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## SECTION 28 31 76.00 22

INTERIOR COMBINATION EMERGENCY COMMUNICATIONS SYSTEMS  
04/16

## PART 1 GENERAL

## 1.1 RELATED SECTIONS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein. In addition, refer to the following sections for related work and coordination:

Section 21 13 13.00 20 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION  
 Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS  
 Section 08 71 00 DOOR HARDWARE  
 Section 07 84 00 FIRESTOPPING for additional work related to firestopping.

## 1.2 REFERENCES

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 S3.2 (2009; R 2014) Method for Measuring the Intelligibility of Speech Over Communication Systems (ASA 85)

## 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

## INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 60268-16 (2003; ED 4.0) Sound System Equipment - Part 16: Objective Rating Of Speech Intelligibility By Speech Transmission Index

## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 7240-16 (2007) Fire Detection And Alarm Systems –  
Part 16: Sound System Control And  
Indicating Equipment

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2015; ERTA 2015) Life Safety Code

NFPA 170 (2015) Standard for Fire Safety and  
Emergency Symbols

NFPA 241 (2013; Errata 2015) Standard for  
Safeguarding Construction, Alteration, and  
Demolition Operations

NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2  
2013; Errata 2 2013; AMD 3 2014; Errata  
3-4 2014; AMD 4-6 2014) National  
Electrical Code

NFPA 72 (2016) National Fire Alarm and Signaling  
Code

NFPA 90A (2015) Standard for the Installation of  
Air Conditioning and Ventilating Systems

## UNDERWRITERS LABORATORIES (UL)

UL 1480 (2003; Reprint Oct 2012) Standard for  
Speakers for Fire Alarm, Emergency, and  
Commercial and Professional Use

UL 1971 (2002; Reprint Oct 2008) Signaling Devices  
for the Hearing Impaired

UL 2017 (2008; Reprint May 2011) General-Purpose  
Signaling Devices and Systems

UL 268 (2009) Smoke Detectors for Fire Alarm  
Systems

UL 268A (2008; Reprint Oct 2014) Smoke Detectors  
for Duct Application

UL 464 (2009; Reprint Apr 2012) Standard for  
Audible Signal Appliances

UL 864 (2014) Standard for Control Units and  
Accessories for Fire Alarm Systems

UL Electrical Constructn (2015) Electrical Construction Equipment  
Directory

UL Fire Prot Dir (2015) Fire Protection Equipment Directory

### 1.3 DEFINITIONS

Wherever indicated in this specification or on the contract drawings, the equipment, devices, and functions shall be defined as follows:

- a. COMBINATION EMERGENCY COMMUNICATIONS SYSTEM: NFPA 72 terminology describing a combination fire alarm and mass notification system where the building mass notification system is integrated with the building fire alarm control unit to form one combined system that performs both functions.
- b. COMBINATION EMERGENCY COMMUNICATIONS SYSTEM PANELS (CECP): Combination Emergency Communications System Panel may consist of separate autonomous control unit and fire alarm control unit supplied from the same or different manufacturers, or a single panel supplied by one manufacturer. Where the term "COMBINATION EMERGENCY COMMUNICATIONS SYSTEM PANEL" or "CECP" is utilized the intent is NOT to limit the designer to one manufacturer or a single enclosure. HOWEVER; whether installed as combined or separate panels or provided by one or separate manufacturers, the panels shall be integrated in their controls and performance to meet the requirements of this section and NFPA 72.
- c. AUTONOMOUS CONTROL UNIT (ACU): The primary control unit for the building mass notification system portion of the CECP. ACU may be physically separate from, or a integral part, of the FACU
- d. FIRE ALARM CONTROL UNIT (FACU): Fire alarm system component portion of the CECP, provided with primary and secondary power sources, which receives signals from initiating devices or other fire alarm control units, and processes these signals to determine part or all of the required fire alarm system output function(s). FACU may be separate from or a portion of the ACU. Where more than one fire alarm control unit is installed in the building, one panel shall be designated as the Master Fire Alarm Control Unit.
- h. MONITOR MODULE: Term utilized to describe a Signaling Line Circuit Interface as defined by NFPA 72.
- i. CONTROL MODULE AND RELAY MODULE: Terms utilized to describe an "Emergency Control Function Interface" as defined in NFPA 72.
- j. TERMINAL CABINET: A steel cabinet with locking, hinge-mounted door that terminal strips are securely mounted inside. Utilizing tape or glue is not an acceptable means of mounting terminal strips.
- k. TEXTUAL AUDIBLE APPLIANCES: Term utilized by NFPA 72 to describe speaker appliances. The term "textual audible appliance" is utilized because the term "speaker" might also refer to a person who is speaking.

### 1.4 SYSTEM DESCRIPTION

#### 1.4.1 Scope

This work includes completion of design and providing a new, complete, combination emergency communications system as described herein and on the

contract drawings for building 2009.

Fire Alarm Control Unit portion shall be an analog/addressable system. Include in the system all necessary wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm, and 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 indicated or described. Provide system s complete and ready for operation.

Equipment and devices shall be compatible and operable with the existing fire alarm reporting system and shall not impair reliability or operational functions of the existing system. Existing fire alarm reporting system is a "100mA Gamewell loop" system and utilizes digital electronic telegraphic fire alarm transmitter.

Equipment and devices shall be compatible and operable with existing installation-wide mass notification system and shall not impair reliability or operational functions of the existing system. The installation-wide mass notification system utilizes Cooper/Madahcomtranceivers.

- a. Provide equipment, materials, inspection, and testing in strict accordance with the required and advisory provisions of NFPA 72, ISO 7240-16, and IEC 60268-16 except as modified herein. The system layouts on the contract drawings show the intent of coverage and are shown in suggested locations. Final quantity, system layout, and coordination are the responsibility of the Contractor.

#### 1.4.2 Technical Data and Computer Software

Computer software and technical data relating to computer software that are specifically identified in this project, and may be defined/required in other specifications, shall be delivered in accordance with the CONTRACT CLAUSES. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of the contract. The data package shall also include the following listed. Failure to fully comply with the following stipulations shall result in the removal and replacement of the combination emergency communications system at no cost to the Government. Requests for extension of time for any delay to the completion of the project due to the removal, redesign, resubmittal process, and replacement of the original system will not be considered. Liquidated damages shall apply and will be accessed in accordance with the contract clauses.

- a. Identification of programmable portions of system equipment and capabilities.
- b. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.
- c. Provision of operational software data on all modes of programmable portions of the combination emergency communications system.
- d. Description of Fire Alarm Control Unit equipment operation.
- e. Description of auxiliary and remote equipment operations.

- f. Library of application software.
- g. Operation and maintenance manuals.

#### 1.4.3 Keys

Keys and locks for equipment, panels and devices shall be identical. Provide the Contracting Officer with no less than six (6) keys of each type required. Direct requests for keys from all Government personnel to the Contracting Officer. Under no circumstances shall the contractor provide any keys to the building occupants. If any portion of building is occupied during construction or occupants begin moving into the building prior to project completion, the fire alarm contractor shall remove and secure all keys to the combination emergency communications system. Keys shall be CAT 60.

#### 1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for the Prime Contractor Quality Control approval. The NAVFAC MIDLANT Fire Protection Engineer shall review and approve all submittals requiring Government approval.

Provide electronic submittals. File format of electronic submittal materials shall be portable document format. No other electronic formats shall be accepted. Catalog data shall be first generation scans or manufacturer's originals. Shop drawings shall be plotted to scale. Scale all line weights. Submittals consisting of illegible pdf's shall be returned disapproved without review. One hard copy review set of the entire package, including full scale shop drawings, shall accompany each submittal for use by the NAVFAC MIDLANT Fire Protection Engineer. The single hard copy review set shall be retained by the Government reviewer. The Government reviewer shall digitally stamp, sign and lock the electronic submittal package prior to returning the electronic copy to the Contracting Officer.

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

##### SD-01 Preconstruction Submittals

Within 36 days of contract award but no less than 14 days prior to commencing any work on site, the Prime Contractor shall submit the following for review and approval:

Qualifications for Fire Alarm System Subcontractor; G

On Staff Fire Alarm System Designer(s); G

Supervising Fire Alarm Technician; G

Installing Technicians; G

Testing Personnel; G

Contractor SD-02,SD-03 & SD-05 submittals received prior to the review and approval of the Qualifications of the Fire Alarm Subcontractor shall be returned Disapproved Without Review. All

resultant delays shall be the sole responsibility of the Prime Contractor.

