

SECTION 16770.2 PUBLIC ADDRESS, INTERCOM, & MUSIC SYSTEMS

PART 1 GENERAL

1.1 SUMMARY:

- A. This Section includes public address systems, extensions of existing intercom systems, and stand alone sound systems.

1.2 RELATED SECTIONS:

- A. The following Division 16 Section contains requirements that relate to this Section:
 - 1. "Raceways", for raceways used for public address system cables.
 - 2. "Electrical Boxes and Fittings", for boxes, cabinets, and fittings used with public address systems.

1.3 SUBMITTALS:

- A. Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
 - 1. Product data for each type of product specified.
 - 2. Shop drawings detailing public address system including, but not limited to:
 - a. Control panels
 - b. Rack arrangements.
 - 3. Wiring Diagrams detailing wiring for power, signal, and control differentiating clearly between manufacturer-installed wiring and field-installed wiring. Identify terminal numbers and wiring color codes to facilitate installation, operation, and maintenance.
 - 4. Maintenance data for materials and products, for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 16 Section "Basic Electrical Requirements." Provide complete manual material concurrently with system submittal and provide updated final versions of manuals one month before completion of construction and final system turnover.

1.4 QUALITY ASSURANCE:

- A. Installer Qualifications: Engage an experienced Installer who is a factory-authorized sales and service representative to perform the work of this Section. Refer to Division 1 Section "Definitions and Standards" for definition of experienced Installer. Upon request, submit evidence of such qualifications to the Architect.
- B. Electrical Component Standard: Provide work complying with applicable requirements of:
 - 1. NFPA 70 "National Electrical Code."
 - 2. NFPA 72A, 72B, 72C, 72D.
- C. EIA Compliance: Comply with the following Electronics Industries Association Standards:
 - 1. Sound Systems, EIA-160.
 - 2. Loudspeaker, Dynamic Magnetic Structures, and Impedance, EIA-299-A.
 - 3. Racks, Panels, and Associated Equipment, EIA-310-A.

4. Amplifiers for Sound Equipment, SE-101-A.
5. Speakers for Sound Equipment, SE-103.
6. Microphones for Sound Equipment, SE-105.

D. UL Compliance: Comply with applicable requirements of UL.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver products in factory containers. Store in clean, dry space, in original containers. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide products of the following:

1. Soundolier
2. Dukane Corp.
3. Bose

2.2 SYSTEM REQUIREMENTS:

- A. Provide complete and fully functional public address, intercom, and stand alone music systems using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction in accordance with published product information. Coordinate the features of materials and equipment so they form an integrated system with components and interconnections matched for optimum performance of specified functions.

2.3 EQUIPMENT AND MATERIALS:

- A. Provide equipment using all solid-state components, fully-rated for continuous duty at the ratings indicated or specified. Select equipment for normal operation on input power supplied at 105-130 V, 60 Hz.
- B. Battery to be on float charge when not supplying system and to transfer automatically to supply system after three to five seconds of continuous outage of normal power, as sensed by time delay relay. Provide for automatic retransfer of system to normal supply when normal power has been reestablished for three to five seconds continuously. Provide on/off switch and "normal" and "emergency" indicating lights. Provide adequate capacity for unit to provide maximum system power requirements for one hour of full operation.
- C. Wire and Cable:
1. Conductors:
 - a. P.A. wiring: Provide 2 twisted pair from racks to loudspeaker outlets not smaller than 18 gage and conductors from microphone receptacles to amplifiers not smaller than 22 gage. Use jacketed, twisted-pair, un-tinned, solid copper conductors.
 - b. Intercom wiring: Provide 2 pair #18AWG (1 pair shielded) from each intercom station to the central intercom equipment.

2. Insulation for Wire In Conduit: Thermoplastic not less than 1/32 inch thick.
 3. Shielding: 34 gage, tinned, soft copper strands formed into a braid or approved equivalent foil type. Shielding coverage on the conductors shall not be less than 60 percent.
 4. Microphone Cables: Neoprene jacketed not less than 2/64 inch thick over shield with filled interstices.
 5. Exposed Wiring: Where wiring is indicated to be not in metal raceway, use paired cables with plastic jackets. Where such cable will be installed in air plenums or plenum-type ceilings, provide cable UL approved for plenum installation.
- D. Weatherproof Equipment: Where equipment is indicated to be weatherproof, or is exposed to the weather, provide items specifically designed and listed for such duty.

