SECTION 275123 - EDUCATIONAL INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

Latest Update 5-7-2017 See underlined text for Edits.

(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project.)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 27.

1.2 SUMMARY

A. Section Includes: [Manually switched intercommunications] [Microprocessor-switched intercommunications] [Microprocessor-switched telephone/intercommunications] <Select Comm type> and program systems with the following components:

1. Master stations.
2. Call control console.
3. Speaker-microphone stations.
4. Call-switch unit.
5. All-call amplifier.
6. Intercommunication amplifier.
7. Paging amplifier.
8. Loudspeakers/speaker microphones.
9. Conductors and cables.
10. Raceways.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For educational intercommunications and program systems. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include scaled drawings for station arrangement of built-in equipment.

3. Wiring Diagrams: For power, signal, and control wiring.

   a. Identify terminals to facilitate installation, operation, and maintenance.
   b. Single-line diagram showing interconnection of components.
   c. Cabling diagram showing cable routing.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.

D. Qualification Data: For qualified Installer and testing agency.

E. Field quality-control reports.

F. Operation and Maintenance Data: For educational intercommunications and program systems to include in operation and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. A record of final matching transformer-tap settings and signal ground-resistance measurement certified by Installer.
2. A record of Owner's equipment-programming option decisions.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated.

1. Testing Agency's Field Supervisor: Certified by NICET as Audio Systems Level III Technician.

C. Source Limitations: Obtain educational intercommunications and program systems from single source from single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for location and application.

E. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of ceiling-mounted speaker microphones and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.6 WARRANTY/GUARANTEE

A. See Division 26 Specification Section "Basic Electrical Requirements' for warranty and guarantee requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Bogen Communications, Inc.
2. Dukane Communication Systems; part of GE Infrastructure, Security.
3. Jeron Electronic Systems, Inc.
4. Rauland-Borg Corporation.

2.2 FUNCTIONAL DESCRIPTION OF MANUALLY SWITCHED SYSTEMS

A. Master Station:

1. Communicating selectively with other master and speaker-microphone stations by actuating selector switches.
2. Communicating simultaneously with all other stations by actuating a single all-call switch.
3. Communicating with individual stations in privacy.
4. Including other master-station connections in a multiple-station conference call.
5. Accessing separate paging speakers or groups of paging speakers by actuating selector switches.
6. Overriding any conversation by a designated master station.

B. Speaker-Microphone Station:

1. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.

2. Communicating hands free.
3. Calling master station by actuating call switch.
4. Returning a busy signal to indicate that station is already in use.
5. Being free of noise and distortion during operation and when in standby mode.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.3 FUNCTIONAL DESCRIPTION OF MICROPROCESSOR-SWITCHED SYSTEMS

A. Master Station:

1. Communicating selectively with other master and speaker-microphone stations by dialing station's number on a twelve (12) digit keypad.
2. Communicating with individual stations in privacy.
3. Communicating on a minimum of three voice channels with up to two simultaneous conversations between master stations and one conversation between a master station and a speaker-microphone station.
4. Increasing the number of conversation channels by adding a module in central-control cabinet.
5. Including up to three other station connections in a conference call.
6. Accessing separate paging speakers or groups of paging speakers by dialing designated numbers on a twelve (12) digit keypad.
7. Overriding any conversation by a designated master station.
8. Displaying selected station.
9. Communicating simultaneously with all other stations by dialing a designated number on a twelve (12) digit keypad.
10. Automatically controlling gain to ensure constant intercom speech level.
11. Controlling the simultaneous distribution of program material to various combinations of speaker-microphone stations or groups over two program channels by using keypad to control sources and distribute programs.
12. Operating and correcting secondary clocks and controlling class-change signals to speakers and bells by using keypad.
13. User-programmable features include the following:

    a. Station calling by room number.
    b. Room station call-in priority levels.
    c. Clock signal schedule functions.
    d. Schedule characteristics of audible signals.
    e. Call-in tone characteristic.
    f. Precedence among master stations as destinations for incoming calls from room stations.
    g. Grouping of rooms and speakers into zones for paging and program distribution purposes.

