
USACE / NAVFAC / AFCEC / NASA UFGS-28 31 00.00 10 (November 2008)

Preparing Activity: USACE Superseding
UFGS-28 31 00.00 10 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2017

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DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

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FIRE DETECTION AND ALARM SYSTEM, DIRECT CURRENT LOOP

11/08

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SECTION 28 31 00.00 10

FIRE DETECTION AND ALARM SYSTEM, DIRECT CURRENT LOOP 11/08

NOTE: This guide specification covers the requirements for fire detection and alarm systems, direct current loop.

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

NOTE: A smoke detector should be shown on the drawings per NFPA 72, paragraph 1-5.6. The following information should be on the project drawings:

1. On electrical floor plans, show location of control panel, batteries and charger, transmitter, annunciator, primary power supply, remote trouble device, remote annunciator, detectors, notification appliances, and each alarm initiating device including fire extinguishing system switches.
2. Show single-line fire alarm riser diagram, device and zone schedules. Each device on the riser should be identified by type and location, with

device number. Indicate connection of equipment by
circuit runs, or conduit runs.

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.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

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

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 1221 (2016) Standard for the Installation,
Maintenance and Use of Emergency Services
Communications Systems

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2)
National Electrical Code

NFPA 72 (2016) National Fire Alarm and Signaling Code

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

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

47 CFR 15 Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 1242 (2006; Reprint Mar 2014) Standard for Electrical Intermediate Metal Conduit -- Steel

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

UL 38 (2008; Reprint Nov 2013) Manual Signaling Boxes for Fire Alarm Systems

UL 464 (2016) Standard for Audible Signal Appliances

UL 521 (1999; Reprint Oct 2016) UL Standard for Safety Heat Detectors for Fire Protective Signaling Systems

UL 6 (2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel

UL 797 (2007; Reprint Mar 2017) UL Standard for Safety Electrical Metallic Tubing -- Steel

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

1.2 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.

Use the "S" classification only in SD-11 Closeout Submittals. 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.

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.] [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:

SD-02 Shop Drawings

Detail Drawings

SD-03 Product Data

Storage Batteries

Low Battery Voltage

Spare Parts

Technical Data and Computer Software; G[, [_____]]

Training

Testing

SD-06 Test Reports

Testing

SD-07 Certificates

Equipment
Qualifications

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions; G[, [____]]
Technical Data and Computer Software; G[, [____]]

1.3 OPERATING AND MAINTENANCE INSTRUCTIONS

- a. The instructions shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. Include complete procedures for system revision and expansion, detailing both equipment and software requirements. Provide original and backup copies of all software delivered for this project, on each type of media utilized. Obtain approval of instructions prior to training.
- b. Submit [six] [____] copies of operating instructions outlining step-by-step procedures required for system startup, operation, and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features. Submit [six] [____] copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide.

1.4 SPECIAL TOOLS AND SPARE PARTS

NOTE: Remove last sentence when not required.

Submit spare parts data for each different item of material and equipment specified, not later than [3] [____] months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after [one] [____] year of service.

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

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

NOTE: Since some states require that persons performing the installation of Fire Alarm Systems be NICET certified, the number of certified NICET Fire Alarm technicians will vary from state to state. The actual number of NICET certified technicians should be checked with the state fire marshal. If

the availability of NICET technicians is a problem,
delete all references to NICET.

NICET level 4 Fire Alarm Technicians should be
required for hospitals and large complex systems.

Submit proof of qualifications for required personnel. The installer shall submit proof of experience for the Professional Engineer, fire alarm technician, and the installing company.

1.5.2 Engineer and Technician

- a. Registered Professional Engineer with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.
- b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems program with verification of experience and current NICET certificate.
- c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

1.5.3 Installer

The installing Contractor shall provide the following: [NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level [3] [4] Fire Alarm Technician shall supervise the installation of the fire alarm system. NICET Level 2 or higher Fire Alarm Technician shall install and terminate fire alarm devices, cabinets and panels. An electrician or NICET Level 1 Fire Alarm Technician shall install conduit for the fire alarm system.] [Fire Alarm Technicians to perform the installation of the system. A Fire Alarm Technician with a minimum of 4 years of experience shall perform/supervise the installation of the fire alarm system. Fire Alarm technicians with a minimum of 2 years of experience shall be utilized to assist in the installation and terminate fire alarm devices, cabinets and panels. An electrician shall be allowed to install wire or cable and to install conduit for the fire alarm system.] The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.5.4 Fire Protection Engineer

Installations needing designs or modifications of fire detection, fire alarm, or fire suppression systems will require the services and review of a qualified fire protection engineer. For the purposes of meeting this requirement, a qualified fire protection engineer is defined as an individual meeting one of the following conditions:

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

- b. A registered professional engineer (P.E.) in fire protection engineering.
- c. A registered PE in a related engineering discipline and member grade status in the National Society of Fire Protection Engineers.
- d. An engineer with a minimum of 10 years' experience in fire protection engineering and member grade status in the National Society of Fire Protection Engineers.

