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USACE / NAVFAC / AFCEC / NASA **UFGS-28 31 33.00 10 (November 2008)**

Preparing Activity: USACE **Superseding**
UFGS-28 31 33.00 10 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2022
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DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

SECTION 28 31 33.00 10

FIRE ALARM REPORTING SYSTEM, RADIO TYPE

11/08

-- End of Section Table of Contents --

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SECTION 28 31 33.00 10

FIRE ALARM REPORTING SYSTEM, RADIO TYPE
11/08

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NOTE: This guide specification covers the requirements for radio transmitted fire alarm reporting systems.

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

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

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

PART 1 GENERAL

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.

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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.

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
IEEE C135.30	(1988) Standard for Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; TIA 22-1; ERTA 1 2022) National Electrical Code
NFPA 72	(2022) National Fire Alarm and Signaling Code
NFPA 780	(2023) Standard for the Installation of Lightning Protection Systems

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-222	(2018H; Add 1 2019) Structural Standard for Antenna Supporting Structures and Antennas and Small Wind Turbine Support Structures

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

47 CFR 15	Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 6	(2007; Reprint Sep 2019) UL Standard for Safety Electrical Rigid Metal Conduit-Steel
UL 467	(2022) UL Standard for Safety Grounding

	and Bonding Equipment
UL 797	(2007; Reprint Mar 2021) UL Standard for Safety Electrical Metallic Tubing -- Steel
UL 1242	(2006; Reprint Apr 2022) UL Standard for Safety Electrical Intermediate Metal Conduit -- Steel

1.2 SUBMITTALS

****

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

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fire Alarm Reporting System; G[, [_____]]
Wiring for Systems; G[, [_____]]

SD-03 Product Data

Battery
Spare Parts
Qualifications
Training
Test Procedures

SD-06 Test Reports

Testing

SD-07 Certificates

Equipment

SD-10 Operation and Maintenance Data

Fire Alarm Reporting System; G[, [_____]]

1.3 QUALITY ASSURANCE

Provide the services of a Registered Professional Engineer with at least 4 years of current experience in the design of fire protection and detection systems. Submit the qualifications, with verification of experience and license number, for this engineer.

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 SPECIAL TOOLS AND SPARE PARTS

Furnish special tools necessary for the maintenance of the equipment. Submit certified copies of current applicable approvals or listings issued by UL, FM or other nationally recognized testing laboratory showing compliance with applicable NFPA standards. Submit spare parts data for each different item of material and equipment specified, after approval of detail drawings, and not later than [_____] months prior to the date of beneficial occupancy. Include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after [1] [_____] year of service. Provide one spare set of fuses of each type and size required and 5 spare lamps of each type.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

****

NOTE: Radio link supervision may be by periodic reporting of radio fire alarm transmitters or by periodic polling of all transmitters by the radio fire alarm receiver. The total number of transmitters on any one frequency and their polling rate in a two-way system must be determined and checked to ensure code compliance. The following

definitions are given to help clarify the use of the words transmitter and receiver in this specification.

1. "Fire Alarm Transmitter" refers to any device that transmits a fire alarm message back to the fire alarm receiver at the alarm monitoring station.

2. "Radio Transmitter" is an electronic device that generates a coded RF signal.

3. "Radio Fire Alarm Transmitter" refers to a device that uses radio signals to transmit a fire alarm message back to the alarm monitoring station. The radio fire alarm transmitter may operate with either one-way or two-way data transmission. For one-way data transmission, the radio fire alarm transmitter would incorporate a radio transmitter, antenna, cables, power supply, message encoder, and possibly an interface circuit.

a. The radio fire alarm transmitter generates and sends a coded alarm when an alarm is received at the transmitter. The signal is received at the radio fire alarm receiver and an alarm is given.

b. Radio fire alarm transmitters that use two-way data transmissions have all the same components as the one-way system, but, in addition, they have a receiver and controller. They operate by waiting for the radio fire alarm receiver to send them a radio signal to report. The radio fire alarm transmitter then sends back a signal reporting any alarms. Another method involves two-way radio transmission systems which transmit signals as soon as they are received.

4. "Fire Alarm Receivers" refer to equipment that receives fire alarm messages from one or more fire alarm transmitters.

5. "Radio Receiver" is an electronic device that detects radio signals and generates an alarm message.

6. "Radio Fire Alarm Receiver" is a system that receives fire alarm signals, displays, and records the alarm messages. It may simply listen for any alarm messages (one-way data transmission) or it may sequentially transmit a radio signal asking each radio fire alarm transmitter to report any alarms (two-way data transmission).

