 - c) Alarm Level 3 (Fire 1): Activate building alarm systems and initiate call to fire response unit.
 - d) Alarm Level 4 (Fire 2): Activate suppression system or other countermeasures.
 - 2) Final Detection System Settings: Approved by Owner.
 - 3) Initial Detection Alarm Settings:
 - a) Alarm Level 1 (Alert): 0.08 percent obs/ft.
 - b) Alarm Level 2 (Action): 1.0 percent obs/ft.
 - c) Alarm Level 3 (Fire 1): 2.0 percent obs/ft.
 - d) Alarm Level 4 (Fire 2): 4.0 percent obs/ft.
- j. Power Supply:
 - 1) Regulated 24 V(dc), monitored by FACU, with battery backup.
 - 2) Battery backup must provide 24 hours' standby, followed by 30 minutes at maximum connected load.
- k. Detector must also transmit the following faults:
 - 1) Detector.
 - 2) Airflow.
 - 3) Filter.
 - 4) System.
 - 5) Zone.
 - 6) Network.
 - 7) Power.
- l. Provide four in-line sample pipe inlets that must contain flow sensor for each pipe inlet. Detector must be capable of identifying pipe from which smoke was detected.
- m. Aspirator: Air pump capable of allowing for multiple sampling pipe runs up to 650 ft. (200 m) in total, (four pipe runs per detector) with transport time of less than 120 seconds from farthest sample port.
- n. Air-Sampling Flow Rates Outside Manufacturer's Specified Range: Result in trouble alarm.

- o. Provide software-programmable relays rated at 2 A at 30 V(dc) for alarm and fault conditions.
 - p. Provide built-in event and smoke logging; store smoke levels, alarm conditions, operator actions, and faults with date and time of each event. Each detector (zone) must be capable of storing up to 18,000 events.
 - q. Urgent and Minor Faults. Minor faults must be designated as trouble alarms. Urgent faults, which indicate unit may not be able to detect smoke, must be designated as supervisory alarms.
- 3. Displays:
 - a. Include display module within each detector.
 - b. Each display must include the following features:
 - 1) Bar-graph display.
 - 2) Four independent, high-intensity alarm indicators (Alert, Action, Fire 1, and Fire 2), corresponding to four alarm thresholds of indicated sector.
 - 3) Alarm threshold indicators for Alert, Action, and Fire 1.
 - 4) LED indication that first alarm sector is established.
 - 5) Detector fault and airflow fault indicators.
 - 6) LED indicators must be provided for faults originating in particular zone (Zone Fault), faults produced by overall smoke-detection system, and faults resulting from network wiring errors (Network Fault).
 - 7) Minor and urgent LED fault indicators.
- 4. Sampling Tubes:
 - a. Smooth bore with nominal 1 inch (25 mm) OD and 7/8 inch (21 mm) ID. Sampling pipe with between 5/8 and 1 inch (15 and 25 mm) ID can be used in specifically approved locations when recommended by manufacturer.
 - b. Pipe Material: CPVC and complying with UL 1887.
 - c. Joints in sampling pipe must be airtight. Use solvent cement approved by pipe manufacturer on joints except at entry to detector.
 - d. Identify piping with labels reading: "Aspirating Smoke Detector Pipe - Do Not Paint or Disturb" along its entire length at regular intervals in accordance with NFPA 72.
 - e. Support pipes at not more than 60 inch (1.5 m) centers.
 - f. Fit end of each trunk or branch pipe with end cap and drilled with hole appropriately sized to achieve performance as specified and as calculated by system design.
- 5. Sampling Holes:
 - a. Sampling holes of 5/64 inch (2 mm), or other sized holes per manufacturer's written instructions, must be separated by not more than maximum distance allowable for conventional smoke detectors. Intervals may vary in accordance with calculations.
 - b. Follow manufacturer's written instructions to determine number and spacing of sampling points and distance from sampling points to ceiling or roof structure and to forced ventilation systems.

- c. Each sampling point must be identified by applied decal.

2.11 FIRE-ALARM NOTIFICATION APPLIANCES

A. Fire-Alarm Audible Notification Appliances:

- 1. Notification Appliances shall be listed for use with the system.
- 2. Description: Horns, bells, or other notification devices that cannot output voice messages.
- 3. Performance Criteria:

- a. Regulatory Requirements:

- 1) NFPA 72.