1.5.5 Detail Drawings

Submit detail drawings prepared and signed by a Registered Professional Engineer or a NICET Level [3] [4] Fire Alarm Technician, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical detectors. Check the layout based on the actual detectors to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detailed point-to-point wiring diagram shall be prepared and signed by a Registered Professional Engineer or a NICET Level [3] [4] Fire Alarm Technician showing points of connection. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and equipment that is activated or controlled by the panel.

1.6 TECHNICAL DATA AND COMPUTER SOFTWARE

NOTE: The acquisition of all technical data, data bases and computer software items that are identified herein will be accomplished strictly in accordance with the Federal Acquisition Regulation (FAR) and the Department of Defense Acquisition Regulation Supplement (DOD FARS). Those regulations, as well as the Army and Corps of Engineers implementations thereof, should also be consulted to ensure that a delivery of critical items of technical data is not inadvertently lost. Specifically, the Rights in Technical Data and Computer Software Clause, DOD FAR 52.227-7013, and the Data Requirements Clause, DOD FAR 52.227-7031, as well as any requisite software licensing agreements will be made a part of the CONTRACT CLAUSES or SPECIAL CONTRACT REQUIREMENTS. In addition, the appropriate DD Form 1423 Contract Data Requirements List, will be filled out for each distinct deliverable data item and made a part of the contract. Where necessary, a DD Form 1664, Data Item Description, will be used to explain and more fully identify the data items listed on the DD Form 1423. It is to be noted that all of these clauses and forms are required to ensure the delivery of the data in question and that such data is obtained with the requisite rights to use by the Government.

Include with the request for proposals a completed DD Form 1423, Contract Data Requirements List. This form is essential to obtain delivery of all documentation. Each deliverable will be clearly specified, both description and quantity being required.

Deliver technical data and computer software (meaning technical data which relates to computer software) which is specifically identified in this project, and which may be defined/required in other specifications, in accordance with the CONTRACT CLAUSES, and in accordance with the Contract Data Requirements List, DD Form 1423. Identify the data delivered by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

- a. Identification of programmable portions of system equipment and capabilities.
- b. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.
- c. Provision of operational software data on all modes of programmable portions of the fire alarm and detection system.
- d. Description of Fire Alarm Control Panel equipment operation.
- e. Description of auxiliary and remote equipment operations.
- f. Library of application software.
- g. Operation and maintenance manuals described under SD-19 in the SUBMITTALS paragraph.

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Configure the fire detection and alarm system and the central reporting system in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer. The equipment furnished shall be compatible and be UL listed, FM approved, or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards. Furnish tags with stamped identification number for keys and locks. Locks shall be keyed alike. Provide four keys for the system.

2.1.1 Operation

NOTE: If an addressable (multiplex) system is to be

provided, utilize Section 28 31 64.00 10 FIRE
DETECTION AND ALARM SYSTEM, ADDRESSABLE.

If an addition to an existing system is required, provide the make, model number, and other pertinent information on existing components that are to operate with the new equipment. Since new interfaces will have to be compatible with the existing system or to the central fire alarm reporting system, it may be necessary to edit major items out of this specification. If a new fire alarm panel is required, it has to be compatible with the existing central fire alarm reporting system.

Provide a fire alarm and detection system that is a complete, supervised fire alarm reporting system. Activate the system into the alarm mode by actuation of any alarm initiating device. Remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. Connect alarm initiating devices to initiating device circuits (IDC), Style D, in accordance with NFPA 72. Connect alarm notification appliances to notification appliance circuits (NAC), Style Z in accordance with NFPA 72. Provide a looped conduit system so that if the conduit and all conductors within are severed at any point, all IDC, or NAC will remain functional. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the Supervising Station (fire station, fire alarm central communication center). Textual, audible, and visual appliances and systems shall comply with NFPA 72. Operate fire alarm system components requiring power, except for the control panel power supply, on 24 Volts dc.

2.1.2 Operational Features

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

The designer will list zones and indicate the exact wording of the descriptive zone labeling.

Remove item j. below when elevators are not involved.

The system shall have the following operating features:

- a. Monitor electrical supervision of alarm IDC and NAC. Smoke detectors [shall] [shall not] have combined alarm initiating and power circuits.
- b. Monitor electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.
- c. A trouble buzzer and trouble light emitting diode (LED) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the

circuit used for transmitting alarm signals off-premises.

