

SECTION 27 53 15

~~~ PROJECT NOTE ~~~~~

ARCHITECT OF RECORD/ENGINEER OF RECORD IS RESPONSIBLE FOR REVIEWING THIS SPECIFICATION SECTION IN DETAIL FOR COORDINATION WITH THE PROJECT SCOPE OF WORK.

ALL "PROJECT NOTE" TEXT IS TO BE REMOVED FOLLOWING REVIEW OF THE CONTENT OF EACH NOTE BY THE ARCHITECT OF RECORD/ENGINEER OF RECORD.

EDIT THE DOCUMENT FOOTER TO INCLUDE THE PROJECT NAME AND NUMBER.

EDIT THE DOCUMENT HEADER TO INDICATE THE ARCHITECT OF RECORD PROJECT ISSUE" DATE. THE "CPS CONTROL" DATE SHOULD NOT BE EDITED.

ANY MODIFICATIONS TO THE TECHNICAL STANDARDS IN THIS SECTION - INCLUDING THE REMOVAL OR ADDITION OF MANUFACTURERS - MUST BE APPROVED BY CPS.

REQUESTS FOR MODIFICATION ARE TO BE SUBMITTED TO THE DESIGN MANAGER DURING THE DESIGN PHASE FOR REVIEW AND APPROVAL.

~~~ END OF PROJECT NOTE ~~~~~

INTERCOM/MASTER CLOCK AND PROGRAM EQUIPMENT INTERFACE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Section includes user-programmable, multichannel, microprocessor-switched, centrally controlled, school intercom, master clock and scheduling system and program equipment independent of, but capable of interfacing with the IT network and/or telephone equipment.

~~~ PROJECT NOTE ~~~~~

SPECIFIER SHALL COORDINATE WITH CPS REPRESENTATIVE ON FUNCTION OF SCHOOL BUILDING.

~~~ END OF PROJECT NOTE ~~~~~

- B. Provide an intercom, master clock module and program equipment system located in the workroom for the following type of school:
 - 1. Single School - Elementary or High School.
 - 2. Single School - Elementary or High School plus Park District.
 - 3. Multiple School - Elementary or High School.
 - 4. Multiple School - Elementary or High School plus Park District.

~~~ PROJECT NOTE ~~~~~

FOR A MULTIPLE SCHOOL BUILDING INCLUDE FOLLOWING PARAGRAPH:

~~~ END OF PROJECT NOTE ~~~~~

- C. For a multiple school building: Provide one intercom head end system with up to three programmed sources maximum with one program source designated for each school.

~~~ PROJECT NOTE ~~~~~

FOR A MULTIPLE SCHOOL BUILDING WITH THREE OR MORE SCHOOLS INCLUDE THE FOLLOWING PARAGRAPH AND EOR AND CPS ITS TO REVIEW SCHOOL PROGRAM DESIGN INTENT:

~~~ END OF PROJECT NOTE ~~~~~

- D. For a multiple school building with two or more schools: Provide one intercom head end system that may require customized design to provide designated program sources for each school. Coordinate with CPS ITS Representative.
- E. System functional description as detailed in Part 2 Article.
- F. Zoning:

1. Each classroom / office / administrative area / individual hallway /common area/ pool / gym / cafeteria / auditorium / exterior location shall be defined as a zone.
 2. Schools that are shared by Park District will have separate zones for their offices / administrative areas / individual hallways / common areas / etc.
 3. Paging zone outputs shall be provided where paging speakers are located but do not have a call button associated with them (i.e. hallways, common areas).
- G. Provide, as part of system, the following number of groups or schedules as indicated per type:
1. Paging Groups: eight (8) groups minimum for elementary school or sixteen (16) groups minimum for high school.
 2. Time Groups: eight (8) groups minimum Time Schedules: eight (8) schedules minimum

~~~ PROJECT NOTE ~~~~~
COORDINATE REQUIREMENTS WITH TYPE OF PROJECT: NEW, EXISTING, ADDITION, ETC.
~~~ END OF PROJECT NOTE ~~~~~