2.4 ALTERATIONS & ADDITIONS TO EXISTING INTERCOM SYSTEM:

- A. All materials added to the existing intercom system shall match the existing equipment in manufacturer, model and color for the specific area to be located. Components required to expand the system station capability shall be provided by an authorized distributor of that manufacturer. A two year warranty period for intercom system additions shall be part of this contract.
- B. Intercom stations shall be as manufactured by Dukane, Model Number HL512 Series. Refer to drawings for quantities required.
- C. Intercom outlet receptacles shall be supplied as required and manufactured by Dukane.
- D. Wall flush mount kits shall be supplied as required and as manufactured by Dukane. Custom equipment is not acceptable.
- E. Two (2) speech path boards Dukane Model Number H14251 and two (2) station boards Dukane Model Number H14270 shall be added to the existing central equipment. Any components not listed here but required to add to the existing system for proper operation shall be included within this bid.

2.5 PUBLIC ADDRESS SYSTEM:

A. GENERAL

1. The contractor shall furnish and install all equipment, accessories and material for the Dukane 12A957 Emergency Audio Communication System. Any materials and/or equipment necessary for the proper operation of the system and not specified or described herein shall be deemed part of these specifications.
2. The equipment described and furnished under these specifications shall be the standard product of one manufacturer. All reference to model numbers and other pertinent information herein is intended to establish the standards of performance, quality, and appearance and is based upon equipment designed and manufactured by the Dukane Corporation, St. Charles, Illinois.
3. The Emergency Audio Communication System shall comply with the provisions of the National Fire Protection Association Codes 72A, 72B, 72C and 72D covering Local, Auxiliary and Remote Protective Signaling Systems. The System shall meet the

requirements of UL 864, Control Units for Fire Protective Signaling Systems, and is so listed by Underwriters' Laboratories.

4. The amplifiers and speaker assemblies shall meet the requirement of UL 1480, Speakers and Amplifiers for Fire Protective Signaling Systems, and are so listed by Underwriters' Laboratories.
5. The equipment shall be installed under the supervision of the manufacturer's authorized distributor, who shall make final test and adjustments to the completed system. At the completion of the installation and before the final acceptance by the owner or owner's representative, the contractor shall furnish two (2) copies of the Operating Manual for the system and the wiring diagrams for the equipment and system. The system shall be provided with a minimum of one year warranty from the manufacturer.
6. The contractor shall have available to the purchaser a service department capable of servicing all of the equipment. On-premise maintenance is to be provided during normal working hours at no cost to the purchaser for a period of twelve months from the date of system acceptance unless failure or damage is caused by misuse, neglect, abuse or accident.

B. SYSTEM DESCRIPTION

1. The Dukane 12A957 Emergency Audio Communication System shall provide one-way communication from the Central PBX Control Station to designated zone(s). The system shall provide Fire Alarm Tone and Voice Page to the zone(s).
2. The Emergency Audio Communication shall be combined with a U.L. approved Fire Alarm System resulting in a combination system. The Fire Alarm System shall provide dry contacts that will initiate the Alarm Tone to the zone(s).
3. The Emergency Audio Communication System shall be:

A two channel system--Sounding of an Alarm Tone in one zone shall not prohibit voice page to other zones.

The system shall consist of a Communication Control Panel, Input Control Panel and appropriate preamplifiers, power amplifiers, signal generating equipment, zone selection panels, and supervisory equipment to meet the requirements of this specification. All equipment shall be located as specified herein.