Contract requirements for the Fire Alarm Contractor to have NICET Certified Fire Alarm Technicians on staff are NOT negotiable. The Prime Contractor's Quality Control Manager shall not endorse nor submit the qualifications for the fire alarm system subcontractor if fire alarm contractor does not have the required NICET Technicians on staff. All resultant delays shall be the sole responsibility of the Prime Contractor.

#### SD-02 Shop Drawings

Include Annotated catalog data, in table format on the drawings, showing manufacturer's name, model, voltage, and catalog numbers for equipment and components. Submitted shop drawings shall not be smaller than ANSI D (22 in x 34 in).

#### Wiring Diagrams; G

Provide point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems that are supervised or controlled by the system. Diagrams shall show connections from field devices to the CECP and remote fire alarm control units, initiating circuits, switches, relays and terminals. Point-to-point wiring diagrams shall be job specific. Point-to-point wiring diagrams shall not indicate connections or circuits not being utilized.

Provide 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, appliances, and equipment.

#### System Layout; G

Plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, conduit sizes, wire counts, wire color-coding, circuit identification in each conduit, and circuit layouts for all floors. Drawings shall comply with the requirements of NFPA 170, and NFPA 72. Indicate candela rating of each visual notification appliance. Indicate the wattage of each speaker. Clearly identify the locations of isolation modules. Indicate the addresses of all devices, modules, relays, etc.

#### System Operation; G

A complete list of device addresses, and corresponding messages.

Provide a complete description of the system operation in matrix format.

#### Notification Appliances; G

Provide data on each circuit to indicate that there is at least 25 percent spare capacity on each notification appliance circuit, a 25 percent spare capacity for each auxiliary power supply panel,

and 25 percent spare capacity for each signaling line circuit. Annotate data for each circuit on the drawings.

#### Amplifiers; G

Provide data to indicate the amplifiers have sufficient capacity to simultaneously drive all notification speakers at the wattage setting required to meet intelligibility requirements while maintaining a minimum 25 percent spare capacity. Annotate data for each circuit on the drawings. Contractor shall be responsible for additional and/or larger amplifiers if adjustments during testing to meet intelligibility requirements reduces the spare capacities to less than 25 percent.

#### As-Built Drawings

Provide four sets of detailed as-built drawings. Furnish four sets of CD or DVD discs containing software backup with CAD-based drawings in latest version of AutoCAD \*.dwg format of as-built drawings and schematics. Discs shall also include as-built drawings plotted to scale in \*.pdf format along with \*.pdf copies of the manufacturer's data, and calculations. The drawings shall include complete wiring diagrams showing point-to-point connections between devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as-built location of devices and equipment. The drawings shall show the system as installed, including deviations from both the contract drawings and the approved shop drawings. These drawings shall be submitted within 14 days after the final acceptance test of the system. At least one copy of the as-built (red-lined) drawings shall be provided at the time of, or prior to, the final acceptance test.

#### SD-03 Product Data

Provide UL or FM listing cards for equipment provided. Include annotated catalog data, in table format, showing manufacturer's name, model, voltage and catalog numbers for all equipment and components.

Technical Data And Computer Software; G  
Fire alarm control unit (FACU); G

Autonomous control unit (ACU); G

Combination emergency communications system panel (CECP); G

Amplifiers; G

Digitalized voice generators; G

Auxiliary power supply panel; G

Remote annunciator; G

Installation-wide mass notification system transceiver; G

Solid state telegraph transmitter; G

Batteries; G

Battery chargers; G

Wiring and cable; G

Surge protection; G

Ceiling bridges for ceiling mounted appliances; G

Back boxes and conduit; G

Terminal cabinets/assemblies; G

Notification appliances; G

LED Text Displays; G

Addressable monitor module; G  
Addressable control/relay module; G  
Manual stations; G  
Smoke detectors; G  
Duct mounted smoke detectors; G  
Waterflow switches; G  
Tamper switches; G  
Environmental enclosures or guards; G  
Manufacturer's installation and maintenance manuals; G

Provide one copy of the most recent Manufacturer's installation and maintenance manuals for each piece of equipment being installed. This data is necessary for use by NAVFAC MIDLANT Fire Protection Engineering when reviewing the contractor's submittal. Manual may be submitted in \*.pdf format and submitted directly to NAVFAC MIDLANT Fire Protection Engineering.

#### SD-05 Design Data

System Operation; G

Provide a complete description of the system operation, in matrix format, on the shop drawings.

Battery power; G

- a. Verify battery capacity exceeds supervisory and alarm power requirements.
  - 1). Substantiate the battery calculations for alarm, alert, and supervisory power requirements. Ampere-hour requirements for each system component and each panel component, and the battery-recharging period, shall be included.
  - 2). Provide complete battery calculations for both the alarm, alert, and supervisory power requirements. Ampere-hour requirements for each system component shall be submitted with the calculations.
- b. For battery calculations, use the following assumptions: Assume a starting voltage of 24 VDC for starting the calculations to size the batteries. Calculate the required Ampere-hour for the specified standby time, and then calculate the required Ampere-hour for the specified alarm time. Calculate the nominal battery voltage after operation on batteries for the specified time period.

Voltage Drop Calculations; G

Provide voltage drop calculations to indicate sufficient voltage is available for proper operation of the system and all components, at the minimum rated voltage of the system operating on batteries.

Utilize the lump sum method for voltage drop calculations. Assume the entire appliance load is at the end of the circuit (lump sum). Utilize 16 VDC as the operating voltage of the appliances and 21.6 VDC as the voltage at the circuit terminals.

Spare Capacity Calculations; G

Provide calculations verifying the contract stipulated 25 spare capacity is provided for each notification appliance circuit, FACU/ACU, and auxiliary power supply panel. Also provide a calculation indicating a 25 percent spare capacity is maintained for each SLC.

#### SD-06 Test Reports

Field Quality Control  
Testing Procedures; G  
Smoke detector testing procedures; G

#### SD-07 Certificates

Installer

#### SD-09 Manufacturer's Field Reports

Combination emergency communications system panel (CECP)

Provide reports on preliminary tests, include printer information. Include the NFPA 72 Record of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports. printer generated data shall consist of a unique identifier for each device, combination emergency communications system panel, initiating device and notification appliance, with an indication of test results, and signature of the factory-trained technician of the control panel manufacturer and equipment installer.

#### SD-10 Operation and Maintenance Data

Operation and Maintenance (O&M) Instructions; G

Provide one copies of the Operation and Maintenance Instructions, indexed and in booklet form and electronic PDF format. The Operation and Maintenance Instructions shall be a single volume or in separate volumes, and may be submitted as a Technical Data Package. Manuals shall be approved prior to training.

Original and backup copies of all software delivered for this contract on each type of CD/DVD media utilized.

File format of electronic submittal materials shall be portable document format. No other electronic formats shall be accepted.

Instruction of Government Employees

The installers training history for the employees involved with this contract.

### 1.6 QUALITY ASSURANCE

Equipment and devices shall be compatible and operable with existing installation-wide fire alarm reporting and mass notification systems and shall not impair reliability or operational functions of existing system. The installation-wide fire reporting system utilizes 100mA Gamewell loop. The installation-wide mass notification system utilizes Cooper/Madahcom

tranceivers.

- a. 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 reference to "authority having jurisdiction" and/or AHJ to mean the Naval Facilities Engineering Command, MIDLANT , Fire Protection Engineer.
- b. The recommended practices stated in the manufacturer's literature or documentation shall be considered as mandatory requirements.
- c. Devices and equipment for fire alarm service shall be listed by UL Fire Prot Dir or approved by FM APP GUIDE.