- b. General Characteristics:

- 1) Individually addressed, connected to signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
 - 2) Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
 - 3) Audible notification appliances must have functional humidity range of 10 to 95 percent relative humidity.
 - 4) ISO Temporal 3 Evacuation Tone: 90 plus or minus 4 dB(A-weighted) at 24 V.
 - 5) ISO Temporal 3 Alert Tone: 95 plus or minus 5 dB(A-weighted) at 24 V.
 - 6) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Fire-Alarm Voice/Tone Notification Appliances:

- 1. Notification Appliances shall be listed for use with the system.
- 2. Description: Notification appliances capable of outputting voice evacuation messages.
- 3. Performance Criteria:

- a. Regulatory Requirements:

- 1) NFPA 72.
 - 2) UL 1480.

- b. General Characteristics:

- 1) Speakers for Voice Notification: Locate speakers for voice notification to provide intelligibility requirements of "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
 - 2) High-Range Units: Rated 2 to 15 W.
 - 3) Low-Range Units: Rated 1 to 2 W.
 - 4) Mounting: Flush or semi-recessed.
 - 5) Matching Transformers: Tap range matched to acoustical environment of speaker location.

- 6) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- C. Fire-Alarm Visible Notification Appliances:
1. Notification Appliances shall be listed for use with the system.
 2. Performance Criteria:
 - a. Regulatory Requirements:
 - 1) NFPA 72.
 - 2) UL 1971.
 - b. General Characteristics:
 - 1) Rated Light Output:
 - a) 15/30/75/110 cd, selectable in field.
 - 2) Clear or nominal white polycarbonate lens mounted on aluminum faceplate.
 - 3) Mounting: Wall mounted unless otherwise indicated.
 - 4) For units with guards to prevent physical damage, light output ratings must be determined with guards in place.
 - 5) Flashing must be in temporal pattern, synchronized with other units.
 - 6) Strobe Leads: Factory connected to screw terminals.
 - 7) Mounting Faceplate: Factory finished, white.

2.12 EXIT-MARKING AUDIBLE NOTIFICATION APPLIANCES

- A. Notification Appliances shall be listed for use with the system.
- B. Performance Criteria:
1. Regulatory Requirements:
 - a. NFPA 72.
 2. General Characteristics:
 - a. Provide exit-marking audible notification appliances at entrance to building exits.
 - b. Provide exit-marking audible notification appliances at entrance to areas of refuge with audible signals distinct from those used for building exit marking.

2.13 FIRE-ALARM GRAPHIC ANNUNCIATORS

- A. Annunciators shall be listed for use with the system.
- B. Performance Criteria:
1. Regulatory Requirements:

- a. NFPA 72.
2. General Characteristics:
 - a. Graphic Annunciator Panel: Mounted in aluminum frame with nonglare, minimum 3/16 inch (4.76 mm) thick, clear acrylic cover over graphic representation of facility. Detector locations must be represented by red LED lamps. Normal system operation must be indicated by lighted, green LED. Trouble and supervisory alarms must be represented by amber LED.
 - 1) Comply with UL 864.
 - 2) Operating voltage must be 24 V(dc) provided by local 24 V power supply provided with annunciator.
 - 3) Include built-in voltage regulation, reverse polarity protection, RS 232/422 serial communications, and lamp test switch.
 - 4) Semiflush mounted in NEMA 250, Type 1 cabinet, with key lock and no exposed screws or hinges.
 - 5) Graphic representation of facility must be CAD drawing and each detector must be represented by LED in its actual location. CAD drawing must be at 1:96 (1:100) scale or larger.
 - 6) LED representing detector must flash two times per second while detector is in alarm.
 - b. Graphic Annunciator Workstation: PC-based, with fire-alarm annunciator software with historical logging, report generation, and graphic interface showing alarm points in system. PC with operating system software, appropriate sized hard drive, 24 inch minimum digital display monitor, with wireless keyboard and mouse.

2.14 FIRE-ALARM REMOTE ANNUNCIATORS

A. Annunciators shall be listed for use with the system Performance Criteria:

1. Regulatory Requirements:
 - a. NFPA 72.
2. General Characteristics:
 - a. Annunciator functions must match those of FACU for alarm, supervisory, and trouble indications. Manual switching functions must match those of FACU, including acknowledging, silencing, resetting, and testing.
 - 1) Mounting: Flush cabinet, NEMA 250, Type 1.
 - b. Display Type and Functional Performance: Alphanumeric display and LED indicating lights must match those of FACU. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.15 FIRE-ALARM ADDRESSABLE INTERFACE DEVICES

A. Interface devices shall be listed for use with the system Performance Criteria:

1. Regulatory Requirements:
 - a. NFPA 72.
2. General Characteristics:
 - a. Include address-setting means on module.
 - b. Store internal identifying code for control panel use to identify module type.
 - c. Listed for controlling HVAC fan motor controllers.
 - d. Monitor Module: Microelectronic module providing system address for alarm-initiating devices for wired applications with normally open contacts.
 - e. Integral Relay: Capable of providing direct signal for Building Code and Elevator Code required elevator control.
 - 1) Allow control panel to switch relay contacts on command.
 - 2) Have minimum of two normally open and two normally closed contacts available for field wiring.
 - f. Control Module:
 - 1) Operate notification devices.
 - 2) Operate solenoids for use in sprinkler service.