C. FUNCTIONAL SPECIFICATION

1. The system shall provide, as a minimum, the following functions and features.
 - a. Interface with the fire alarm system utilizing appropriate and approved interfacing methods.
 - b. Continuous electronic supervision of all components for opens, shorts, grounds or other faults that would interfere with the distribution of the Fire Alarm Tone or Voice Page. Failure of a component shall cause an audible and visual trouble fault indication at the equipment rack, Central Control Station and at the Fire Alarm System Control Panel.
 - c. Supervision of the speaker lines for opens, shorts or grounds that would prevent the proper distribution of the Emergency Audio Communications. Speaker line

fault will cause an audible and visual trouble fault indication at the equipment rack, Central Control Station and at the Fire Alarm System Control Panel.

- d. Provide for automatic fire alarm tone to zone(s) as initiated by Fire Alarm System.
- e. Provide a predetermined and adjustable all-alarm timing circuit to provide Fire Alarm Tone to all zones unless defeated at the control panel.
- f. Provide for emergency voice communications to zone(s). Emergency voice communications shall have priority over all other modes of communication.
- g. (Optional) Provide Manual Fire Alarm Tone initiation to selected zone(s). Manual Fire Alarm Tone initiation will function the same as the Automatic initiation. This shall provide for selecting other zones when used with the Automatic initiation.
- h. Provide prerecorded voice messages to follow the Fire Alarm Tone. The alarm initiation shall start the Fire Alarm Tone to the zone. After a predetermined time, the prerecorded voice message will be transmitted to the alarmed zone. Additional prerecorded voice messages will be delivered to floor above, floor below and elevators. If the Prerecorded Voice Message unit fails, the Fire Alarm Tone shall be transmitted to the alarmed zone. The content of the prerecorded message shall be determined by the authority having jurisdiction in cooperation with the building owner or manager.
- i. (Optional) Provisions for the system to be used for normal paging and background music. Provide circuits to cut out all normal paging and background music source and controls when the system is activated for emergency.
- j. Provide speaker assemblies as outlined on drawings. All speaker assemblies shall be U.L. listed as approved under section 1480, Speakers and Amplifiers for Fire Protective Signaling Systems.
- k. Provide for audible and visual monitoring of the amplifier(s).

D. EQUIPMENT SPECIFICATIONS

1. The equipment shall be housed in a Dukane Model 13A161B Vertical Rack which shall be approximately 67-3/8 inches (1.71 m) high, 22-1/8 inches (56.2 cm) wide and 19-3/8 inches (49.21 cm) deep. The rack shall provide 61-1/4 inches (1.56 m) of front panel space for mounting standard 19 inches (48.26 cm) equipment panels horizontally. There shall also be provisions to vertically mount 19 inches (48.26 cm) panels inside the rack assembly.
2. The unit shall be constructed of 16 gauge steel with panel mounting rails of 14 gauge steel. All joining steel must be welded and bonded to form a sturdy, solid assembly. Use of lighter gauge steel and bolted-type construction does not provide the rigidity desired and, thus, it is not acceptable.
3. All panel mounting screws shall be concealed by vertical trim strips when the rack is completely assembled. The rack shall provide a hinged, removable, louvered, locking, back door. The rack shall be finished in off white and textured charcoal, baked enamel and shall bear the Underwriters' Laboratories approval label for "Sound Recording/Reproducing Equipment Enclosures".

4. The Emergency Page Zone Selector Module shall be the Dukane Model 9A1539 or an approved equal. It shall provide ten (10) push-to-lock/push-to-release selector switches and replaceable lamps. The selector switches shall permit emergency paging to a zone or group of zones. The module shall provide visual indication of the zone or zones selected or a busy indication for the zone(s). The switches shall have provision for protected interchangeable identification.

The Emergency Page Zone Selector Module shall be 11-3/4 inches (29.8 cm) high, 2-1/2 inches (6.35 cm) wide, 3 inches (7.62 cm) deep and finished in charcoal, baked enamel. Weight shall not exceed 1 pound, 12 ounces (.79 kg).

5. The Input Control Panel shall be Dukane's Model 9A1540. It shall contain all the necessary switching and circuitry to provide the following:
- Alarm tone in the event of a fire.
 - Automatic switching to a spare alarm tone or mixer should the primary supervised unit fail (optional).
 - Reduced alarm tone to an adjustable level during a page.
 - Emergency paging to a selectable zone or all zones.
 - Priority switching of the various input signals.