#### 1.6.1 Qualifications

##### 1.6.1.1 Qualifications for Fire Alarm System Subcontractor

The Prime Contractor shall be responsible for obtaining the services of a qualified fire alarm system subcontractor for the design and installation of the combination emergency communications system. The firm designated by the Prime Contractor as their qualified fire alarm system subcontractor:

- a. Shall have been in existence a minimum of four years prior to contract award.
- b. Shall provide proof of previous experience installing a system of equal or greater complexity, utilizing the same equipment to be provided under this contract.
- c. Shall provide proof of adequate qualified staffing to meet all of the following requirements:

##### 1.6.1.1.1 On-Staff Fire Alarm System Designer(s)

A qualified fire alarm contractor shall have at least one on staff NICET Level IV SET, (Senior Engineering Technician) fire alarm technician. This technician shall also have proof of factory certified training for the design of the systems utilizing the equipment being installed. The NICET Level IV technician(s) shall be the lead technician responsible for the contractor's design of the combination emergency communications system, including, but not limited to, the selection and design of necessary equipment, battery, power and circuit calculations, provision of the required manufacturers data and the creation and completion of the shop drawings. The submittal materials (drawings, calculations & manufacturer's data) shall bear the stamp and signature of the NICET Level IV technician. RFI's pertaining to the combination emergency communications system shall be reviewed and signed by the NICET Level IV technician prior to submission to the Contracting Officer.

A NICET Level III, ET (Engineering Technician) fire alarm technician may be utilized to create the shop drawings, calculations and submittal material provided the Level III technician is directly supervised by the NICET Level IV technician. The NICET Level IV technician remains responsible for the system design and submittal materials. Both technicians' signatures and stamps shall be included on the submittal material.

#### 1.6.1.1.2 Supervising Fire Alarm Technician

A NICET Level II, AET (Associate Engineering Technician) fire alarm technician with a minimum of 8 years experience shall supervise the installation of the combination emergency communications system. The fire alarm technicians supervising the installation of equipment shall also be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the approved shop drawings. Supervising technician shall be a direct employee of the firm designated by the Prime Contractor as their qualified fire alarm system subcontractor.

#### 1.6.1.1.3 Installing Technicians

The installing Contractor shall provide fire alarm technicians with a minimum of four years of experience utilized to assist in the installation and termination devices, appliances, cabinets and panels. The fire alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the approved shop drawings. Technicians with minimum NICET Level I or II Certification are preferred. Installing technicians shall be direct employees of the firm designated by the Prime Contractor as their qualified fire alarm system subcontractor.

#### 1.6.1.1.4 Testing Personnel

The installing Contractor shall provide Fire Alarm Technicians with a minimum of eight years of experience utilized to test and certify the installation of the combination emergency communications system devices, appliances, cabinets and panels. The fire alarm technicians testing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the approved shop drawings. Testing personnel shall be direct employees of the firm designated by the Prime Contractor as their qualified fire alarm system subcontractor.

### 1.6.2 Regulatory Requirements

#### 1.6.2.1 Requirements for Fire Protection Service

Equipment and material shall be Listed by UL and listed in UL Fire Prot Dir, UL Electrical Constructn or Approved by FM and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, they shall mean listed in UL Fire Prot Dir or FM APP GUIDE. The omission of these terms under the description of any item of equipment described shall not be interpreted as waiving this requirement. All listings or approval by testing laboratories shall be from an existing ANSI or UL published standard.

### 1.7 DELIVERY, STORAGE, AND HANDLING

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

### 1.8 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

The combination emergency communications system Operation and Maintenance Instructions shall include:

- a. "Manufacturer Data Package 5" as specified in Section 01 78 23

OPERATION AND MAINTENANCE DATA. Provide an electronic copy of the OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

- b. Manufacturer's installation and maintenance manuals outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features.
- c. Maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed.
- d. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements.
- e. Software delivered for this project shall be provided, on CD or DVD discs.
- f. Printouts of configuration settings for all devices.
- g. Routine maintenance checklist. The routine maintenance checklist shall be arranged in columnar format. The first column shall list all installed devices, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.

#### 1.9 WARRANTY PERIOD REPAIR SERVICE, MAINTENANCE AND ADJUSTMENTS

During guarantee period, the service technician shall be on-site within 24 hours after notification. All repairs shall be completed within 24 hours of arrival on-site. During the guarantee period, the installing fire alarm contractor is responsible for conducting all required testing and maintenance in accordance with the requirements and recommended practices of NFPA 72 and the system manufacturer. Installing fire alarm contractor is NOT responsible for any damage resulting from abuse, misuse or neglect of equipment by the end user

#### 1.10 EXTRA MATERIALS

##### 1.10.1 Repair Service/Replacement Parts

Repair services and replacement parts for the system shall be available for a period of ten years after the date of final acceptance of this work by the Contracting Officer.

##### 1.10.2 Interchangeable Parts

Spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be suitably packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the Contracting Officer at the time of the final acceptance testing.

##### 1.10.3 Spare Parts

Furnish the following spare parts and accessories:

- a. Four fuses for each fused circuit
- b. Two smoke detectors
- c. Two notification appliance
- d. Two initiating device
- e. One addressable control modules
- f. One addressable interface modules

#### 1.10.4 Special Tools

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer.

## PART 2 PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

#### 2.1.1 Manufacturer

Components shall be of current design and shall be in regular and recurrent production at the time of installation. Provide design, materials, and devices for a combination emergency communications system, complete, conforming to NFPA 72, except as otherwise or additionally specified herein.

#### 2.1.2 Standard Products

Provide materials, equipment, and devices that are UL Listed or FM Approved for fire protection service when so required by NFPA 72 or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for any particular classification of materials. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least two years prior to bid opening.

#### 2.1.3 Nameplates

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

- a. CECP (includes component panels)
- b. Automatic transmitters (for both the installation-wide fire alarm reporting system and installation-wide mass notification systems)

Furnish nameplates to obtain approval by the Contracting Officer before installation. Obtain approval by the Contracting Officer for installation locations. Nameplates shall be etched metal or plastic, permanently attached by screws to panels or adjacent walls.

## 2.2 GENERAL PRODUCT REQUIREMENT

All combination emergency communications system equipment shall be listed for use under the applicable reference standards.

## 2.3 FIRE ALARM CONTROL UNIT(FACU) AND AUTONOMOUS CONTROL UNIT(ACU)

Provide a complete control panel fully enclosed in a lockable steel enclosure as specified herein. At the designer's discretion, the FACU and ACU may be housed in separate panels that contain independent power supplies and batteries or the ACU may be housed in the same panel with the FACU as a combination emergency communications system panel (CECP). Operations required for testing or for normal care and maintenance of the systems shall be performed from the front of the FACU enclosure. If more than a single unit is required at a location to form a complete control panel, the unit enclosures shall match exactly.

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

b. Visual indication of alarm, supervisory, or trouble initiation on the fire alarm control unit shall be by liquid crystal display or similar means with a minimum of 80 characters, that at least 32 are field changeable. The ACU shall have the capability of temporarily deactivating the fire alarm messages while delivering voice messages. Provide conductor integrity monitoring for strobe, display, temporary deactivation of fire alarm audible notification appliances and speaker wiring.

c. Provide secure operator console with a microphone for delivering live voice messages. Provide adequate discrete outputs to temporarily deactivate fire alarm audible notification, and initiate/synchronize strobes. Provide a complete set of self-diagnostics for controller and appliance network. Provide local diagnostic information display and local diagnostic information and system event log file.

### 2.3.1 Cabinet

Install control panel components in cabinets large enough to accommodate all components and also to allow ample gutter space for interconnection of panels as well as field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall say "Fire Alarm and Mass Notification Control Panel" and shall not be less than one inch high. Provide prominent rigid plastic or metal identification plates for lamps, circuits, meters, fuses, and switches. The cabinet shall be provided in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions.

### 2.3.2 Control Modules

Provide power and control modules to perform all functions of the FACU. Provide audible signals to indicate any alarm, supervisory, or trouble condition. The alarm signals shall be different from the trouble signal. Connect circuit conductors entering or leaving the panel to screw-type terminals with each terminal marked for identification. Locate diodes and

relays, if any, on screw terminals in the FACU. Circuits operating at 24 VDC shall not operate at less than 21.6 Volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10 percent of nominal voltage.