- H. Bell Schedule Interface:
1. New schools: The intercom system shall have tones that can be sounded through the intercom speakers to provide a bell schedule.
 2. Existing Schools: The intercom system shall have tones that can be sounded through the intercom speakers to provide a bell schedule and shall be able to be interfaced with the existing hardwired 120VAC bells.
 - a. The interface consists of the Electrical Contractor (EC) identifying the bell circuits inside the existing bell programmer, removing the internal components of the existing bell programmer, installing a low voltage relay for each individual 120-Volt AC bell circuit, wiring the 120-Volt AC bell circuit across the dry contacts of the relay and feeding one side of the dry contact with a 120-Volt AC source (already existing), and bring back to the head end of the new Intercom control circuit for each relay controlling a 120-Volt AC bell circuit. The intercom System can be programmed to track these relays on with the bell schedule that sounds the tones, thus tones and bells ring together. The control circuit for the relays is 24-Volt DC allowing the wiring of the control circuits to be run in a metal raceway.

~~~ PROJECT NOTE ~~~~~
RETAIN THE FOLLOWING PARAGRAPH FOR ADDITION/ANNEX PROJECTS ONLY. THE DESIGNER SHALL REVIEW THE EXISTING SYSTEM'S CAPABILITIES WITH THE MANUFACTURER. IF THE EXISTING EQUIPMENT IS A SWITCHBANK TYPE AND/OR NONMICROPROCESSOR BASED SYSTEM, A NEW MICROPROCESSOR BASED HEAD-END SYSTEM SHALL BE EITHER (1) INSTALLED IN THE EXISTING SCHOOL AND EXTENDED INTO THE ADDITION, OR (2) PLACED IN THE NEW ADDITION/ANNEX, AT AN ADMINISTRATIVE/BUSINESS OFFICE LOCATION SPECIFIED BY THE SCHOOL PRINCIPAL, TO BE CONNECTED BACK TO AND OPERATE THE EXISTING SYSTEM. COORDINATE SCOPE WITH PARAGRAPH BELOW.
~~~ END OF PROJECT NOTE ~~~~~

- I. For Additions/Annexes Only: **[The School's existing intercommunication system shall be extended into the addition.] [A new microprocessor-based head-end system shall replace existing switchbank intercommunication system. The new system shall support and be compatible with the existing system components. The existing schools intercom console shall be removed and the existing call-in stations, paging speakers, etc. shall be connected to the new system. The existing intercom head-end equipment and administrative stations shall be turned over to the Board. Contact the CPS Sr. Infrastructure Manager for instructions.]**

1.02 DEFINITIONS

- A. Refer to Section 27 05 03 - Communications General Requirements for definitions.

1.03 REFERENCE STANDARDS

- A. City of Chicago Building Code - Municipal Code of Chicago for the Building Industry; 2017.

- B. City of Chicago Electrical Code - National Electrical Code with Chicago Amendments; 2017.
- C. EIA SE 101 - Amplifiers for Sound Equipment; 1954.
- D. EIA SE 103 - Speakers for Sound Equipment; 1949.
- E. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; Revision E, 2005.
- F. TIA-569-D - Telecommunications Pathways and Spaces; Rev D, 2015.
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. 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.
 - 2. Coordinate on placement of horizontal Category 5e UTP outlets, for voice communications services, with location of School Intercom and Program Equipment.
 - 3. Coordinate all room numbers and paging zones with final signage room numbers.

1.05 SUBMITTALS

- A. Shop Drawings: Indicate wiring diagrams and interconnection diagrams.
 - 1. Equipment Details: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.
 - 2. Station-Arrangement Details: Scaled drawings for built-in equipment.
 - 3. Wiring Diagrams: Power, signal, and control wiring. Include the following:
 - a. Identify terminals to facilitate installation, operation, and maintenance.
 - b. Single-line diagram showing interconnection of components.
 - c. Cabling diagram showing cable routing.
 - d. Differentiate between manufacturer-installed and field-installed wiring.
 - e. Clock System: identify terminals and wiring color-codes to facilitate installation, operation, and maintenance.
- B. Product Data: Provide for each item of equipment; show specified ratings, colors, finishes, and physical dimensions.
 - 1. Admin Master Stations.
 - 2. Speaker-microphone stations.
 - 3. Call-switch units.
 - 4. All-call amplifier.
 - 5. Intercom amplifier.
 - 6. Paging amplifier.
 - 7. Loudspeakers/speaker microphones.
 - 8. Auxiliary components.

~~~ **PROJECT NOTE** ~~~~~  
*WHEN PROVIDING A NEW HEAD END SYSTEM: PROVIDE A CLOCK SYSTEM.*  
~~~ **END OF PROJECT NOTE** ~~~~~

