TeachLogic® Forum™ Classroom Sound Field System

Architect's and Engineer's Specifications

PART 1 - GENERAL

1.01 SUMMARY

A. This Specification includes all components required for a fully functional Classroom Sound Field System to amplify voice and other audio sources and create an evenly distributed sound field throughout the classroom for the purpose of increasing student performance and reducing teacher voice fatigue.

B. Related Requirements in this Specification

1. Division 01 - General Requirements.
2. Section 26 0500: Common Work Results for Electrical.
3. Section 26 0513: Basic Electrical Materials and Methods.
4. Section 26 0526: Grounding and Bonding.
5. Section 26 0519: Low-Voltage Wire (600 Volts AC).
6. Section 26 0533: Raceways, Boxes, Fittings, and Supports.

C. Related Codes and Standards

1. ANSI S12.60 Acoustical Performance Criteria, Design Requirements, Guidelines for Schools.
2. Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual, current edition.
3. Federal Communications Commission (FCC) Listing requirements.
4. Underwriters Laboratory (UL ®) or other Nationally Recognized Testing laboratory (NRTL).
5. Telecommunications Industry Association (TIA), and Electronic Industries Alliance (EIA) applicable sections to sound amplification systems and loud speakers.
6. NFPA 72 - National Fire Alarm and Signaling Code ®
7. NFPA 70 - National Electrical Code ® (NEC ®)
8. ISO - International Standards Organization
9. CSA-Canadian Standards Association
10. CE Code - Canadian Electrical Code as Published by the Canadian Standards Association referencing 24th Edition / 2018.
11. Local and regional codes and standards as required by Authorities Having Jurisdiction (AHJ) over this project or the systems being installed.

1.02 DEFINITIONS

A. Classroom Sound Field System: An electronic system to amplify voice and other audio sources and create an evenly distributed sound field throughout the classroom for the purposes of increasing student comprehension and performance and reducing teacher voice fatigue.

B. Mixer/Amplifier: A component of the Classroom Sound Field System that receives and mixes inputs from one or more IR wireless microphones and other audio sources, amplifies them through the system loudspeakers and, optionally, distributes them to a classroom assistive listening system, lesson capture recorder or other external devices.

C. Loudspeaker: A component of the Classroom Sound Field System that emits voice and other audio sources enabling students to hear clearly.

D. Infrared: A means of wireless signal transmission using infrared light. Abbreviated as “IR”.

E. Pendant-Style IR Wireless Microphone/Transmitter: An IR wireless microphone component of the Classroom Sound Field System designed as a neck-worn pendant with a built-in microphone and an IR wireless transmitter to send a teacher’s voice to the Mixer/Amplifier via its sensor(s).

F. IR Wireless Handheld Microphone/Transmitter: A handheld IR wireless microphone to receive a teacher’s voice or a student’s voice that includes a built-in IR wireless transmitter to send the signal to the Mixer/Amplifier via its sensor(s).

G. Ceiling Infrared Dome Sensor: Receives IR transmission from IR wireless microphones and sends these signals to the Mixer/Amplifier.

H. Manufacturer: The manufacturer of the Classroom Sound Field System

I. Dealer: A party authorized by the Manufacturer to sell products of the Manufacturer

J. Classroom Sound Field System Designer: A qualified consultant, architect or engineer that has designed or will design interconnection and layout of the Classroom Sound Field System as set forth in section 1.05A.

K. Contractor: A contractor qualified per Section 1.06 and authorized by the Manufacturer to install and/or configure and test the Classroom Sound Field System

L. Consultant: A consultant qualified to design and/or configure and test the Classroom Sound Field System

M. Project Manager: The general contractor or other project manager chosen by the owner and/or architect to manage the overall project.

N. Owner: The school, university or other institution that owns the facility where the Classroom Sound Field System is to be installed

O. Authority Having Jurisdiction (AHJ): Any safety or other regulatory body whose regulations and/or required inspections have jurisdiction over the project and/or systems being installed.

1.03 SYSTEM DESCRIPTION

A. Classroom Sound Field System shall be composed of all equipment, materials and labor needed to create an evenly distributed sound field throughout the classroom that

amplifies the teachers' and students' miked voices and other classroom audio-visual equipment including teacher's computer station.

B. The Classroom Sound Field System shall be complete and independent of other classroom systems. A typical system shall have a combined wireless receiver, audio mixer and amplifier, a ceiling mounted IR wireless signal sensor, a teacher's (lapel, collar, or neck hang) IR wireless microphone, a handheld student IR wireless microphone, a battery charger for both microphones, four speakers evenly distributed throughout the classroom (typically ceiling mounted), and all required cables to interconnect the system to classroom audio/visual components, assistive listening equipment and lesson capture recorder.