### 2.3.3 Silencing Switches

- a. Alarm Silencing Switch: Provide an alarm silencing switch at the FACU that shall silence the audible signal but not affect the visual alarm indicator. This switch shall be overridden upon activation of a subsequent alarm.
- b. Supervisory/Trouble Silencing Switch: Provide supervisory and trouble silencing switch that shall silence the audible trouble and supervisory signal, but not affect the visual indicator. This switch shall be overridden upon activation of a subsequent alarm, supervision, or trouble condition. Audible trouble indication must resound automatically every 24 hours after the silencing feature has been operated.

### 2.3.4 Non-Interfering

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

### 2.3.5 Voice Notification System

The Voice Notification System shall comply with the requirements of NFPA 72 for Emergency Voice/Alarm Communications System requirements ISO 7240-16, IEC 60268-16, except as specified herein.

Tones and voice messages shall repeat until the control panel is reset or silenced. A live voice message shall override the automatic audible output through use of a microphone input at the control panel.

- a. The system shall be a single channel voice notification system incorporating user selectability of a minimum 8 distinct sounds for tone signaling, and the incorporation of a voice module for delivery of prerecorded messages.
- b. The digitalized voice message shall consist of a non-volatile (EPROM) microprocessor based input to the amplifiers. The microprocessor shall actively interrogate circuitry, field wiring, and digital coding necessary for the immediate and accurate rebroadcasting of the stored voice data into the appropriate amplifier input. Loss of operating power, supervisory power, or any other malfunction that could render the digitalized voice module inoperative shall automatically cause the three tone temporal signal to take over all functions assigned to the failed unit.
- c. When using the microphone, live messages shall be broadcast through all speakers. The system shall be capable of operating all speakers at the same time.
- d. The Mass Notification functions shall override the manual or automatic fire alarm notification functions. The system shall have the capability of utilizing a remote microphone station with redundant

controls of the notification system control panel. A hand held microphone shall be provided and, upon activation, shall take priority over any tone signal, recorded message in progress, while maintaining the strobe Notification Appliance Circuits activation.

The activation of the strobe circuits shall follow the operation of the speaker notification appliance circuits.

Audio output shall be selectable for line level (600 ohms), 25 or 70.7 volt output.

The audio amplifier outputs shall be not greater than 100 watts RMS output.

The strobe notification appliance circuits shall provide at least 2 amps of 24 VDC power to operate strobes and have the ability to synchronize all strobes.

All outputs and operational modules shall be fully supervised with on-board diagnostics and trouble reporting circuits.

Form "C" contacts shall be provided for system alarm and trouble conditions.

Circuits shall be provided for operation of auxiliary appliances during trouble conditions.

During a Mass Notification event the panel shall not generate nor cause any trouble alarms to be generated with the fire alarm portion of the combination emergency communications system.

Mass Notification functions shall take precedence over all other function performed by the Voice Notification System.

Messages shall be recorded professionally utilizing standard industry methods and be recorded utilizing a professional female voice. Message and tone volumes shall both be at the same decibel level. Messages recorded from the system microphone shall not be accepted. Messages shall be the following:

(1) FIRE ALARM MESSAGE: Three Tone Temporal Pattern (0.5 sec on, 0.5 second off, 0.5 second on, 0.5 second off, 0.5 second on, 1.5 second off.) The alarm signal shall be a square wave. The wave shall have a fundamental frequency of 520 Hz  $\pm$  10 percent followed by:

"May I have your attention, please. May I have your attention, please. A fire has been reported in the building. Please leave the building by the nearest exit . " Provide a 2 second pause. Repeat the tones and message.

a. Auxiliary Input Module shall be designed to be an outboard expansion module to either expand the number of optional remote microphone stations, or allow a telephone interface.

#### 2.3.6 Memory

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

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

#### 2.3.7 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. The system program configuration shall be menu driven. System changes shall be password protected and shall be accomplished using personal computer-based equipment. Any proprietary equipment and proprietary software needed by qualified technicians to implement future changes to the combination emergency communications system shall be provided as part of this contract. Passwords for all levels of access shall be the manufacturer's default password and be provided to the Contracting Officer.

#### 2.3.8 Input/Output Modifications

The FACU shall contain features allowing the bypass of input devices from the system or the modification of system outputs. These control features shall consist of a panel mounted keypad. Any bypass or modification to the system shall indicate a trouble condition on the FACU and a printed output of the trouble condition.

#### 2.3.9 Resetting

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

#### 2.3.10 Instructions

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

#### 2.3.11 Walk Test

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

#### 2.3.12 History Logging

In addition to the required printer output, the control panel shall have the ability to store a minimum of 400 events in a log. These events shall be stored in a battery-protected memory and shall remain in the memory until the memory is downloaded or cleared manually. Resetting of the control panel shall not clear the memory.

#### 2.3.13 RS-232-C Output

Each local control panel shall be capable of operating remote service type

printers, and/or modems. The output shall be paralleled ASCII from an EIA RS-232-C connection with a baud rate of 1200 or 2400 to allow use of any commonly available CRT, printer, or modem.

#### 2.4 AMPLIFIERS PREAMPLIFIERS, DIGITALIZED VOICE GENERATORS

Any amplifiers, preamplifiers, digitalized voice generators, and other hardware necessary for a complete, operational, textual audible circuit conforming to NFPA 72 shall be housed within panels. The system shall automatically operate and control all building fire alarm speakers. Each amplifier shall be single output channel. The provision of backup amplifiers is not a contract requirement.

##### 2.4.1 Construction

Amplifiers shall utilize computer-grade, solid-state components and shall be provided with output protection devices sufficient to protect the amplifier against any transient voltage up to ten times the highest rated voltage in the system.

##### 2.4.2 Inputs

Each system shall be equipped with separate inputs from the tone generator, digitalized voice driver and panel mounted microphone. Microphone inputs shall be of the low impedance, balanced line type. Both microphone and tone generator input shall be operational on any amplifier.

##### 2.4.3 Message Tones

Message tones shall be stored digitally. Tones shall be either attached to the recorded message or be able to be programmed via the system software or by selector programming switches within the main control unit.

##### 2.4.4 Protection Circuits

Each amplifier shall be constantly supervised for any condition that could render the amplifier inoperable at its maximum output. Failure of any component shall cause, illumination of a visual "amplifier trouble" indicator on the CECP,

#### 2.5 AUXILIARY POWER SUPPLY PANEL

Provide auxiliary power supply panels as necessary to power combination emergency communications system devices, relays and control modules where power requirements exceed the capacity of the FACU. Trouble contacts of auxiliary power supply panels shall be individually monitored for trouble conditions.

#### 2.6 Remote Annunciator

Provide a semi-recessed mounted remote annunciator as indicated on the contract drawings. The remote annunciator shall duplicate functions of the FACU for message display, fire alarm, supervisory alarm and trouble condition visual and audible notification and system reset functions. Remote annunciator shall require the use of a key for accessing the reset,

control and other functions.

## 2.7 Installation-Wide Control

If an installation-wide control system for mass notification exists, the autonomous control unit shall communicate with the central control unit of the installation-wide system. The autonomous control unit shall receive commands/messages from the central control unit and provide status information.

## 2.8 INTERFACE TO THE INSTALLATION-WIDE MASS NOTIFICATION NETWORK

### 2.8.1 Wide Area Mass Notification Network/Local-Area Network (WAN/LAN)

The Wide Area Network/Local Area Network (WAN/LAN) Interface shall be a 10BASE-T/100BASE-TX Category 6. The ANSI/TIA/EIA 568 wiring method of the RJ-45 outlet shall be as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM. The WAN/LAN Interface shall support sensitive data at rated data transmission speeds with DES/3DES encryption, MD5 and SHA-1 hashing, RFC 2402 authentication and meet security features of FIPS 140-2 criteria. The WAN/LAN Interface shall have the following characteristics:

- a. 10BASE-T/100BASE-TX, autonegotiation
- b. WAN/LAN Connection: RJ-45
- c. Cabling: as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM
- d. Security Protocols: 168-bit 3DES, 56-bit DES, SHA-1, MD5, RFC 2402; up to 75 security associations
- e. Network protocols: TCP/IP, ISO 8802-3

### 2.8.2 Installation-wide mass notification system transceiver

The radio transceiver shall be bi-direction and meet all the requirements of paragraph, RADIO TRANSMITTER AND INTERFACE PANELS as specified in this Specification Section. The transceiver utilized in the Mass Notification System shall be capable of the following:

- a. Communication with the Central Control/Monitoring System to provide supervision of communication link and status changes are reported by automatic and manual poll/reply/acknowledge routines.
- b. All monitored points/status changes are transmitted immediately and at programmed intervals until acknowledged by the Central Control/Monitoring System.
- c. Each transceiver shall transmits a unique identity code as part of all messages; the code is set by the user at the transceiver.