- 9. Clock System: master unit, indicating clocks, signal equipment, equipment enclosures and back boxes, and accessory components.
- C. Samples for Initial Selection: Include the following:
 - 1. Manufacturer's color photographs or color chips showing the full range of colors available for clocks, signal equipment, and control panels.
 - 2. Representative operating models of clock type [**Insert designations of clocks for which Samples are required**].

- D. Qualification Data: For Installer; certificate signed by manufacturer(s) certifying that installer complies with requirements.
- E. Product Certificates: Signed by manufacturers of equipment certifying that products furnished comply with specified requirements.
- F. Field quality-control test reports and manufacturer(s)' field-visit/inspection report.
- G. Operation Data: Operating instructions for school intercom, [master clock,] and program equipment to include in emergency, operation, and maintenance manuals.
- H. Maintenance Data: Maintenance and repair instructions for school intercom, [master clock,] and program equipment to include in emergency, operation, and maintenance manuals.
- I. In addition to items specified in Sections 01 77 00 - Closeout Procedures and 01 78 00 - Closeout Submittals include the following:
 - 1. Record of final matching transformer-tap settings and signal ground-resistance measurement certified by Installer.
 - 2. Prepare a written record of system programming decisions, implementation methodology, and final results.
 - 3. Include manufacturer's brochures and parts lists describing the actual materials used in the work, including microprocessor, signal generator, power supplies, and other major components. Assemble manuals for component parts into single binders identified for each system. Manuals shall include the items below and other information recommended by the manufacturer:
 - a. Schematic wiring diagrams.
 - b. Parts lists.
 - c. Troubleshooting guide.
 - d. Name and telephone number of factory-authorized service representative within 100 miles of the Project.
 - e. Copies of warranties and guarantees.
 - f. Provide four (4) quick reference guides for Building Engineer.
- J. System Programming: Record of the Board's system programming options decisions, implementation methodology and final results.
- K. Field Service Report: Record of factory authorized representative's inspection report of field assembled components and equipment installation, including connections and initial system programming.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project (contact purchasing).
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in City of Chicago Electrical Code, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with City of Chicago Building Code.
- D. Comply with UL 50.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Do not install electronic components until major construction work in the area is complete. Do not install in areas where dust or moisture can contaminate the working parts or where finish can be marred by construction work.
- B. Stage materials in a secure area of the project site until installation. Materials and items shall be placed so that they are protected from damage and deterioration.

1.08 MAINTENANCE COMPONENTS

- A. Provide the following components or spare capacities, as part of the Project, to the Board Representative, or as part of installed system as indicated:
 - 1. Components to be given to the Board:

- a. Five percent or no less than two (2), whichever is greater, of the following:
 - 1) Call In Switch.
 - 2) Paging Speakers.
 - b. One (1) Admin Master Station.
 - c. Programming software.
 - d. Administration software.
 - e. 10% of total of maximum of five analog clocks.
2. Components to be included in the installed system:
 - a. Ten percent spare capacity in:
 - 1) Amplifiers, typical of each type.
 - 2) Zone/Circuit Cards.

1.09 WARRANTY

- A. The Contractor shall unconditionally warrant all equipment and systems provided under this Section to be free from defects in materials and workmanship for a period of at least five years parts and one year labor from the date of Preliminary Acceptance of all work of this Section.
 1. Warranty service for the equipment shall be provided during normal working hours, Monday through Friday, excluding holidays. Emergency service provided at times other than as stipulated above shall be available from the same source at additional cost. Emergency service response time shall be within four business hours for high school and eight business hours for elementary school.