C. The Classroom Sound Field System shall deliver a well-distributed sound reinforcement or "voice lift" throughout the classroom regardless of the arrangement of teacher and students, and materials and equipment.

D. The Classroom Sound Field System shall function without audible or visual distortions, hum, buzz or rattle under normal operating conditions.

E. Audio and wireless transmission from the Classroom Sound Field System shall be contained within the solid walled perimeter of the classroom and/or educational space without the risk of broadcast to other rooms.

F. Ceiling loudspeakers shall be equipped with adequate seals to prevent sound leakage/dissipation through the space above the finished grid ceiling.

1.04 FUNCTIONAL REQUIREMENTS OF SYSTEMS:

A. Distribute sound field evenly to all classroom areas as indicated on the project drawings.

B. Sound field shall be clear, high fidelity, uniform and of sufficient sound pressure level ("SPL") to override expected classroom noise levels.

C. SPL shall meet applicable state and local standards.

D. Provide inputs for audio from video and audio players.

E. Provide outputs for facility's assistive listening, lesson capture, and conferencing systems.

1.05 SYSTEM DESIGN, CONFIGURATION, TESTING AND EQUIPMENT SUPPLY

A. Classroom Sound Field System Designer shall be (Choose one):
   1. A qualified architect, engineer, or Consultant
   2. A Dealer for the manufacturer

B. Classroom Sound Field System installation shall be performed by (Choose one):
   1. An authorized Dealer for the manufacturer
   2. A Contractor supervised by the Dealer

C. Classroom Sound Field System configuration and testing shall be performed by (Choose one):
   1. A Consultant
   2. A Dealer for the manufacturer
   3. A Contractor supervised by the Dealer

D. Equipment and accessories, including such things as cabling where applicable, shall be supplied by a Dealer.

1.06 INSTALLING CONTRACTOR QUALIFICATIONS

A. Classroom Sound Field System shall be installed by a Dealer or Contractor.

B. To be considered qualified for this work, the Contractor must be experienced in the provision of low-voltage electronic systems similar in complexity to those required for this project and meet the following: (Choose one or more).
   1. The Contractor's primary business is the provision, fabrication, and installation of integrated audio and video systems including distributed sound systems, structured cabling, and/or related systems in the commercial environment.
   2. The Contractor is an authorized dealer for the major product components furnished.
   3. The Contractor has a verifiable history of successful installations of at least three projects of similar scope and size.
   4. The Contractor has all applicable business and regulatory licenses and certifications.
   5. The Contractor has verifiable financial capability to satisfy project and bonding requirements.
   6. When so directed by the Classroom Sound Field System Designer, the Contractor must have obtained the necessary personnel expertise and test and measurement equipment to configure and test the Classroom Sound Field System.

1.07 BID SUBMITTALS

A. Instructions to Bidders: To be considered, Bids must be made in accord with the Classroom Sound Field System Designer's Instructions to Bidders and this Article.

B. Examinations: Carefully examine the contract documents and, when possible, the construction site to obtain first-hand knowledge of existing conditions. Contractor will not be given extra payments for conditions that can be determined by examining documents or by making on-site examinations and will not be relieved of any obligations with respect to bid.

C. Questions: Submit all questions about the contract documents to the Project Manager in writing. Replies requiring changes to the contract documents will be issued to all bidders

as addenda and will become part of the Contract. The Project Manager may give, but will not be responsible for, oral clarifications. Questions received less than 10 days before bid date cannot be answered in writing.

D. Basis of Consideration: shall consist of the following items: (Optional Paragraph)
   1. Classroom Sound Field System Performance.
   2. Classroom Sound Field System Functional Capabilities.
   3. Contractor's qualifications
   4. Classroom Sound Field System ease of use
   5. Classroom Sound Field System cost.