#### 2.8.2.1 Radio Frequency Communications for Installation-Wide Mass Notification System

Use of radio frequency-type communications systems shall comply with

National Telecommunications and Information Administration (NTIA) requirements.

#### 2.8.2.2 Licensed Radio Frequency Systems for Installation-Wide Mass Notification System

An approved DD Form 1494 for the system is required prior to operation.

#### 2.8.3 RS-232/RS-485

The panel shall support a direct connect via RS-232 or RS-485 connections.

### 2.9 AUTOMATIC FIRE TRANSMITTERS

#### 2.9.1 Solid state telegraph transmitter

Provide a 16-zone digital electronic telegraphic fire alarm transmitter. Electronic transmitter shall be compatible with the existing installation's fire alarm reporting system.

#### 2.9.2 Signals to Be Transmitted to the Installation Receiving Station

The following signals shall be sent to the installation's receiving station:

- a. Fire alarm
- b. Supervisory
- c. Trouble

### 2.10 EMERGENCY POWER SUPPLY

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

#### 2.10.1 Batteries

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

##### 2.10.1.1 Capacity

Provide the batteries with sufficient capacity and battery power to operate the system under the most demanding of the following conditions.

- a. Under supervisory and trouble conditions, including audible trouble signal devices for 48 hours and audible and visual signal appliances under alarm conditions for an additional 15 minutes.

#### 2.10.2 Battery Chargers

Provide a solid-state, fully automatic, variable charging rate battery charger. The charger shall be capable of providing 150 percent of the

connected system load and shall maintain the batteries at full charge. In the event the batteries are fully discharged (18 Volts DC), the charger shall recharge the batteries back to 95 percent of full charge within 48 hours. Provide pilot light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided.

### 2.10.3 Battery Cabinets

Locate battery cabinets below the FACU. Battery cabinets shall be installed at an accessible location when standing at floor level. Battery cabinets shall not be installed lower than 12 inches above finished floor. Installing batteries above drop ceilings or in inaccessible locations is prohibited. Battery cabinets shall be large enough to accommodate batteries and also to allow ample gutter space for interconnection of panels as well as field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall indicate the panel(s) the batteries power and shall not be less than one inch high. The cabinet shall be provided in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions.

### 2.11 WIRING

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

#### 2.11.1 Alarm Wiring

The SLC wiring shall be solid copper or stranded cable in accordance with the manufacturers requirements. Copper signaling line circuits and initiating device circuit field wiring shall be No. 18 AWG size conductors at a minimum. Notification appliance circuit conductors, shall be solid copper or stranded No. 16 AWG size conductors at a minimum. Wire size shall be sufficient to prevent excessive voltage drop. Circuits operating at 24 VDC shall not operate at less than 21.6 volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10 percent of nominal voltage. Power wiring, operating at 120 VAC minimum, shall be a minimum No. 12 AWG solid copper having similar insulation.

#### 2.11.2 Wiring to Station Telegraphic Fire Alarm Circuit

Wiring from the digital electronic telegraphic fire alarm transmitter to the station telegraphic fire alarm circuit shall be a two-conductor No. 8 AWG type UF cable in conduit.

### 2.12 OVERVOLTAGE AND SURGE PROTECTION

#### 2.12.1 Signaling Line Circuit Surge Protection

For systems having circuits located outdoors, communications equipment shall be protected against surges induced on any signaling line circuit and shall comply with the applicable requirements of IEEE C62.41.1 and IEEE C62.41.2. Cables and conductors, that serve as communications links, shall have surge protection circuits installed at each end that meet the following waveform(s):

- a. A 10 microsecond by 1000 microsecond waveform with a peak voltage

of 1500 volts and a peak current of 60 amperes.

b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Protection shall be provided at the equipment. Additional triple electrode gas surge protectors, rated for the application, shall be installed on each wireline circuit within 3 feet of the building cable entrance. Fuses shall not be used for surge protection.

#### 2.12.2 Wiring Surge Protection

Digital and analog inputs and outputs shall be protected against surges induced by sensor wiring installed outdoors and as shown. The inputs and outputs shall be tested with the following waveforms:

a. A 10 by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

b. An 8 by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Fuses shall not be used for surge protection.

#### 2.13 CEILING BRIDGES

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

#### 2.14 BACK BOXES AND CONDUIT

In addition to the requirements of SPECIFICATION SECTION 26 20 00 INTERIOR DISTRIBUTION SYSTEM; provide all wiring in rigid metal conduit or intermediate metal conduit unless specifically indicated otherwise. Minimum conduit size shall be 3/4 inch in diameter except for 1/2 inch drops to individual devices. Do not use electrical non-metallic tubing (ENT) or flexible non-metallic tubing and associated fittings.

Provide rigid metal back boxes of adequate size and depth as recommended by the manufacturer of the appliance or device installed.

#### 2.15 NOTIFICATION APPLIANCES

##### 2.15.1 Audio Notification Appliance Network

The notification appliance network consists of textual audible appliances (speakers) located to provide intelligible instructions at areas as indicated on the contract drawings.

##### 2.15.2 Fire Alarm/Mass Notification Speakers

Audible appliances shall conform to the applicable requirements of UL 464. Appliances shall be connected into notification appliance circuits. Surface mounted audible appliances shall be painted white. Recessed audible appliances shall be installed with a grill that is painted white.

a. Textual audible appliances (speakers) shall conform to the applicable requirements of UL 1480. Speakers shall have six different sound output levels and operate with audio line input levels of 70 Volts AC, and 25 Volts AC, by means of

selectable tap settings.

Speaker tap settings shall include taps of 1/4, 1/2, 1, and 2. Speakers shall incorporate a high efficiency speaker for maximum output at minimum power across a frequency range of 400Hz to 4000Hz. Speakers shall have a sealed back construction.

Where speakers and strobes are provided in the same location, they may be combined into a single unit. All inputs shall be polarized for compatibility with standard reverse polarity supervision of circuit wiring via the Fire Alarm Control Unit .

b. Provide speaker mounting plates constructed of cold rolled steel having a minimum thickness of 16 gauge and equipped with mounting holes and other openings as needed for a complete installation. Fabrication marks and holes shall be ground and finished to provide a smooth and neat appearance for each plate. Each plate shall be primed and painted.

Speakers mounted on the exterior of the building, within unconditioned spaces or in the vicinity of showers shall be Listed weather-proof appliances.

#### 2.15.3 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and conform to the Americans With Disabilities Act (ADA). Fire Alarm/Mass Notification Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light and be marked "ALERT" in red letters. Appliances with decals or adhesive labels, whether factory or field applied, are prohibited. The light pattern shall be disbursed so that it is visible above and below the strobe and from a 90 degree angle on both sides of the strobe. Strobe flash rate shall be one flash per second and a minimum of 15 candela based on the UL 1971 test. Strobes shall be surface mounted. Provide synchronized operation.

#### 2.15.4 Connections

Provide screw terminals for each notification appliance. Terminals shall be designed to accept the size conductors used in this project without modification.

#### 2.15.5 LED Text Displays

An LED text display shall be provided at locations as shown on the contract drawings. The LED text display shall have minimum character size of 4-inches high and shall spell out the words "EVACUATE" and "ANNOUNCEMENT". The design of LED text display shall be such that it cannot be read when not illuminated. The LED text display shall be capable of being wall or ceiling mounted. LED Text signs shall be reverse polarity sensitive and powered via notification appliance circuits.

#### 2.16 ADDRESSABLE MONITOR MODULE

The initiating device being monitored shall be configured as a Class B initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm, trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling such as waterflow switches, valve supervisory switches, fire pump monitoring, independent smoke detection systems, relays for

output function actuation, and other similar functions. The module shall be UL or FM listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain 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. LED shall be visible without needing to remove the backbox cover plate.