2.16 DIGITAL ALARM COMMUNICATOR TRANSMITTERS (DACTs)

A. Transmitters shall be listed for use with the system Performance Criteria:

1. Regulatory Requirements:
 - a. NFPA 72.
2. General Characteristics:
 - a. DACT must be acceptable to remote central station and must be listed for fire-alarm use.
 - b. Functional Performance: Unit must receive alarm, supervisory, or trouble signal from FACU and automatically capture two telephone line(s) and dial preset number for remote central station. When contact is made with central station(s), signals must be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter must initiate local trouble signal and transmit signal indicating loss of telephone line to remote alarm receiving station over remaining line. Transmitter must automatically report telephone service restoration to central station. If service is lost on both telephone lines, transmitter must initiate local trouble signal.
 - c. Local functions and display at DACT must include the following:

- 1) Verification that both telephone lines are available.
 - 2) Programming device.
 - 3) LED display.
 - 4) Manual test report function and manual transmission clear indication.
 - 5) Communications failure with central station or FACU.
- d. Digital data transmission must include the following:
- 1) Address of alarm-initiating device.
 - 2) Address of supervisory signal.
 - 3) Address of trouble-initiating device.
 - 4) Loss of ac supply.
 - 5) Loss of power.
 - 6) Low battery.
 - 7) Abnormal test signal.
 - 8) Communication bus failure..
- e. Secondary Power: Integral rechargeable battery and automatic charger.
- f. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.17 FIRE-ALARM RADIO TRANSMITTERS

A. Transmitters shall be listed for use with the system Performance Criteria:

1. Regulatory Requirements:

- a. NFPA 72.
- b. NFPA 1221.
- c. 47 CFR 90.

2. General Characteristics:

- a. Must be factory assembled, wired, and tested; ready for installation and operation.
 - b. Packaging: Single, modular, NEMA 250, Type 1 metal enclosure with tamper-resistant flush tumbler lock.
 - c. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of established remote alarm receiving station designated by Owner.
 - d. Normal Power Input: 120 V(ac).
 - e. Secondary Power: Integral-sealed, rechargeable, 12 V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
- 1) Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports must withstand **100 mph (160 km/h)** with gust factor of 1.3 without failure.

- 2) Antenna Cable: Coaxial cable with impedance matched to transmitter output impedance.
 - 3) Antenna-Cable Connectors: Weatherproof.
 - 4) Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to transmitter, matching fire-alarm and other system outputs to message-generating inputs of transmitter that produce required message transmissions.
- f. Functional Performance: Unit must receive alarm, supervisory, or trouble signal from FACU or from its own internal sensors or controls and must automatically transmit signal along with unique code that identifies transmitting station to remote alarm receiving station. Transmitted messages must correspond to standard designations for fire-reporting system to which signal is being transmitted and must include separately designated messages in response to the following events or conditions:
- 1) Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
 - 2) System Test Message: Initiated manually by test switch within transmitter cabinet, or automatically at optionally preselected time, once every 24 hours, with transmission time controlled by programmed timing device integral to transmitter controls.
 - 3) Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of transmitter normal power source, derangement of wiring of transmitter, or alarm input interface circuit or device connected to it.
 - 4) Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause trouble signal to be indicated on building system.
 - 5) Local Fire-Alarm-System Alarm Message: Actuated when building system goes into alarm state. Identifies device that initiated alarm.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Preinstallation Testing: Perform verification of functionality of installed components of existing system prior to starting work. Document equipment or components not functioning as designed.

3.3 INSTALLATION OF EQUIPMENT

- A. Comply with NECA 305, NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
 - 1. Devices placed in service before other trades have completed cleanup must be replaced.
 - 2. Devices installed, but not yet placed, in service must be protected from construction dust, debris, dirt, moisture, and damage in accordance with manufacturer's written storage instructions.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 - 1. Connect new equipment to existing control panel in existing part of building.
 - 2. Connect new equipment to existing monitoring equipment at supervising station.
 - 3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to new points. New components must be capable of merging with existing configuration without degrading performance of either system.
- C. Equipment Floor and Wall Mounting: Install FACU on finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 270548.16 "Seismic Controls for Communications Systems."
- D. Install wall-mounted equipment, with tops of cabinets not more than 78 inch (1980 mm) above finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 270548.16 "Seismic Controls for Communications Systems."
- E. Manual Fire-Alarm Boxes:
 - 1. Install manual fire-alarm box in normal path of egress within 60 inch (1520 mm) of exit doorway.
 - 2. Mount manual fire-alarm box on background of contrasting color.
 - 3. Operable part of manual fire-alarm box must be between 42 and 48 inch (1060 and 1220 mm) above floor level. Devices must be mounted at same height unless otherwise indicated.
- F. Smoke- and Heat-Detector Spacing:

1. Comply with "Smoke-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
 2. Comply with "Heat-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
 3. Smooth ceiling spacing must not exceed 30 ft. (9 m).
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas must be determined in accordance with Annex A or Annex B in NFPA 72.
 5. HVAC: Locate detectors not closer than 60 inch (1520 mm) from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inch (300 mm) from lighting fixture and not directly above pendant mounted or indirect lighting.
- G. Install cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.
- H. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend full width of duct. Tubes more than 36 inch (9100 mm) long must be supported at both ends.
1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- I. Air-Sampling Smoke Detectors: If using multiple pipe runs, runs must be pneumatically balanced.
- J. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- K. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within dwelling or suite, they must be connected so that operation of smoke alarm causes alarm in smoke alarms to sound.
- L. Remote Status and Alarm Indicators: Install in visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- M. Audible Alarm-Indicating Devices: Install not less than 6 inch (150 mm) below ceiling. Install bells and horns on flush-mounted back boxes with device-operating mechanism concealed behind grille. Install devices at same height unless otherwise indicated.
- N. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inch (150 mm) below ceiling. Install devices at same height unless otherwise indicated.
- O. Device Location-Indicating Lights: Locate in public space near device they monitor.
- P. Antenna for Radio Alarm Transmitter: Mount to building structure. Use mounting arrangement and substrate connection that resists wind load of 100 mph (160 km/h) with gust factor of 1.3 without damage.

3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate must be laminated acrylic or melamine plastic signs.

3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."
- C. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.

3.6 PATHWAYS

- A. Pathways above recessed ceilings and in inaccessible locations may be routed exposed.
 - 1. Exposed pathways located less than 96 inch (2440 mm) above floor must be installed in EMT.
- B. Pathways must be installed in EMT.
- C. Exposed EMT must be painted red enamel.

3.7 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with supervised interface device to the following devices and systems. Install interface device less than 36 inch (910 mm) from device controlled. Make

addressable confirmation connection when such feedback is available at device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated HVAC duct systems.
4. Magnetically held-open doors.
5. Electronically locked doors and access gates.
6. Alarm-initiating connection to elevator recall system and components.
7. Alarm-initiating connection to activate emergency lighting control.
8. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
9. Supervisory connections at valve supervisory switches.
10. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
11. Supervisory connections at elevator shunt-trip breaker.
12. Data communication circuits for connection to building management system.
13. Data communication circuits for connection to mass notification system.
14. Supervisory connections at fire-extinguisher locations.
15. Supervisory connections at fire-pump power failure including dead-phase or phase-reversal condition.
16. Supervisory connections at fire-pump engine control panel.

3.8 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
- B. Install framed instructions in location visible from FACU.

3.9 GROUNDING

- A. Ground FACU and associated circuits in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Ground shielded cables at control panel location only. Insulate shield at device location.

3.10 FIELD QUALITY CONTROL

- A. Field tests must be witnessed by Architect/Engineer and authorities having jurisdiction.
- B. Adminstrant for Tests and Inspections:
 1. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
- C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.
 - b. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.
 2. System Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
 3. Test audible appliances for public operating mode in accordance with manufacturer's written instructions. Perform test using portable sound-level meter complying with Type 2 requirements in ASA S1.4 Part 1/IEC 61672-1.
 4. Test audible appliances for private operating mode in accordance with manufacturer's written instructions.
 5. Test visible appliances for public operating mode in accordance with manufacturer's written instructions.
 6. Factory-authorized service representative must prepare "Fire Alarm System Record of Completion" in "Documentation" section of "Fundamentals" chapter in NFPA 72 and "Inspection and Testing Form" in "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
- D. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.
- 3.11 DEMONSTRATION
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system. Provide video recording of training to Owner.
- 3.12 MAINTENANCE
- A. Maintenance Service: Beginning at Substantial Completion, maintenance service must include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective

components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies must be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections in accordance with "Visual Inspection Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in "Test Methods" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per "Testing Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.13 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement must include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software must include operating system and new or revised licenses for using software.
 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

END OF SECTION 284621.11