E. Submittal Documents:
   1. All submittals shall be delivered in electronic format as combined PDF files via FTP posting, CD-ROM, DVD, e-mail or cloud storage download link.
   2. CAD drawings will be in AutoCAD 2018 dwg format and portable document format (PDF). All other submissions unless otherwise stated will be provided as PDFs.
   3. CAD drawings shall include details of proposed means of support and attachment to wall and ceiling for the mounting of equipment and devices.
   4. Submit Contractor qualifications per Section 1.06.
   5. Submit a list of proposed major components along with Manufacturer's detailed technical data sheets.
   6. Provide samples of material and equipment as required by the Classroom Sound Field System Designer. If samples are requested, they shall be submitted within ten days from date of request.
   7. Product data shall be sufficiently detailed to allow the Classroom Sound Field System Designer to review the product and to allow other trades to provide necessary coordination.
   8. Provide details for interface between the Classroom Sound Field System and equipment furnished by others including number of wires, termination requirements, voltages, mounting plate arrangement, and required coordination items.
   9. A substitution request form with all supporting documentation shall be submitted when Contractor proposes to utilize non-specified products.
   10. Substitution materials and products shall not be used unless previous approval has been obtained.
   11. Unless otherwise directed by contract, do not order equipment until the bill of materials has been reviewed and approved by the Project Manager.
   12. Coordinate all submittals with requirements set forth elsewhere in this Specification.

1.08 INSTALLATION AND QUALITY ASSURANCE

A. Required Permits: Installing Contractor or Project Manager shall obtain all necessary permits for installation work.

B. Project Management: Contractor shall assign a qualified person to manage the installation and maintain the same person in charge of work throughout installation.

C. Contract Documents: Contractor shall maintain a complete set of system drawings and specifications on the job site.

D. Installation: All equipment, cabling, accessories and associated hardware shall be installed in accordance with manufacturers' instructions and according to standards of good engineering practice and other conditions as specified by the Project Manager.

E. Workmanship: shall be of professional quality, best commercial practice and shall be accomplished by qualified personnel.

1.09 JOB CONDITIONS

A. Sequencing and Scheduling:
   1. Coordinate work with Project Manager and other trades to facilitate construction and prevent conflicts.
   2. Afford other trades reasonable opportunity for installation of work and for the storage of materials.
   3. Staff the job to keep pace with the other trades; otherwise, the Project Manager will require an increase in force or overtime work without additional expenses to the Owner.
   4. Abide by the decision of the Project Manager in case of conflict or interference by other trades.

B. Refuse: Remove all refuse from the job site to the satisfaction of the Project Manager and Owner.

C. Insurance: Insurance on the work of this specialty trade shall be provided if specified by the Classroom Sound Field System Designer or Project Manager.

D. Notify the Project Manager of any defects in work by other trades affecting system installation, operation, or performance.

1.10 WARRANTY

A. Contractor shall warrant the installation of all equipment, cabling, and labor for an initial period of one year from the date of installation.

B. Owner requested and other required services, including telephone support, shall be at no charge during the duration of the initial one-year warranty period.

C. On-site service shall be provided within one business day of request.

D. During the initial warranty period, services shall include two semi-annual visits to the site for routine adjustment and maintenance of all equipment. Provide a preliminary schedule for the semi-annual visits.

E. Maintenance and testing shall include any required tests by local Authorities Having Jurisdiction. Provide a maintenance schedule that describes the plan for preventive maintenance of devices and subassemblies requiring regular maintenance.

F. Manufacturer shall warrant all equipment to be free of faulty workmanship and manufacturing defects for a minimum period of three years from date of installation. Batteries shall be warranted for a minimum period of two years from date of installation.

G. Immediately upon receipt of written notice from the Owner, repair or replace, at no expense to the Owner, defective material or work that may be discovered before final acceptance.

H. Manufacturer shall provide warranty repair and/or replacement services on all supplied components. Owner shall prepay shipping for items returned to manufacturer for repair. Manufacturer shall repair or replace, and items shall be returned to owner via appropriate method with shipping paid by manufacturer.

I. Contractor shall be liable for any damages caused to existing structure or systems during its execution of this contract.

J. Contractor shall recommend, and, with Owner’s approval, procure, sell, and supply an inventory of spares to include amplifiers, microphones, chargers, and cables so that Owner may remedy breakage, loss, and warranted failures quickly in the future.

1.11 SERVICE CONTRACT

A. At Owner's request, provide an annual service and maintenance contract to commence after the one-year warranty period has expired.

B. Services to include two semi-annual visits to the site for routine adjustment and maintenance of all equipment.

C. Service contract shall include unit pricing for equipment and labor.

D. Maintenance and testing shall include any required tests by local Authorities Having Jurisdiction. Provide a maintenance schedule that describes the plan for preventive maintenance of devices and subassemblies requiring regular maintenance.

1.12 TRAINING

A. Provide sufficient training to personnel selected by the Owner on operation and basic maintenance of all systems, software, and equipment. Explain operation of system, set-up and operation of individual pieces of equipment, and functions of overall system.