The Dukane Model 9A1540 Input Control Panel shall be 3-1/2 inches (8.9 cm) high, 19 inches (48.26 cm) wide, 8 inches (20.3 cm) deep and be finished in charcoal, baked enamel. Its weight shall not exceed 3 pounds (1.35 kg).

6. The Zone Relay Panel shall be Dukane Model 9A1535 or an approved equal. The Zone Relay Panel shall provide remote switching through relay circuits. The panel shall have a capacity of from one to ten relay circuits. The panel shall be 3-1/2 inches (8.9 cm) high, 19 inches (48.26 cm) wide, 7-3/4 inches (19.6 cm) deep and have screw terminations. The panel shall weigh 6 pounds, 7 ounces (2.9 kg) and be finished in charcoal, baked enamel.
7. The Remote Powered Mixer-Preamplifier shall be Dukane Model 2A68. The unit shall provide facilities for two low Z microphone inputs (expandable to six), two fader controlled auxiliary inputs, and a bridging input. The panel shall be completely solid-state with low distortion and noise operation. The microphone inputs shall be transformer coupled, and the unit shall be protected from RF interference. The unit shall provide a single-ended audio output of 1 Vrms (nominal) and shall require a 24 to 30 Vdc input of at least 50 mA. Controls shall include individual microphone level controls, auxiliary fader control, bass and treble controls, a master volume control, and a lighted power ON-OFF switch. The unit shall require 1-3/4 inches (4.5 cm) of vertical space in a standard 19 inch (48.3 cm) equipment rack and shall be finished in charcoal, baked enamel. Control Locking Plate 438-586 must be installed over all controls.
8. The Power Amplifier shall be Dukane Model 1A3125 or an approved equal. It shall be capable of delivering 125 watts continuous (rms) power with less than .5 percent harmonic distortion, 45 Hz to 20 kHz (measurements are made at the 70.7 V tap). The frequency response shall be 20 Hz to 20 kHz (+0, -1 dB) per EIA Standard SE-101A. The signal-to-noise ratio shall be greater than -90 dB below rated output for the 20 Hz to 20 kHz band width. Input sensitivity shall be 1 volt rms at 1 kHz for rated output, and input impedance shall be 75 K ohms. Balanced output load shall be 40 ohms (70.7 V), 5 ohms (25 V), and 8 ohms (31.6 V), and there shall be a 25-volt center tap. Output regulation shall be better than 1 dB, no load to full load. A rear mounted input level control shall be provided. There shall be an LED indicator for power and an LED indicator for a thermal overload condition. The power source shall be 120/240 volts, 50/60 Hz, AC, and the system shall draw 3.0 amps at 120 V. A 4-amp, slow-blow fuse

shall be provided for overload protection. Terminations shall be screw terminal strips with barriers on the output. The Power Amplifier shall be 5-1/4 inches (13.5 cm) high, 19 inches (48.3 cm) wide, 6-5/8 inches (16.8 cm) deep and finished in charcoal, baked enamel. Net weight shall not exceed 22 pounds (9.9 kg). The amplifier shall be acceptable for Fire Protective Signaling Systems approved and tested under U.L. Standards 1711, 1480 and 813.

9. The 110-1286 Signal Generator PCB shall operate with a supply voltage between 24 and 30 Vdc and shall draw between 15 and 35 milliamperes respectively. The output shall vary no more than .2 dB over this range. The output voltage shall be 5 Vac (rms) maximum. The load impedance shall be more than 600 ohms, and the output impedance shall be 70 ohms.

The 110-1287A Trouble Detection PCB shall operate on 24 Vdc @ 75 milliamperes. The input shall be internally clamped to 0.7 volts. The output indicator shall be a light emitting diode. The remote control relay shall be Type C contacts (maximum voltage 250 Vac @ .5 amperes into a resistive load). Reset voltage shall be +4 Vdc.

