
USACE / NAVFAC / AFCEC / NASA UFGS-28 31 63.00 20 (October 2007)

Preparing Activity: NAVFAC Superseding
UFGS-28 31 63.00 20 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2019

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DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

SECTION 28 31 63.00 20

ANALOG/ADDRESSABLE INTERIOR FIRE ALARM SYSTEM

10/07

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SECTION 28 31 63.00 20

ANALOG/ADDRESSABLE INTERIOR FIRE ALARM SYSTEM 10/07

NOTE: This guide specification covers the requirements for analog/ addressable interior fire alarm systems in single or multiple buildings.

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

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

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

PART 1 GENERAL

1.1 REFERENCES

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

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

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

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

ASME INTERNATIONAL (ASME)

ASME A17.1/CSA B44 (2016) Safety Code for Elevators and
Escalators

FM GLOBAL (FM)

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

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

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

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2018; TIA 18-1; TIA 18-2; TIA 18-3) Life
Safety Code

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

NFPA 72 (2019; TIA 19-1; ERTA 2019) National Fire
Alarm and Signaling Code

NFPA 90A (2018) Standard for the Installation of
Air Conditioning and Ventilating Systems

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

47 CFR 90 Private Land Mobile Radio Services

UNDERWRITERS LABORATORIES (UL)

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

UL 228 (2006; Reprint Nov 2008) Door
Closers-Holders, With or Without Integral
Smoke Detectors

UL 268 (2016; Reprint Jul 2016) UL Standard for

Safety Smoke Detectors for Fire Alarm
Systems

UL 464 (2016; Reprint Sep 2017) UL Standard for
Safety Audible Signaling Devices for Fire
Alarm and Signaling Systems, Including
Accessories

UL 864 (2014; Reprint Mar 2018) UL Standard for
Safety Control Units and Accessories for
Fire Alarm Systems

UL Electrical Constructn (2012) Electrical Construction Equipment
Directory

UL Fire Prot Dir (2012) Fire Protection Equipment Directory

1.2 RELATED REQUIREMENTS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS, applies to
this section, with the additions and modifications specified herein.

1.3 DESCRIPTION OF WORK

1.3.1 Scope

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

This work includes designing and providing [a new, complete,] [and]
[modifying the existing] analog/addressable fire alarm system as described
herein and on the contract drawings for the [Building name]. The system
shall include 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
mentioned or described. Provide system[s] complete and ready for
operation. Equipment, materials, installation, workmanship, inspection, and
testing shall be in strict accordance with the required and advisory
provisions of NFPA 72 [and] [_____] except as modified herein. [The system
layout on the drawings show the intent of coverage and are shown in
suggested locations. Final quantity, layout, and coordination is the
responsibility of the Contractor.] [A single fire alarm control panel is
indicated with terminal cabinets at each floor at each riser location.
Where remote fire alarm control units are needed, they shall be provided at
a terminal cabinet location.] Each remote fire alarm control unit shall be
powered from a wiring riser specifically for that use or from a local
emergency power panel located on the same floor as the remote fire alarm
control unit. Where remote fire control units are provided, equipment for
notification appliances may be located in the remote fire alarm control
units.

1.4 SUBMITTALS

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G". Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" following a submittal item indicates that the submittal is required for the Sustainability eNotebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING. Locate the "S" submittal under the SD number that best describes the submittal item.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Provide six complete sets of submittals. Partial submittals will not be acceptable and will be returned without review. [The [_____] Division] [Engineering Field Activity (EFA) [_____]], Naval Facilities Engineering Command, Fire Protection Engineer, will review and approve submittals.

SD-02 Shop Drawings

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

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 which are supervised or controlled by the system. Diagrams shall show connections from field devices to the FACP and remote fire alarm control units, initiating circuits, switches, relays and terminals.

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

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

Provide a complete list of device addresses and corresponding messages.

Provide detailed drawings of the graphic annunciator.

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

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 and equipment.

Battery power calculations

Submit shop drawings not smaller than 600 by 900 mm 24 by 36 inches. As a minimum, the shop drawing submittal shall include the items listed above.

SD-03 Product Data

Fire alarm control panel (FACP); G[, [_____]]

Printers, covers, console rack, video display unit (VDU), etc.; G[, [_____]]

Terminal cabinets/assemblies; G[, [_____]]

Manual stations; G[, [_____]]

Transmitters (including housing); G[, [_____]]

Batteries; G[, [_____]]

Battery chargers; G[, [____]]
 Smoke sensors; G[, [____]]
 Thermal sensors; G[, [____]]
 Wiring and cable; G[, [____]]
 Notification appliances; G[, [____]]
 Addressable interface devices; G[, [____]]
 [Graphic annunciator; G[, [____]]]
 [Amplifiers; G[, [____]]]
 [Tone generators; G[, [____]]]
 [Digitalized voice generators; G[, [____]]]
 [Firefighter telephone; G[, [____]]]
 Waterflow detectors; G[, [____]]
 Tamper switches; G[, [____]]
 [Electromagnetic door holders; G[, [____]]]
 [Remote fire alarm control units; G[, [____]]]
 Smoke sensor testing procedures; G[, [____]]
 [Radio transmitter and interface panels; G[, [____]]]
 [Digital alarm communicator transmitter (DACT); G[, [____]]]
 [Telegraphic transmitter; G[, [____]]]

Submit data on proposed equipment, including, but not limited to the items listed above. Include UL or FM listing cards for equipment provided.

SD-06 Test Reports

Furnish preliminary test results to the Contracting Officer. Include the control panel and initiating and indicating devices, a unique identifier for each device with an indication of test results, and signature of the factory-trained technician of the control panel manufacturer and equipment installer. With reports on preliminary tests, include printer information.

SD-07 Certificates

Qualifications of installer

SD-10 Operation and Maintenance Data

INTERIOR FIRE ALARM SYSTEM, Data Package [5] [____]; G[, [____]]

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

Record drawing software

SD-11 Closeout Submittals

Prepare and submit to the Contracting Officer six sets of detailed as-built drawings. The drawings shall include complete wiring diagrams showing 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 project drawings and the approved shop drawings. The drawings shall be prepared on uniform sized mylar sheets not less than 760 by 1065 mm with 200 by 100 mm 30 by 42 inches with 8 by 4 inch title block similar to contract drawings. These drawings shall be submitted within 2 weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings shall be provided at the time of, or prior to the final acceptance test.

Submit the installer's training history for the employees involved with this contract.

1.5 ADDITIONAL SUBMITTAL REQUIREMENTS

1.5.1 Battery Power Calculations

Verify that battery capacity exceeds supervisory and alarm power requirements.