*~~~ PROJECT NOTE ~~~~~
REVISE ARTICLES IF CERTAIN FEATURES OR EQUIPMENT NOT REQUIRED. COORDINATE WITH
SYSTEM FUNCTIONAL PERFORMANCE DESCRIPTION AND CONTRACT DRAWINGS.
~~~ END OF PROJECT NOTE ~~~~~*

## PART 2 PRODUCTS

### 2.01 SYSTEM DESIGN

- A. Clock System Description:
  1. Supply power to remote indicating clocks.
  2. Maintain correct synchronized time and transmit time-correction signals over dedicated system wiring from a master clock module to analog synchronous clocks. Correct for minute and second-hand synchronization at least once each hour and for hour-hand synchronization at least once each day.
  3. Initiate and execute programs for scheduled automatic operation of remote devices.
  4. Provide for manual control of programmed signal and equipment switching circuits.
  5. Regulate system timing functions backed up for power outages by an internal battery-powered, temperature-compensated crystal-controlled oscillator.
  6. System shall be capable of programming multiple independent event schedules into memory and running them simultaneously for different output circuits.
    - a. Quantity of Programmable Schedules: Four minimum.
    - b. Number of Weekly Events that can be programmed for each schedule: 600 minimum.
    - c. Simultaneous operation of independent schedules shall be limited only by the number of signal-device and equipment switching output circuits.
    - d. Advance Programming for Automatic Holiday Schedule Changes: Number of schedule changes that can be programmed to suit holidays and vacations shall be 10, and each change may be programmed up to a year in advance to occur on any day of the calendar year.
    - e. System Display: an internal program shall automatically check functioning of LEDs, switches, input keys, central processor, read only memory, random access memory, and output circuits. A display on the control panel shall indicate failure by identifying faulty component or circuit and shall recommend corrective action.

- f. Daylight Savings Time Correction: Programmable for automatic correction, or accomplished by manual controls on front of panel.
  - g. Adjustments to Master Clock Output Signals: Duration of momentary signal shall be individually programmable for each signal and equipment-control output circuit from 1 to 99 seconds. Signals shall be programmable for either on or off switching to suit equipment-operation scheduling.
- B. Functional Description of Microprocessor-Switched Intercom System:
- 1. Station Selection: Capable of the following:
    - a. Communicating selectively with other master and speaker-microphone stations by dialing station's number on a 12-digit keypad.
    - b. 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.
    - c. Increasing the number of conversation channels by adding a module in central-control cabinet.
    - d. Including up to three other station connections in a conference call.
    - e. Accessing separate paging speakers or groups of paging speakers by dialing designated numbers on a 12-digit keypad.
    - f. Overriding any conversation by a designated master station.
    - g. Displaying selected station/room number.
    - h. Providing Dial Directory Sheet.
    - i. Communicating simultaneously with other stations on system by dialing a designated number on a 12-digit keypad.
    - j. Automatically controlling gain to ensure constant intercom speech level.
    - k. 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.
    - l. Operating and correcting secondary clocks and controlling class-change signals to speakers and bells by using keypad.
    - m. Emergency Call Operation: Emergency call is initiated when a call-in button is pushed repeatedly. If the call is not answered, system automatically transfers to a user definable emergency sequence.
    - n. Output Relays: System is to provide eight (8) auxiliary relays, which may be programmed to respond to various programmed functions within the system.
    - o. User-programmable features include the following:
      - 1) Station calling by room number.
      - 2) Room station call-in priority levels.
      - 3) Clock signal schedule functions.
      - 4) Schedule characteristics of audible signals.
      - 5) Call-in tone characteristic.