- (1) A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator LED. Subsequent trouble and supervisory alarms shall sound the trouble signal until silenced. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.
 - (2) Submit voltage drop calculations for notification appliance circuits to indicate that sufficient voltage is available for proper appliance operation.
- d. A one person test mode. Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.
 - e. A transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but providing a trouble signal when disconnected and a restoration signal when reconnected.
 - f. Evacuation alarm silencing switch which, when activated, will silence alarm devices, but will not affect the zone indicating LED/LCD nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed zone and the NAC devices will be activated.
 - g. Electrical supervision for circuits used for supervisory signal services (i.e., sprinkler systems, valves, etc.). Supervision shall detect any open, short, or ground.
 - h. Confirmation or verification modules for smoke detection initiating circuits. The modules shall interrupt the transmission of an alarm signal to the system control panel for a factory preset period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at [20] [____] seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal, if present, will be sent immediately to the control panel. Fire alarm devices, other than smoke detectors, will be prohibited on circuits controlled by confirmation or verification modules.
 - i. The fire alarm control panel shall provide supervised relays for HVAC shutdown. An override at the HVAC panel shall not be provided.
 - j. Provide one person test mode - Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.
 - k. The fire alarm control panel shall provide the required monitoring and supervised control outputs needed to accomplish elevator recall.
 - l. The fire alarm control panel shall provide the required modules to monitor and control the fire sprinkler system, or other fire protection extinguishing system.

- m. Zones for alarm IDC and NAC shall be [arranged as indicated on the contract drawings.] [as follows: [_____]]
- n. The fire alarm control panel shall be readily capable of future expansion and modification by qualified technicians. Examples of required changes are: adding or deleting devices or zones; changing system responses to particular input signals; programming certain input signals to activate auxiliary devices.

2.1.3 Alarm Functions

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

The designer will list zones and indicate the exact wording of the descriptive zone labeling.

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

An alarm condition on a circuit shall automatically initiate the following functions:

- a. Transmission of [a signal] [signals] over the station [telephonic] [telegraphic] [radio] fire reporting system. [The signal shall be common for all zones] [The signals shall be different for each zone].
- b. Visual indications of the alarmed [zone] [zones] on the fire alarm control panel annunciator [and on the remote annunciator].
- c. Continuous sounding or operation of alarm notification appliances [only in designated areas] [throughout the building] as required by ASA S3.41.
- d. Closure of doors held open by electromagnetic devices.
- e. Operation of the smoke control system.
- f. Deactivation of the air handling units [in the alarmed zone] [throughout the building].
- g. Shutdown of power to the data processing equipment in the alarmed zones.
- h. Automatic discharge of the designated fire suppression systems. A [_____] [15] second maximum delay shall be provided for the deluge system, a [_____] [30] second delay for the wet pipe system.

2.1.4 Primary Power

Provide operating power as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

2.1.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

2.1.6 Interface With Existing Fire Alarm Equipment

**NOTE: The existing Fire Alarm equipment must be
clearly identified by the fire alarm system designer
in the specification and on the drawings.**

The equipment specified herein shall operate as an extension to an existing configuration. The new equipment shall be connected to [an existing control panel in the existing part of the building] [existing monitoring equipment at the Supervising Station (Building [____])]. Existing [control] [monitoring] equipment shall be expanded, modified, or supplemented as necessary to extend the existing [control] [monitoring] functions to the new points or zones. New components shall be capable of merging with the existing configuration without degrading the performance of either system. The scope of the acceptance tests of paragraph Testing shall include aspects of operation that involve combined use of both new and existing portions of the final configuration.

2.1.7 Interface With Other Equipment

Furnish interfacing components as required to connect to subsystems or devices which interact with the fire alarm system, such as supervisory or alarm contacts in suppression systems, operating interfaces for smoke control systems, door releases, etc.

2.2 STANDARD PRODUCTS

Provide material and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products for at least [2] [____] years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours of notification.

2.3 NAMEPLATES

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

2.4 CONTROL PANEL

Control panel shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a [flush] [surface] [semi-flush] mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for LEDs, zones, controls, meters, fuses, and switches.

- a. Nameplates for fuses shall also include ampere rating. Separate alarm and trouble LEDs shall be provided for each zone alarm. These LEDs shall be located on the exterior of the cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet.
- b. A suitable means (single operation) shall be provided for testing the control panel visual indicating devices (meters or LEDs). Meters and LEDs shall be plainly visible when the cabinet door is closed. Signals and LEDs shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Each IDC shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other zones.
- c. Loss of power, including batteries, shall not require the reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals. Visual annunciators shall be provided for each active zone and spare zone. [_____] spare zones shall be provided [as shown on the drawing]. Each LED shall provide specific identification of the zone by means of a permanently attached rigid plastic, phenolic, or metal sign with either raised or engraved letters.
- d. Zone identification shall consist of a word description of the zone. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate units. Cabinets shall be painted [red] [beige] [_____].

