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USACE / NAVFAC / AFCEC / NASA **UFGS-27 51 23.10 (May 2011)**

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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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05/11

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SECTION 27 51 23.10

INTERCOMMUNICATION SYSTEM
05/11

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NOTE: This guide specification covers the requirements for electronic intercommunication systems, including master and remote stations of the wired and wireless types.

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

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NOTE: This guide specification covers intercommunication systems and lists desirable features of electronic systems; however, not all manufacturers produce products with all the listed features. Manufacturers' catalogs may be consulted as to the features wanted and those features specified. Additional features, requirements, etc., may be made to this specification. Where intercommunication systems are to be used with other communication devices, consideration must be given to the electromagnetic compatibility of the intercommunication system in accordance with AR 5-12. This intercommunication system guide

specification does not include all features and design parameters which are available. However, specifying exact equipment configuration or design parameters which are unnecessarily restrictive to competition should be avoided.
****

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.

ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)

ECIA EIA/ECA 310-E	(2005) Cabinets, Racks, Panels, and Associated Equipment

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 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 50	(2015) UL Standard for Safety Enclosures for Electrical Equipment,

	Non-Environmental Considerations
UL 1449	(2014; Reprint Jul 2017) UL Standard for Safety Surge Protective Devices

1.2 SYSTEM DESCRIPTION

****

NOTE: This guide specification covers the requirements for three different types of intercommunication systems, one of which shall be selected for the project. The various types are as follows:

Type 1, Direct Connected, Keyed System. This type of system is applicable for relatively small systems (maximum quantity of remote stations approximately 30) and generally when only a small number of master stations (usually 1 or 2) are required. However, if there is a requirement for annunciation at more than one location or a requirement for multiple conversation paths, the use of this system with more than 1 or 2 master stations, or with many more than 30 remote stations may be justified or required.

Type 2, Single Conversation Path, Central Control System. This type of system is applicable to relatively large systems (more than approximately 30 stations) where only one conversation path is required and usually only one master station. This type of system is applicable to BEQ's. This type of system includes public address and paging systems when the unique requirements are included.

Type 3, Multiple Conversation Paths, Central Control System. This type of system is applicable to various size systems where a large portion of the total quantity of stations are master stations. A limited quantity of conversation paths may be specified as required.

****

Provide an Intercommunication System, Data Package 3 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA, which is solid state, modular in design, and of the [wired] [and] [wireless] type as indicated. [Stations shall have capacity for later expansion to [[_____] master] [and] [[_____] remote] stations [with [_____] handset] [and] [or] [with hands free operation] without sacrificing any equipment or feature of performance.] [When both wired and wireless circuitry are used, such interface shall not present a reduction of function or quality.]

1.2.1 Sound Reproduction

Provide an intercommunication system to reproduce a signal at all receiving stations from a 40 dB minimum input signal referenced to a microphone sound pressure level (SPL) over the frequency range of [300] [_____] to [3300] [_____] Hz. The received signal shall have a dynamic range of 30 dB, adjustable at the receiving station. Unless otherwise specified SPL shall be 20 micro Paschal. The root-mean-square (rms)

extraneous noise (e.g. hum) level introduced by the intercommunication system shall be at least [30] [_____] dB below the nominal signal level. Distortion, including envelope delay, intermodulation, cross talk, and other nonlinear sources, shall not exceed 5 percent.

1.2.2 System Operation and Service Features

1.2.2.1 Control and Power Requirements

Provide a system with a power switch and an associated pilot light for ON and OFF operations. USE a volume control at each station to regulate listening volume. System shall operate on 110-125 Vac, single phase, 60 Hz.

1.2.2.2 Call-In Indication

Master stations shall have a "call-in" switch to provide an audible and/or visual indication of incoming calls from remote stations. Individual visual indication shall identify calling station and status, and remain actuated until a call is answered by a master station.

1.2.2.3 Identification Plates

In addition to the manufacturer's standard identification plates, provide engraved laminated phenolic identification plates for each component connection and terminal. Identification labels shall be 3-layer black on white on black, engraved to show white letters on a black background. Any warning or caution labels shall be 3-layered red on white on red, engraved to show white letters on red background. Control switches and knobs shall be clearly marked with their function and status. Identification strips for station selector switches shall be located to clearly identify remote and master stations and shall be protected by transparent plastic inserts.