When an addition to an existing system is required, provide the make, model number, and other pertinent information to the designer. This will eliminate most of this specification because the additional interfaces have to be compatible with the existing central radio fire alarm reporting system.

NOTE: Insert appropriate NFPA Standard in blank.

****

Provide a central reporting system complying with [NFPA 72] [_____]. Furnish equipment furnished listed by Underwriters Laboratories, or Factory Mutual Engineering and Research, or be approved or listed by a nationally recognized testing laboratory.

a. Furnish tags with stamped identification numbers for keys and locks. Key locks alike. Provide radio system that reports alarms to the radio fire alarm monitoring base station. Provide a completely supervised radio type fire alarm reporting system.

b. Submit detail drawings, signed by the Registered Professional Engineer, 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.

c. Also, provide detail drawings containing 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. Indicate the area of alarm. Supervise and operate the radio communication link in accordance with NFPA 72. Provide electrical supervision for all circuits and for all positions of interface panel control switches.

d. Submit [6] [_____] complete copies of operating instructions outlining step-by-step procedures required for system startup, operation, and shutdown. Include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features.

e. Submit [6] [_____] copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. Include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. Instructions must be approved prior to training.

2.2 STANDARD PRODUCTS

Provide material and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Provide equipment supported by a service organization that can provide service within 24 hours.

2.3 NAMEPLATES

Securely attach a noncorrosive and nonheat-sensitive plate to the major components of equipment containing the manufacturer's name, address, type or style, voltage and current rating, and catalog number.

2.4 RADIO FIRE ALARM TRANSMITTER (TRANSCEIVER)

****

NOTE: Transceiver is a radio device that receives an interrogating or challenging radio signal and

automatically transmits a response on the same or a different frequency.

****

Provide Radio Fire Alarm Transmitter (Transceiver) compatible with the Radio Fire Alarm Monitoring Base Station. Provide all solid state transmitter complying with applicable portions of 47 CFR 15 governing type acceptance. All transmitters of a common configuration must be interchangeable with the other devices furnished by the manufacturer. Provide transmitter [and interface device] that is the manufacturer's current commercial product completely assembled, wired, tested at the factory, and delivered ready for installation and operation.

2.4.1 Frequency Allocation

****

NOTE: Frequency assignment is made by the base's communications Officer. The frequency must be reserved in advance. Multiple frequencies may be needed to meet response time requirements. Polling type systems will need separate polling frequencies.

****

Operate transmitters on a frequency of [_____] MHz.

2.4.2 Power Requirements

****

NOTE: Delete requirements for manual street boxes if not applicable.

****

Power transmitters by a combination of locally available 120 Vac, and sealed [nickel-cadmium] [or] [lead-acid] type batteries requiring no additional water. [Power transmitters used in manual street box configuration [as indicated] by battery only.] In the event of loss of 120 Vac power, automatically switch the transmitter to battery operation. Accomplish the switchover with no interruption of protective service, without adversely affecting the battery-powered capabilities, and causing the transmission of a trouble message in no less than [_____] seconds. Upon restoration of ac power, transfer back to normal ac power automatically and recharge the battery. Install the converter/battery charger within the transmitter housing. Provide power supply transient filtering.

2.4.2.1 Battery Power

Furnish battery package capable of supplying all the power requirements for a given transmitter. Submit substantiating battery calculations for supervisory and alarm power requirements. Include ampere-hour requirements for each system component, each panel component and the battery recharging period.

2.4.2.2 Battery Duration

Provide radio fire alarm transmitter standby battery capacity with sufficient power to operate the transmitter in a normal standby status for a minimum of 60 hours and capable of transmitting alarms during that period. The capacity for battery-only powered transmitters must be 6

months before recharging is necessary.

2.4.2.3 Battery Supervision

Each radio fire alarm transmitter must constantly monitor and supervise its own battery powered supply. Report a low-battery condition when battery voltage falls below 85 percent of the rated voltage.

2.4.3 Functional Requirements

2.4.3.1 Interfacing Indicators and Controls

Provide transmitters that incorporate the provisions for auxiliary interconnection to existing interior alarm systems.

2.4.3.2 Generation of Signals

Each transmitter must be a standard design which allows the immediate transmission of all initiated signals.