B. Provide Manufacturer's instruction manuals for all products used in the system to each person attending the training session.

C. Provide three copies of overall system operation manual for use by the Owner's maintenance personnel.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Basis of Design: TeachLogic, LLC., Longmont, Colorado USA, Phone 1-760-631-7800, website: www.teachlogic.com

B. Alternate manufacturers shall be considered as the basis of design only when they meet the same form, function and performance, are accompanied by appropriate supporting documentation and approved by the Classroom Sound Field System Designer.

2.02 GENERAL

A. Product requirements include all system components with associated wiring, software, and controls.

B. Only complete, integrated Classroom Sound Field Systems from a sole manufacturer shall be acceptable.

C. All equipment shall be new and of current model.

2.03 PENDANT-STYLE IR WIRELESS MICROPHONE/TRANSMITTER

A. Pendant Style IR Wireless Microphone/Transmitter shall be a wireless microphone to send a teacher's voice to the Mixer/Amplifier using infrared transmission.

B. Pendant Style IR Wireless Microphone/Transmitter shall transmit over a range of at least 50 feet and no greater than 150 feet to avoid interference with other classrooms.

C. Pendant Style IR Wireless Microphone/Transmitter shall be designed as a neck-worn pendant with adjustable lanyard and safety break away clasp.

D. Pendant Style IR Wireless Microphone/Transmitter shall be unidirectional to reduce feedback (howling) and reject ambient noise.

E. When connected with Receiver/Amplifier via Ceiling Infrared Dome Sensor, the Pendant Style IR Wireless Microphone/Transmitter shall meet these specifications:
   1. Frequency response shall be 100Hz to 10 kHz (at -3 dB), allowing for certain shaping to maximize gain before feedback.
   2. Signal to noise ratio shall be at least 65 dB (1 kHz, @ 25W and 4-ohm loading)
   3. Latency (delay) from microphone to speaker shall be less than 2 milliseconds.

F. Pendant Style IR Wireless Microphone/Transmitter shall include:
   1. Microphone volume control
   2. Teacher Priority instant attenuation button that attenuates line input audio sources by approximately 15 dB.
   3. Remote control of Receiver/Amplifier line input levels increase or decrease gain on these inputs.

4. Muting button with visual indication of mute condition so that all audio from the mic is muted until button pressed again.
5. IR channel A/B selection switch
6. Microphone power switch with LED that illuminates red for low-battery condition and purple for charge state nearing the low-battery condition.
7. Auxiliary Input for wireless playback of an audio device like a music player
8. Connector for charging from a universal micro-USB cable or Drop-In Charger.

G. Pendant Style IR Wireless Microphone/Transmitter shall be powered by a rechargeable battery that provides 8 hours of typical use between charges.

H. Pendant Style IR Wireless Microphone/Transmitter shall weigh no more than 1.5 ounces including battery (but excluding lanyard).

I. Pendant Style IR Wireless Microphone/Transmitter shall be TeachLogic model IRT-60N Sapphire.

2.04 HANDHELD IR WIRELESS MICROPHONE/TRANSMITTER

A. Handheld IR Wireless Microphone/Transmitter shall be a handheld microphone to send a teacher's voice or student's voice to the Mixer/Amplifier using infrared transmission.

B. Handheld IR Wireless Microphone/Transmitter shall be unidirectional to reduce feedback (howling) and reject ambient noise.

C. When connected to the Receiver/Amplifier via Ceiling Infrared Dome Sensor, Handheld IR Wireless Microphone/Transmitter shall meet these specifications:
1. Frequency response shall be 100Hz to 10 kHz (at -3 dB), allowing for certain shaping to maximize gain before feedback.
2. Latency (delay) from microphone to loudspeaker shall be less than 2 milliseconds.

D. Handheld IR Wireless Microphone/Transmitter shall include power switch and LED that glows green when power is on and glows red to indicate low battery.

E. Handheld IR Wireless Microphone/Transmitter shall include power contacts for use with Drop-In Charger.

F. Handheld IR Wireless Microphone/Transmitter shall be powered by rechargeable AA or AAA sized batteries.

G. Handheld IR Wireless Microphone/Transmitter shall be TeachLogic model IRH-35.

2.05 DROP-IN CHARGER

A. Drop-In Charger shall be capable of simultaneously charging up to two (2) IR Pendant Style Wireless Microphone/Transmitters and one (1) IR Handheld Wireless Microphone/Transmitter.