1.2.2.4 Speaker/Handset Stations

At speaker/handset stations, lifting the handset shall automatically cut out the loudspeaker in the station and all conversation shall be carried through the handset.

1.2.2.5 Privacy Switch

****

NOTE: Where noise does not exceed 55 dB, specify hands-free operation from distances up to 6 m 20 feet. In areas where the noise occasionally exceeds 55 dB, a talk-listen switch which overrides the hands-free operation should be specified. Where a high noise environment exists, delete hands-free operation and specify only a talk-listen switch.

****

Provide a privacy switch at each remote station. When in the ON position, the switch shall prevent any transmission of sound from the remote station. When in the OFF position, without further switch manipulation, the station shall respond to incoming calls upon voice activation from anywhere within a 6 m 20 foot radius of station.

1.3 SUBMITTALS

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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

Intercommunication System Installation

SD-03 Product Data

Spare Parts
Acceptance Tests

SD-06 Test Reports

Acceptance Tests

SD-10 Operation and Maintenance Data

Intercommunication System; G[, [_____]]

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 EXTRA MATERIALS

After approval of detail drawings and not later than [_____] months prior to the date of beneficial occupancy, furnish spare parts data for each different item of equipment and component in the system. Include with the data a complete list of parts and supplies, with current unit prices and source of supply.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

****

NOTE: Project drawings should clearly indicate the exact location of all stations, conduit, wiring, and junction boxes. If no drawings of the locations of master stations, remote stations, junction boxes, etc., are furnished with the specification, the number and type of stations and junction boxes and the distance between them must be included as a part of the project specification.

****

2.1.1 Standard Products

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicate equipment that have been in satisfactory use at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.2 Identical Items

Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.

2.1.3 Nameplates

Each major component of equipment shall have the manufacturer's name, model number, and serial number on a plate screwed to the equipment.

2.2 TYPE 1 SYSTEM

****

NOTE: Delete this System unless specifying a Type 1 System.

****

A manually switched direct connected keyed intercommunication system shall accommodate [_____] stations in any combination of master stations and remote stations. Master and remote stations shall be provided in the quantities indicated. Each master station shall selectively communicate with any other master station and any remote station by actuation of an appropriate selector switch. [Each master station shall be designed to be capable of initiating a message to all other master stations and all remote stations simultaneously or in groups of not less than 10 stations per group.]

2.2.1 Master Station

[Desk] [Surface wall] [Recessed wall] [Rack]-mounted master stations shall have:

a. Station-selector switches and talk-listen switches that are heavy duty type gold plated contacts rated for five million operations.

b. Volume Control to regulate incoming call volume.

c. A light annunciation that identifies the calling stations and stations in use. The light shall remain on until the call is answered.

d. A tone annunciator with a momentary audible tone signal that announces incoming calls.

[e. A handset with hook switch, telephone type, arranged to disconnect the speaker when the handset is lifted. The cord shall be 450 mm 18 inches long and permanently coiled.]

e. A metallic central control cabinet that shall comply with ECIA EIA/ECA 310-E. The cabinet shall houses terminal strips, power supplies,amplifiers, system volume control, and auxiliary equipment. It shall be lockable and ventilated.

f. The master station shall accommodate [_____] stations and shall have a speaker sensitivity of 40 dB minimum.

2.2.2 Intercommunication Amplifier

The system intercommunication amplifier shall, as a minimum, conform to the following specifications:

Output Power	2 watts rms minimum with adequate power for all functions and a 20 percent spare capacity
Total Harmonic Distortion	Less than 5 percent at rated output power with a load equivalent to one station connected to output terminals
Signal-To-Noise Ratio	60 dB or greater at rated output
Frequency Response	Plus or minus 2 dB from 200 Hz to 10,000 Hz
Output Regulation	Maintains output level within 2dB from full to no load

Input Sensitivity	Matched to input circuit and providing full-rated output with sound-pressure level of not more than 10 dynes/sq. cm 0.000145 psi impinging on master stations, speaker microphones, or handset transmitters.

2.2.3 Remote Station

[Desk] [Surface wall] [Recessed wall] [Rack]-mounted remote station shall have [stainless steel] [anodized aluminum] faceplate with tamper proof mounting screws and [galvanized steel] [aluminum] backbox. The remote station shall have:

a. A speaker with a minimum sensitivity of 40 dB for speakers less than 200 mm 8 inches in diameter and 45 dB for speakers 200 mm 8 inches or greater.

b. A call announcement monitor lamp that lights when there are incoming calls.

c. A recurring momentary tone that announces incoming calls.

d. Call Switch that permits a call to the master station.

e. Privacy Switch. When in the on position, the switch prevents the transmission of sound from the remote station to the system. When in the off position, without further switch manipulation, response can be made to incoming calls.