#### 2.17 ADDRESSABLE CONTROL/RELAY MODULE

The control module shall be capable of operating as a relay (form C contacts) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL or FM listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Class B Pathway. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. Circuit between the module and the equipment/feature controls is permitted be configured as Class D pathways. The pathway is unsupervised but has a fail-safe operation that performs the intended function when the connection is lost. The control module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled. Control Modules shall be located in environmental areas that reflect the conditions to which they were listed. LED shall be visible without needing to remove the backbox cover plate.

#### 2.18 MANUAL STATIONS

Provide addressable manual pull stations. Manual pull stations shall be metal or plastic, semi-flush mounted, double action, addressable manual stations, that are not subject to operation by jarring or vibration. Stations shall be equipped with screw terminals for each conductor. Stations that require the replacement of any portion of the device after activation are not permitted. Stations shall be finished in fire-engine red with molded raised lettering operating instructions of contrasting color. The use of a key or wrench shall be required to reset the station. Manual stations shall be mounted at 48 inches. Stations shall have a separate screw terminal for each conductor.

#### 2.19 SMOKE DETECTORS

##### 2.19.1 Photoelectric Smoke Detectors

Provide addressable photoelectric smoke detectors as follows:

- a. Provide analog/addressable photoelectric smoke detectors utilizing the photoelectric light scattering principle for operation in accordance with UL 268. Smoke detectors shall be listed for use with the fire alarm control unit.
- b. Provide self-restoring type detectors that do not require any readjustment after actuation at the FACU to restore them to normal operation. detectors shall be UL Listed or FM Approved as smoke-automatic fire detectors.

c. Components shall be rust and corrosion resistant. Vibration shall have no effect on the detector's operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen shall not inhibit the movement of smoke particles into the chamber.

d. Provide twist lock bases with sounder that produces a minimum of 90 dBA at 10 feet for the detectors. The detectors shall maintain contact with their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on the screw terminals. The detector shall have a visual indicator to show actuation.

e. The detector address shall identify the particular unit, its location within the system, and its sensitivity setting. detectors shall be of the low voltage type rated for use on a 24 VDC system.

f. An operator at the control panel, having a proper access level, shall have the capability to manually access the following information for each initiating device.

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

#### 2.19.2 Smoke detector with sounder bases

Provide smoke detectors with sounder bases in dwelling units. Activation of a dwelling unit smoke detector shall activate a supervisory alarm at the FACU. Dwelling unit smoke detectors are prohibited from activating any general building alarms.

#### 2.19.3 Duct mounted smoke detectors

Provide addressable duct smoke detectors as follows:

Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated on the contract drawings and in accordance with NFPA 90A. Units shall consist of smoke detectors, as specified in the paragraph titled Photoelectric Smoke Detectors, mounted in a housing fitted with duct sampling tubes. Detectors shall be rated for air velocities that include air flows between 500 and 4000 cubic feet per minute (CFM). Detectors shall be powered from the fire alarm control unit.

a. Sampling tubes shall run the full width of the duct. The duct smoke detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed or FM Approved for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the FACU.

b. Lights to indicate the operation and alarm condition; shall be visible and accessible with the unit installed and the cover in place.

Detectors mounted above 6 feet and those mounted below 6 feet that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test switches.

c. Remote lamps and switches, as well as the affected fan units, shall be properly identified in etched plastic placards. Detectors shall provide for control of auxiliary contacts that provide control, interlock, and shutdown functions specified in Section 23 09 23 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER LOCAL BUILDING SYSTEMS. Auxiliary contacts provided for this function shall be located within 3 feet of the controlled circuit or appliance. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

#### 2.19.4 Smoke Detector Testing

Smoke detectors shall be tested in accordance with NFPA 72 and the manufacturer's recommended calibrated test method.

#### 2.20 Waterflow switches

a. Provide vane-type waterflow switches for wet pipe sprinkler systems. The device shall contain double pole, double throw contacts. Equip the detector with a pneumatic time delay, field adjustable from 0 to 90 seconds. The time delay shall be set initially to 30seconds. Waterflow switches shall be a UL Listed extinguishing system attachments rated for the particular pressure and location that it is installed. Flow switches shall be equipped with screw terminals for each conductor.

The Prime Contractor is responsible for coordination between their sub-tier contractors. Flow switches are provided by the sprinkler contractor but shall be included in the submittal package required by this section.

#### 2.21 VALVE MONITOR SWITCHES (TAMPER SWITCHES)

Provide a tamper switch for each fire protection system control valve. Tamper switches shall be a UL Listed extinguishing system attachments for the location and type of valve supervised. The device shall contain double pole, double throw contacts. Operation of the switch shall cause a supervisory signal to be transmitted to the FACU upon not more than two complete turns of the valve wheel or a closure of 10 percent, whichever is less. Tamper switches shall be equipped with screw terminals for each conductor.

The Prime Contractor is responsible for coordination between their sub-tier contractors. Tamper switches are provided by the sprinkler contractor but shall be included in the submittal package required by this section.

#### 2.22 ENVIRONMENTAL ENCLOSURES OR GUARDS

Environmental enclosures shall be provided to permit Fire Alarm or Mass Notification components to be used in areas that exceed the environmental limits of the listing. The enclosure shall be listed for the device or appliance as either a manufactured part number or as a listed compatible accessory for the UL category the component is currently listed. Guards required to deter mechanical damage shall be either a listed manufactured

part or a listed accessory for the category of the initiating device or notification appliance.

## 2.23 SYSTEM OPERATION

The combination emergency communications system shall be a complete, supervised, noncoded, analog/addressable fire alarm and mass notification system conforming to NFPA 72, UL 864, and UL 2017. The system shall be activated into the alarm mode by actuation of any fire alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. The system may be placed in the alert mode by local microphones or remotely from authorized locations/users.

### 2.23.1 Fire Alarm and Supervisory Initiating Devices

Connect alarm initiating devices to Class A or Class B signal line circuit (SLC) pathways, and install in accordance with NFPA 72.

The contract required 25 percent spare capacity per SLC limits the design to 38 addresses per Class B SLC.

In accordance with NFPA 72 the number of addresses between isolation modules on a Class A SLC pathway is limited to 50 addresses OR the maximum number of addresses per the manufacturer (most manufacturers limit the number of addresses between isolation modules to 20 addresses.)

- a. Contractor shall utilize Class B signal line circuit pathways
- b. The system shall operate in the alarm mode upon activation of any fire alarm initiating device. The system shall remain in alarm mode until initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal. Audible and visual appliances and systems shall comply with NFPA 72. Fire alarm system/mass notification system components requiring power, except for the control panel power supply, shall operate on 24 VDC.

### 2.23.2 Functions and Operating Features

The system shall provide the following functions and operating features:

- a. The Combination Emergency Communications System Panels (CECP) whether separate or combined Fire Alarm Control Units (FACU) and Autonomous Control Units (ACU), shall provide power, annunciation, supervision, and control for the system. Systems shall be microcomputer (microprocessor or microcontroller) based addressable systems with a minimum word size of eight bits with sufficient memory to perform as specified.
- b. Provide Class B initiating device circuit pathways for conductor lengths of 10 feet or less.
- c. Provide Class B signaling line circuit pathways
- d. Provide Class B control circuits.
- e. Provide Class B notification appliance circuit pathways. Visual alarm notification appliances shall have the flash rates synchronized.
- f. Provide alarm verification capability for smoke detectors. Alarm

verification shall initially be set for 20 seconds.

g. Provide program capability via switches in a locked portion of the FACU to bypass the automatic notification appliance circuits, fire reporting system, and air handler shutdown features. Operation of this programming shall indicate this action on the FACU display and system printer output.

h. Alarm, supervisory, and trouble signals shall be automatically transmitted to the a UL Listed central station.

i. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.

j. Programmed information shall be stored in non-volatile memory.

k. The system shall be capable of operating, supervising, and/or monitoring both addressable and non-addressable alarm and supervisory devices.