B. Speaker-Microphone Station:

1. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
2. Communicating hands free.
3. Calling master station by actuating call switch.
4. Returning a busy signal to indicate that station is already in use.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.4 FUNCTIONAL DESCRIPTION OF TELEPHONE/INTERCOMMUNICATION SYSTEMS

A. Integrated central system with the following:

1. Direct-dial, full duplex private telephone communications between all locations equipped with telephones. Call initiation among master stations and between master and remote stations by dialing station's number on a twelve (12) digit keypad.
2. [Sixteen (16)] <Insert number> channels for unrestricted simultaneous communications.
3. Initial system operation with <Insert number> master and remote stations, expandable to three hundred sixty (360) stations.
4. Direct-dial, two (2) way amplified voice intercommunication between master telephones and remote stations without use of press-to-talk or talk-listen switches.
5. Automatic queuing for intercommunication channels, with automatic call waiting.
6. Call transfer among master stations.
7. Display of selected station and answering calling station by pressing a single "response button."
8. Simultaneous communication with other stations on system by dialing a designated number on a twelve (12) digit keypad.
9. Automatic gain control to ensure constant intercom speech level.
10. Simultaneous distribution of emergency announcements to all locations equipped with speakers by dialing a predetermined code number.
11. User-selectable facility for providing selected telephones with dial tone.
12. User-selectable facility for permitting linkage of selected stations to media retrieval center and for permitting on- and off-premise computer linkage.
13. Assignment of speaker locations within any one or more of eight zones for zone paging or time signal reception.
14. Digital readout displays on which up to three incoming calls are displayed with additional calls stored for subsequent display.
15. Off-site diagnostics through a serial data port on central-control station.
16. Control of simultaneous distribution of program material to various combinations of remote stations or groups by using keypad to control sources and distribute programs.

17. Operation and correction of secondary clocks and control of class-change signals to speakers and bells by using keypad.
18. User-programmable features include the following:

    a. Station calling by room number.
    b. Room station call-in priority levels.
    c. Clock signal schedule functions.
    d. Schedule characteristics of audible signals.
    e. Call-in tone characteristic.
    f. Precedence among master stations as destinations for incoming calls from room stations.
    g. Grouping rooms and speakers into zones for paging and program distribution purposes.

19. Telephone interconnect features include the following:

    a. Direct connection to central office trunk lines with initial system wiring for <Insert number> trunk lines.
    b. Routing of outside trunk lines for "attendant answer incoming" and "direct inward line" functions.
    c. Station programming for access to outside trunk lines to be any of the following:

        1) Totally unrestricted access.
        2) Restricted access.
        3) No access.

    d. System programming to allow or disallow local prefixes, and to authorize access for as many as three area codes.
    e. Discriminating ringing for identifying internal and outside calls.
    f. Circular hunting for outside trunks to prevent excess usage of any one trunk.
    g. Direct connection of a single trunk to designated telephone with transfer to attendant if unanswered.
    h. Call parking allowing paged party to remotely pick up outside call from any master station.
    i. Night-answer mode to allow one or all of the following:

        1) Incoming call transferred to predetermined extension.
        2) Tone transmitted to speakers to notify key personnel to answer telephone.
        3) Dial tone to remote stations to allow answering call from all locations.

    j. Call control console to do as follows:

1) Identify, answer, and route incoming outside calls, with reminder and recall features.
2) Directly access outside trunk lines.
3) Hold, park, and transfer calls.
4) Screen outside calls.

B. Remote Stations:

1. Speaker-Microphone Station:

a. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
b. Communicating hands free.
c. Calling master station by actuating call switch.
d. Returning a busy signal to indicate that station is already in use.

C. Speakers: Free of noise and distortion during operation and when in standby mode.

2.5 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

A. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.

B. Expansion Capability: Increase number of stations in the future by 25 % above those indicated without adding any internal or external components or main trunk cable conductors.

C. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz. Comply with UL 813.

D. Weather-Resistant Equipment: Listed and labeled by an NRTL for duty outdoors or in damp locations.

2.6 MASTER STATION FOR MANUALLY SWITCHED SYSTEMS

A. Station-Selector and Talk-Listen Switches: Heavy-duty type with gold-plated contacts rated for five million operations.

B. Volume Control: Regulates incoming-call volume.

C. LED Annunciation: Identifies calling stations and stations in use. LED remains on until call is answered.

D. Tone Annunciation: Momentary audible tone signal announces incoming calls.

E. Speaker Microphone: Transmits and receives calls.

1. Minimum Speaker Sensitivity: 91 dB at one meter, with 1-W input.

F. Handset with Hook Switch: Telephone type with eighteen (18) inch long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.