  - 2. Interconnection with the Board's networked IT System: IT Network interconnect features to include the following:
    - a. Interconnection with the Board's networked IT System: IT Network interconnect features to include the following:
      - 1) Hard wired connection capability to the CPS WAN network, utilizing the CPS Standards for connectivity.
      - 2) System shall allow for remote Access by CPS System Administrators through the CPS Data network. System must have a web front end to manage the device in all aspects that is not reliant on any frameworks (Java, activex, etc..) HTML 5 preferred. The Headend should also allow for SNMP monitoring and support Active directory. At a minimum this access should allow CPS the following administrative capabilities:
        - (a) Schedule - Creation, modification, deletion.
        - (b) System adjustment for Daylight Savings Time.

- (c) Ability to monitor health of system major components.
3. Interconnection with the Board's Private Phone System: Telephone interconnect features include the following:
    - a. Direct connection to central office trunk lines with initial system wiring for two (2) trunk lines, using one or two digit number associated with outgoing line for interconnection.
    - b. System shall be setup to accept the telephone at security desk as an administrative handset.
    - c. Station programming for access to outside trunk lines to be totally unrestricted access.
    - d. Call parking allowing paged party to remotely pick-up outside call from any master station, internal or external telephone.
  4. Speakers: Free of noise and distortion during operation and when in standby mode.

## **2.02 EQUIPMENT AND MATERIALS**

- A. Coordinate features 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 percent 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.
- D. Waterproof Equipment: Listed and labeled for duty outdoors or in damp locations.
- E. Central-Control Cabinet: Comply with EIA/ECA-310. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, program/monitor and other switching and control devices required for conversation channels and control functions.
- F. Remote-Control Cabinet: Comply with EIA/ECA-310. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, program/monitor and other switching and control devices required for conversation channels and control functions.

## **2.03 ADMIN MASTER STATION**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
  1. Rauland-Borg Corporation; [www.rauland.com](http://www.rauland.com).
  2. Simplex Grinnell; [www.tycosimplexgrinnell.com](http://www.tycosimplexgrinnell.com).
  3. Dukane / CareHawk; [www.dukane.com](http://www.dukane.com).
- B. 12-Digit Keypad Selector: Transmits calls to other stations and initiates commands for programming and operation.
- C. Volume Control: Regulates incoming-call volume.
- D. Tone Annunciation: Momentary audible tone signal announces incoming calls.
- E. Speaker Microphone: Hands-free; transmits intercom voice signals when used via a voice-operated switch.
  1. Minimum Speaker Sensitivity: EIA SE 103 pressure rating of 40 dB.
- F. Reset Control: Cancels call and resets system for next call.
- G. Digital Display: 16-digit alphanumeric LCD readout to register up to four 3-digit station numbers.
- H. Minimum Quantity to be included in system design: Coordinate with school type as follows:
  1. High School: Five.
  2. School Additions: Four.
  3. Elementary Schools: Three.
  4. Park District-Office: One.

## 2.04 SPEAKER-CALL STATIONS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
  - 1. Rauland-Borg Corporation; [www.rauland.com](http://www.rauland.com).
  - 2. Simplex Grinnell; [www.tycosimplexgrinnell.com](http://www.tycosimplexgrinnell.com).
  - 3. Dukane; [www.dukane.com](http://www.dukane.com).
  - 4. Quam; [www.quamspeakers.com](http://www.quamspeakers.com).
- B. Mounting: Flush, unless otherwise indicated, and suitable for mounting conditions indicated.
- C. Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws; waterproof where indicated.
- D. Back Box: Two-gang galvanized steel with 2-1/2-inch minimum depth.
- E. Speaker: Comply with EIA SE 103. 2.5-inch, 2.3-oz. minimum, permanent magnet.