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

m. Where the fire alarm system is responsible for initiating an action in another emergency control device or system, such as an HVAC system, the addressable fire alarm relay shall be within 3 feet of the emergency control device.

o. An alarm signal shall automatically initiate the following functions:

- (1) Transmission of an alarm signal to a UL Listed central station.
- (2) Visual indication of the device operated on the FACU, and on the remote annunciator. Indication on the annunciator shall be by floor & room number, device address, and device type.
- (3) Continuous actuation of all alarm notification appliances.
- (4) Recording of the event electronically in the history log of the FACU.

p. A supervisory signal shall automatically initiate the following functions:

- (1) Visual indication of the device operated on the FACU, and on the remote annunciator. Indication on the annunciator shall be by floor & room number, device address, and device type.
- (2) Sound the audible alarm at the respective panels.
- (3) Transmission of a supervisory signal to a UL Listed central station.
- (4) Recording of the event electronically in the history log of the FACU.
- (5) Supervisory signals shall be non-latching.

(4) Operation of a duct smoke detectors shall shut down the appropriate air handler in accordance with NFPA 90A in addition to other requirements of this paragraph.

q. A trouble condition shall automatically initiate the following functions:

(1) Visual indication of the system trouble on the FACU, and on the remote annunciator and sound the audible alarm at the respective panels.

(2) Transmission of a trouble signal to a UL Listed central station.

(3) Recording of the event electronically in the history log of the fire control system unit.

(4) Trouble conditions shall be non-latching.

## 2.24 SYSTEM MONITORING

### 2.24.1 Valves

Each valve affecting the proper operation of a fire protection system, including automatic sprinkler control valves, standpipe control valves, sprinkler service entrance valve, valves at fire pumps, isolating valves for pressure type waterflow or supervision switches, and valves at backflow preventers, whether supplied under this contract or existing, shall be electrically monitored to ensure its proper position. Each tamper switch shall be provided with a separate address.

### 2.24.2 Independent Fire Detection System

Each existing independent smoke detection subsystem, and kitchen fire extinguishing system shall be monitored both for the presence of an alarm condition and for a trouble condition. Each monitored condition shall be provided with a separate address.

## 2.25 ELECTRIC POWER

Primary power to combination emergency communications system panels and equipment

Primary power shall be 120 VAC service for the CECPs and equipment. Primary power shall be supplied from the AC service to the building. Provide dedicated branch circuit(s) supplying all CECPs & equipment including but not limited to FACU's, ACU's, LED message control/interface panels, LED Text signs, etc. Branch circuits shall supply no loads other than those associated with the combination emergency communications system. The circuit disconnecting means and all branch-circuit overcurrent protective devices shall be located within a single panel located in the building's main electrical room. The location of the branch-circuit overcurrent protective device shall be permanently identified at the combination emergency communications system panels/enclosures. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as "FIRE ALARM CIRCUIT." The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. This branch circuit shall not be

supplied through ground-fault circuit interrupters or arc-fault circuit-interrupters.

Combination emergency communications system panels and equipment(s) includes, but is not limited to; fire alarm control units (FACU), autonomous control units (ACU), auxiliary power supply panels, fire alarm system printers, mass notification system transceivers, fire alarm reporting system transmitters, LED text displays, LED text display control panels, circuits powering the elevator power shunt trip feature, circuits powering computer room power shunt trip feature and circuits powering 120VAC door holders.

### PART 3 EXECUTION

#### 3.1 INSTALLATION OF COMBINATION EMERGENCY COMMUNICATIONS SYSTEM EQUIPMENT DEVICES AND APPLIANCES

- a. Locate the panels associated with the COMBINATION EMERGENCY COMMUNICATIONS SYSTEM (FACU, ACU, Amplifiers, Auxiliary power supply panels, MNS transmitter and Fire alarm transmitter) where indicated on the contract drawings. Surface mount panels with the top of the cabinet 6 feet above the finished floor or center the panels at 5 feet, whichever is lower. Conductor terminations shall be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection shall be permanently mounted inside the panels.
- b. Manual Stations: Locate manual stations as required by NFPA 101 IEC 60268, Part 16, and ASA S3.2 and NFPA 72. Mount stations so the operating handles are 4 feet above the finished floor. Mount stations so they are located no more than 5 feet from the exit door they serve, measured horizontally.
- c. Notification Appliances: Locate notification appliances as required by NFPA 72. Mount assemblies on walls 90 inches above the finished floor or 6 inches below the ceiling whichever is lower. Ceiling mounted speakers shall conform to NFPA 72.
- d. Smoke detectors: Locate detectors as required by NFPA 72 and their listings on a 4 inch mounting box. Detectors located on the ceiling shall be installed not less than 4 inches from a side wall to the near edge. Those located on the wall shall have the top of the detector at least 4 inches below the ceiling, but not more than 12 inches below the ceiling. In raised floor spaces, the smoke detectors shall be installed to protect 225 square feet per detector. Install smoke detectors no closer than 5 feet from air handling supply outlets.
- e. Remote Annunciator: Locate the remote annunciator as shown on the contract drawings. Surface mount the panel, with the top of the panel 6 feet above the finished floor or center the panel at 5 feet, whichever is lower.
- f. Waterflow Switches and Tamper Switches: Locate waterflow switches and tamper switches at each supervised sprinkler control valve.
- g. The modification of any fire alarm system and the procedures shall comply with the requirements of NFPA 241.

### 3.2 SYSTEM FIELD WIRING

#### 3.2.1 Wiring within Cabinets, Enclosures, and Boxes

Provide wiring installed in a neat and workmanlike manner and installed parallel with or at right angles to the sides and back of any box, enclosure, or cabinet. Conductors that are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting, or junction box shall be connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make connections with approved pressure type terminal blocks, that are securely mounted. The use of wire nuts or similar devices shall be prohibited. Wiring shall conform to NFPA 70.

#### 3.2.2 Terminal Cabinets

Provide a terminal cabinet at the base of any circuit riser, on each floor at each riser, and where indicated on the drawings. Terminal size shall be appropriate for the size of the wiring to be connected. Conductor terminations shall be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection shall be permanently mounted in the terminal cabinet. Minimum size is 8 inches by 8 inches. Terminal strips shall be securely mounted inside. Utilizing tape or glue is not an acceptable means of mounting terminal strips.

#### 3.2.3 Conduit

Minimum conduit size shall be 3/4 inch in diameter except for 1/2 inch drops to individual devices. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. Run conduit or tubing concealed unless specifically shown otherwise on the drawings.

- a. Galvanized rigid steel (GRS) conduit shall be utilized where exposed to weather, where subject to physical damage, and where exposed on exterior of buildings. Intermediate Metal Conduit (IMC). IMC may be used in lieu of GRS as allowed by NFPA 70.
- b. Electrical Metallic Tubing (EMT) is permitted above suspended ceilings or exposed where not subject to physical damage. Do not use EMT underground, encased in concrete, mortar or grout, in hazardous locations, where exposed to physical damage, outdoors or in fire pump rooms. Use die-cast compression connectors.
- c. Flexible metal conduit is permitted for initiating device circuits 6 ft length in length or less. Flexible metal conduit is prohibited for notification appliance circuits and signaling line circuits. Use liquidtight flexible metal conduit in damp and wet locations.
- d. Schedule 40 (minimum) Polyvinyl Chloride (PVC) is permitted where conduit is routed underground below floor slabs. Convert nonmetallic conduit, other than PVC Schedule 40 or 80, to plastic-coated rigid, or IMC, steel conduit before turning up through floor slab.

#### 3.2.4 Wire

Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Shielded wiring shall be utilized where recommended by the manufacturer. For shielded wiring,

the shield shall be grounded at only one point, that shall be in or adjacent to the FACU. Pigtail or T-tap connections to signal line circuits, initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. Pull all conductors splice free. Color coding is required for circuits and shall be maintained throughout the circuit. Conductors used for the same functions shall be similarly color coded. Wiring shall conform to NFPA 70.

### 3.2.5 Conductor Terminations

Label all conductor terminations in panels and equipment associated with the combination emergency communications system (FACU, ACU, Amplifiers, Auxiliary power supply panels, MNS transmitter and Fire alarm transmitter) Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each combination emergency communications system cabinet and panel shall contain a laminated drawing that indicates each conductor, its label, circuit, and terminal. The laminated drawing shall be neat, using 12 point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

### 3.3 DISCONNECTION AND REMOVAL OF EXISTING SYSTEM

Existing fire alarm equipment shall be maintained fully operational until the new equipment has been tested and accepted by the Contracting Officer. As new equipment is installed, it shall be labeled "NOT IN SERVICE" until the new equipment is accepted. Once the new system is completed, tested, and accepted by the Government, it shall be placed in service and connected to the installation-wide fire reporting system. New equipment shall have tags removed and the existing equipment shall be tagged "NOT IN SERVICE" until removed from the building.