- a. Provide complete battery calculations for both the alarm and supervisory power requirements. Ampere hour requirements for each system component shall be submitted with the calculations.
- b. Provide data on each circuit to indicate that there is at least 25 percent spare capacity for notification appliances, [25] [50] percent spare capacity for initiating devices. Annotate data for each circuit on the drawings.
- [c. Provide data to indicate that the amplifiers have sufficient capacity to simultaneously drive fire alarm speakers at their 1/2 watt tap plus 50 percent spare capacity. Annotate data for each circuit on the drawings.]
- [d. Provide a detailed description of the final acceptance testing procedures (including equipment necessary for testing smoke detectors using real smoke).]

1.5.2 Qualifications of Installer

[Design shall be by a National Institute for Certification in Engineering Technologies (NICET) Level III or Level IV Technician.] Installer shall have an office, which has been in existence for at least 3 years[, within a [____] mile radius of the job site]. Installation shall be accomplished by an electrical contractor with a minimum of 5 years' experience in the installation of fire alarm systems. The Contracting Officer may reject any

proposed installer who cannot show evidence of such qualifications. The services of a technician provided by the control equipment manufacturer shall be provided to supervise installation, adjustments, and tests of the system. The Contractor shall furnish evidence that the fire alarm equipment supplier has an experienced and effective service organization which carries a stock of repair parts for the system to be furnished. The Contractor shall guarantee labor, materials, and equipment provided under this contract against defects for a period of one year after the date of final acceptance of this work by the Contracting Officer and the receipt of as-built drawings and schematics of all equipment. Prior to installation, submit data for approval by the [[_____] Division] [EFA [_____]], Naval Facilities Engineering Command, Fire Protection Engineer, showing that the Contractor has successfully installed addressable, analog intelligent interior fire alarm systems of the same type as specified herein, or that the Contractor has a firm contractual agreement with a subcontractor having such required experience. Include the names and locations of at least three installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months. Submit names and phone numbers of points of contact at each site.

1.5.3 Record Drawing Software

Furnish one set of floppy diskettes containing CAD based drawings in DXF format of as-built drawings and schematics.

1.6 QUALITY ASSURANCE

Equipment and devices shall be compatible and operable with existing station fire alarm system and shall not impair reliability or operational functions of existing supervising station fire alarm system. [Existing supervising station fire alarm system is [____].]

1.6.1 Regulatory Requirements

Devices and equipment for fire alarm service shall be listed by UL Fire Prot Dir or approved by FM APP GUIDE.

1.6.1.1 Requirements for Fire Protection Service

Equipment and material shall have been tested by UL and listed in UL Fire Prot Dir or approved by FM and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, 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 construed as waiving this requirement.

1.6.1.2 Testing Services or Laboratories

Fire alarm and fire detection equipment shall be constructed in accordance with UL Fire Prot Dir, UL Electrical Constructn, or FM APP GUIDE.

1.6.2 Standard Products

Provide materials, equipment, and devices that have been tested by a nationally recognized testing laboratory, such as UL or FM, and listed or approved for fire protection service when so required by NFPA 72 or this specification. Select material from one manufacturer, where possible, and

not a combination of manufacturers, for any particular classification of materials.

1.6.3 Modification of References

- 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" to mean the [[_____] Division] [EFA [_____]], Naval Facilities Engineering Command, Fire Protection Engineer.
- [b. The recommended practices stated in the manufacturer's literature or documentation shall be considered as mandatory requirements.]

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 SPARE PARTS AND TOOLS

1.8.1 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.

1.8.2 Spare Parts

Furnish the following spare parts and accessories:

- a. [4][_____]audiovisual devices of each type installed
- b. [4] [_____] fuses for each fused circuit
- c. [1] [_____] electromagnetic door holders
- d. [1] [_____] manual stations
- e. [9] [_____] spare reams of paper for the system printer, plus sufficient paper for fire alarm acceptance tests
- f. [2] [_____] smoke sensors and base of each type installed
- g. [2] [_____] heat sensors and base of each type installed
- h. [3] [_____] spare printer ribbons
- i. [3] [_____] test magnets/devices for each type of sensors installed
- j. [3] [_____] break rods for manual stations

1.8.3 Parts List

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

1.9 KEYS

Keys and locks for equipment shall be identical. Provide not less than six keys of each type required. Keys shall be CAT [60] [_____].

PART 2 PRODUCTS

2.1 [EXISTING FIRE ALARM EQUIPMENT]

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 station fire alarm system. New equipment shall have tags removed and the existing equipment shall be tagged "NOT IN SERVICE" until removed from the building.

2.1.1 [Equipment Removal]

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

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.

]2.1.2 [Repair Service/Replacement Parts]

Repair services and replacement parts for the system furnished under this contract shall be available for a period of 10 years after the date of final acceptance of this work by the Contracting Officer. On-site service during the guarantee period shall be provided within 24 hours after notification. All repairs shall be completed within 48 hours after notification.

]2.1.3 Other Divisions To Be Coordinated With

Refer to the following sections for related work and coordination:

[Section 21 13 13.00 20 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION]
[Section 21 30 00 FIRE PUMPS] [Section 21 23 00.00 20 WET CHEMICAL FIRE
EXTINGUISHING SYSTEMS FOR KITCHEN CABINET] [Section 21 13 16.00 20 DRY-PIPE
FIRE SPRINKLER SYSTEMS] [Section 21 13 19.00 20 [DELUGE] [PREACTION] FIRE
SPRINKLER SYSTEMS] [Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION,
AND EXHAUST SYSTEMS].

[Section 08 71 00 DOOR HARDWARE for [door release] [door unlocking] and
additional work related to finish hardware.]

[Section[s] [14 21 13 ELECTRIC TRACTION FREIGHT ELEVATORS][14 21 23
ELECTRIC TRACTION PASSENGER ELEVATORS] [14 24 13 HYDRAULIC FREIGHT
ELEVATORS][14 24 23 HYDRAULIC PASSENGER ELEVATORS] for additional work
related to elevators.]

[Section 07 84 00 FIRESTOPPING for additional work related to firestopping.]

2.1.4 Manufacturer Qualifications

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 protected premises fire alarm system, complete, conforming to NFPA 72, except as otherwise or additionally specified herein.