2.4.1 Remote System Trouble Audible/Visual Appliance

NOTE: Provide a remote trouble audible/visual appliance when the control panel is located in an area where the control panel integral trouble signal normally cannot be heard.

Audible appliance shall have a minimum sound level output rating of [85] [_____] dBA at 3.05 m 10 feet and operate in conjunction with the panel's integral trouble signal. The audible device shall be silenced by the system trouble silence switch located at the remote location, but shall not extinguish the visual indicator. Provide a rigid plastic, phenolic or metal identification sign which reads "Fire Alarm System Trouble" at the audible appliance. The visual appliance located with the audible appliance shall not be extinguished until the trouble has been cleared.

2.4.2 Circuit Connections

Connect circuit conductors entering or leaving the panel to screw-type terminals with each conductor and terminal marked for identification.

2.4.3 System Expansion and Modification Capabilities

Provide any equipment and software needed by qualified technicians to implement future changes to the fire alarm system as part of this contract.

2.5 STORAGE BATTERIES

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

2.5.1 Capacity

Provide storage batteries that are 24 Vdc sealed, lead-calcium type requiring no additional water with ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 72 hours. Following this period of battery operation, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 15 minutes. Submit substantiating battery calculations for supervisory and alarm power requirements. Include ampere-hour requirements for each system component and each panel component, and the battery recharging period.

2.5.2 Placement

Locate batteries [at the bottom of the panel] [in a separate battery cabinet]. Provide batteries with overcurrent protection in accordance with NFPA 72. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm panel. Key the lock the same as the fire alarm control panel. [Paint cabinets to match the fire alarm control panel.]

2.6 BATTERY CHARGER

Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18 Volts dc) to full charge within 48 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Locate charger in control panel cabinet or in a separate battery cabinet.

2.7 MANUAL FIRE ALARM STATIONS

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

Manual fire alarm stations shall conform to the applicable requirements of UL 38. Connect manual stations into signal line circuits. Stations shall be installed on [surface] [semi-flush] [flush] mounted outlet boxes at [1220] [1370] [_____] mm [48] [54] [_____] inches. Stations shall be [single] [double] action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods [are] [are not] acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Stations shall have a

separate screw terminal for each conductor. Surface mounted boxes shall be matched and painted the same color as the [fire alarm manual stations] [mounting surface].

2.8 FIRE DETECTING DEVICES

NOTE: Remove last sentence when not applicable.

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors located in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD. Installed devices shall conform to the NFPA 70 hazard classification of the area where devices are to be installed.

2.8.1 Heat Detectors

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

2.8.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors shall be designed for [surface] [semi-flush] outlet box mounting and supported independently of wiring connections. Contacts shall be self-resetting after response to rate-of-rise principle. Under fixed temperature actuation, the detector shall have a permanent external indication which is readily visible. Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes shall operate on fixed temperature principle only. The UL 521 test rating for the fixed temperature portion shall be [[57.2] [_____] degrees C [135] [_____] degrees F] [as shown]. The UL 521 test rating for the Rate-of-Rise detectors shall be rated for 15 by 15 m 50 by 50 ft.

2.8.1.2 Rate Compensating Detectors

Detectors shall be [surface] [flush] mounted [vertical] [horizontal] type, with outlet box supported independently of wiring connections. Detectors shall be hermetically sealed and automatically resetting. Rate Compensated detectors shall be rated for 15 by 15 m 50 by 50 ft.

2.8.1.3 Fixed Temperature Detectors

Detectors shall be designed for [surface] [semi-flush] outlet box mounting and supported independently of wiring connections. Detectors shall be designed to detect high heat. The detectors shall have a specific temperature setting [of [57.2] [_____] degrees C [135] [_____] degrees F] [as shown]. The UL 521 test rating for the fixed temperature detectors shall be rated for 4.57 by 4.57 m 15 by 15 ft.

2.8.2 Smoke Detectors

**NOTE: Choose the type of smoke detector most suited
for application or design.**

Smoke detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be [ionization] [photoelectric] [or] [projected beam] type. Detectors shall contain a visible indicator LED that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making wiring connections. Detectors that are to be installed in concealed (above false ceilings, etc.) locations shall be provided with a remote indicator LED suitable for mounting in a finished, visible location.