B. Drop-In Charger shall be a regulated design with automatic full charge maintenance and charging Indicator that glows red when batteries are being charged and green when batteries are fully charged.

C. Drop-In Charger shall include a UL listed AC adapter and be capable of being powered by Mixer/Amplifier or a USB-A power source so that fewer electrical outlets are required for Classroom Sound Field System.

D. Drop-In Charger shall have magnetic feet or base to secure its attachment to ferrous metal surfaces.

E. Drop-In Charger shall be TeachLogic model BRC-60 or BRC-65.

2.06 IR CEILING DOME SENSOR

A. IR Ceiling Dome Sensor shall be a ceiling-mounted infrared sensor designed to receive infrared transmission simultaneously from Pendant Style IR Wireless Microphone/Transmitter and Handheld IR Wireless Microphone/Transmitter and transmit these signals to the Receiver/Amplifier.

B. IR Ceiling Dome Sensor shall have a 60-foot line-of-sight operating range.

C. IR Ceiling Dome Sensor shall include a support bracket for mounting to suspended ceiling grid without tools and a nylon tie for secondary safety support.

D. IR Ceiling Dome Sensor shall include 50 feet of coaxial plenum-rated cable with “RCA” connectors, and it shall be phantom powered from the Mixer/Amplifier. IR Ceiling Dome Sensor shall be TeachLogic model ICS-55.

E. IR Ceiling Dome Sensor shall be TeachLogic model ICS-55.

2.07 RECEIVER / AMPLIFIER

A. Receiver/Amplifier shall include two, 25-watt @ 4-ohm amplifiers with frequency response of 40 Hz to 20 kHz.

B. Receiver/Amplifier shall be short-circuit protected and capable of driving loudspeaker(s) of 4Ω or greater impedance from each amplifier.

C. Receiver/Amplifier shall include two wireless receivers that receive signals from IR Ceiling Dome Sensor for two microphones (or other IR transmitters including mobile display audio transmitters) transmitting simultaneously.

D. Receiver/Amplifier shall include individual volume controls for each microphone channel.

E. Receiver/Amplifier shall include separate inputs with volume controls for audio from two separate sources, accepting either monophonic or stereophonic line level inputs on each input. All inputs shall be combined to monophonic signals before amplification. One of the two input channels shall provide physical access on both the front and rear panels of the Receiver/Amplifier.

F. One line-level input channel shall include switchable hum suppression circuit to isolate reduce ground loop hum.

G. Receiver/Amplifier shall provide two separate outputs with a volume control for each output to provide mixed audio for conferencing and for student assistive listening system and/or lesson capture recording.

H. Receiver/Amplifier shall include a 3-band equalizer with rotary controls located on the back of the unit and an internal limiter to minimize dropped microphone and other sudden noises.

I. Receiver/Amplifier shall include a 5 VDC, 1 A USB-A charging port for use with Drop-In Charger or other devices requiring USB power.

J. Receiver/Amplifier shall include a power-saving sleep mode allowing the unit to remain active in a low-power, energy conserving state, and it shall revert to active state shortly after microphone or other audio signal inputs are received.

K. Manufacturer shall offer an optional shelf-mounting kit and an optional wall mounting cabinet for Receiver/Amplifier and Drop in Battery Charger.

L. Receiver/Amplifier shall be TeachLogic Model IMA-240 Forum™.

M. For classrooms requiring more than 4 loudspeakers, the TeachLogic Model IMA-840 Spectrum™ shall be substituted. The IMA-840 includes all the features of the IMA-240 (and more) but contains four 25W, 4-ohm amplifiers, nominally for 8 loudspeakers.

N. Optional Shelf-Mounting Kit shall be TeachLogic Model SM-401.

O. Optional Low-Profile Wall Mounting Cabinet shall be TeachLogic Model WC-400.

2.08 LOUDSPEAKERS

A. Loudspeakers may be Ceiling Mount, Lay-In Panel type, Wall-Mount or a combination thereof as chosen by the Classroom Sound Field System Designer.

B. Quantity and Location:

1. Each classroom shall be fitted with 4 loudspeakers, depending on classroom size and as chosen by the Classroom Sound Field System Designer. If more than 4, and up 8 loudspeakers are specified, then the receiver/amplifier shall be the TeachLogic IMA-840 Spectrum™.
2. Loudspeakers shall be installed in locations chosen by the Classroom Sound Field System Designer to provide uniform sound levels across all classroom areas.