The 110-1288A Trouble Detection PCB shall operate on 24 Vdc @ 75 milliamperes. Input shall be 20 millivolts and shall be internally clamped to 0.7 volts. The remote control relay shall be Type C contacts (maximum voltage 250 Vac @ .5 amperes into a resistive load). Reset voltage shall be +4 Vdc.

The 110-1289A Trouble Indication PCB shall operate on 24 Vdc @ 75 milliamperes standby. The output of the system power supply shall be constantly monitored.

The 110-1437A Chassis shall measure 19 inches (48.26 cm) x 3-1/2 inches (8.9 cm) x 9-1/4 inches (23.5 cm) deep. It shall weigh 6 pounds, 12 ounces (3 kg). It shall have a capacity of 12 cards, and terminations shall be via screw terminals.

The 110-1493 Emergency Tone Generator is a dual card, emergency tone generator. It shall operate on 24 volts dc, 75 mA. The output voltage is 5 volts with an output impedance of 1 k. The frequency of the tone shall be modulated in a sweeping frequency of 600 to 1100 Hz with a duration of 10 seconds "on" and 5 seconds "off".

The 110-1494 is the End of Line Sense Card for the Supervisory System. It shall operate on 24 volts dc, 75 mA. It is of solid-state construction. The fault indicator shall be a light emitting diode. The card is constructed to "read" voltages between 8 and 15 volts, as provided with an end of line resistance of 11 k ohms. Anything above or below these readings will cause the LED to indicate a failure. The remote control relay shall be Type C contacts (maximum voltage 250 Vac @ .5 amperes into a resistive load).

The 9A1475 Trouble Indication and Control Panel shall measure 19 inches (48.26 cm) x 1-3/4 inches (4.5 cm) x 3-1/2 inches (8.9 cm) deep and shall weigh 4 pounds (1.8 kg). It shall operate on 24 Vdc @ 150 milliamperes.

The 9A1480 Trouble Indication and Control Panel with 50 Annunciators shall measure 13 inches (33 cm) x 4-1/2 inches (11.4 cm) x 2-1/2 inches (6.4 cm) deep. It shall weigh 2 pounds, 8 ounces (1.1 kg). It shall operate on 24 Vdc @ 150 milliamperes standby. Lamp current shall be 40 milliamperes each. Terminations shall be via screw terminals and spade terminals.

10. The Power Supply shall be Dukane Model 17A365. It shall furnish 24 volts dc at 3.2 amperes. The supply shall operate on 105 to 125 Vac by use of primary transformer taps. The input shall be protected by a 2 ampere and a 3 ampere fuse. The output shall be protected by an electronic fold-back circuit and a 3.2 ampere resettable circuit

breaker. The fold-back circuit shall be self-restoring when the overload or short condition is removed.

The Power Supply shall be 3-1/2 inches (8.9 cm) high, 19 inches (48.26 cm) wide, 5-1/2 inches (14.0 cm) deep and finished in charcoal. External connections shall be to screw terminals.

11. The Secondary Voltage Indicator Panel shall be Dukane Model 9A1830 or an approved equal. The lamp shall be red, and the lamp rating shall be 28 volts @ .040 amperes. Terminations shall be screw terminals. The finish shall be charcoal, baked enamel. The unit shall be 1-3/4 inches (4.5 cm) high, 19 inches (48.3 cm) wide and 2 inches (5.08 cm) deep. The net weight shall be 13 ounces (.37 kg).
12. The Manual Fire Alarm Initiation Module shall be the Dukane Model 9A1538 or an approved equal. It shall provide ten push-to-lock/push-to-release type selector switches with replaceable lamps. The module switches shall provide selection of a zone or group of zones for transmission of an alarm tone. The module shall provide visual indication of the zone(s) receiving the alarm tone. The switches shall have provision for protected interchangeable identification.

The Manual Fire Alarm Initiation Module shall be 11-3/4 inches (29.8 cm) high, 2-1/2 inches (6.35 cm) wide, 3 inches (7.62 cm) deep and finished in charcoal, baked enamel. Weight shall not exceed 1 pound, 12 ounces (.79 kg).

