

**SECTION 27 51 23**  
**INTEGRATED IP BASED SAFETY & INTERCOMMUNICATION SYSTEM**  
**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. The requirements of the contract documents, including the General and Supplementary General Conditions and Division 1 – General Requirements shall apply to the work of this section.
- B. At the time of proposal, any exceptions taken of these specifications, all variances from these specifications and all substitutions of operating capabilities or equipment called for in these specifications shall be listed in writing and forwarded to the Architect / Engineer. Any such exception, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval with comment.

**1.02 SCOPE OF WORK**

- A. The work covered by this section of the specifications shall include all material, labor, hardware, software, firmware and programming to install a completed and operating system as described herein and shown in the drawings. The system shall utilize the schools shared data network, and not require the use of any proprietary switches, routers, or other network components. The physical network components shall be provided by the owner or the contractor, the scope of this document does not include the physical network including switches, routers, or network cabling. Beyond the shared data network hardware, the rest of the system shall be complete with all necessary materials, labor, hardware, software, firmware and programming specifically tailored for the installation. It shall be possible to permanently modify the software on site by using a system administrator software network interface.
- B. The intent of this specification shall maximize communications between the classroom and administrative areas utilizing VoIP (Voice over Internet Protocol) Technology while enhancing school safety and reducing maintenance, operational, and installation cost.
- C. Under this specification, the system shall provide a complete VoIP Communication System for all classrooms and flex spaces as indicated on the drawings. An analog solution using speakers and volume controls in the offices, corridors, exterior locations, restrooms, gymnasium and cafeteria shall also be part of this project.
- D. The Communication System shall provide VoIP or network distribution of intercom, overhead paging, emergency paging, class change time tones, emergency tones and program material.
- E. Any and all miscellaneous materials, labor, hardware, software, firmware and programming that is not listed in the specification section that is required to provide a complete and operating system shall be provided as part of the scope of work for this installation.
- F. The work covered by this section of the specifications shall be coordinated with any and all trades that are affected by the installation of this system. All work shall be complete and as required and specified elsewhere under these project specifications.
- G. All the actual required system components and cabling are not shown or specified as this carries between acceptable manufactures and suppliers. It shall be the responsibility of the contractor to obtain this information from the acceptable supplier and or manufacturer and include the cost of the same in his bid.

**1.03 APPLICABLE CODES AND STANDARDS**

- A. All devices of the system shall be listed by UL (Underwriters Laboratory). All components of the system shall bear the UL label.

- B. The system shall be installed in strict accordance with all the requirements of the National Electric Code.
- C. The system shall be installation in strict accordance with the requirements of the Americans with Disabilities Act (ADA).
- D. The system shall be installed in strict accordance with the requirements of all other applicable codes as well as all Federal, State, and local codes.

#### **1.04 RELATED DOCUMENTS**

- A. Secure any and all required permits and approvals prior to installation.

#### **1.05 RELATED WORK**

- A. The contractor shall coordinate work in this section with all related trades that the system effects of integrates with. Work and / or equipment provided in other sections and related to the system shall include but not be limited to the following:
  - 1. Cable support system
  - 2. Structured Cabling System installer
  - 3. Network Infrastructure Supplier – switches/routers

#### **1.06 SUBMITTALS**

- A. Furnish to the Architect / Engineer complete equipment submittal technical specification sheets and shop drawing submittals in .pdf format for this system including but not limited to the following:
  - 1. A material list with the quantity of each piece of equipment, names of manufacturers, model numbers and the technical data information on all equipment the contractor proposes to install. This material list shall be broken out and listed by Specification Section, per piece of equipment. If a piece of equipment is needed but not listed in this specification section, it shall be listed in the area of the submittal it pertains to. The technical information shall be a piece of the manufacturers printed literature that is produced by the equipment manufacturer. Internet web page listings will not be accepted. Provide a description of any special installation procedures that will differ from what is specified or shown on drawings.
  - 2. Complete system circuit diagrams of the entire system, point to point on scaled floor plans scaled to match that of the scale of the project documents. The shop drawings are required to clearly illustrate how all components related to each other and how they interconnect to each other. A complete point to point wiring diagram of any and all panels and how they interconnect with all the components and or devices that are part of the system as well as any ancillary devices that are being provided by other trades. All cables run shall be shown of the shop drawing submittals. Cable tags shown on the shop drawing submittals shall correspond with cable tags that are located inside equipment enclosures as well as documented on the as-built drawing. The shop drawing submittals shall include scaled drawings of all racks, panels, consoles and special assemblies. The show drawing shall include all circuit numbers of all cables and terminal connections as well as how they are labels. Each drawing shall have a descriptive title and all subparts of each drawing shall be completely described. All drawings shall have the name of the project, Architect / Engineer and contractor in the title block. The floor plans, rooms names and numbers for the submittal drawings shall match that of the project documents. The symbol used on the submittal drawings shall match that of the project documents. The only information to be shown on the submittal drawings for this Specification Section shall be information that pertains to the system that is being submitted on.