2.4.3.3 Power Output

****
NOTE: The designer should provide the necessary data to determined the required RF power level; this may require a site visit.
****

The radio frequency (RF) power output of each transmitter must be sufficient for reliable alarm reporting. Provide minimum RF power output of [1] [_____] watt.

2.4.3.4 Memory

Provide transmitters that have memory capability. Multiple, simultaneous alarms must not result in the loss of any messages. Store messages until they are transmitted.

2.4.3.5 Transmission Confirmation

****
NOTE: Use with fire alarm boxes only.
****

When a signal is initiated at a public box (push button or pull lever), produce an audible or visual indication that the transmitter is operating and that a signal is being sent.

2.4.3.6 Transmitter Identity Code

Transmit a distinct identity code number as part of all signals emanating from the transmitter. The identity code allows for no less than a [_____] digit code selection and transmits no less than three complete rounds (cycles).

2.4.3.7 Message Designations

Do not allow as a minimum no less than 10 [_____] distinct and individually identifiable message designations as to the types or causes

of transmitter actuation.

2.4.3.7.1 Master Message

Transmit master messages upon automatic actuation of the transmitter. Identify the building and zone causing actuation individually as part of this transmission. Provide transmitter that is capable of identifying and transmitting a minimum of [_____] master (zone) messages.

2.4.3.7.2 Test Message

Provide test message that is capable of both manual and automatic actuation. When a transceiver method is employed, provide for automatic interrogation at preselected periods or continuous automatic interrogation in accordance with the governing standard. Additionally, provide for selective interrogation at times determined by the user. Test the automatic test actuation a minimum of once in each [24-] [_____] hour period, at an optionally preselected time. Stability of the electronic actuating device must be plus or minus 1 minute per month within the temperature range stipulated for system operation. During actuation of the "Test" message designation, regardless of initiating means, cause no less than 1 complete message to be sent.

2.4.3.7.3 Tamper Message Designation

Automatically transmit the tamper message when a tamper switch is tripped in the transmitter housing.

2.4.3.7.4 Trouble Message Designation

Automatically transmit trouble message in the event of a failure in excess of 1 minute of the main operating power source of the transmitter.

2.4.4 Transmitter Housings

Provide housings on transmitters fabricated from corrosion-resistant cast metal or suitable substitute which has the physical strength sufficient to ward off physical damage normally expected to be received by vandalism. Seal the housing against the entry of moisture, dust, dirt, insects, and other foreign objects. Provide NEMA 4X exterior housings.

2.4.4.1 Lock

Protect internal components from vandalism by a tamper-proof lock on the transmitter housing. Allow access to all internal components for testing, servicing, and replacement at the installation site.

2.4.4.2 Mounting

****
NOTE: Choose the type of mounting most suited for application of design.
****

Design transmitter housings for universal mounting on walls, poles, or pedestals. Utilize either lag bolts, anchor bolts, stainless steel banding, mounting brackets, or a shackle/bolt combination, as applicable to the specific installation.

2.4.4.3 Operating Panel

****
NOTE: Use with manual street boxes only.
****

For each publicly accessible transmitter, provide an operating panel that incorporates a dedicated signal initiating device (pull hook or push button) clearly identified for the initiation of "FIRE" signals. Protect the device with a conventional spring-loaded, "fast-action" break-glass, or similar pull-type door that allows observation of the actuation device when in the closed position. Fabricate and finish the door in a manner consistent with that required of the main housing.

2.4.4.4 Labeling

****
NOTE: Use with manual street boxes only.
****

Label each publicly accessible transmitter on both sides and on the front surface with the word "FIRE." Provide a white label with red lettering.

2.4.5 Environmental Operating Requirements

****
NOTE: Check local condition for design wind gust and ice loading. Lowest design wind speed is 160 km/hour 100 mph; typical design wind speed is 200 km/hour 125 mph.
****

Design the transmitter for reliable outside operation in an ambient temperature range of [-30] [_____] to [60] [_____] degrees C [-22] [_____] to [140] [_____] degrees F. Provide corrosion-resistant transmitters designed for reliable operation under adverse climatic conditions including [160.9] [_____] km/hour [100] [_____] mph winds, ice, rain, and snow storms.

2.4.6 Painting

Factory paint radio fire alarm transmitter [and interface housings]. Provide [fire engine red] [_____] finish color. Repaint painted surfaces damaged during installation to match existing paint.