]2.2 INTERIOR FIRE ALARM SYSTEM DESIGN

2.2.1 Definitions

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

- a. Analog/Addressable System: A system in which multiple signals are transmitted via the same conduction path to a remote fire alarm control unit and fire alarm control panel, decoded and separated so that each signal will initiate the specified response.
- b. Hard Wired System: A system in which alarm and supervisory initiating devices are directly connected, through individual dedicated conductors, to a central control panel without the use of analog/addressable circuits or devices.
- c. Interface Device: An addressable device which interconnects hard wired systems or devices to an analog/addressable system.
- d. Fire Alarm Control Unit: A control panel, remote from the fire alarm control panel, that receives inputs from automatic and manual fire alarm devices; may supply power to detection devices and interface devices; may provide transfer of power to the notification appliances; may provide transfer of condition to relays or devices connected to the control unit; and reports to and receives signals from the fire alarm control panel.
- e. Fire Alarm Control Panel (FACP): A master control panel having the features of a fire alarm control unit and to which fire alarm control units are interconnected. The panel has central processing, memory, input and output terminals, [video display units (VDUs),] [and] [printers].
- f. Terminal Cabinet: A steel cabinet with locking, hinge-mounted door in which terminal strips are securely mounted.

2.2.2 System Operation

NOTE: The supply and return portions of the Style 6 loop shall not be located in the same room or shaft to ensure system reliability. They shall be separated by a sufficient distance so that a single fire will not involve both the supply and return portions of the loop.

The system shall be a complete, supervised, noncoded, analog/addressable

fire alarm system conforming to NFPA 72. The system shall have an interconnected riser loop or network having Style [6] [_____] supervision that shall not be located in the same room or shaft. The return portion of the loop shall be remote from the supply portion of the loop. [Where the building has two stairs for egress from floors above grade, a single impairment cannot adversely affect more than one floor. Where three or more stairs are provided for egress from floors above grade, a single impairment cannot adversely affect more than 1/2 of any floor.] [Any single impairment of the system shall not affect the system on more than [one] [one-half] of any floor.] The system shall operate in the alarm mode upon actuation of any alarm initiating device. The system shall remain in the alarm mode until initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal. The system shall provide the following functions and operating features:

- a. The FACP and fire alarm control units, if used, shall provide power, annunciation, supervision, and control for the system.
- b. Provide Style [B] [_____] initiating device circuits [for conductor lengths of 3050 mm 10 feet or less].
- c. Provide Style [4] [_____] signaling line circuits for each floor.
- d. Provide Style [6] [_____] signaling line circuits for the network.
- e. Provide Style [Z] [_____] notification appliance circuits. The visual alarm notification appliances shall have the flash rates synchronized.
- f. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.
- g. Provide an audible and visual trouble signal to activate upon a single break or open condition, or ground fault. The trouble signal shall also operate upon loss of primary power (AC) supply, absence of a battery supply, low battery voltage, or removal of alarm or supervisory panel modules. Provide a trouble alarm silence feature which shall silence the audible trouble signal, without affecting the visual indicator. After the system returns to normal operating conditions, the trouble signal shall again sound until the trouble is acknowledged. A smoke sensor in the process of being verified for the actual presence of smoke shall not initiate a trouble condition.
- h. Provide a notification appliance silencing switch which, when activated, will silence the audible signal appliance, but will not affect the visual alarm indicator, the liquid crystal display, or the automatic notification of the [fire department] [central station service]. This switch shall be overridden upon activation of a subsequent alarm.
- i. Provide alarm verification capability for smoke sensors. Alarm verification shall initially be set for [30] [_____] seconds.
- j. Provide program capability via switches in a locked portion of the FACP to bypass the automatic notification appliance circuits, [fire reporting system] [air handler shutdown] [smoke control operation] [elevator recall] [door release] [door unlocking] features. Operation of this programming shall indicate this action on the FACP display and printer output.

- k. Alarm, supervisory, and/or trouble signals shall be automatically transmitted to the [fire department] [a UL listed central station].
- l. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.
- m. The system shall be capable of being programmed from the panel's keyboard. Programmed information shall be stored in non-volatile memory.
- n. The system shall be capable of operating, supervising, and/or monitoring both addressable and non-addressable alarm and supervisory devices.
- o. There shall be no limit, other than maximum system capacity, as to the number of addressable devices which may be in alarm simultaneously.
- p. Where the fire alarm system is responsible for initiating an action in another emergency control device or system, such as [an HVAC system] [an atrium exhaust system] [a smoke control system] [an elevator system], the addressable fire alarm relay shall be within 915 mm 3 feet of the emergency control device.

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

- q. An alarm signal shall automatically initiate the following functions:
 - (1) Transmission of an alarm signal to [the fire department] [a UL listed central station].
 - (2) Visual indication of the device operated on the fire alarm control panel (FACP), [video display unit (VDU),] [and on the graphic annunciator]. [Indication on the graphic annunciator shall be by floor, zone or circuit, and type of device.]

NOTE: Where a high-rise building in which the fire alarm system is being provided is fully sprinkler protected, the fire alarm notification appliances should operate only on the fire floor, (one/two) floor(s) above, and floor below. Where the building has some fire protection or life safety concerns or the building can be evacuated quickly, the fire alarm system should operate all notification appliances in the building upon a fire alarm. In those buildings designed for total evacuation due to fire protection or life safety concerns, design the system so that it can easily be modified when the fire protection or life safety improvements have been made to the building.

- (3) [Continuous actuation of all alarm notification appliances, except those in stairs or in elevator cabs.] [Continuous

actuation of alarm notification appliances on the floor of fire alarm origin, the floor above the floor of fire alarm origin, and the floor below the floor of fire alarm origin, except those in stairs or in elevator cabs.]

- [(4) Recording of the event via the system printer.]
- [(5) Release of doors held open by electromagnetic devices.]
- [(6) Operation of the [smoke control system] [atrium exhaust system].]
- [(7) Release of power to electric locks on doors which are part of the means of egress.]
- [(8) Operation of a smoke sensor in an elevator lobby or other location associated with the automatic recall of elevators, shall recall the elevators in addition to other requirements of this paragraph.]
- [(9) Operation of a duct smoke sensor shall shut down the appropriate air handler in accordance with NFPA 90A in addition to other requirements of this paragraph.]

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

- [(10) Operation of [_____] shall release the [_____] fire extinguishing system after a [_____] second time delay.]
- [(11) Operation of a sprinkler waterflow switch serving an elevator machinery room shall operate shunt trip circuit breaker(s) to shut down power to the elevators in accordance with ASME A17.1/CSA B44.]
- [(12) Operation of an interface, which operates vibrating pagers worn by hearing-impaired occupants.]

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

- (1) Visual indication of the device operated on the FACP, [VDU,] and on the graphic annunciator, and sound the audible alarm at the respective panel.
- (2) Transmission of a supervisory signal to [the fire department] [a UL listed central station].
- [(3) Recording of the event via the system printer.]

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

- (1) Visual indication of the system trouble on the FACP, [VDU,] and on the graphic annunciator, and sound the audible alarm at the respective panel.
- (2) Transmission of a trouble signal to [the fire department] [a UL

listed central station].