G. Central-Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and auxiliary equipment.

2.7 MASTER STATION FOR MICROPROCESSOR-SWITCHED SYSTEMS

A. Twelve (12) Digit Keypad Selector: Transmits calls to other stations and initiates commands for programming and operation.

B. Volume Control: Regulates incoming-call volume.

C. Tone Annunciation: Momentary audible tone signal announces incoming calls.

D. Lamp Annunciation: Identifies calling stations and stations in use. Lamp remains on until call is answered.

E. Speaker Microphone: Transmits intercom voice signals when used via a voice-operated switch.

1. Minimum Speaker Sensitivity: 91 dB at one meter, with 1-W input.

F. Link Button: To transfer calls.

G. Reset Control: Cancels call and resets system for next call.

H. Digital Display: Sixteen (16) digit alphanumeric LCD readout to register up to four three-digit station numbers.

I. Central-Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions.

2.8 CALL CONTROL CONSOLE

A. Microprocessor-based instrument to process outside and internal calls with a twelve (12) digit keypad selector.

B. Twenty (20) character alphanumeric display for the following:

1. Simultaneous display of up to three (3) calling stations plus last station dialed.
2. Display of calls in order received with emergency calls taking precedence on the display.
3. Review of calls stored in groups of four (4).
4. Display of prompt messages to assist in system operation.

C. Programmable Keys: Minimum of twenty (20) with LED indicators for ringing/busy status; programmable for trunk and operator functions.

D. Transfer Button: Calls to busy extensions and unanswered calls automatically returned to call control console.

E. Hold Button: With reminder feature every thirty (30) seconds for parked calls or calls placed on hold.

F. Release Button: For use with parked calls or calls placed on hold.

G. Page Button: For engaging system paging functions.

H. Programmable for night answer, remote answer, and remote pickup features.

I. Programmable for distribution of emergency announcements, all-page announcements, zone-page announcements, and emergency/evacuation alert.

J. Central-Control Cabinet Equipment: Central switching equipment, central office adapter module, line link modules, power supplies, chassis adapters, and other switching and control devices required for trunk and internal conversation channels and control functions.

2.9 SPEAKER-MICROPHONE STATIONS

A. Mounting: Flush unless otherwise indicated, and suitable for mounting conditions indicated.

B. Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.

C. Back Box: Two (2) gang galvanized steel with two and one half (2-1/2) inch minimum depth.

D. Speaker: Minimum axial sensitivity shall be 91 dB at one meter, with 1-W input. Voice coil shall be not less than three (3) inches, 2.3 oz. minimum; permanent magnet.

E. Tone Annunciation: Recurring momentary tone indicates incoming calls.

F. Call Switch: Mount on faceplate. Permits calls to master station.

G. Privacy Switch: Mount on faceplate. When in on position, switch prevents transmission of sound from remote station to system; when in off position, without further switch manipulation, response can be made to incoming calls.

2.10 CALL-SWITCH UNIT

A. Enclosure: Single-gang box with stainless-steel faceplate.

B. Call Switch: Momentary contact signals system that a call has been placed.

C. Privacy Switch: Prevents transmission of sound signals from station to system.

D. Volume Control: Operated by screwdriver blade through a hole in faceplate to adjust output level of associated speaker.

2.11 ALL-CALL AMPLIFIER

A. Output Power: 70-V balanced line. [80 % of the sum of wattage settings of connected] <Insert wattage> for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.

B. Total Harmonic Distortion: Less than 5 % at rated output power with load equivalent to quantity of stations connected in all-call mode of operation.

C. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.

D. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.

E. Output Regulation: Maintains output level within 2 dB from full to no load.

F. Input Sensitivity: Compatible with master stations and central equipment so amplifier delivers full-rated output with sound-pressure level of less than ten (10) dynes/sq. cm impinging on master stations, speaker microphones, or handset transmitters.

G. Amplifier Protection: Prevents damage from shorted or open output.

2.12 INTERCOMMUNICATION AMPLIFIER

A. Minimum Output Power: 15 W; adequate for all functions.

B. Total Harmonic Distortion: Less than 5 % at rated output power with load equivalent to one station connected to output terminals.