2.5 RADIO TRANSMITTER INTERFACE DEVICE

****
NOTE: If a radio transmitter interface device is not required, delete this paragraph.
****

Provide a means of converting the signals that are available from the local control equipment into a form that is compatible with the transmitter inputs, while still maintaining electrical supervision of the entire system. Utilize when direct connection between local control equipment and the transmitter is not possible. Completely assemble, wire, test at the factory, and deliver ready for installation and operation.

2.5.1 Enclosure

****
NOTE: Use with manual street boxes only.
****

When furnished as an independent self-contained device, incorporate the interface device into an enclosure conforming to NEMA ICS 1or other national standard as required by its location.

2.5.2 Indicators

****
NOTE: Use with manual street boxes only.
****

Provide indicators to indicate alarm and trouble conditions and that consist of a red fire alarm and an amber trouble light. Design indicators to ensure visibility during daylight hours and to indicate the reporting zone.

2.5.3 Access

Switches and other controls must not be accessible without the use of a key. Access to controls must be by unlocking and opening a panel or door.

2.5.4 Mounting

****
NOTE: Choose the type of mounting most suited for application of design.
****

Design interface housings for universal mounting on walls, poles, or pedestals. Utilize either lag bolts, anchor bolts, stainless steel banding, mounting brackets, or a shackle/bolt combination, as applicable to the specific installation.

2.5.5 Inputs/Outputs

Provide, as a minimum, the number of alarm circuit inputs and outputs indicated. Arrange each input circuit so that the alarm signals override the trouble signals.

2.6 RADIO FIRE ALARM MONITORING BASE STATION

****
NOTE: Radio link supervision may be by periodic reporting of radio fire alarm transmitters or by periodic polling of all transmitters by the radio fire alarm receiver. The total number of transmitters on any one frequency and the polling rate of the transmitters in a two-way system must be determined and checked to ensure code compliance.
****

2.6.1 Receiver (Transceiver) System

Provide [two identical] [one] master radio fire alarm receiving

(transceiver) system compatible with transmitter frequency. Completely assemble, wire, test at the factory, and deliver ready for installation and operation. Provide solid-state transceivers that use frequency modulation. The transceiver can be a single integrated unit, or it may consist of separate transmitter and receiver modules with a common power supply, amplifier, and control unit.

2.6.1.1 Transmitter Section

Operate transmitter on a frequency of [_____] MHz. Frequency stability must be within 0.00025 percent over the operating temperature range. Design transmitter to work into a 50-ohm load. Provide frequency deviation less than or equal to 5 kHz. Audio response must be within plus 1 dB and minus 3 dB over the 300 Hz to 3,000 Hz range.

2.6.1.2 Receiver Section

Provide receiver antenna input impedance of 50 ohms. Tune receiver to a frequency assignment of [_____] mHz. Receiver must have no more than 5 percent audio distortion measured at 1,000 Hz. Receiver with a noise level greater than minus 50 dB below the signal level is not acceptable. Receiver output must be compatible with the associated device.

2.6.2 Fire Alarm Console

Furnish console containing a complete and independent fire alarm receiving system, consisting of, as a minimum, a radio receiver/transmitter, signal to message decoder, audio alarm signaling devices, audio alarm silence switch, visual display, alarm reset switch(es), alarm recording printer, primary and emergency power supplies, power supply monitors, memory devices, and all necessary interconnecting cables.

2.6.2.1 Audible Fire Alarm

The audible alarm signaling devices used to indicate the receipt of fire alarm messages must produce a unique sound. Mount the device internally in the console and activate upon receipt of all fire alarm signals. Use separate and distinct audible devices to indicate the receipt of transmitter/interface trouble messages, including tamper and low-battery voltage, from the device used to denote receipt of fire alarm messages.

2.6.2.2 Visual Display

****
NOTE: Listed displays are minimum requirements, but if additional visual displays are required, such displays must be added to the list.
****

Indicate, as a minimum, the originating transmitter identity code number and include the following message designations:

a. Fire
b. Trouble
c. Battery
d. Test
e. Tamper
f. Master Zone [_____] thru [_____]

2.6.2.3 Console Memory

Provide a memory buffer capable of retaining a minimum of [500] [_____] transmitter codes, together with the specific message designations associated with each transmitter. Reject any received message not matching the programmed transmitter codes where such message identification code is not stored in the system. Upon command, display and print a summary of transmitters which have transmitted a low-battery or trouble message, or failed to transmit a message during the previous 24 [_____]-hour test period. Any incoming transmitter signal must pre-empt the command display and printout function, and be processed, displayed, and printed. Do not purge 24-hour memory and always be current and available. Do not lose transmitter memory data in the event of a total loss of operating or emergency power supplies.