3. Provide a custom detailed description of the operation of the submitted system for this particular installation and a statement listing every technical and operation parameter wherein the submitted equipment varies from what was originally specified. If the submitter fails to list a particular variance and his submittal is accepted; but subsequently, deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once without cost to the Owner. A letter or certificate from the manufacturer stating that the system contractor is an authorized distributor and installer of the submitted equipment shall be supplied.
4. The contractor shall be responsible for providing to the Architect / Engineer any and all additional information required and as deemed necessary by the Architect / Engineer for submittal and shop drawing submittal review.

#### **1.07 QUALITY ASSURANCE**

- A. This specification section shall be a one (1) manufacturer responsibility or as specified herein with no exceptions. Any variances to this specification item shall be submitted to the Architect / Engineer ten (10) working days prior to proposal for review by the Architect / Engineer. The equipment manufacturer for this specification section to have been in business and manufacturing the specified equipment for a minimum of ten (10) years.
- B. The contractor shall be the factory authorized and factory certified distributor and installer of the equipment to be provided for this specification section. The installation contractor's factory certification shall be submitted to the Architect / Engineer as part of the contractor's subcontractor and materials list at the time of the bid as well as with the shop drawing submittal.
- C. The contract for the systems described herein shall be assigned to the general contractor for the building construction. The intercommunication system contractor shall coordinate all work and work sequencing with the general contractor.
- D. Owner and Architect / Engineer Inspections: The Owners technology staff and Architect / Engineer shall provide advising as requested. The Owners technology staff shall inspect the project as the work progresses. Prior to final acceptance of the work, the Contractor shall make arrangements with the appropriate authorized Owner personal to inspect the construction areas, both to ensure satisfactory completion of the work and to ensure complete cleanup and restoration of areas affected by the work. Temporary protection, coverings, and structures shall be removed at or before time of inspection.

#### **1.08 CIRCUITING GUIDELINES**

- A. All wiring shall be Cat. 6/6a for connections to speakers, call switches, etc... for future migration to a complete IP (Internet Protocol) based intercom paging system. Cabling from the MDF or IDF to each classroom enclosure shall be provided by others. A patch cable, providing connectivity from the work outlet faceplate to the MS-500 shall be provided by others to the AV contractor for connection to the network.
- B. Each classroom / education space to have a dedicated network connection to the intercom paging system head-end to provide 2-way communications from the integrated paging system console as well as the district IP based phone system.
- C. Each office / administrative space to have 1-way communications from the paging system and be capable to being addressed from the building telephone system handset.
- D. Each corridor / common space / exterior space including library, cafeteria and gymnasium to have 1-way communications from the paging system and be capable of being addressed from the building telephone system handset.
- E. All wiring shall be in accordance with the Manufacturers specifications and certified for performance.