2.8.2.1 Ionization Detectors

Ionization detectors with a dual chamber shall be responsive to both invisible and visible particles of combustion. One chamber shall be a reference chamber and the second a sampling chamber. Detectors containing radium shall not be provided. Detectors shall not cause an alarm condition due to anticipated fluctuations in relative humidity. The sensitivity of the detector shall be field adjustable to compensate for operating conditions. Detector shall require no replacement or readjustment to restore it to normal operation after an alarm condition. Each detector shall be capable of withstanding ambient air velocity up to [1.5] [_____] meters/second [300] [_____] fpm in accordance with UL 268.

2.8.2.2 Photoelectric Detectors

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating in accordance with UL 268.

2.8.2.3 Projected Beam Smoke Detectors

Detectors shall be designed for detection of abnormal smoke densities. Detectors shall consist of separate transmitter and receiver units. The transmitter unit shall emit an infrared beam to the receiver unit. When the signal at the receiver falls below a preset sensitivity, the detector shall initiate an alarm. The receiver shall contain an LED which is powered upon an alarm condition. Long-term changes to the received signal caused by environmental variations shall be automatically compensated. Detectors shall incorporate features to assure that they are operational; a trouble signal shall be initiated if the beam is obstructed, the limits of the compensation circuit are reached, or the housing cover is removed. Detectors shall have multiple sensitivity settings in order to meet UL listings for the different distances covered by the beam. In the event of beam interference for more than three seconds a trouble alarm shall be transmitted.

2.8.2.4 Duct Detectors

NOTE: The requirements for Duct Detectors will be

coordinated with the HVAC requirements and Section
23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC. All
required duct detectors will be shown on the
contract drawings.

Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between [2.5 and 20] [[_____] and [_____]] m/s [500 and 4000] [[_____] and [_____]] fpm. Detectors shall be powered from the fire alarm panel. Sampling tubes shall run the full width of the duct. The duct detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the fire alarm control panel. Lights to indicate the operation and alarm condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above 1.83 m 6 feet and those mounted below 1.83 m 6 feet that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset switches. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. Detectors shall have auxiliary contacts to provide control, interlock, and shutdown functions specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

2.8.3 Combination Smoke and Heat Detectors

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

2.8.4 Flame Detectors

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

The detectors shall comply with FM APP GUIDE. The detectors shall be sensitive to the micron range best suited for their intended use. The

detectors shall operate over electrically supervised wiring circuits and the loss of power to the detector shall result in a trouble signal. A self-test feature shall be provided for each detector to be individually tested.

2.8.4.1 Infrared (IR) Single Frequency Flame Detector

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

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

2.8.4.2 Infrared (IR) Dual Frequency Flame Detector

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

The IR detector shall consist of two or more IR sensors, each selected for a different IR frequency. The primary sensor shall be sensitive in the range of [_____] to [_____] micrometers only. Secondary sensors are tuned to different IR wavelengths to null out the effect of black body radiation to the primary sensor.

2.8.4.3 Ultraviolet (UV) Flame Detectors

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

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

UV detectors have an 80 to 90 degree cone of vision. The UV detector has a fast response time and usually is not affected by rain, wind, snow, high humidity, or temperature and pressure extremes. UV units will produce false alarms if they are exposed to arc welding or X-ray and gamma radiation. They can also be blinded by oil film or smoke. UV flame detectors that are used in dirty

and dusty environments should be equipped with automatic self-test and self-cleaning devices. The cleaning device uses a stream of clean air across the lens surface to minimize the build-up of contaminants.

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

2.8.4.4 Combination UV/IR Flame Detector

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

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

2.9 NOTIFICATION APPLIANCES

NOTE: If provided, electrically powered internally illuminated emergency exit signs shall flash as a visual emergency alarm in conjunction with audible emergency alarms. **EXCEPTION:** Visual alarms devices that are mounted adjacent to emergency exit signs can be used in lieu of flashing exit signs.

Audible appliances shall conform to the applicable requirements of UL 464. Devices shall be connected into notification appliance circuits. Devices shall have a separate screw terminal for each conductor. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface mounted audible appliances shall be painted [red] [white] [_____]. Recessed audible appliances shall be installed with a grill that is painted [red] [white] [_____] [with a factory finish to match the surface to which it is mounted].

2.9.1 Alarm Bells

Bells shall be surface mounted with the matching mounting back box [surface mounted] [recessed]. Bells shall be suitable for use in an electrically supervised circuit. Bells shall be the underdome type producing a minimum output rating of [85] [_____] dBA at 3 m 10 feet. Bells used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles. Single stroke, electrically operated, supervised, solenoid bells shall be used for coded applications.

2.9.2 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box [surface mounted] [recessed] [[single] [double] projector,] [grille and] vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a sound rating of at least [85] [_____] dBA at 3 m 10 feet. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles.