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

- t. The maximum permissible elapsed time between the actuation of an initiating device and its indication at the FACP shall be 15 seconds.
- u. The maximum elapsed time between the occurrence of the trouble condition and its indication at the FACP shall not exceed 200 seconds.

2.2.3 System Monitoring

- a. 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, 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[, unless they are within the same room, then a maximum of [5] [_____] can use the same address].
- [b. 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.]

2.2.4 Overvoltage and Surge Protection

- a. 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, which serve as communications links, shall have surge protection circuits installed at each end that meet the following waveform[s]:
 - (1) A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
 - [(2) 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 915 mm 3 feet of the building cable entrance. Fuses shall not be used for surge protection.]
- [b. Sensor 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 waveform[s]:
 - (1) A 10 by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
 - [(2) 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.]]

2.2.5 Addressable Interface Devices

The addressable interface (AI) device shall provide an addressable input interface to the FACP for monitoring normally open or normally closed contact devices such as waterflow switches, valve supervisory switches, fire pump monitoring, independent smoke detection systems, relays for output function actuation, etc.

2.2.6 [Smoke Sensors

**NOTE: Provide smoke sensors only in spaces where
they are specifically required by MIL-HDBK-1008.**

2.2.6.1 Photoelectric Smoke Sensors

Provide addressable photoelectric smoke sensors as follows:

- a. Provide analog/addressable photoelectric smoke sensors utilizing the photoelectric light scattering principle for operation in accordance with UL 268. Smoke sensors shall be listed for use with the fire alarm control panel.
- b. Provide self-restoring type sensors which do not require any readjustment after actuation at the FACP to restore them to normal operation. Sensors shall be UL listed as smoke-automatic fire sensors.
- c. Components shall be rust and corrosion resistant. Vibration shall have no effect on the sensor's operation. Protect the detection chamber with a fine mesh metallic screen which 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 for the sensors. The sensors 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 sensor shall have a visual indicator to show actuation.
- e. The sensor address shall identify the particular unit, its location within the system, and its sensitivity setting. Sensors 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) Sensor range (normal, dirty, etc.)

2.2.6.2 [Ionization Type Smoke Sensors

Provide addressable ionization type smoke sensors as follows:

- a. Provide analog smoke sensors which operate on the ionization principle

and are actuated by the presence of visible or invisible products of combustion. Smoke sensors shall be listed for use with the fire alarm control panel.

- b. Provide self-restoring type sensors which do not require any readjustment after actuation at the FACP to restore them to normal operation. Sensors shall be UL listed as smoke-automatic fire sensors.
- c. Components shall be rust and corrosion resistant. Vibration shall have no effect on the sensor's operation. Protect the detection chamber with a fine mesh metallic screen which 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 for the sensors. The sensors 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 sensor shall have a visual indicator to show actuation.
- [e. The sensor address shall identify the particular unit, its location within the system, and its sensitivity setting. Sensors 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) Sensor range (normal, dirty, etc.)

]2.2.6.3 Duct Smoke Sensors

Duct smoke sensors shall be analog/addressable photoelectric type as described in paragraph entitled "Photoelectric Smoke Sensors," and shall be provided in ductwork in accordance with NFPA 90A and in accordance with manufacturer's recommendations.

]2.2.6.4 Smoke Sensor Testing

Smoke sensors shall be tested in accordance with manufacturer's recommended calibrated test method. Submit smoke sensor testing procedures for approval.

2.2.7 Thermal Sensors

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

- a. Thermal sensors shall be combination rate-of-rise/fixed temperature sensing. The alarm condition shall be determined by comparing sensor valve with the stored values.
- b. A moving average of the sensor's heat sensing value to automatically compensate for conditions that could affect detection operations. System shall automatically maintain a constant heat sensing sensitivity from each sensor by compensating for environmental factors.
- c. Automatic self-test routines shall be performed on each sensor which will functionally check sensor sensitivity electronics and ensure the accuracy of the value being transmitted. Any sensor that fails this test shall indicate a trouble condition with the sensor location at the control panel.
- d. An operator at the control panel, having the proper access level, shall have the capability to manually access the following information for each heat sensor:
 - (1) Primary status
 - (2) Device type
 - (3) Present average value
 - (4) Sensor range ([____])
- e. An operator at the control panel, having the proper access level, shall have the capability to manually control the following information for each heat sensor:
 - (1) Alarm detection sensitivity values
 - (2) Enable or disable the point/device
 - (3) Control sensor's relay driver output

2.2.8 Electric Power

2.2.8.1 Primary Power

Provide primary power for the FACP from the normal AC service to the building [where shown on the drawings] [or] [____]. Power shall be 120 VAC service, transformed through a two-winding, isolation type transformer and rectified to low voltage DC for operation of circuits and devices. Make the service connection for the FACP at the [main service switchgear] [emergency distribution panel where shown] [a main distribution panel where shown]. Provide appropriate equipment to protect against power surges. Provide a separate NEMA 1 "general purpose enclosure" for the circuit breaker. The circuit breaker enclosure shall be painted red, marked "FIRE ALARM SYSTEM," provided with a red and white engraved plastic sign permanently affixed to the face of the switch, and provided with a lockable handle or cover.

2.2.8.2 [Generator]

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

the fire alarm system.

2.2.9 Emergency Power Supply

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

2.2.9.1 Batteries

Provide sealed, maintenance-free, [lead-calcium] [sealed lead acid] [gel cell] [nickel-cadmium] [lithium] batteries as the source for emergency power to the FACP. 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.

2.2.9.2 Capacity

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

Provide the batteries with sufficient capacity to operate the system under supervisory and trouble conditions, including audible trouble signal devices for [48] [_____] hours and audible and visual signal devices under alarm conditions for an additional [10] [_____] minutes.

2.2.9.3 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, 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.

2.2.10 System Field Wiring

2.2.10.1 Wiring Within Cabinets, Enclosures, Boxes, Junction Boxes, and Fittings

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 which 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, which are securely mounted. The use of wire nuts or similar devices shall be prohibited.

2.2.10.2 Terminal Cabinets

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

Provide a terminal cabinet at the base of any circuit riser, on each floor at each riser, and where indicated on the drawings. Terminal size 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 200 mm by 200 mm 8 inches high by 8 inches.