### 1.09 SEQUENCE OF OPERATIONS

- A. The ability to be distributed via a fiber 10/100/1000mB switched, VLAN enabled network or 10/100/1000mB switched stand-alone intercom network. It shall be possible to eliminate the need for copper feeder cables between the Main and Intermediate distribution frames through the use of fiber optics.
- B. Shall have SIP (Session Initiation Protocol) Integration to connect all talk-paths to the VoIP phone system of choice.
- C. The system shall provide the ability to support a SIP tunnel from the building's VoIP phone system to provide two-way communication from all administrative telephones to any location equipped with a talkback speaker or audio system with room microphone.
- D. System shall interface with any VoIP telephone system using SIP type integration thus allowing the school(s) to upgrade or replace their telephone system without suffering a requirement to replace, or lose any feature of, their internal communications (intercom) system. Any system that limits system features based upon any selected telephone system and is not SIP based shall not be acceptable.
- E. Automatically sound a tone or play a pre-page WAV file over any loudspeaker connected for two-way communication to alert the classroom teacher that this 2-way call has been established. This is intended to prevent unauthorized monitoring.
- F. Distribution of emergency announcement(s) from any authorized telephone to all areas furnished with a loudspeaker. Emergency announcements shall have the highest system priority
- G. Distribution of general announcements from any administrative telephone, staff telephone, or classroom telephone. The system shall be capable of providing all-call, group call, or multiple group call.
- H. Classroom speakers or audio systems with room microphone shall be software assignable to unlimited paging groups.
- I. Provide the ability to define and archive unlimited schedules with up to three hundred (300) events per schedule. Each scheduled event shall be capable of activating included tones or playing custom audio/voice phrases or controlling any I/O port on a system network interface for building control. Schedule administration, modification and creation functions shall be available through web access on remote computers and mobile devices.
- J. The system shall provide an administrative console for the front office, consisting of a touch screen interface no less than 22" diagonal interface.
- K. The User Interface shall be map based. The manufacturer shall provide the ability to take a map in any format, including paper copy, PDF, Visio, etc. and create from that the map used for the primary user interface. Non map based User Interfaces will not be considered.
- L. The WAV or MP3 files shall be activated via the administration software, telephone and / or telephone system and / or pushbuttons.
- M. The WAV or MP3 files shall be programmable as to what level of priority they can be broadcast. They shall be programmable as to override any class change tones, normal all call, music, and intercom in the event of an emergency.
- N. The WAV or MP3 files shall also have the ability to be broadcast into any one or all of the zones with the system.
- O. The WAV or MP3 files shall have the ability to be broadcast via a schedule for any day of the week or time of the day. They shall also have the ability to be broadcast for any duration of time and repeat number of plays with the ability to select how long the duration is between each repeated broadcast.

- P. The WAV or MP3 files shall also have the ability to be a part of the classroom change tones within the system. These files shall be able to replace any tone within the class change schedules as to offer the flexibility of customizable tones and or phrases in this class change mode.
- Q. It shall be possible without the cost of additional hardware/software to incorporate a LAN / WAN district wide paging system by means of the built in VoIP district Paging Adapter or district software. This adapter shall give the district the ability to page each school independently, as a group of schools, or all schools.
- R. The system shall allow for the integration of changeable message signs to support bells and notifications. These signs shall be multi-color, multi segment LED scrolling displays and powered and controlled via a network PoE (Power over Ethernet) connection.
- S. The system shall also allow for the integration of third-party system through the use of contact closure, TCP (Transmission Control Protocol) communication, RS-232 communications and HTTP (HyperText Transfer Protocol) communications.
- T. The system shall support and allow for device managed within the system itself including device discovery, automated programming and automated assignment to rooms and zones.
- U. System shall support management of IP based PoE visual message displays and automate the programming of devices through the interface including automatically applying visual messages for bells and notifications without the use of a secondary application or software.
- V. The system shall support an automated commissioning function that allows the system to be placed into a test mode and monitors and reports the commissioning status of the devices.

#### **1.10 WARRANTY**

- A. The manufacturer and installation contractor shall guarantee the system, equipment and all its components for a minimum of one (1) year from date of final acceptance of the system as documented by the Architect / Engineer. This guarantee shall cover the replacement of all parts and labor to replace the same made necessary by normal usage and wear.
- B. Upon completion of the installation of the system, the contractor shall provide to the Architect / Engineer and Owner a signed written statement, on company letterhead, substantially in form as follows: "The undersigned, have engaged as the Intercom paging system contractor for the \_\_\_\_\_ building project confirms that the system was installed in accordance with the wiring diagrams, instructions and directions provided by the manufacturer."
- C. Contractor shall repair, adjust, and / or replace, whichever the Owner and / or Architect / Engineer determines to be in its best interests, any defective equipment, materials, or workmanship, as well as such parts of the work damaged or destroyed by such defect, during warranty period, at the contractor's sole cost and expense.
- D. In the event that any of the equipment specified, supplied, and / or installed as part of the work should fail to produce capacities or meet design specification as published or warranted by the manufacturer of the equipment involved or as specified in this document, the contractor shall, in conjunction with the equipment manufacturer, remove and replace such equipment with equipment that will meet requirements without additional cost to the Owner.

#### **1.11 TRAINING AND INSTRUCTION FOR OWNER MAINTENANCE**

- A. A training program including a minimum of four (4) hours on the use of the system shall be provided to the Owner to use at their discretion. A full and complete overview of the system shall be included in this training as well as any literature required by the Owner to allow complete and total use of the system by the Owner's designated staff. System maintenance requirements for the equipment will also be documented and turned over the Owner. User and

help videos shall also be made available to the customer via USB thumb drive or via an online fashion.