2.9.3 Chimes

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

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

2.9.4 Visual Notification Appliances

NOTE: ADA requires that Visual Notification Appliances be provided in buildings and facilities in each of the following areas: restrooms, and any general usage area (e.g., meeting rooms), hallways, lobbies, and any other area for common use. The Visual Notification Appliance shall be mounted at 2 m 80 inches AFF or 150 mm 6 inches below the ceiling, whichever is lower. In general, ADA requires no place in any space or room to be greater than 15 m 50 feet horizontally from a Visual Notification Appliance. In large rooms and open spaces, without obstructions over 1.8 m 6 feet AFF, the designer should not suspend Visual Notification Appliances from the ceiling.

Visual notification appliances shall conform to the applicable requirements of UL 1971. Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light. Strobe flash rate shall be between 1 to 3 flashes per second and a minimum of 75 candela. Strobe shall be [surface] [semi-flush] mounted.

2.9.5 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units, except that they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the Contracting Officer.

2.10 REMOTE ANNUNCIATION EQUIPMENT

NOTE: Provide remote annunciator or remote graphic annunciator only where the fire department would normally respond through a door remote from the control panel location. Use graphic annunciators only for large or complex buildings. Supervisory LED is for supervision of sprinkler and other extinguishing systems.

2.10.1 Remote Annunciator

Annunciator shall have indicator LEDs. The LED for the proper zone shall light upon any alarm. Provide a supervisory LED to indicate a supervisory malfunction. A system trouble LED shall be provided to indicate a system failure. Annunciator LEDs shall be extinguished only by operating the alarm reset switch on the control panel. Annunciator shall contain a LED test switch, an audible trouble signal, and a trouble silence switch to silence the audible alarm, but not extinguish the trouble LED. Switches shall be located within a locked panel and easily visible through a glass or plastic viewing plate. Panel door shall have a keyed lock identical to the lock on the control panel. Zone identification shall be by silk-screened or engraved labels and shall consist of word description of the zone. Annunciator shall be [surface] [semi-flush] [flush] mounted.

2.10.2 Remote Graphic Annunciator

Graphic annunciator shall have a plan view of [each floor] [the building]. Each initiating device (identical devices in the same room may be combined, as approved) shall be indicated by an LED shown in its relative position in the building and shall illuminate for abnormal condition in that area. LEDs shall be red for alarm condition, [] for supervisory malfunction condition, and amber for trouble condition. Plan views shall be approximately to scale and in no case smaller than [300] [375] mm [12] [15] inches in length or width. Annunciator shall have a door with piano hinge and two point cylinder lock or two cylinder locks. Lock shall be operable using the same key as the control panel. Annunciator shall contain a LED test switch, audible trouble signal and a trouble switch to silence the audible alarm, but not extinguish the trouble LED. Annunciator shall be [surface] [semi-flush] [flush] mounted.

2.11 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.11.1 Electromagnetic Door Hold-Open Devices

Attach devices to the walls unless otherwise indicated. Devices shall comply with the appropriate requirements of UL 228. Devices shall operate on 24 Volt dc power. Compatible magnetic component shall be attached to the door. Under normal conditions, the magnets will attract and hold the doors open. When magnets are de-energized, they shall release the doors. Magnets shall have a holding force of 111 N 25 pounds. Devices shall be UL or FM approved. Housing for devices shall be brushed aluminum or stainless steel. Operation shall be fail safe with no moving parts. Electromagnetic door hold-open devices shall not be required to be held open during building power failure.

2.11.2 Conduit

Conduit and fittings shall comply with UL 6, UL 1242 and UL 797.

2.11.3 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. Wiring for Fire Alarm circuits shall be No. [16] [14] AWG minimum. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited.

2.12 TRANSMITTERS

NOTE: State the make and model number of existing proprietary supervising station receiving equipment.

The choice of code transmitter, or radio transmitter depends upon the type of existing fire reporting system at the activity. When telegraphic systems exist, use code transmitter. Determine the type of activity reporting system (i.e., positive non interfering or shunt). In most cases a local energy-tripping device will be required.

The facility Fire Dept. or Engineering office should be contacted to determine the type and amount of data to be supervised (monitored), i.e. -type: separate or common transmission of alarm, supervisory, and trouble type signals; -amount: all points, all zones, or the combined premises. Verify that existing monitoring equipment has sufficient capacity to support the additional premises or that it can be expanded as necessary to accommodate the new fire alarm system. Identify existing components.