- a. After acceptance of the new system by the Contracting Officer, existing equipment not connected to the new system shall be removed, unused exposed conduit shall be removed, and damaged surfaces shall be restored. The material shall be removed from the site and disposed of by the Contractor.
- b. Disconnect and remove the existing fire alarm and smoke detection systems where indicated and elsewhere in the specification.
- c. Fire alarm control panels and fire alarm devices disconnected and removed shall be turned over to the Contracting Officer.
- d. Properly dispose of fire alarm outlet and junction boxes, wiring, conduit, supports, and other such items. Existing wiring shall not be abandoned in place.

### 3.4 CONNECTION OF NEW SYSTEM

The following new system connections shall be made during the last phase of construction, at the beginning of the preliminary tests. New system connections shall include:

- a. Connection of new control modules to existing magnetically held door (hold-open) devices.
- b. Connection of new elevator recall control modules to existing

elevator controllers.

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

Once these connections are made, system shall be left energized and new audio/visual appliances deactivated. Report immediately to the Contracting Officer any coordination and field problems resulting from the connection of the above components.

### 3.5 FIRESTOPPING

Provide firestopping for conduit penetrations through fire rated floor slabs, walls, partitions, and shaft enclosures in accordance with Section 07 84 00 FIRESTOPPING.

### 3.6 PAINTING

Paint exposed electrical, fire alarm conduit, and surface metal raceway to match adjacent finishes in exposed areas. In lieu of painting conduit, the contractor may utilize red conduit with a factory applied finish. Paint junction boxes conduit and surface metal raceways red in unfinished areas. Painting shall comply with Section 09 90 00 PAINTS AND COATINGS.

In unfinished areas, paint all fire alarm conduit, junction boxes and covers red. In lieu of painting conduit, the contractor may utilize red conduit with a factory applied finish.

In finished areas, paint exposed fire alarm conduit, surface metal raceways, junction boxes, and electrical boxes to match adjacent finishes. The inside cover of the junction box must be identified as "Fire Alarm" and the conduit must have painted red bands 3/4 inch wide at 10 foot centers and at each side of a floor, wall, or ceiling penetration.

### 3.7 FIELD QUALITY CONTROL

#### 3.7.1 Testing Procedures

Submit detailed test procedures prepared and signed by a registered professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveys (NCEES). Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, and signed by representative of the installing company, for the fire detection and alarm system 60 days prior to performing system tests. Detailed test procedures shall list all components of the installed system such as initiating devices and circuits, notification appliances and circuits, signaling line devices and circuits, control devices/equipment, batteries, transmitting and receiving equipment, power sources/supply, annunciators, special hazard equipment, emergency communication equipment, interface equipment, and transient (surge) suppressors. Test procedures shall include sequence of testing, time estimate for each test, and sample test data forms. The test data forms shall be in a check-off format (pass/fail with space to add applicable test data) and shall be used for the preliminary testing and the acceptance testing. The test data forms shall record the test results and shall:

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

- b. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how this test shall be performed.
- c. Identify each component and circuit as to type, location within the facility, and unique identity within the installed system. Provide necessary floor plan sheets showing each component location, test location, and alphanumeric identity.
- d. Identify all test equipment and personnel required to perform each test (including equipment necessary for testing smoke detectors using real smoke).
- e. Provide space to identify the date and time of each test.
- f. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

### 3.7.2 Tests Stages

- a. Preliminary Testing: Conduct preliminary tests to ensure devices and circuits are functioning properly. Tests shall meet the requirements of paragraph entitled "Minimum System Tests." After preliminary testing is complete, provide a letter certifying the installation is complete and fully operable. The letter shall state each initiating and indicating device was tested in place and functioned properly. The letter shall also state that panel functions were tested and operated properly. The letter shall include the names and titles of the witnesses to the preliminary tests. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.
- b. Request for Formal Inspection and Tests: Requests for Formal Inspection and Tests shall not be submitted until after the connections to the installation-wide fire reporting system and the installation-wide mass notification system have been completed and fully functional. When preliminary tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the MIDLANT Division Naval Facilities Engineering Command, Fire Protection Engineer.
- c. Final Testing: Notify the Contracting Officer in writing when the system is ready for final acceptance testing. Submit request for test at least 15 calendar days prior to the test date. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. Furnish instruments and personnel required for the tests. 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 provided at the project site:
  - (1) The systems manufacturer's technical representative
  - (2) As-built (red-lined) drawings of the system as actually installed
  - (3) Megger test results

- (4) Loop resistance test results
- (5) Complete program printout including input/output addresses

The final tests shall be witnessed by the NAVFAC MIDLANT Fire Protection Engineer. At this time, any and all required tests shall be repeated at their discretion. Following acceptance of the system, as-built drawings and O&M manuals shall be delivered 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, will not be permitted until the as-built drawings and O&M manuals are received.

### 3.7.3 Minimum System Tests

Test the system in accordance with the procedures outlined in NFPA 72, ISO 7240-16, IEC 60268-16. The required tests are as follows:

Demonstrate communications with the supervising station as specified by the Contracting Officer. As a minimum, verify all points are correctly received at the supervising station receiver and automated software system.

Demonstrate communications with the installation-wide mass notification system as specified by the Contracting Officer.

a. Megger Tests: After wiring has been installed, and prior to making any connections to panels or devices, wiring shall be megger tested for insulation resistance, grounds, and/or shorts. Conductors with 300 volt rated insulation shall be tested at a minimum of 250 VDC. Conductors with 600 volt rated insulation shall be tested at a minimum of 500 VDC. The tests shall be witnessed by the Contracting Officer and test results 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. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.

c. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.

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

e. Test each initiating and indicating device and circuit for proper operation and response at the control unit. Smoke detectors shall be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors shall comply with the requirements of NFPA 72.

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

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

- h. Determine that the system is operable under trouble conditions as specified.
- i. Visually inspect wiring.
- j. Test the battery charger and batteries.
- k. Verify that software control and data files have been entered or programmed into the FACU. Hard copy records of the software shall be provided to the Contracting Officer.
- l. Verify that red-line drawings are accurate.
- m. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.
- n. Measure voltage readings for circuits to ensure that voltage drop is not excessive.
- o. Disconnect the verification feature for smoke detectors during tests to minimize the amount of smoke needed to activate the detector. Testing of smoke detectors shall be conducted using real smoke. The use of canned smoke is prohibited.
- p. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.
- q. Audibility Intelligibility testing of the Voice Evacuation Notification System shall be accomplished in accordance with NFPA 72 for Voice Evacuation Systems, IEC 60268-16, and ASA S3.2.
- r. Opening the circuit at not less than 25% of alarm initiating devices and notification appliances to test the wiring supervisory feature.
- s. Demonstrate modem communications with remote sites as specified by the Contracting Officer. Dial in capability shall also, be demonstrated, using specified security.
- t. Demonstrate fiber optic communications with remote sites as specified by the Contracting Officer. Dial in capability shall also, be demonstrated, using specified security.

### 3.8 INSTRUCTION OF GOVERNMENT EMPLOYEES

Provide 2 days (16 hours) of onsite instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

#### 3.8.1 Instructor

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. The instructor shall train the Government employees designated by the

Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm and fire detection system. Each instructor shall be thoroughly familiar with all parts of this installation. The instructor shall be trained in operating theory as well as in practical O&M work.

### 3.8.2 Required Instruction Time

Provide 2 days (16 hours) of onsite instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

### 3.8.3 Technical Data and Computer Software

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

Any proprietary equipment and proprietary software needed by qualified technicians to implement future changes to the fire alarm system shall be provided as part of this contract. Maintenance software required and provided as part of this contract shall not require any type of annual license agreement or annual cost to continue use of the software. The software that is provided will continue to operate during the entire lifetime of the installed equipment without any additional cost to the Government.

-- End of Section --