- F. Recurring momentary tone indicates incoming calls.
- G. Call Switch: Mount on faceplate. Permits a call to master station.
- H. Capable of the following:
  - 1. Communicating hands free.
  - 2. Calling master station by actuating call switch.
  - 3. Returning a busy signal to indicate that station is already in use.

## 2.05 CALL-SWITCH UNIT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
  - 1. Rauland-Borg Corporation; [www.rauland.com](http://www.rauland.com).
  - 2. Simplex Grinnell; [www.tycosimplexgrinnell.com](http://www.tycosimplexgrinnell.com).
  - 3. Dukane; [www.dukane.com](http://www.dukane.com).
  - 4. Quam / CIB9; [www.quamspeakers.com](http://www.quamspeakers.com).
- B. Enclosure: Single-gang box with stainless-steel faceplate.
- C. Call Switch: Momentary contact signals system that a call has been placed. Switch also to include separate "Normal" and "Emergency" call conditions.
- D. Volume Control: Adjust output level of associated speaker.

## 2.06 ALL-CALL AMPLIFIER

- A. Manufacturers: Subject to compliance with requirements, provide part numbered products by one of the following manufacturers:
  - 1. Rauland-Borg Corporation; [www.rauland.com](http://www.rauland.com).
  - 2. Simplex Grinnell; [www.tycosimplexgrinnell.com](http://www.tycosimplexgrinnell.com).
  - 3. Dukane / CareHawk; [www.dukane.com](http://www.dukane.com).
- B. Comply with EIA SE 101.
- C. Minimum Output Power: 1-W RMS for each station and speaker that can be connected in all-call mode of operation, plus an allowance for future stations.
- D. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to quantity of stations connected in all-call mode of operation.
- E. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
- F. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.
- G. Output Regulation: Maintains output level within 2 dB from full to no load.
- H. 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 impinging on master station, speaker microphone, or handset transmitter.
- I. Amplifier Protection: Prevents damage from shorted or open output.



## 2.07 INTERCOM AMPLIFIER

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
  - 1. Rauland-Borg Corporation; www.rauland.com.
  - 2. Simplex Grinnell; www.tycosimplexgrinnell.com.
  - 3. Dukane / CareHawk; www.dukane.com.
- B. Comply with EIA SE 101.
- C. Minimum Output Power: 15 W and adequate for all functions.
- D. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to 1 station connected to output terminals.
- E. Minimum Signal-to-Noise Ratio: 50 dB, at rated output.
- F. Frequency Response: Within plus or minus 3 dB from 70 to 10,000 Hz.
- G. Output Regulation: Maintains output level within 2 dB from full to no load.
- H. Input Sensitivity: Matched to input circuit and providing full-rated output with sound-pressure level of not more than 10 dynes/sq. cm impinging on microphones in master stations, speaker microphones, and handset transmitters.
- I. Amplifier Protection: Prevents damage from shorted or open output.

## 2.08 PAGING AMPLIFIER

- A. Subject to compliance with requirements, provide part numbered products by one of the following manufacturers:
  - 1. Rauland-Borg Corporation; www.rauland.com.
  - 2. Simplex Grinnell; www.tycosimplexgrinnell.com.
  - 3. Dukane / CareHawk; www.dukane.com.
- B. Comply with EIA SE 101.
- C. Input Voltage: 120-Volt AC, 60 Hz.
- D. Frequency Response: Within plus or minus 3 dB from 60 to 10,000 Hz.
- E. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
- F. Total Harmonic Distortion: Less than 3 percent at rated output power from 70 to 12,000 Hz.
- G. Output Regulation: Less than 2 dB from full to no load.
- H. Controls: On/off, input levels, and low-cut filter.
- I. Input Sensitivity: Matched to input circuit and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
- J. Amplifier Protection: Prevents damage from shorted or open output.
- K. Provide a minimum of four (4) 35W outputs to provide for gym, pool, cafeteria, multi-purpose areas, auditorium, etc. or as indicated on Contract Drawings.
- L. For common corridor and outside speakers.

## 2.09 CONE-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES

- A. Comply with EIA SE 103.