C. Ceiling Mount Loudspeakers:

1. Ceiling Mount Loudspeakers shall be full-range, 6.5” diameter cone type direct-field loudspeakers with coaxially-mounted 1” diameter mylar tweeter with separate voice coil, integrated crossover network, air-sealed metal enclosure, white metal grille and trim ring

2. Ceiling Mount Loudspeakers shall have a frequency response of at least 145 Hz to 20 kHz ±3 dB and shall have 8-ohm impedance with a power handling capability of at least 30 watts nominal.
3. Each Ceiling Mount Loudspeaker shall be fitted with quick-mount screw clamps for efficient installation, and the installation of clamps shall be achievable from speaker front side so that they may be installed in walls or ceilings without requiring access to back side of speaker.
4. Each speaker shall have a bracket to facilitate support wire connection.
5. Speaker wire terminals shall of a spring loaded quick connect type and not screw terminals.
6. Each Ceiling Mount Loudspeaker shall be supplied with a galvanized steel tile support bridge, and the bridge shall have holes to facilitate support wire connection.
7. Ceiling Mount Loudspeakers shall be TeachLogic model SP-628, and the support component shall be TeachLogic model TB-6.1 tile bridges.

D. Lay-In Panel Loudspeakers:
1. Lay-In Panel Loudspeaker shall be a Ceiling Mount Loudspeaker mounted on a quarter ceiling panel (1' x 2') with attached T-bar suspension.
2. Quarter ceiling panel and T-bar suspension shall consist of heavy duty, perforated, powder coated steel and be designed for buzz-free performance.
3. Lay-In Panel Loudspeakers shall have a frequency response of at least 145 Hz to 20 kHz ±3 dB and shall have 8-ohm impedance with a power handling capability of at least 30 watts nominal.
4. Each Lay-In Panel Loudspeaker shall have three brackets to facilitate support wire connection.
5. Speaker wire terminals shall of a spring loaded quick connect type and not screw terminals.
6. Lay-In Panel Loudspeakers shall be TeachLogic model SP-628L.

E. Wall-Mount Loudspeakers:
1. Wall-Mount Loudspeakers shall be of two-way design with 5.25" woofer, separate high efficiency domed tweeter and passive crossover housed in an attractive ported enclosure formed of structurally reinforced ABS with metal mesh grille and include metal spring terminal speaker wire connection and magnetic shielding to prevent interference with video monitors.
2. Wall-Mount Loudspeakers shall include steel mounting bracket for wall-mount and plastic screw-down mounts for situating in a shelf-top stance
3. Wall-Mount Loudspeakers shall have a frequency response of at least 120Hz – 16,000 Hz ± 6 dB and shall have 8-ohm impedance with a power handling capability of at least 30 watts nominal.
4. Each speaker shall have a bracket to facilitate support wire connection.
5. Wall-Mount Loudspeakers shall be TeachLogic model SP-2000.

F. Manufacturer shall include 100 feet of 2-conductor plenum-rated loudspeaker cable for a 4-loudspeaker system.

G. Loudspeakers must be installed to meet seismic and other safety regulations as required by Classroom Sound Field System Designer and Authorities Having Jurisdiction (AHJ).

H. Install loudspeakers where indicated on project drawings. Space evenly as recommended by the product manufacturer based on site conditions and ceiling heights avoiding ceiling or other obstructions.

I. Loudspeakers and accessories mounted in air handling spaces shall be UL 2043 compliant.

2.09 LABELS

A. Except where otherwise specified, label each item of equipment as shown on drawings.

B. Identify all wires and cables at every connection point with reference number keyed to the as-built wiring diagrams.

C. All labels shall reflect the Owner's final room designations.

D. Use high-grade PVC clip-on or permanent-type cable markers with permanent markings, or printed vinyl tape protected by clear shrink tubing or adhesive wrap.

2.10 SAFETY LISTINGS

A. General

Products and system shall comply with all applicable local, regional and national safety codes.

B. Electrical Safety

All electronics with internal power supplies shall be UL Listed. Electronics with external power supplies shall have UL Listed power supplies. Safety listing through an equivalent body such as Intertek ETL is acceptable. Outside the USA, the electronics shall be certified by an equivalent certification body to meet local and/or national safety standards.

C. Seismic Safety

When required by local regulations, loudspeaker seismic support system(s) must be approved by authorities having jurisdiction and based on local code requirements.

D. The Classroom Sound Field System shall not be a primary means of emergency communications system or ECS. For this reason, UL2572 compliance is not required under this specification.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation, ensure the site is suitable for system installation.

B. Verify all locations where system components are to be installed are free of conflicts with other trades prior to installation.