2.2.10.3 Alarm Wiring

Signaling line circuits and initiating device circuit field wiring shall be copper, No. [16] [18] [_____] AWG size conductors at a minimum. Notification appliance circuit conductors, that contain audible alarm devices, [other than speakers,] shall be solid copper No. 14 AWG size conductors at a minimum. [Speaker circuits shall be copper No. [16] [_____] AWG size conductors at a minimum.] [Firefighter telephone circuits shall be No. [16] [18] [_____] AWG size conductors as a minimum.] Wire size shall be sufficient to prevent voltage drop problems. 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 No. 12 AWG solid copper having similar insulation. Provide all wiring in rigid metal conduit or intermediate metal conduit. Electrical metallic tubing conduit is acceptable in dry locations not enclosed in concrete or where not subject to mechanical damage. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. The use of flexible conduit not exceeding a 1830 mm [6] [_____] foot length shall be permitted in initiating device circuits. Run conduit or tubing concealed unless specifically shown otherwise on the drawings. Shielded wiring shall be utilized where recommended by the manufacturer. For shielded wiring, the shield shall be grounded at only one point, which shall be in or adjacent to the FACP. T-taps are permitted in Style 4 circuits with interconnections occurring on terminal strips. Color coding is required for circuits and shall be maintained throughout the circuit.

2.2.10.4 Conductor Terminations

Labeling of conductors at terminal blocks in terminal cabinets, FACP, and remote fire alarm control units shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet, FACP, and fire alarm control unit shall contain a laminated drawing which 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.

2.2.10.5 Wiring to Station Telegraphic Fire Alarm Circuit

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

2.2.11 Fire Alarm Control Panel (FACP)

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

Provide a complete control panel fully enclosed in a lockable steel enclosure as specified herein. Operations required for testing or for normal care and maintenance of the systems shall be performed from the front of the enclosure. If more than a single unit is required at a location to form a complete control panel, the unit enclosures shall match exactly. [If more than a single unit is required, and is located in the lobby/entrance, notify the [[_____] Division] [EFA [_____] Fire Protection Engineer, via the Contracting Officer, prior to installing the equipment.] 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. Visual indication of alarm, supervisory, or trouble initiation on the fire alarm control panel shall be by liquid crystal display or similar means with a minimum of 80 characters of which at least 32 are field changeable.

2.2.11.1 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 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.

2.2.11.2 Control Modules

Provide power and control modules to perform all functions of the FACP. Provide audible signals to indicate any alarm, supervisory, or trouble condition. 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 FACP. 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.

2.2.11.3 Silencing Switches

- a. Alarm Silencing Switch: Provide an alarm silencing switch at the FACP which 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 which shall silence the audible trouble and supervisory signal, but not extinguish the visual indicator. This switch shall be overridden upon activation of a subsequent alarm, supervision, or trouble condition.

2.2.11.4 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 resettable by switch from the FACP after the initiating device or devices have been restored to normal.

2.2.11.5 [Fire Alarm Voice Message

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

A fire alarm shall activate notification appliance circuits. Textual audible appliances shall produce a slow whoop tone for three cycles followed by a voice message which is repeated until the control panel is reset or silenced. Automatic messages shall be broadcast through speakers on appropriate floors, but not in stairs or elevator cabs. The visual strobes and audible message shall automatically be broadcast on the floor of fire alarm origin, [the floor] [two floors] immediately above the floor of fire alarm origin, and the floor immediately below the floor of fire alarm origin. A live voice message shall override the automatic audible output through use of a microphone input at the control panel. When using the microphone, live messages shall be broadcast through speakers in stairs, in elevator cabs, and throughout a selected floor or floors. The system shall be capable of operating all speakers at the same time. 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 which could render the digitalized voice module inoperative shall automatically cause the slow whoop tone to take over all functions assigned to the failed unit. Messages shall utilize a [male] [female] voice and shall be as follows:

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

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

[_____]

2.2.11.6 [Fire Alarm Signal

A fire alarm shall activate notification appliances throughout the

building. Audible devices shall be fire alarm horns which produce a [three-pulse temporal pattern] [continuous slow whoop tone] [_____]. Visual devices shall be strobes operating in accordance with NFPA 72.

]2.2.11.7 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.

2.2.11.8 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.

2.2.11.9 Input/Output Modifications

The FACP shall contain features which allow the bypassing of input devices from the system or the modification of system outputs. These control features shall consist of a panel mounted keypad [and a keyboard]. Any bypass or modification to the system shall indicate a trouble condition on the FACP[, VDU] [and a printed output of the trouble condition].

2.2.11.10 Resetting

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

2.2.11.11 Instructions

Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. [Install the instructions on the interior of the FACP.] [Install the frame in a conspicuous location observable from the FACP.] 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.

2.2.11.12 Walk Test

The FACP 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.

2.2.11.13 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.

2.2.11.14 RS-232-C Output

Each local control panel shall be capable of operating remote service type cathode ray tubes (CRTs), 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.

2.2.12 Remote Fire Alarm Control Units

Provide complete remote control units fully enclosed in a lockable steel enclosure as specified herein. Operations required for testing or for normal care and maintenance of the control units shall be performed from the front of the enclosure. If more than a single unit is required at a location to form a complete control panel, the unit enclosures shall match exactly. Each control unit shall provide power, supervision, control, and logic for its portion of 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 unit with supervisory functions for power failure, internal component placement, and operation.

2.2.12.1 Cabinet

Install remote control unit components in cabinets large enough to accommodate components and also to allow ample gutter space for interconnection of units as well as field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall be labeled "Remote Fire Alarm Control Unit" 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.

2.2.12.2 Control Modules

Provide power and control modules to perform all functions of the remote control unit. Provide audible signals to indicate any alarm or trouble condition. 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 remote control unit. 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. Circuits shall be arranged so that there is 25 percent spare capacity for any circuit.

2.2.12.3 Silencing Switches

Provide an alarm silencing switch at the remote control unit which will silence the audible signal but not affect the visual alarm indicator. This switch shall be overridden upon activation of a subsequent alarm. Provide trouble and supervisory silencing switch which will silence the audible trouble and supervisory signal, but not extinguish the visual indicator. This switch shall be overridden upon activation of a subsequent trouble or supervisory signal.

2.2.12.4 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 resettable by switch from the remote control unit after the initiating device or devices have been restored to normal.

2.2.12.5 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.

2.2.12.6 Field Programmability

Provide control units that are fully field programmable for control, initiating, 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.

2.2.12.7 Input/Output Modifications

Each remote control unit shall contain features which allow the elimination of input devices from the system or the modification of system outputs. Any such modifications shall indicate a trouble condition on the remote control unit, the FACP, and a printed output of the trouble condition.

2.2.12.8 Resetting

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

2.2.12.9 Instructions

Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the remote fire alarm control unit. [Install the frame in a conspicuous location observable from the remote fire alarm control unit.] 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.

2.2.12.10 Walk Test

Each remote control unit 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.

2.2.12.11 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.