- B. Sensitivity: 90 dB SPL (1 watt 1 meter).
- C. Frequency Response: Within plus or minus 3 dB from 75 to 15,000 Hz.
- D. Minimum Dispersion Angle: 90 degrees.
- E. Speaker with Line Matching Transformer:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
    - a. Quam, part no. 8C10PAX/TBLUB.
    - b. Rauland-Borg Corp. , part no. USO188.

- c. Simplex, part no. 5120-9416.
  - d. Dukane part no. 5A606.
  - 2. Speaker: 8 inches with ¾-inch voice coil and minimum 4.8 oz. Ceramic magnet.
  - 3. Transformer: Comply with EIA-160, maximum insertion loss of 1 dB, 5 watt power rating 25 volt and 70 volt primary with 8 ohm secondary and at least four level taps.
- F. Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.03-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; and with relief of back pressure.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
    - a. Flush Ceiling Mount Backboxes:
      - 1) Quam, part no. ERD8U.
      - 2) Rauland-Borg Corp., part no. ACC1101.
      - 3) Simplex, part no. 5120-9491.
      - 4) Dukane part no. 145-226.
    - b. Flush Wall Mount Backboxes:
      - 1) Quam, part no. ES8.
      - 2) Rauland-Borg Corp., part no. ACC1105.
      - 3) Simplex, part no. 5120-9492.
      - 4) Dukane part no. 145-223.
- G. Baffle: For flush speakers, minimum thickness of 0.03-inch steel, with white hybrid epoxy power coat finish.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
    - a. Round Flush Ceiling Baffle:
      - 1) Quam, part no. BR8W.
      - 2) Rauland-Borg Corp., part no. ACC1000.
      - 3) Simplex, part no. 5120-9420.
      - 4) Dukane part no. 6A633.
    - b. Square Flush Wall Baffle:
      - 1) Quam, part no. BS8W.
      - 2) Rauland-Borg Corp., part no. ACC1003.
      - 3) Simplex, part no. 5120-9430.
      - 4) Dukane (Quam).

## **2.10 HORN-TYPE LOUDSPEAKERS/SPEAKER MICROPHONES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
- 1. Flush or surface mounted vandal-proof:
    - a. Quam, part no. H16/SVP vandal-proof.
    - b. Rauland-Borg Corp., part no. ACC1105.
    - c. Simplex 5120-9417.
- B. Comply with EIA SE 103. All-metal, weatherproof construction; complete with universal mounting brackets.
- C. Frequency Response: Within plus or minus 3 dB from 300 to 15,000 Hz.
- D. Minimum Power Rating of Driver: 15 W, continuous.
- E. Minimum Dispersion Angle: 100 degrees.
- F. Line Transformer: 25 to 70 volt primary, maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least 6 level taps.
- G. The following locations (but not limited to) shall be provided with vandal proof horn type paging speakers:

1. Gymnasium.
2. Exterior Speakers.
3. Pool/Natatorium.
4. Mechanical Rooms.
5. Cafeterias.
6. Assembly Hall.
7. Boiler Room.

## 2.11 CONDUCTORS AND CABLES

- A. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but not smaller than No. 22 AWG.
- B. Insulation: Thermoplastic, not less than 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 percent.

## 2.12 AUXILIARY COMPONENTS

- A. Program Paging 2-Way Speaker, weatherproof for exterior locations.
- B. Program source: AM-FM tuner, separate five (5) CD player with auxiliary input (MP3) with roof mounted type antenna. Provide the capability of utilizing both components via the program monitor and capable of playing sources over individual selected stations and or paging zone outputs. Program monitor with three (3) individual source input and source monitoring speaker.
- C. Antenna: Roof mounted type antenna. Antenna location shall be above MDF room area on roof. Antenna shall provide AM/FM signals with amplifier/splitter equipment to provide inputs from five (5) auxiliary audio system located in: ICC Location, Natatorium, Gymnasium, Auxiliary Gymnasium and Auditorium.
- D. Vandal Resistant weatherproof call switch.

## 2.13 PATHWAYS

- A. General Requirements: Comply with TIA-569-D.
- B. Conduit and Boxes: Comply with requirements in Sections 26 05 33.13 - Conduit for Electrical Systems, 26 05 33.16 - Boxes for Electrical Systems, and 26 05 33.23 - Surface Raceways for Electrical Systems. Flexible metal conduit shall not be used.

## PART 3 EXECUTION

*~~~ PROJECT NOTE ~~~~~  
INCLUDE THE FOLLOWING FOR EXISTING BUILDINGS; DELETE FOR NEW CONSTRUCTION.  
~~~ END OF PROJECT NOTE ~~~~~*