[f. A handset with hook switch, telephone type, arranged to disconnect the speaker when the handset is lifted. The cord shall be 450 mm 18 inches long and [permanently coiled] [metallic jacketed].]

2.2.4 All-Call Amplifier

All-call amplifier shall, as a minimum, conform to the following specifications:

Output Power	Minimum of 0.5 watt rms for each station
Total Harmonic Distortion	Less than 5 percent at rated output power with a load equivalent to the quantity of stations connected to it in all-call mode of operation
Signal-To-Noise Ratio	60 dB or greater at rated output
Frequency Response	Plus or minus 2 dB from 200 Hz to 10,000 Hz
Output Regulation	Maintains output level within 2dB from full to no load

Input Sensitivity	Compatible with master stations and central equipment so amplifier delivers full-rated output with sound pressure level of less than 10 dynes/sq. cm 0.000145 psi impinging on master station, speaker microphone or hand set transmitter.
Amplifier Protection	Prevent damage from shorted or open circuit

2.2.5 Power Line Surge Protection

All amplifiers shall have a device, whether internal or external, which provides protection against voltage spikes and current surges originating from commercial power sources in accordance with IEEE C62.41.1/ IEEE C62.41.2 B3, combination wave form 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 Volts ac (neutral to ground). Surge protection device shall be UL listed and labeled as having been tested in accordance with UL 1449.

2.2.6 Signal Surge Protection

All amplifiers shall have internal protection circuits which protects the component from mismatched loads, direct current and shorted output lines. Communication cables/conductors shall have surge protection installed at each point where it exits or enters a building.

2.3 TYPE 2 SYSTEM

****
NOTE: Delete this Type unless specifying a Type 2 System.
****

A microprocessor switched single conversation path, central control intercommunication system shall include [an annunciator panel,] a master station, automatic switching equipment, remote stations and all amplifiers, control equipment and ancillary devices required to provide features specified. The master station shall selectively communicate with any remote station by actuating the [two] [three] digit number assigned to that remote station. [The master station shall be designed to communicate with all remote stations simultaneously or in groups of not less than 10 stations by actuating an assigned "all-call" number.] Only the selected remote station shall listen or talk to the master station. A nonselected remote station shall not be able to hear or interfere with any portion of conversation between a master station and the selected remote station. Hanging up the master station handset shall reset the system for next call. The quantity and location of remote stations shall be as indicated on the drawings. [A paging function shall also be part of the system.]

2.3.1 Master Station

[Desk-top][Surface wall] [Recessed wall] [Rack-mounted] type master station equipped with:

a. A 12 digit keypad selector to transmit calls to other stations and initiate commands for programming operations.

b. Volume control to regulate incoming call volume.

c. Light annunciation to identify calling stations and stations in use. The light shall remain on until a call is answered.

d. Tone annunciation with a momentary audible tone signal that announces incoming calls.

e. Reset controls that cancels calls and resets system for the next call.

[f. A handset with hook switch, telephone type, arranged to disconnect the speaker when the handset is lifted. The cord shall be 450 mm 18 inches long and permanently coiled.]

g. A metallic central control cabinet that shall comply with ECIA EIA/ECA 310-E. The cabinet shall houses terminal strips, power supplies,amplifiers, system volume control, and auxiliary equipment. It shall be lockable and ventilated.

h. The master station shall accommodate [_____] stations and shall have a speaker sensitivity of 40 dB minimum.

2.3.2 Remote Station

[Desk-top] [Surface wall] [Recessed wall] [Rack-mounted] remote stations with [stainless steel] [anodized aluminum] face plates with tamperproof mounting screws and [galvanized steel] [aluminum] backbox shall be provided. The remote station shall have:

a. A speaker with a minimum sensitivity of 40 dB for speakers less than 200 mm 8 inches in diameter and 45 dB for speakers 200 mm 8 inches or greater.

b. A call announcement monitor lamp that lights when during incoming calls.

c. A recurring momentary tone that announces incoming calls.

d. Call Switch that permits a call to the master station.

e. Privacy Switch. When in the on position, the switch prevents the transmission of sound from the remote station to the system. When in the off position, without further switch manipulation, response can be made to incoming calls.