2.2.13 [Amplifiers, Preamplifiers, Tone Generators]

Any amplifiers, preamplifiers, tone generators, digitalized voice generators, and other hardware necessary for a complete, operational, textual audible circuit conforming to NFPA 72 shall be housed in a fire alarm control unit, terminal cabinet, or in the fire alarm control panel. The system shall automatically operate and control all building fire alarm speakers except those installed in the stairs and within elevator cabs. The speakers in the stairs and elevator cabs shall operate only when the microphone is used to deliver live messages. Each amplifier shall have two channels; one to broadcast a message and the other for paging.

2.2.13.1 [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 up to 10 times the highest rated voltage in the system.

]2.2.13.2 [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.

]2.2.13.3 [Tone Generator]

The tone generator shall be of the modular, plug-in type with securely attached labels to identify the component as a tone generator and to identify the specific tone it produces. The tone generator shall produce a slow whoop tone, which shall slowly ascend from low (500 hertz) to high (1200 hertz), and shall be constantly repeated until interrupted by either the digitalized voice message, the microphone input, or the alarm silence mode as specified. Each slow whoop cycle shall last approximately 4 seconds. The tone generator shall be single channel with an automatic backup generator per channel such that failure of the primary tone generator causes the backup generator to automatically take over the functions of the failed unit and also causes transfer of the common trouble relay.

]2.2.13.4 [Protection Circuits]

Each amplifier shall be constantly supervised for any condition which could render the amplifier inoperable at its maximum output. Failure of any component shall cause automatic transfer to a designated backup amplifier, illumination of a visual "amplifier trouble" indicator on the control panel, appropriate logging of the condition on the system printer, and other actions for trouble conditions as specified.

]2.2.14 [Video Display Unit (VDU)]

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

- a. The VDU shall be the secondary operator-to-system interface for data retrieval, alarm annunciation, commands, and programming functions. The desk mounted VDU shall consist of a CRT monitor and a keyboard. The VDU shall have a [300] [430] [_____] mm [12] [17] [_____] inch minimum [touch] screen, capable of displaying 25 lines of 80 characters each. Communications with the FACP shall be supervised. Faults shall be recorded on the printer. Power required shall be 120 VAC, 60 Hz from the same source as the fire alarm control panel.
- b. To eliminate confusion during an alarm situation, the screen shall have dedicated areas for the following functions:
 - (1) Alarm and returns to normal
 - (2) Commands, reports, and programming
 - (3) Time, day, and date
- c. Full English language shall be used throughout to describe system activity and instructions. Full English language descriptors defining system points shall be 100 percent field programmable by factory trained personnel, alterable and user definable to accurately describe building areas.
- d. Alarms and other changes of status shall be displayed in the screen area reserved for this information. The following information shall be provided in English:
 - (1) Condition of device (alarm, trouble, or supervisory).
 - (2) Type of device (manual pull, waterflow, etc.)
 - (3) Location of device plus numerical system address.

Upon receipt of alarm, an audible alarm shall sound and the condition and point type shall flash until acknowledged by the operator. Returns to normal shall also be annunciated and shall require operator acknowledgment.

- e. The system shall have multiple levels of priority for displaying alarms to conform with UL 864. Priority levels shall be as follows:
 - (1) Level 1 - Fire Alarms
 - (2) Level 2 - Supervisory Alarms
 - (3) Level 3 - Trouble Signals
- f. The system shall be provided with memory so that no alarm shall be lost. A highlighted message shall advise the operator when unacknowledged alarms are in the system.
- g. Multiple levels of access shall be provided for operators and supervisors via user-defined passwords. The following functions shall be provided for each level:
 - (1) Operator level access functions
 - (a) Display system directory, definable by device.

- (b) Display status of an individual device.
 - (c) Manual command (alarm device with an associated command shall use the same system address for both functions).
 - (d) Report generation, definable by device, output on either the VDU or printer, as desired by the operator.
 - (e) Activate building notification appliances.
- (2) Supervisory level access functions
- (a) Reset time and date.
 - (b) Enable or disable event initiated programs, printouts, and initiators.
 - (c) Enable or disable individual devices and system components.
- h. The above supervisory level functions shall not require computer programming skills. Changes to system programs shall be recorded on the printer and maintained in the control panel as a trouble condition.

12.2.15 [Graphic Annunciator

NOTE: Provide the graphic annunciator at a location convenient for fire department. It should be near the door through which they will enter the building as indicated in their pre-fire plan.

2.2.15.1 [Annunciator Panel

Provide a graphic annunciator which indicates the building floor plan, including the locations of stairs and elevators. Stairs and elevators shall be identified by [letter] [number]. Alarm circuit boundaries shall be clearly marked on the floor plan. Annunciator shall include a north arrow, [location of the fire alarm control panel,] and a "you are here" indicator. The graphic annunciator shall be [a minimum size of 915 by 915 mm 3 by 3 feet] [as indicated on the contract drawings].

12.2.15.2 [Indicating Lights

Provide the graphic annunciator with individual light emitting diode (LED) indicating lights for each type of alarm and supervisory device. Provide an amber LED for indicating a system trouble condition and a separate amber LED for indicating a supervisory condition. Provide a green LED to indicate presence of power and a red LED to indicate an alarm condition. The actuation of any alarm signal shall cause the illumination of a boundary LED, a floor LED, and a device LED. System supervisory or trouble shall cause the illumination of a trouble LED. In addition to all of these LED indicators, provide normal power and emergency power indicating LEDs. Provide a push button LED test switch. The test switch shall not require key operation. Annunciator LEDs shall only be extinguished by operation of the system reset switch on the FACP.

]2.2.15.3 [Material

Construct the graphic annunciator face plate of [smoked Plexiglas] [bronze]. The LEDs shall be backlit. Control equipment and wiring shall be housed in a [recessed] [semi-recessed] [surface mounted] back box. The exposed portions of the back box shall be [chrome plated] [bronze plated] with knockouts.

]2.2.15.4 [Programming

Where programming for the operation of the proper LEDs is accomplished by a separate software program than the software for the FACP, the software program shall not require reprogramming after loss of power. The software shall be reprogrammable in the field.

]2.2.16 [System Printers

- a. Provide a system printer to record alarm, supervisory, and trouble conditions without loss of any signal or signals. Printout shall be by circuit, device, and function as provided in the FACP. Printer shall operate on a 120 VAC, 60 Hz power supply.

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

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

]2.2.17 [Firefighter Telephone Communication System

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

- a. Provide a firefighter telephone system as follows:
 - (1) Provide a firefighter telephone communication system with complete, common talk, closed circuits. The system shall include, but not be limited to, a master control station mounted in the fire alarm control panel, a power supply and standby battery

system, and remote telephone stations.