C. Minimum Signal-to-Noise Ratio: 50 dB, at rated output.

D. Frequency Response: Within plus or minus 3 dB from 70 to 10,000 Hz.

E. Output Regulation: Maintains output level within 2 dB from full to no load.

F. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than ten (10) dynes/sq. cm impinging on microphones in master stations, speaker microphones, or handset transmitters.

G. Amplifier Protection: Prevents damage from shorted or open output.

2.13 PAGING AMPLIFIER

A. Input Voltage: 120-V ac, 60 Hz.

B. Frequency Response: Within plus or minus 3 dB from 60 to 10,000 Hz.

C. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.

D. Total Harmonic Distortion: Less than 3 % at rated output power from 70 to 12,000 Hz.

E. Output Regulation: Less than 2 dB from full to no load.

F. Controls: On-off, input levels, and low-cut filter.

G. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than ten (10) dynes/sq. cm impinging on speaker microphones or handset transmitters.

H. Amplifier Protection: Prevents damage from shorted or open output.

2.14 CONE-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES

A. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.

B. Frequency Response: Within plus or minus 3 dB from 70 to 15,000 Hz.

C. Minimum Dispersion Angle: 100 degrees.

D. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.

E. Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.0478-inch steel and whole assembly rust proofed and factory primed; complete

with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; with relief of back pressure.

F. Baffle: For flush speakers, minimum thickness of 0.032-inch aluminum [brushed to a satin sheen and lacquered] [with textured white finish] <Insert finish>.

G. Vandal-Proof, High-Strength Baffle: For [flush] [surface]-mounted speakers, self-aging cast aluminum with tensile strength of 44,000 psi, 0.025-inch minimum thickness; countersunk heat-treated alloy mounting screws; and textured white epoxy finish. <Engineer to Edit for Project Requirements>

H. Size: Eight (8) inches with one (1) inch voice coil and minimum 5-oz. ceramic magnet.

2.15 HORN-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES

A. Speakers shall be all-metal, weatherproof construction; complete with universal mounting brackets.

B. Frequency Response: Within plus or minus 3 dB from 275 to 14,000 Hz.

C. Minimum Power Rating of Driver: 15 W, continuous.

D. Minimum Dispersion Angle: 110 degrees.

E. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.

2.16 CONDUCTORS AND CABLES

A. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.

B. Insulation: Thermoplastic, not less than one thirty second (1/32) inch thick.

C. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.

1. Minimum Shielding Coverage on Conductors: 60 %.

D. Plenum Cable: Listed and labeled for plenum installation.

2.17 RACEWAYS

A. Educational Intercommunication and Program System Raceways and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible with acceptable supporting means

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF RACEWAYS

A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements:

1. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at outlets and terminals.
2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.

3. Secure and support cables at intervals not exceeding thirty (30) inches and not more than six (6) inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
6. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating
7. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
2. Suspend speaker cable not in a wireway or pathway a minimum of eight (8) inches above ceiling by cable supports not more than forty eight (48) inches apart.
3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least twelve (12) inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

C. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

3.6 SYSTEM PROGRAMMING

A. Programming: Fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Schedule tests with at least ten (10) days' advance written notice of test performance.
2. After installing educational intercommunications and program systems and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: Test originating station-to-station, all-call, and page messages at each intercommunication station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.
4. 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 2,500 Hz.
5. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

    a. Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1,000-Hz signal. Measure signal-to-noise ratio at paging speakers.

b. Repeat test for three speaker microphones, and one master station microphone, and for each separately controlled zone of paging loudspeakers.
c. Minimum acceptable ratio is 45 dB.

6. 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 intercom, paging, and all-call amplifier. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 % total harmonics.
7. 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 five 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.<Engineer to Edit for Project Requirements>
8. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 150, 1000, and 2500 Hz. Maximum variation in power output at these frequencies is plus or minus 3 dB.
9. Signal Ground Test: Measure and report ground resistance at system signal ground. Comply with testing requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging and independent room speaker-line matching transformers.

E. Educational intercommunications and program systems will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports noting all deficiencies and corrective measures.

3.8 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service and initial system programming.

1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
2. Complete installation and startup checks according to manufacturer's written instructions.

3.9 ADJUSTING

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

B. Occupancy Adjustments: When requested within twelve (12) months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the educational intercommunications and program systems, a minimum of four (4) hours.

1. Train Owner's maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining the system and equipment, a minimum of four (4) hours.

END OF SECTION 275123.50