2.6.2.4 Console Supervision

Provide constant supervision of the operating conditions of the console. Provide indicators for each major component, and produce an audible signal in the event of failure of any major component. Provide a switch to silence the audible trouble signal.

2.6.2.5 Receiver Supervision

Provide constant supervision and display of the operating condition of the radio receivers, and indicate an abnormal condition when a radio fire alarm transmitter carrier lasting more than 15 seconds is detected. Test the receiver's ability to properly receive and decode an incoming signal at least once every [_____] minutes.

2.6.2.6 Manual Battery Test

Provide a switch to manually place the console on emergency battery power for test purposes.

2.6.2.7 Electrical Connections

Design console with modular components to allow interchange of components for maintenance purposes. Primary power cables must incorporate positive twist-lock connections. Provide interconnecting cables and connectors compatible with computer quality signal data transmission.

2.6.3 Antenna System

****

NOTE: The antenna for the dual transmitter and receivers must be installed with a maximum vertical separation. The designer must check local conditions for design wind gust and ice loading. The lowest design wind speed is 160 km per hour 100 mph; typical design wind speed is 200 km per hour 125 mph).

****

Utilize vertical polarization antennas, communication links between transmitters/receivers and antennas, and matching networks as needed for the proper coverage. The antenna system must be either omni-directional or shaped-coveraged as selected by the Contractor based on the topography. Furnish the antenna system and cabling to provide adequate

system gain. Provide antennas capable of withstanding the environmental conditions of [200] [_____] km/hour [125] [_____] mph wind and [13 mm 1/2 inch radial] [_____] ice without failure. Provide lightning protection in compliance with NFPA 780. Antenna supporting structures must comply with TIA-222.

2.6.3.1 Grounding Conductors

Antenna grounding conductors must be minimum 32-strand, No. 17 AWG copper.

2.6.3.2 Communication Links

Transmission line between the transmitter/receiver and the antenna must be 50-ohm impedance rated for the transmitter output power. As a minimum, cable must exhibit an attenuation not exceeding 1.1 dB per 30.5 m 100 feet at 200 mHz.

2.7 FIRE ALARM SYSTEM PERIPHERAL EQUIPMENT

****
NOTE: Check the terrain and distances to determine if a repeater will be needed to transmit a signal from a remote location to the main control console.
****

2.7.1 Repeaters

Provide repeaters where indicated or required to meet system requirements. The repeater must receive on [_____] MHz and transmit on [_____] mHz. Provide receiver and transmitter sections conforming to the requirements specified for transceivers. Relay two-way data transmission between the base station and remote stations. Utilize a bandpass-type duplexer and one antenna, or multiple-bandpass cavity filters and multiple antennas. Provide duplexer or filter cavities that isolate the receiver from transmitter spurious noise and prevent receiver desensitization. Rate the duplexer or filter cavities to handle the output power of the transmitter. Key repeater with tone-encoded control circuit. Provide a transmitter time-out circuit to prevent system lockup.

2.7.2 Radio Fire Alarm Transmitter Box Location Light

****
NOTE: Use with fire alarm boxes only. Delete paragraph where a light is not required. Do not use for radio fire alarm transmitters that operate on batteries only.
****

Provide each indicated transmitter providing publicly accessible actuating functions with a vapor-tight, incandescent type light fixture constructed of a flame retardant, nonplastic, polycarbonate material with a threaded ruby globe. Support the light with 13 mm 1/2 inch galvanized steel conduit and locate approximately 300 mm 1 foot above the box. Provide the light with an incandescent, 50-watt, 120-volt extended service lamp. Do not equip transmitters which are powered by battery only with location lights.

2.7.3 Conduit

Provide conduit and fittings in compliance with UL 6, UL 1242, and UL 797.

2.7.4 Ground Rods

****

NOTE: Designer will determine the size, type, and number of ground rods to be used based on local conditions, earth resistivity data, and on the size and type of the electrical installation. Copper-clad steel rods will be specified for normal conditions. Zinc-coated steel or stainless steel rods will be used where low soil resistivities are encountered and galvanic corrosion may occur between adjacent underground metallic masses and the copper-clad rods. Stainless steel rods have a longer life than the zinc-coated steel, but use of zinc-coated steel must be justified based on the higher cost. Rods 16 mm 5/8 inch in diameter and 2.5 m 8 feet in length are generally acceptable; however, in rocky soils 19 mm 3/4 inch rods must be specified. In high resistivity soils, 3 m 10 foot or sectional rods may be used to obtain the required resistance to ground. Where rock is encountered, additional rods, a counterpoise, or ground grid may be necessary. Coordinate and standardize rod selection for individual facilities with other specification sections.