- (2) Provide a master control station which shall provide power, supervision, and control for wiring, components, and circuits. The act of lifting any remote telephone hand set from its cradle shall cause both a visual and audible signal to annunciate at the master control station. Removing the hand set at the master control station and depressing a button at the remote telephone hand set shall cause the automatic silencing of the audible signal. Communication between the master control station hand set and any/or all remote hand sets shall require the depressing of a push-to-talk switch located on any/all remote hand sets. During the time that the master control hand set is removed from its cradle it shall be possible to communicate between five remote hand sets and the master control station. Hand sets shall be able to monitor any conversation in progress and join the conversation by pressing the push-to-talk button. It shall not be possible to communicate between two or more remote hand sets with the master control station hand set in its cradle. The master control station hand set shall be red in color and equipped with a 5-foot long strain-relieved coiled cord. Wiring connections shall be made to terminal strips. The master control station shall monitor wire and connections for any opens, shorts, or grounds which would render the system inoperable or unintelligible. The master control station shall be equipped with a silencing switch and ring-back feature such that any audible trouble signal can be silenced and shall be so indicated by the lighting of an amber LED. Once any trouble condition has been corrected, the amber LED shall be extinguished and the silencing switch shall sound again until the switch is restored to its original position. The master control station shall be equipped with a separate, LED annunciated switch for each telephone circuit. In addition, LEDs shall provide for the annunciation of operating and supervisory power. The loss of operating or supervisory power shall cause an audible and visual indication at the master control station and shall also cause the fire alarm trouble signal to sound on the FACP. Switches, LEDs, and controls shall be fully labeled.
- (3) Provide [surface] [flush] mounted remote telephone stations. Each station shall be equipped with a hinged door that is magnetically locked. Each hand set shall be permanently wired in place with a coiled cord. Each hand set shall be red high-impact cyclac and shall be equipped with a push-to-talk switch which, when operated, shall signal the master control station and a switch-equipped, storage cradle.
- (4) Provide operating and supervising power from the same supply circuit(s) utilized for the fire alarm control panel.

]2.2.18 Manual Stations

Provide metal or plastic, semi-flush mounted, double action, addressable manual stations, which are not subject to operation by jarring or vibration. Stations shall be equipped with screw terminals for each conductor. Stations which 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.

2.2.19 Notification Appliances

2.2.19.1 [Fire Alarm Speakers

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

- a. Provide fire alarm speakers conforming to UL 464 having a minimum of three tap settings and separate terminations for each in and out connection. Tap settings shall include taps of 1/4, 1/2 and 1 watt. Speakers shall utilize the 1/2 watt tap in the system. Speakers shall have an output rating of 84 dBA at 3050 mm 10 feet as determined by the reverberant room test; data on peak output as determined in an anechoic chamber is not suitable. Speakers shall be capable of installation on standard 100 mm 4 inch square electrical boxes. Where speakers and strobes are provided in the same location, they may be combined into a single wall mounted unit.
- b. Provide speaker mounting plates constructed of cold rolled steel having a minimum thickness of 16 gage 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.

]2.2.19.2 Visual Alarm Signals

NOTE: Locate strobes wall mounted in corridors no more than 4570 mm 15 feet from the end of a corridor with 30.48 m 100 feet maximum distance between strobes. Where there is an obstruction to the viewing path in the corridors, such as a cross-corridor door or ceiling elevation change, consider the obstruction as defining a new corridor. Provide wall mounted strobes in rooms accessible to the public, such as conference rooms, restrooms, courtrooms, cafeterias, and auditoriums in accordance with NFPA 72.

Provide strobe light visual alarm signals which operate on a supervised 24 volt DC circuit. The strobe lens shall comply with UL 1971 and conform to the Americans With Disabilities Act. 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. The strobe flash output shall be a minimum of [15] [_____] candela based on the UL 1971 test. The strobe shall have a xenon flash tube. Visible appliances may be part of an audio-visual assembly. [Where more than two appliances are located in the same room or corridor, provide synchronized operation.]

2.2.19.3 [Fire Alarm Horns

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

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

]2.2.19.4 [Fire Alarm Bells

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

Provide [surface] [flush] mounted bells suitable for use in an electrically supervised circuit. Bells shall be 255 mm 10 inch vibrating type with a sound output rating of at least 90 dBA at 3050 mm 10 feet when tested in accordance with UL 464.

]2.2.19.5 Connections

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

2.2.20 [Valve Monitor Switches (Tamper Switches)

Provide a tamper switch for each fire protection system control valve. Tamper switches shall be UL listed as "Extinguishing System Attachment" 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 FACP 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.

]2.2.21 [Waterflow Detectors

- a. [Provide vane type waterflow detectors 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 [30] [45] [_____] seconds. The device shall be a UL listed extinguishing system attachment rated for the particular pressure and location at which it

is installed. Flow switches shall be equipped with screw terminals for each conductor.]

- b. Provide pressure type waterflow detectors for dry pipe sprinkler systems. The device shall contain double pole, double throw contacts. The device shall be a UL listed extinguishing system attachment rated for the particular pressure and location at which it is installed. Switch shall be equipped with screw terminals for each conductor.

]2.2.22 [Electromagnetic Door Holders

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

Where indicated on the drawings, provide magnetic fire door hold open devices. The electromagnetic holding devices shall be designed to operate on 120 VAC, and require not more than 3 watts of power to develop 172.4 kPa 25 psi of holding force. The initiation of any fire alarm shall cause the release of the electromagnetic door holding device permitting the door to be closed by the door closer. The device shall be UL listed based on UL 228 tests.

]2.2.23 Automatic Transmitters

2.2.23.1 [Telegraphic Transmitter

Provide transmitter of the electric motor-driven or pre-wound spring mechanism type which shall transmit not less than four rounds of code. When motor-driven transmitters are provided, the motor shall be connected to a supervised circuit in a control panel. Provide metallic or rigid plastic code number plates on the exterior face of transmitters. Transmitters shall be designed to provide the same features as the fire alarm boxes for electrically supervised, coded positive noninterfering type and shall have the ability to transmit signals on grounded or open circuits. Activation of box when a single open fault is present on exterior fire alarm circuit shall have box to idle for one complete round only, then immediately transmit four complete code rounds via the box earth ground connection. Transmitter shall have a local energy type auxiliary tripping device. Code wheel shall be metallic and box code shall be as directed by the Contracting Officer.

]2.2.23.2 [Radio Transmitter and Interface Panels

Provide radio transmitter with antenna that is compatible with the existing supervising station fire alarm system. Transmitter shall have a means to transmit alarm, supervisory, and trouble conditions via a single transmitter. Provide transmitters in accordance with applicable portions of [NFPA 72,] Federal Communications Commission (FCC) 47 CFR 90. Protect the antenna from physical damage. Transmitter shall have a source of power for operation which conforms to NFPA 72. Transmitter shall be capable of initiating a test signal daily at any selected time.