3.01 COMMUNICATIONS DEMOLITION

- A. Comply with requirements of Section 27 05 03 - Communications General Requirements for demolition of communications systems.

3.02 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field measurements are as shown on Contract Drawings.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Notify Architect/Engineer of Record of conditions that would adversely affect installation or subsequent use.
- E. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of substrate conditions and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.03 WIRING METHODS AND INSTALLATION OF PATHWAYS

- A. Wiring Method: Install wiring in dedicated raceway system for School Intercom and Program Equipment. Conceal raceways except in unfinished spaces.
 - 1. Comply with requirements for raceways and boxes and their installation specified in Sections 26 05 33.13 - Conduit for Electrical Systems, "26 05 33.16 - Boxes for Electrical Systems, and 26 05 33.23 - Surface Raceways for Electrical Systems.
 - 2. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
- B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points without exceeding manufacturer's limitations on bending radii. Use lacing bars in cabinets.
- C. Comply with requirements for cabinets, and racks specified in Section 27 11 16 - Communications Cabinets, Racks, and Enclosures. Drawings indicate general arrangement of pathways and fittings.

3.04 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.
- C. 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 12 inches for speaker microphones and adjacent parallel power and telephone wiring. Separate other school intercom and program equipment conductors as recommended by equipment manufacturer.
- D. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- E. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- F. 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.
- G. Comply with requirements of Section 27 05 03 - Communications General Requirements for cutting and patching.
- H. Connect wiring according to Section 26 27 26 - Wiring Devices.
- I. Provide an audio control relay interface from the ICC to auxiliary audio systems.
- J. Antenna wiring: Provide antenna wiring in minimum 1 inch diameter conduit from ICC program source to MDF room. Locate antenna on roof above MDF room area. Provide antenna wiring from MDF room to roof via satellite conduit provisions.
- K. GC shall provide two (2) dedicated 120V, 20Amp, IG Quadruplex Orange receptacles for ICP head end equipment.

3.05 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.
- C. Provide dedicated No. #12 AWG ground from the MDF room ground bus to the ICC.

3.06 SYSTEM PROGRAMMING

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

3.07 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections and initial system programming. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Schedule tests with at least seven days' advance notice of test performance.
 - 2. After installing school intercom and program equipment 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 intercom 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 300 to 2500 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 1000-Hz signal. Measure signal-to-noise ratio at paging speakers.
 - b. Repeat test for three speaker microphones, 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 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 percent 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.
 - 8. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 400, 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 Section "26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Retesting: Correct deficiencies and retest. Prepare a written record of tests.
- 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. Prepare written test reports.
 - 1. Include a record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

3.08 ADJUSTING

- A. Adjust program functions to meet Board's revised schedule. Revisit site upon Board's request within one year of Substantial Completion and make additional adjustments to program schedule as directed.
 - 1. 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.
 - 2. Occupancy Adjustments: When requested within 12 months (one year) of date of Preliminary Acceptance, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to site outside normal occupancy hours for this purpose, without additional cost.

3.09 CLEANING

- A. Comply with requirements of Section 27 05 03 - Communications General Requirements for cleaning.

3.10 CONTRACTOR STARTUP AND REPORTING

- A. System Startup: Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements. Complete installation and startup checks according to manufacturer's written instructions.
- B. Demonstration: Engage a factory-authorized service representative to train Board's maintenance personnel to adjust, operate, and maintain school intercom and program equipment. Refer to Sections 01 79 00 - Demonstration and Training, 01 77 00 - Closeout Procedures, and 01 78 00 - Closeout Submittals.
 - 1. Train Board's maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining equipment.
 - 2. Review data in maintenance manuals.
 - 3. Schedule training with the Board's Representative, through the Architect/Engineer of Record, with at least seven days' advance notice.
 - 4. Training should consist of a minimum of three sessions which are to be scheduled with a minimum of three weeks between sessions. Each training session shall be a minimum of 90 minutes in duration with final scheduling as agreed to by the School Principal.
- C. Contractor to provide sign off sheet to Board Representative upon completion.

END OF SECTION 27 53 15