****

Provide ground rods consisting of [copper-clad steel conforming to UL 467] [zinc-coated steel conforming to IEEE C135.30] [solid stainless steel not less than [16] [19] mm [5/8] [3/4] inch in diameter by [2.5] [3] m [8] [10] feet in length] [of the sectional type].

2.7.5 Power Supply

****

NOTE: Locations with automatic backup power generation will require as a minimum 4 hours backup.

****

The operating power for the system must be single phase taken from the building electric service as specified in paragraph Power Supply for the System. Provide emergency backup power by sealed [lead-acid] [or] [nickel-calcium] type batteries requiring no additional water. The charging system must recharge fully discharged batteries within 12 hours and maintain the batteries in the fully charged state. The battery must have the capacity to operate the system for not less than 48 hours under maximum normal load with the power supply to the charger disconnected.

2.7.6 Wiring

Perform wiring in accordance with NFPA 70 and as indicated. Color code station wiring.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

Perform installation as shown and in accordance with the manufacturer's recommendations, unless otherwise specified. Provide all necessary interconnections, services, and adjustments required for a complete and operational system. Perform electrical work in accordance with NFPA 70.

3.2.1 Power Supply for the System

Provide a single dedicated branch-circuit connection for supplying power to the fire alarm system. Provide backup power supply that automatically energizes upon failure of the normal power supply.

3.2.2 Wiring for Systems

Install wiring for systems in rigid conduit, intermediate metallic conduit, or electric metallic tubing. Do not install the conductors for the fire alarm system in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. The sum of the cross-sectional areas of individual conductors must not exceed 40 percent of the interior cross-sectional area of the conduit. Provide conduit complying with NFPA 70. Provide ample gutter space to accommodate necessary wiring. Submit detail point-to-point wiring diagram, signed by the Registered Professional Engineer, showing all points of connection. Include connections between system devices, appliances, control panels, supervised devices, an all equipment that is activated or controlled by the panel.

3.3 OVERVOLTAGE AND SURGE PROTECTION

Protect equipment connected to alternating current circuits from surges in accordance with IEEE C62.41.1, IEEE C62.41.2 and NFPA 70. Install surge protection circuits installed at each end of cables and conductors which serve as communications links, except fiber optics. Do not use fuses for surge protection.

3.4 GROUNDING

Ground rods that protrude more than 150 mm 6 inches above grade are not permitted. Noncurrent-carrying metallic parts associated with radio fire alarm equipment must have a maximum resistance to solid "earth" ground not to exceed 25 ohms.

3.5 TRAINING

Conduct a training course for operating staff in the building where the system is installed as designated by the Contracting Officer. The training period must consist of [1 training day] [[_____] training days], [8] [_____] hours per day and start after the system is functionally completed but prior to the final acceptance tests. TCover all of the items contained in the approved operating and maintenance instructions.

3.6 TESTING

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. Document all readings, test results, and indicate the final position of controls in each test report. Notify the Contracting Officer 30 days before the performance and acceptance tests are to be conducted and submit the test procedures to be used. Submit detailed test procedures for the fire alarm reporting system [30] [_____] days prior to performing system tests. The test procedures must be signed by the Registered Professional Engineer. Perform the tests in the presence of the Contracting Officer under the supervision of the fire alarm system manufacturer's qualified representative. Furnish all instruments and personnel required for the tests.

3.6.1 Performance Testing

Upon completion of the installation, subject the system to a complete functional and operational performance test. Determine that the system is free from grounded, shorted, or open circuits. When all corrections have been made, retest the system to assure that it is functional. Submit copies of performance test reports in accordance with paragraph SUBMITTALS.

3.6.2 Acceptance Test

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NOTE: Listed tests are minimum required. If additional tests are required such tests must be added to the list.
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Perform testing in accordance with NFPA 72. The recommended tests in NFPA 72 are mandatory and verify that all previous deficiencies have been corrected. Include the following:

a. Tests to indicate there are no grounded, shorted, or open circuits.

b. Tests of each radio fire alarm transmitter/receiver/transceiver/ repeater.

c. Tests of radio fire alarm monitoring base station for all required functions.

d. Tests of normal and emergency power supplies.

-- End of Section --