[f. A handset with hook switch, telephone type, arranged to disconnect the speaker when the handset is lifted. The cord shall be 450 mm 18 inches long and [permanently coiled] [metallic jacketed].]

2.3.3 Amplifier

2.3.3.1 Intercommunication Amplifier

Intercommunication amplifiers shall as a minimum conform to the following specifications:

Output Power	2 watts rms minimum with adequate power for all functions and a 20 percent spare capacity
Total Harmonic Distortion	Less than 5 percent at rated output power with a load equivalent to one station connected to output terminals
Signal-To-Noise Ratio	60 dB or greater at rated output
Frequency Response	Plus or minus 2 dB from 200 Hz to 10,000 Hz
Output Regulation	Maintains output level within 2dB from full to no load
Input Sensitivity	Matched to input circuit and providing full-rated output with sound-pressure level of not more than 10 dynes/sq. cm 0.000145 psi impinging on master stations, speaker microphones, or handset transmitters.

2.3.3.2 All-Call Amplifier

All-call amplifiers shall as a minimum conform to the following specifications:

Output Power	Minimum of 0.5 watt rms for each station
Total Harmonic Distortion	Less than 5 percent at rated output power with a load equivalent to the quantity of stations connected to it in all-call mode of operation
Signal-To-Noise Ratio	60 dB or greater at rated output
Frequency Response	Plus or minus 2 dB from 200 Hz to 10,000 Hz
Output Regulation	Maintains output level within 2dB from full to no load
Input Sensitivity	Compatible with master stations and central equipment so amplifier delivers full-rated output with sound pressure level of less than 10 dynes/sq. cm 0.000145 psi impinging on master station, speaker microphone or hand set transmitter.
Amplifier Protection	Prevent damage from shorted or open circuit

2.3.3.3 Paging Amplifier

****

NOTE: To specify proper power rating of amplifier, allow 1 watt for each cone type speaker and 1.5 watts for each horn type. Special circumstances may dictate greater power requirements.

****

The paging amplifiers as a minimum shall conform to the following specifications:

Input Voltage	120 V ac, 60 Hz
Frequency Response	Within plus or minus 3 dB from 60 to 10,000 Hz
Minimum Signal-To-Noise Ratio	60 dB at rated output
Total Harmonic Distortion	Less than 3 percent at rated power output from 70 to 12,000 Hz
Output Regulation	Less than 2 dB from full to no load
Controls	On/off, Input levels, and low cut filter
Amplifier Protection	Prevent damage from shorted or open circuit
Power Output	[_____] watts or greater

2.3.3.4 Power Line Surge Protection

All amplifiers shall have a device, whether internal or external, which provides protection against voltage spikes and current surges originating from commercial power sources in accordance with IEEE C62.41.1/ IEEE C62.41.2 B3, combination wave form 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 Volts ac (neutral to ground). Surge protection device shall be UL listed and labeled as having been tested in accordance with UL 1449.

2.3.3.5 Signal Surge Protection

All amplifiers shall have internal protection circuits which protects the component from mismatched loads, direct current and shorted output lines. Communication cables/conductors shall have surge protection installed at each point where it exits or enters a building.

2.3.4 Horn-Type Loudspeakers

Horn-type loudspeakers shall be all metal [weather proof] construction complete with universal mounting brackets. [Shall be suitable for Class [1, Groups C and D] [1, Groups B,C, and D] [2, Groups E, F and G] hazardous locations and equipped with 13 mm 1/2 inch threaded conduit entry]. The horn type loudspeakers shall be provided with an internally mounted, factory installed line transformers. and shall as a minimum conform to the following specifications:

Power Rating	[25][_____] watts
Horizontal Dispersion Angle	[57][70][90][115][_____]
Vertical Dispersion Angle	[57][90][115][_____]
Axial Sensitivity	Minimum of [60][_____] dB

Line Transformers Power Rating	At least 4 watts with at least four taps with insertion rate of 0.5 dB

2.3.5 Cone-Type Loud speakers

Cone-type loud speakers shall be enclosed in a [steel housing] [back boxes] and shall be acoustically dampened with a front face of at least 1.21 mm 0.0478 inches steel. The whole assembly shall be rust proofed and factory primed complete with mounting assembly and suitable for for [surface ceiling] [flush ceiling] [pendant] [wall] mounting with a relief of back pressure. The cone-type loudspeakers shall comply with the following specifications:

Minimum Axial Sensitivity	A pressure rating of 45 dB
Frequency Response	Within plus or minus 3 dB from 70 to 15,000 Hz
Minimum Dispersion Angle	100 degrees
Line Transformers Power Rating	At least 4 watts with at least four taps with insertion rate of 0.5 dB
Speaker Size	200 mm 8 inches with 25 mm 1 inch voice coil and minimum 142 grams 5 oz ceramic magnet

2.4 TYPE 3 SYSTEM

****
NOTE: Delete this Type unless specifying a type 3 system.
****

A microprocessor switched multiple conversation path central control intercommunication system shall be provided. The system shall be capable of communicating with other master stations and remote stations selectively or in any combination thereof. Each master station shall selectively communicate with any other master station or any remote station by actuating number assigned to called station. [Each master station shall also be designed to initiate a message to all other master stations and all remote stations simultaneously or in groups of not less than 10 stations.] Station quantities shall be as indicated on drawings. [A paging functions shall also be part of the system.]

2.4.1 Master Station

[Desk-top] [Surface wall] [Recessed wall] [Rack-mounted] master stations equipped with:

a. A 12 digit keypad selector to transmit calls to other stations and initiate commands for programming operations.

b. Volume control to regulate incoming call volume.

c. Light annunciation to identify calling stations and stations in use. The light shall remain on until a call is answered.

d. Tone annunciation with a momentary audible tone signal that announces incoming calls.

e. Reset controls that cancels calls and resets system for the next call.

f. [A handset with hook switch, telephone type, arranged to disconnect the speaker when the handset is lifted. The cord shall be 450 mm 18 inch long and permanently coiled.]

g. A metallic central control cabinet that shall comply with ECIA EIA/ECA 310-E. The cabinet shall houses terminal strips, power supplies,amplifiers, system volume control, and auxiliary equipment. It shall be lockable and ventilated.

h. The master station shall accommodate [_____] stations and shall have a speaker sensitivity of 40 dB minimum.

2.4.2 Remote Station

[Desk-top] [Surface wall] [Recessed wall] [Rack-mounted] remote stations with [stainless steel] [anodized aluminum] face plates with tamperproof mounting screws and [galvanized steel] [aluminum] backbox shall be provided. The remote station shall have:

a. A speaker and with a minimum sensitivity of 40 dB for speakers less than 200 mm 8 inches in diameter and 45 dB for speakers 200 mm 8 inches or greater.

b. A call announcement monitor lamp that lights when during incoming calls.

c. A recurring momentary tone that announces incoming calls.

d. Call Switch that permits a call to the master station.

e. Privacy Switch. When in the on position, the switch prevents the transmission of sound from the remote station to system. When in the off position, without further switch manipulation, response can be made to incoming calls.

[f. A handset with hook switch, telephone type, arranged to disconnect the speaker when the handset is lifted. The cord shall be 450 mm 18 inches long and [permanently coiled] [metallic jacketed].
]

2.4.3 Amplifier

2.4.3.1 Intercommunication Amplifier

Intercommunication amplifiers shall as a minimum conform to the following specifications:

Output Power	2 watts rms minimum with adequate power for all functions and a 20 percent spare capacity
Total Harmonic Distortion	Less than 5 percent at rated output power with a load equivalent to the one station connected to the output terminals

Signal-To-Noise Ratio	60 dB or greater at rated output
Frequency Response	Plus or minus 2 dB from 200 Hz to 10,000 Hz
Output Regulation	Maintains output level within 2dB from full to no load
Input Sensitivity	Matched to input circuit and providing full-rated output with sound-pressure level of not more than 10 dynes/sq. cm 0.000145 psi impinging on master stations, speaker microphones, or handset transmitters

2.4.3.2 All-Call Amplifier

All-call amplifiers shall as a minimum conform to the following specifications:

Output Power	Minimum of 0.5 watt rms for each station
Total Harmonic Distortion	Less than 5 percent at rated output power with a load equivalent to [_____] stations connected to output terminal
Signal-To-Noise Ratio	60 dB or greater at rated output
Frequency Response	Plus or minus 2 dB from 200 Hz to 10,000 Hz
Output Regulation	Maintains output level within 2dB from full to no load
Input Sensitivity	Compatible with master stations and central equipment so amplifier delivers full-rated output with sound pressure level of less than 10 dynes/sq. cm 0.000145 psi impinging on master station, speaker microphone or hand set transmitter.
Amplifier Protection	Prevent damage from shorted or open circuit

2.4.3.3 Paging Amplifier

****

NOTE: To specify proper power rating of amplifier, allow 1 watt for each cone type speaker and 1.5 watts for each horn type. Special circumstances may dictate greater power requirements.