C. Verify that site building conditions match the system design plans including ceiling finishes, wall locations, and obstructions. Immediately notify the Project Manager of any discrepancies prior to the commencement of work.

D. Ensure system power requirements, network connectivity, and any other third-party infrastructure requirements for the system have been provided and installed prior to installation.

3.02 DELIVERY, STORAGE AND HANDLING

A. Protect all system components from moisture, dust and damage during shipping, storage and handling.

B. Materials and equipment installed shall be new and installed in compliance with prevailing national and local engineering practices, codes and standards.

C. Deliver in Manufacturer's original unopened and undamaged packages with Manufacturer's labels legible and intact.

D. Inspect all system components upon receipt and upon unpacking.

3.03 INSTALLATION

A. General

1. Comply with all applicable electrical and other safety codes.
2. Install Classroom Sound Field System in compliance with Manufacturer's recommendations and published documentation.
3. All equipment shall be installed by competent workers at locations shown on the drawings in strict accordance with approved shop drawings. Record any and all necessary changes to the system design in cases where different from the submittal documents.
4. Materials, surface, or existing work damaged during installation shall be repaired or replaced at no cost to Owner. Examination of, or failure to examine work by the Owner shall not relieve Contractor from these obligations.
5. All equipment shall be firmly held in place including loudspeakers, enclosures, amplifiers, processors, cables, etc. Fastenings and supports shall be adequate to support their loads with a safety factor of at least six unless otherwise stated.
6. All system components shall be mounted in a level and plumb fashion utilizing the dimensions indicated on the associated drawings.
7. User controllable devices shall be mounted at a location and height which allows for normal adjustment and operation.
8. Electronics shall be conveniently accessible for service.

B. Loudspeakers

1. Locate ceiling and wall-mount loudspeakers as indicated on project drawings or manufacturer’s instructions and as required to meet manufacturer’s spatial uniformity requirements or other requirements in this specification.

2. Ensure loudspeaker coverage pattern is not obstructed by building systems or structures which may impede performance of the Classroom Sound Field System.
3. Install all loudspeaker cabling to maintain proper polarity (± markings) from Loudspeaker to Receiver/Amplifier.
4. Ensure minimum distance between Ceiling Mount or Lay-In Panel loudspeakers and structure/obstacles is maintained to allow adequate clearance of cabling and connectors.

C. Receiver/Amplifier
1. Place the Receiver/Amplifier in a convenient, well-ventilated location in the classroom. Optionally, mount Receiver/Amplifier on or below a shelf using optional shelf-mounting kit or on a wall using optional low-profile wall mounting cabinet.

D. Ceiling IR Dome Sensor
1. Flush-mount Ceiling IR Dome Sensor below the ceiling tile using the supplied support bracket clipped to the ceiling tile metal support. Route cable through nylon security tie to provide second means of support. Connect the supplied coaxial cable via the “RCA” connector and route the cable back to the Receiver/Amplifier and connect to IR input.

E. Cabling
1. All cable installation shall be done in professional workmanlike manner with adequate service loops where applicable. Dress cabling in a neat and consistent fashion using appropriate methods and materials.
2. Test all field fabricated and manufacturer supplied cables, before installation, for open circuits, shorts, crossed pairs, reversed pairs, split pairs and proper pin-out.
3. Refer to manufacturer recommendations as to maximum cabling distances and types to support control processor unit(s), controls, and loudspeakers. Never exceed manufacturer's cable distance limitations and quantity of devices per cable run.
4. Cabling pathways shall be configured to prevent conflict with other building systems. Care should be taken to minimize and eliminate all RFI and EMI interference sources.
5. Maintain appropriate separation between dissimilar signal types, voltages, and electrical devices.
6. Cabling to be installed/supported in a manner utilizing approved methods and materials as required by the local AHJ.
7. Cabling shall be installed in metallic rigid or flex conduit only as indicated on the associate project drawings/ specification and using manufacturer approved accessories.
8. All cabling shall be supported from structure. Cabling shall not contact ceiling tiles or inhibit their removal for access to the plenum.

3.04 SYSTEM STARTUP

A. Perform the entire Manufacturer’s recommended testing and startup procedure as outlined in the Manufacturer's product manual(s).

B. Ensure functional operation of all ancillary devices to include front panel controls, audio inputs, contact closures, wall controls, software control and third-party controllers. Test each setting and confirm expected results from actions taken. Correct all deficiencies in operation.