2.12.1 Radio Alarm Transmitters

Transmitters shall be compatible with proprietary supervising station receiving equipment. Each radio alarm transmitter shall be the manufacturer's recognized commercial product, completely assembled, wired, factory tested, and delivered ready for installation and operation. Transmitters shall be provided in accordance with applicable portions of NFPA 72, NFPA 1221, and 47 CFR 15. Transmitter electronics module shall be contained within the physical housing as an integral, removable assembly. The proprietary supervising station receiving equipment is [_____] and the transceiver shall be fully compatible with this equipment. At the Contractor's option, and if UL listed, the transmitter may be housed in the same panel as the fire alarm control panel.

2.12.1.1 Transmitter Power Supply

Each radio alarm transmitter shall be powered by a combination of locally available 120-volt ac power and a sealed, lead-calcium battery.

2.12.1.1.1 Operation

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

2.12.1.1.2 Battery Power

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

2.12.1.2 Radio Alarm Transmitter Housing

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

2.12.1.3 Antenna

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

2.12.2 Master Fire Alarm Boxes

Master fire alarm boxes shall be of the coded, [shunt] [positive] noninterfering type with succession features having a [shunt] [local energy] type auxiliary tripping device, and of the prewound, open-door, pull-lever type. Mechanism shall be housed in a weatherproof cottage shell type of housing with metallic or rigid plastic code number plate mounted on the exterior face of the cottage shell. Operation of the actuating pull lever shall cause the box to transmit four complete rounds of code to gongs, recorders, and other devices on the same circuit. Driving springs shall have the capability to transmit not less than eight complete four-round groups of code before being rewound. Boxes shall be designed for operation of 100 milliamperes dc, but with capability of full operation of 70 milliamperes and up to 120 milliamperes. 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. Each box shall be equipped with manual signaling key, telephone jack, silent test device, and box shunt device. Box shall be [[wall-] [pole-] [pedestal-] mounted] [as indicated] with center of box 1525 mm 61 inches above grade, and provided with lighting fixture. Mounting bolts, brackets, fastenings, and conduit shall be copper alloy, cadmium, or zinc-coated steel. Code wheel

shall be metallic and box code shall be as directed. Electrically powered master fire alarm boxes shall have standby sealed, lead calcium battery capacity for a minimum of 72 hours and be capable of transmitting alarms during that period.

2.12.3 Telephonic Reporting System

Transmitters shall be compatible with existing receiving equipment at the Supervising Station. Transmitter shall respond to the actuation of the fire alarm control panel and shall be of the electric motor-driven or prewound spring mechanism type; it 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. Metallic or rigid plastic code number plates on the exterior face of transmitters shall be provided. Transmitters shall be designed to provide the same features as the fire alarm boxes for electrically-supervised, coded [positive] [shunt] 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 [shunt] [local energy] type auxiliary tripping device. Code wheel shall be metallic and box code shall be as directed. Wiring shall be extended to the indicated telephone terminating location [for future connection by other] [and connected to specific twisted pair cable identified by the COR in the field]. [One new [____]-pair [shielded] [non-shielded] twisted-pair cable shall be extended to the Supervising Station and connected to existing terminating equipment.]

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with details of the work, verify dimensions in the field and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

All work shall be installed as shown, and in accordance with NFPA 70 and NFPA 72, and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until construction is essentially complete and the building has been thoroughly cleaned.

3.2.1 Power Supply for the System

NOTE: It is the responsibility of the designer to ensure that the source of power for the fire alarm system is shown on the drawings.

A single dedicated circuit connection for supplying power from a branch circuit to each building fire alarm system shall be provided. The power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked in red with the words "FIRE ALARM CIRCUIT CONTROL".

3.2.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal. Circuit conductors entering or leaving any mounting box, outlet box enclosure, or cabinet shall be connected to screw terminals with each terminal and conductor marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors in the system is prohibited. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.2.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 300 mm 12 inches nor more than 2000 mm 78 inches above the finished floor. Manually operable controls shall be between 900 and 1100 mm 36 and 42 inches above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.2.4 Detectors

Detectors shall be located and installed in accordance with NFPA 72. Detectors shall be connected into signal line circuits or initiating device circuits as indicated on the drawings. Detectors shall be at least 300 mm 12 inches from any part of any lighting fixture. Detectors shall be located at least 900 mm 3 feet from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in open space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 900 mm 3 feet, sway bracing shall be provided. Detectors installed in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD [in a finished, visible location] [as indicated] [_____].

3.2.5 Notification Appliances

Notification appliances shall be mounted 2003 mm 80 inches above the finished floor or 150 mm 6 inches below the ceiling, whichever is lower.

3.2.6 Annunciator Equipment

Annunciator equipment shall be mounted where indicated on the drawings.

3.2.7 Supervisory and Alarm Contacts

NOTE: Remove this paragraph when not required.

Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform supervisory and alarm

functions as identified in NFPA 72 and as indicated on the drawings. Contacts shall be provided in accordance with other sections of the specifications and specific instructions on corresponding drawings. See Section [21 13 13.00 10 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION] [21 13 17.00 10 DRY PIPE SPRINKLER SYSTEM, FIRE PROTECTION] [21 13 18.00 10 PREACTION AND DELUGE SPRINKLER SYSTEMS, FIRE PROTECTION] [_____].

3.3 OVERVOLTAGE AND SURGE PROTECTION

3.3.1 Power Line Surge Protection

All equipment connected to alternating current circuits shall be protected from surges in accordance with IEEE C62.41.1/IEEE C62.41.2 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground).

3.3.2 Low Voltage DC Circuits Surge Protection

All IDC, NAC, and communication cables/conductors, except fiber optics, shall have surge protection installed at each point where it exits or enters a building. Equipment shall be protected from surges in accordance with IEEE C62.41.1/IEEE C62.41.2 B3 combination waveform and NFPA 70. The surge protector shall be rated to protect the 24 Volt dc equipment. The maximum dc clamping voltages shall be 36 V (line-to-ground) and 72 Volt dc (line-to-line).

3.4 GROUNDING

Provide grounding by connecting to building ground system.

3.5 SUPERVISING STATION PROVISIONS

[The proprietary type Supervising Station (PSS) is located [in building [_____]] [_____]] [The supervising equipment is existing and consists of the following brands and models: [supervising station control panel [_____]] [_____], [signal reporting components [_____]], [annunciator [_____]] [_____]].

3.5.1 Revisions to Existing Facilities

Existing supervising components shall be modified as indicated on the drawings and programming shall be updated if required to accommodate the revised configuration. Acceptance testing shall include procedures that would demonstrate that operation of existing equipment has not been degraded and that the revised configuration plus interfacing components operate compatibly with the new fire alarm system at the protected premises. Work on existing equipment shall be performed in accordance with the manufacturer's instructions or under supervision of the manufacturer's representative.

3.5.2 Additions to Existing Facilities

Supplemental components shall be added to the existing supervising equipment [as required to accommodate the new fire alarm system to be installed at the protected premises] [as indicated on the drawings]. All present functions shall be extended, including recording and storage in memory, and programming shall be updated if required to accommodate the revised configuration. Acceptance testing shall include procedures that

would demonstrate that operation of existing equipment has not been degraded and that the expanded configuration operates compatibly with the new fire alarm system.

3.6 TRAINING

Provide training course for the operations and maintenance staff. Conduct the course in the building where the system is installed or as designated by the Contracting Officer. Submit lesson plans, operating instructions, maintenance procedures, and training data, furnished in manual format, for the training courses. The operations training shall familiarize designated government personnel with proper operation of the fire alarm system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

3.6.1 System Operation Training

The training period for systems operation shall consist of [1] [_____] training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests.

3.6.2 System Maintenance Training

The training period for systems maintenance shall consist of [2] [_____] training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover items contained in the operating and maintenance instructions.

3.6.3 System Expansion Training

In addition, training shall be provided on performance of expansions or modifications to the fire detection and alarm system. The training period for system expansions and modifications shall consist of at least [1] [_____] training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests.

3.7 TESTING

Notify the Contracting Officer at least 10 days before the preliminary and acceptance tests are to be conducted. Perform the tests in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise tests. Furnish instruments and personnel required for the tests.

- a. Submit detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level [3] [4] Fire Alarm Technician, for the fire detection and alarm system [60] [_____] days prior to performing system tests.
- b. Submit test reports, in booklet form, showing field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall document readings, test results and indicate the final position of controls. Include the NFPA 72 Certificate of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

3.7.1 Preliminary Tests

Upon completion of the installation, subject the system to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Tests shall include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. Conduct the megger test prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional. After completing the preliminary testing complete and submit the NFPA 72, Certificate of Completion.

3.7.2 Acceptance Test

NOTE: Listed tests are minimum required. If additional tests are required, such tests must be added to the list.

Do not perform acceptance testing until the Contractor has completed and submitted the Certificate of Completion. Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that previous deficiencies have been corrected. Complete and submit the NFPA 72, Inspection and Testing Form. The test shall include all requirements of NFPA 72 and the following:

- a. Test of each function of the control panel.
- b. Test of each circuit in both trouble and normal modes.
- c. Tests of each alarm initiating devices in both normal and trouble conditions.
- d. Tests of each control circuit and device.
- e. Tests of each alarm notification appliance.
- f. Tests of the battery charger and batteries.
- g. Complete operational tests under emergency power supply.
- h. Visual inspection of wiring connections.
- i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.
- j. Ground fault.
- k. Short circuit faults.
- l. Stray voltage.
- m. Loop resistance.

-- End of Section --