]2.2.23.3 [Digital Alarm Communicator Transmitter (DACT)

Provide DACT that is compatible with the existing supervising station fire alarm system. Transmitter shall have a means to transmit alarm,

supervisory, and trouble conditions via a single transmitter. Transmitter shall have a source of power for operation which conforms to NFPA 72. Transmitter shall be capable of initiating a test signal daily at any selected time. Transmitter shall be arranged to seize telephone circuits in accordance with NFPA 72.

]2.2.23.4 [Signals To Be Transmitted to the Base Receiving Station

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

- [a. Sprinkler water flow]
- [b. Manual pull stations]
- [c. Smoke detectors]
- [d. Duct smoke detectors]
- [e. Sleeping room smoke detectors]
- [f. Heat detectors]
- [g. Sprinkler valve supervision]
- [h. Fire pump running]
- [i. Fire pump loss of power/phase reversal]
- [j. [_____]]

]2.3 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. FACPs
- b. Automatic transmitter
- c. Printer

Furnish 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.

2.4 WIRING

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

PART 3 EXECUTION

3.1 INSTALLATION OF FIRE ALARM INITIATING AND INDICATING DEVICES

- a. FACP: Locate the FACP [where indicated on the drawings] [____]. [Recess] [Semi-recess] [Surface mount] the enclosure with the top of the cabinet 1830 mm 6 feet above the finished floor or center the cabinet at [1525] [____] mm [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 in the FACP.
- b. Manual Stations: Locate manual stations [as required by NFPA 101 and NFPA 72] [where shown on the drawings] [____]. Mount stations so that their operating handles are 1220 mm 4 feet above the finished floor. Mount stations so they are located no farther than [1525] [____] mm [5] [____] feet from the exit door they serve, measured horizontally.
- c. Notification Appliance Devices: Locate notification appliance devices [as required by NFPA 72] [where shown on the drawings]. Mount assemblies on walls 2030 mm 80 inches above the finished floor or 150 mm 6 inches below the ceiling whichever is lower. [Ceiling mounted speakers shall conform to NFPA 72].
- [d. Smoke and Heat Sensors: Locate sensors [as required by NFPA 72 and their listings] [as shown on the drawings] on a 4 inch mounting box. Sensors located on the ceiling shall be installed not less than 100 mm 4 inches from a side wall to the near edge. Those located on the wall shall have the top of the sensor at least 100 mm 4 inches below the ceiling, but not more than 300 mm 12 inches below the ceiling. In raised floor spaces, the smoke sensors shall be installed to protect 20.9 square meters 225 square feet per sensor. Install smoke sensors no closer than 1525 mm 5 feet from air handling supply outlets.]
- [e. Graphic Annunciator: Locate the graphic annunciator as shown on the drawings. Surface mount the panel, with the top of the panel 1830 mm 6 feet above the finished floor or center the panel at [1525] [____] mm [5] [____] feet, whichever is lower.]
- [f. Water Flow Detectors and Tamper Switches: Locate water flow detectors and tamper switches [where shown on the drawings] [at each supervised] sprinkler valve station.]
- [g. Firefighter Telephones: Locate wall mounted in each stair at each floor landing, in each elevator lobby, and in each elevator cab 1220 mm 4 feet above the finished floor.]
- [h. The modification of any fire alarm system and the procedures shall comply with the requirements of NFPA 241.]

3.2 [DISCONNECTION AND REMOVAL OF EXISTING SYSTEM

Fire alarm control panels and fire alarm devices disconnected and removed shall be turned over to the Contracting Officer.

- a. The existing fire alarm and smoke detection system shall remain in operation at all times during the installation and commissioning of the new system. Once this new system is on-line and accepted by the Government, remove the old system. As new equipment is installed,

label it "NOT IN SERVICE." Upon acceptance, remove labels.

- b. Disconnect and remove the existing fire alarm and smoke detection systems where indicated and elsewhere in the specification.
- c. Properly dispose of fire alarm outlet and junction boxes, wiring, conduit, supports, and other such items.

]3.3 [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 smoke door (hold-open) devices.]
- [b. Connection of new elevator recall smoke sensors to existing wiring and conduit.]
- [c. Connection of new system transmitter to existing base fire reporting system.]

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

]3.4 FIRESTOPPING

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

3.5 PAINTING

Paint exposed electrical, fire alarm conduit, and surface metal raceway to match adjacent finishes in exposed areas. Paint [junction boxes] [conduit] [and] [surface metal raceways] red in unfinished areas. Painting shall comply with Section 09 90 00 PAINTS AND COATINGS.

3.6 FIELD QUALITY CONTROL

3.6.1 Tests

- 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. Preliminary Testing: Conduct preliminary tests to ensure that 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 that the installation is complete and fully operable. The letter shall state that 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.
- d. Request for Formal Inspection and Tests: When tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the Contracting Officer.
- e. 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. 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 job site:
 - (1) The systems manufacturer's technical representative
 - (2) Marked-up red line 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 [[_____] Division] [EFA [_____]], Naval Facilities Engineering Command, 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.

3.6.2 Minimum System Tests

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

- a. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.
- b. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.
- c. Test each initiating and indicating device and circuit for proper operation and response at the control unit. Smoke sensors shall be tested in accordance with manufacturer's recommended calibrated test

method. Testing of duct smoke detectors shall comply with the requirements of NFPA 72.

- d. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M manual.
- e. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.
- f. Determine that the system is operable under trouble conditions as specified.
- g. Visually inspect wiring.
- h. Test the battery charger and batteries.
- i. Verify that software control and data files have been entered or programmed into the FACP. Hard copy records of the software shall be provided to the Contracting Officer.
- j. Verify that red-line drawings are accurate.
- k. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.
- l. Measure voltage readings for circuits to ensure that voltage drop is not excessive.
- m. Disconnect the verification feature for smoke sensors during tests to minimize the amount of smoke needed to activate the sensor. Testing of smoke sensors shall be conducted using real smoke. The use of canned smoke is prohibited.
- n. Measure the voltage drop at the most remote appliance on each notification appliance circuit.

3.7 INSTRUCTION OF GOVERNMENT EMPLOYEES

Equipment manufacturer shall provide 3 days on site [and 5 days of technical training to the Government at the manufacturing facility.] Training shall allow for classroom instruction as well as individual hands on programming, troubleshooting and diagnostics exercises. [Room and board costs shall be included for two Government personnel.] [Factory] training shall occur within [6] [12] [_____] months of system acceptance.

3.7.1 Instructor

Include in the project the services of an instructor, who shall have 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.

3.7.2 Qualifications

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.

3.7.3 Required Instruction Time

Provide 16 hours of 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.

-- End of Section --