C. Perform system startup at a time when each classroom / space is vacant and free of any noise contamination.

D. Connect Pendant Style Wireless Microphone/Transmitter and Handheld Wireless Microphone/Transmitter to Drop-In Charger.

3.05 SYSTEM TESTS AND ADJUSTMENTS

A. Qualifications of Testing Party

Testing, calibration and setup shall be performed by Consultant or Dealer.

B. Prior to Test and Adjustment, ensure the site conditions are suitable for adjustment of the Classroom Sound Field System. Adjustment can only be made when the following site conditions exist:

1. All ceiling assemblies are currently installed and completed.
2. Mechanical systems have been previously optimized to final operational conditions and are active in areas served by the Classroom Sound Field System.
3. Classroom is not in use.
4. External noise sources (i.e. construction activities) are not present during testing.
5. Final testing shall be scheduled at least 15 days in advance of Owner occupancy.
6. Notify the Classroom Sound Field System Designer, the Project Manager and the Owner's Representative of the testing and adjustment schedule.

C. Testing and Adjustment

1. Perform these tests and adjustments under observation of the Classroom Sound Field System designer and/or Project Manager and/or Owner's Representative when so requested.
2. Perform these tests and adjustments for each classroom or other space served by a Classroom Sound Field System.
3. System Testing and Adjustment shall be performed by the Classroom Sound Field System Designer, a qualified Consultant or an authorized Dealer for the manufacturer.
4. Confirm proper operation of each component supplied by manufacturer including Receiver/Amplifier, IR Ceiling Dome Sensor, Pendant Style Wireless Microphone/Transmitter, Handheld Wireless Microphone/Transmitter, Loudspeakers, and Drop-In Charger.
5. Confirm proper operation of auxiliary devices including video display, computer, DVD player, conferencing computers, other audio sources, assistive listening system, and/or lesson capture recorder.
6. Adjust microphone and other volume controls to meet Manufacturer-specified Classroom Sound Field sound level requirements and local Classroom Sound Field System standards and regulations. Adjust amplifier's microphone gains to avoid audio feedback in all normal use scenarios.

D. Equalizer Adjustment

1. Most classrooms will not require adjustment of the 3-band equalizer, and controls should be set to the “12 O’Clock” position.
2. When so directed by the Classroom Sound Field System Designer, a qualified Consultant or an authorized Dealer for the manufacturer can adjust the 3-Band Equalizer to compensate for unusual room acoustics or other needs.

E. Proof of Performance Testing

1. Confirm the absence of audible hum, static, noise, or distortion. Troubleshoot and correct these or other issues as needed.
2. Ensure no interference exists from nearby classrooms’ IR systems in cases where glass walls or windows between classrooms may be present.
3. If requested, demonstrate to the Owner’s representative that the system is fully operable and installed in compliance with the terms of the performance specifications hereunder.
4. Should this Proof of Performance Testing reveal deficiencies, testing will be discontinued until corrections have been made. When the Contractor has completed the corrections, a subsequent test shall be initiated.
5. The Owner reserves the right to perform independent tests of equipment furnished and completed system, to determine whether equipment and system comply with the specified requirements.

3.06 CLEANING AND WASTE MANAGEMENT

A. Remove unused materials and debris from the work and storage areas. Leave areas in undamaged and acceptable condition

B. Clean all debris created by installation of components.

C. Clean system components where required.

D. Save shipping boxes and leave for the school to use to return product for service.

3.07 FINAL CLOSEOUT AND AS-BUILT DOCUMENTATION

A. Contractor shall document, prepare and submit all final control settings, one-line diagrams, operational instruction, loudspeaker locations and testing results in PDF format or AutoCAD DWG format as appropriate. Submit three copies to the Classroom Sound Field System Designer, the Project Manager and the Owner's representative for final review and acceptance.

B. Provide as-built conditions indicating final location of speakers, remote infrared dome sensor, and amplifier.

C. Submit documented results of system testing and adjustments.

D. Submit completion letter stating effective date of installation warranty.

E. Provide serial numbers of receiver/amplifiers, ceiling sensors, microphone/transmitter(s), and drop-in battery charger.

F. Deliver three copies of operating and servicing manual including at minimum:
   1. A page with Project site and Project name, date of Substantial Completion, Contractor name, address, telephone, and fax numbers.
   2. Warranty and service information.
   3. Instructions for proper operation and servicing of system.
   4. As-built drawings to include one-line diagram of the system indicating items and their point-to-point connections in a manner following floor plans layouts.
   5. Full circuit diagram and wiring details for custom controls or other equipment provided by others.