****

The paging amplifiers shall conform to the following specifications:

Input Voltage	120 V ac, 60 Hz
Frequency Response	Within plus or minus 3 dB from 60 to 10,000 Hz
Minimum Signal-To-Noise Ratio	60 dB at rated output

Total Harmonic Distortion	Less than 3 percent at rated power output from 70 to 12,000 Hz
Output Regulation	Less than 2 dB from full to no load
Controls	On/off, Input levels, and low cut filter
Input Sensitivity	Matched to input circuit and providing full rated output with sound pressure level of less than 10 dynes/sq. cm 0.000145 psi impinging on speaker microphone or handset transmitter
Amplifier Protection	Prevent damage from shorted or open circuit
Power Output	[_____] watts or greater

2.4.3.4 Power Line Surge Protection

All amplifiers shall have a device, whether internal or external, which provides protection against voltage spikes and current surges originating from commercial power sources in accordance with IEEE C62.41.1/ IEEE C62.41.2 B3, combination wave form 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 Volts ac (neutral to ground). Surge protection device shall be UL listed and labeled as having been tested in accordance with UL 1449.

2.4.3.5 Signal Surge Protection

All amplifiers shall have internal protection circuits which protects the component from mismatched loads, direct current and shorted output lines. Communication cables/conductors shall have surge protection installed at each point where it exits or enters a building.

2.4.4 Horn-Type Loudspeakers

Horn-type loudspeakers shall be all metal [weather proof] construction complete with universal mounting brackets. [Shall be suitable for Class[1, Groups C and D] [1, Groups B,C, and D] [2, Groups E, F and G] hazardous locations and equipped with 12.7 mm 1/2 inch threaded conduit entry]. The horn type loudspeakers shall be provided with an internally mounted, factory installed line transformers. and shall as a minimum conform to the following specifications:

Power Rating	[25][_____] watts
Horizontal Dispersion Angle	[57][70][90][115][_____]
Vertical Dispersion Angle	[57][90][115][_____]
Axial Sensitivity	Minimum of [60][_____] dB

Line Transformers Power Rating	At least 4 watts with at least four taps with insertion rate of 0.5 dB

2.4.5 Cone-Type Loud speakers

Cone-type loud speakers shall be enclosed in a [steel housing] [back boxes] and shall be acoustically dampened with a front face of at least 1.21 mm 0.0478 inches steel. The whole assembly shall be rust proofed and factory primed complete with mounting assembly and suitable for [surface ceiling] [flush ceiling] [pendant] [wall] mounting with a relief of back pressure. [Baffle for flush speakers shall be a minimum thickness of 0.8128 mm 0.032 inches aluminum [brushed to a satin sheen and lacquered] [with textured white finish] [_____]]. [Vandal-proof high strength baffles for flush mounted speakers shall be self-aging cast aluminum with tensile strength of 3,093 kg/sq. cm 44,000 psi and a minimum thickness of 0.635 mm 0.025 inch. The mounting screws shall be heat-treated alloy and textured white epoxy finish.] The cone-type loudspeakers shall comply with the following specifications:

Minimum Axial Sensitivity	A pressure rating of 45 dB
Frequency Response	Within plus or minus 3 dB from 70 to 15,000 Hz
Minimum Dispersion Angle	100 degrees
Line Transformers Power Rating	At least 4 watts with at least four taps with insertion rate of 0.5 dB
Speaker Size	200 mm 8 inches with 25 mm 1 inch voice coil and minimum 142 grams 5 oz ceramic magnet

2.5 SPEAKER ENCLOSURES

Speaker enclosures shall be compatible with the speakers specified and comply with UL 50.

2.6 TERMINALS

Terminals shall be [solderless, tool-crimped pressure] [or] [_____] type.

2.7 COMMUNICATIONS WIRING

Type of signal and control circuit wire and number of conductors shall be provided as recommended by the intercommunication system manufacturer, and as necessary to provide a complete and operable system. Where required, cable shall be UL classified low smoke and low flame for use in air plenums in accordance with NFPA 70.