13. The Monitor Panel shall be Dukane Model 9A1685A or an approved equal. The panel shall provide facilities for aurally and visually monitoring 25 or 70 volt speaker lines. The panel shall incorporate a 4-1/2 inch (11.4 cm) by 2-1/2 inch (4.5 cm) oval speaker, a speaker volume control, a VU meter, and a concealed VU meter calibrating control.

The panel shall be 3-1/2 inches (8.9 cm) high, 19 inches (48.26 cm) wide and 2-1/2 inches (6.35 cm) deep. Weight of the panel shall be 3 pounds, 2 ounces (1.4 kg). The panel shall be finished in charcoal, baked enamel.

14. The Universal Selector Panel shall be Dukane Model 4A1445 or an approved equal. The Panel shall provide for the selective connection of any one of eleven inputs to the output of the panel. The panel shall also provide a Panel By-Pass switch to allow cascading selector panels for increased capacity.

Eleven interlocking, "Press to lock" switches plus a "Press to lock" Panel By-Pass switch shall be incorporated in the panel. The panel shall contain provisions for adding lamps and associated wiring to light the pushbutton when the pushbutton is depressed. The panel shall have a baked enamel, charcoal finish. All external connections shall be to screw terminals. The panel shall be 1-3/4 inches (4.45 cm) high, 19 inches (48.26 cm) wide and 4-1/2 inches (11.43 cm) deep.

15. The Multi-Tone Generator shall be Dukane Model 15A266A. The generator shall be completely solid-state with the capability of operating on either 12 or 24 volts dc. The generator shall be capable of producing 7 separate and distinct signals: wail, warble, hi-lo, alarm, repeating chimes, single-stroke, and tone. The unit shall be equipped with a pitch control, which affects both chimes and the tone function, and a volume control, which affects all functions. All terminations shall be to a feed-through, screw-type terminal block. Through the activation switch network, both priority and hierarchy of signal shall be determined.

The Underwriters' Laboratories Listed Speaker Assembly shall be a Dukane Model 6A643 with a 5A543 Speaker/Transformer Assembly and a 6A342 Baffle or a Dukane Model 6A644 with a 5A544 Speaker/Transformer Assembly and a 6A342 Baffle.

The baffle, Dukane Model 6A342, shall be constructed of steel and finished in white epoxy paint. It shall measure 12-7/8 inches (32.7 cm) in diameter, 3/8 inches (1 cm) deep and weigh 20 ounces (567 g). It shall be predrilled to accept Dukane Model 5A543 or 5A544 Speaker/Transformer Assembly and mount on a Model 8A300/8A301 Dukane backbox. The backbox assembly shall be 4-1/16 inches (10.3 cm) deep, 11-1/4 inches (28.5 cm) in diameter and weigh 1 pound, 11 ounces (765 g).

The entire assembly shall be 4-1/8 inches (10.5 cm) deep, 12-3/4 inches (32.4 cm) in diameter and weigh 3 pounds, 14.5 ounces (1.7 kg).

2.6 STAND ALONE MUSIC SYSTEMS:

A. ALL ITEMS OF EQUIPMENT SHALL BE DUKANE UNLESS OTHERWISE NOTED.

1. Speaker Assemblies:
 - a. Speaker/Transformer: 5A606
 - b. Grille: 6A342B
 - c. Backbox: 145-226
 - d. Speakers for Operating Rooms shall be Bose: 812 Series
 - e. Soundolier: 81-8 Tile Bridge
2. Volume Control: 9A1553
3. AM-FM Tuner/ 40 Watt Amplifier: 1A2001
4. Microphone: 7A766

B. MATERIALS

1. Speakers: All speakers shall be 8 inches (20 cm) PM type with a frequency response of 90-15,000 Hz. The transformer shall have primary transformer taps of 25V and 70V. The secondary transformer taps shall be 1/2, 1 and 2 on the 25V line and 1/2, 1, 2 and 4 on the 70V line.
2. Grilles: Shall be of steel construction with epoxy finish as not to chip or mar. The grille shall be 12-7/8" in diameter and shall be finished in solid white.
3. Backboxes: The backbox shall have a rust preventative coating over metal. The interior of the enclosure shall be undercoated to prevent mechanical and acoustical resonances.
4. Volume Control: Shall be a 10 Watt area volume control with an override relay to bypass the attenuator during a page.
5. AM-FM Tuner/ 40Watt Amplifier: Shall be capable of providing background music and microphone paging. A selector switch shall be included so the program source can be selected. A muting relay, when operated from an external closure, shall mute the music completely. It shall incorporate treble, bass and contour loudness controls that only affect the music output. It shall have a digital display for the FM or AM frequency of the station selected and tuning indicators to show the signal strength.

6. Microphone: The microphone shall be an omnidirectional, controlled magnetic type with a frequency range of 100-10,000 Hz. The microphone shall include an on-off switch operated by a finger-tip control bar.

PART 3 EXECUTION

3.1 EXAMINATION:

- A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the Public Address, Intercom, and Stand-alone Music Systems work.
- B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

- A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.
- B. Wiring Methods: Install wiring in raceway except within consoles, desks, and counters, and except in accessible ceiling spaces and in gypsum board partitions, where cable wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal wiring.
- C. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- D. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.
- E. Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed as not to damage the cables. Secure cable at intervals not exceeding 30 inches and not more than 6 inches from every cabinet, box, or fitting.
- F. Wiring Within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.
- G. Provide physical isolation from each other for microphone, line level, speaker, and power wiring. Run in separate raceways or provide 12 inch minimum separation where exposed or in same enclosure. Provide additional physical separation as recommended by equipment manufacturer.
- H. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes, terminal cabinets, and equipment enclosures.
- I. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.
- J. Weatherproofing: Weatherproof units to be mounted out-of-doors or exposed to weather in any degree.
- K. Repairs: Wherever walls, ceilings, floors, or other building finishes are cut for installation, repair, restore, and refinish to original appearance.

3.3 GROUNDING:

- A. Provide equipment grounding connections for systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
 - 1. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

3.4 FIELD QUALITY CONTROL:

- A. Manufacturer's Field Services: Provide services of a factory authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
- B. Pretesting: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new, and retest until materials satisfactory performance and conditions are achieved.
- C. Testing: Upon completion of pretesting, notify the Architect a minimum of 10 days in advance of acceptance test performance. Schedule and conduct tests in his presence. Provide a written record of test results.
- D. Operational Test: Perform an operational system test to verify conformance of system to these Specifications. Perform tests that include originating program and page material at microphone outlets, all preamplifier program inputs, and all other inputs. Observe sound reproduction for proper volume levels and freedom from noise.
- E. Signal-To-Noise Ratio Test: Measure the ratio of signal to noise of the complete system at normal gain settings using the following procedure.
 - 1. Disconnect a microphone at the connector or jack closest to it and replace it in the circuit with a signal generator using a 1,000-Hz signal. Replace all other microphones at the corresponding connectors with dummy loads, each equal in impedance to the microphone it replaces. Measure the ratio of signal to noise.
 - 2. Repeat the test for each separately controlled zone of loudspeakers.
 - 3. The minimum acceptance ratio is 50 dB.
- F. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1,000, 3,000, 8,000 and 12,000 Hz into each pre-amp channel and measure the distortion in the power amplifier output. The maximum distortion at any frequency is 3 percent total harmonics.
- G. Power Output Test: Measure the electrical power output of each power amplifier at normal gain setting at 50, 1,000, and 12,000 Hz. The maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
- H. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of speaker line matching transformers.

- I. Retesting: Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards. Provide a written record of all retest results.
- 3.5 COMMISSIONING:
- A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the systems. Provide a minimum of eight hours training.
 - B. Schedule training with Owner through the Architect, with at least 7 days advance notice.
 - C. Occupancy Adjustments: When requested by the Architect within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, resetting matching transformer taps, and adjusting controls to suit actual occupied conditions. Provide up to three visits to the site for this purpose.
- 3.6 CLEANING AND PROTECTION:
- A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION 16770.2