2.8 SURGE PROTECTION

Major components of the system such as Master Stations, Amplifiers, and Remote Stations, shall have a device, either internal or external, which shall provide protection against voltage spikes and current surges.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

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NOTE: State precisely what is to be shown in detail drawings. State also the calculations that need to be a part of the submittal.

****

Submit detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, catalog cuts, manufacturer's data, materials and equipment lists, and operational and general maintenance instructions, including the overall system and for each major component. Illustrate on the drawings how each item of equipment has been coordinated to function properly in the system. Include on detail drawings an overall system schematic indicating relationship of intercommunication units on one diagram and showing power source, system controls, impedance matches, plus number, size, and maximum lengths of interconnecting wires and indicate clearances required for maintenance and operation. Provide calculations for power requirements of equipment to show that the proper power levels are provided for the specified equipment. Install all system components and appurtenances in accordance with the manufacturer's instructions and as specified and shown. Units to be mounted outside or subject to inclement conditions shall be weatherproof or be mounted in weatherproof enclosures.

3.2.1 Signal and Control Circuits Wiring

Install signal and control circuits in accordance with NFPA 70 and as indicated. The conductors shall be separated as recommended by the equipment manufacturer.

3.2.2 Conduit, Cable Tray and Tubing Systems

Install wiring in rigid conduit, intermediate metal conduits, cable trays, or electric metallic tubing as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.3 GROUNDING

Perform the connection of interfacing components through the use of transformers and the tying of interconnecting lines to a unit ground bus at one end only. The ground and distribution ground buses shall be solid copper wire with insulating covering.

3.4 TRAINING

Conduct a training course for [_____] members of the operating staff and for [_____] members of the maintenance staff as designated by the Contracting Officer. The training course will be given at the installation during normal working hours for a total of [_____] hours for the operating staff and [_____] hours for the maintenance staff, and

shall start after the system is functionally complete but prior to final acceptance tests. The field instructions shall cover all of the items contained in the approved operating and maintenance instructions, as well as the demonstration of routine maintenance operations. The Contracting Officer shall be notified at least 14 days prior to the start of the training course.

3.5 ACCEPTANCE TESTS

After installation has been completed, conduct an acceptance test, using the approved test plan, to demonstrate that the equipment operates in accordance with specification requirements. Submit test plan and procedures for the acceptance test explaining in detail step-by-step actions and expected results to demonstrate compliance with the requirements specified. The procedures shall also explain methods for simulating the necessary conditions of operation to demonstrate system performance. Notify the Contracting Officer [_____] days prior to the performance of tests. In no case shall notice be given until after the Contractor has received written approval of the test plans. The acceptance tests shall include as a minimum the following tests:

3.5.1 Operational Test

Test originating station-to-station, all call, and page messages at each intercommunication station. Verify proper routing and volume levels and that the system is free of noise and distortion. Test available message path from each station on system.

3.5.2 Frequency Response Test

Determine frequency response of two transmission paths, including all-call, and paging, by transmitting and recording audio tones. Minimum acceptable performance is within 3 dB from 150 to 2500 Hz.

3.5.3 Signal-to-Noise Ratio Test

Measure signal-to-noise ratio of complete system at normal gain setting as follows:

a. Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000 Hz signal. Measure signal-to-noise ratio at paging speakers.

b. Repeat test for four speaker microphones and for each separately controlled zone of paging loudspeakers.

c. Minimum acceptable ratio is 35 dB.

3.5.4 Distortion Test

Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into each paging and all-call amplifier, and a minimum of 2 selected intercommunication amplifiers. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.

3.5.5 Acoustic Coverage Test

Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound level meter with octave band filters to measure level at three locations in each paging zone. Maximum permissible variation in level is plus or minus 3 dB; in levels between adjacent zones, plus or minus 5 dB.

3.5.6 Power Output Test

Measure electrical power output of each paging amplifier at normal gain setting of 150, 1000 and 2500 Hz. Maximum variation in power output at these frequencies is plus or minus 3 dB.

3.5.7 Test Reports

Submit test reports in booklet form, upon completion and testing of the installed system, showing all field tests performed to adjust each component and to prove compliance with the specified performance criteria. Include in each test report the final position of controls and operating mode of the system. Include the manufacturer, model number, and serial number of test equipment used in each test.

-- End of Section --