## **PART 2 - PRODUCTS**

### **2.01 ACCEPTABLE MANUFACTURERS**

- A. The following manufacturers are approved to submit proposals for this project:
1. Audio Enhancement – EPIC (Education Paging & Intercom Communications) System™

### **2.02 EQUIPMENT**

- A. Intercom Paging System:
1. The system shall be a software-controlled system, whose primary interface is a web-based portal, accessible from any authorized computer. The system shall support being deployed on physical server hardware or through virtualization on the customer's hardware. For the physical server, the system shall utilize a 1U rack server, operating as an appliance, dedicated to the operation of the IPB (Intercom Paging and Bells) & SAFE (Signal Alert For Education) System™ only. The rack server shall have industry standard redundancy, including RAID1, Dual Power Supplies, and hot swappable hard drives. The entire system shall be Linux based. If virtualized the system shall support VMWare ESXI version 6.5 or later.
  2. The system shall be based on standards compliant SIP and RTP communications across the network and shall allow direct Trunk Integration to the VoIP telephone system.
  3. The system shall provide a simple calendar-based scheduling system for bells. It shall provide the ability to have an unlimited number of bell schedules.
  4. The system shall provide a map-based User Interface. All major functions, including Intercom, Paging, Notifications and Alerts shall be done using the map as the foundation for those actions. Paging shall clearly show on the map where the page audio will be transmitted to.
  5. Bell Schedules shall be easily assigned to days and changed simply with authenticated access to the system through any browser-based device. Bell schedules shall be able to be changed even if a current schedule is active in the system same day and apply immediately.
  6. The system shall support utilizing a shared data network and support (VLAN [Virtual Local Area Network] enabled) or dedicated network as means of distribution for all voice overhead paging, emergency paging, emergency tones, intercom, and class change tones. System shall support routing of traffic across multiple subnets and network segments.
  7. The system shall be capable of accessing remote classrooms (trailers, temporary classrooms etc.) via IP interface or room audio system with room microphone. This shall

- provide intercom, class change tones, emergency tones, and normal / emergency paging via a wired network to these remote locations.
8. Exterior speakers shall be capable of being on separate zones and programmed separately.
  9. The system shall have the ability to synchronize to the same NTP server utilized for the Master Clock system.
  10. The system shall have the ability to produce user defined tone signals for time tones or emergency tones.
  11. The system shall have SIP Integration to connect all talk-paths to the VoIP phone system of choice.
  12. The system shall provide the ability to support a SIP trunk from the building's VoIP phone system to provide two-way communication from all administrative telephones to any location equipped with a talkback speaker or audio system with room microphone.
  13. The system shall interface with any VoIP telephone system using SIP type integration thus allowing the school (s) to upgrade or replace their telephone system without suffering a requirement to replace, or lose any feature of, their internal communications (intercom) system. Any system that limits system features based upon any selected telephone system and is not SIP based shall not be acceptable.
  14. The system shall provide its own SIP environment, and in the case of a failure of the schools VoIP telephone system, be capable of operating completely independently for all functions, save access from the handsets connected to the schools VoIP system.
  15. The system shall not be reliant on WAN or internet connectivity for operation.
  16. The system shall provide web access, which will give ability to monitor operations and functions of the system.
  17. The system shall provide web-based off-site programming and diagnostics of the system. It shall also be capable of determining basic circuit faults.
  18. The system shall have a Web based administration programming tool which allows the administrative personnel to easily manage Audio Sources, Class Change schedules, paging groups, time updates, holiday schedules and day/night mode operation from an internet browser. System shall support HTML5.
  19. The system shall provide calendar-based scheduling up to four years in advance. The system shall be capable of displaying a fully year calendar and differentiating which bell program is scheduled to run on each day. The calendar shall be based on a standard school year and provide a selectable start month for example, it can be configured to run from August to July.
  20. The system shall be capable of being fully integrated with the school's existing LDAP (Lightweight Directory Access Protocol) or Active Directory system. Systems that do not provide LDAP or Active Directory integration shall not be considered.
  21. The system shall provide discreet control over roles for the system. Roles shall be definable down to the individual feature level and provide the district with the ability to restrict or grant access to any roll individual features or groups of features.
  22. The system shall provide web browser access to the system specifically for a teacher. Teacher access shall be assigned through LDAP or Active Directory. The Teacher screen shall provide information specific to the room that the teacher is assigned to. That information shall consist of, but not limited to, the next scheduled event for the room (Bell,

- Announcement, etc.), Audio/Visual Controls for their classroom technology, Teacher Name, Room Number, an Intercom Call button, and an Emergency call button.
23. The system shall have the ability to carry IP Communications to the edge of the classroom Audio/visual Systems. It shall be able to control connected A/V Devices, provided that those devices are controllable by RS-232
  24. The system shall be based on a database structure, utilizing a robust commercially available database such as SQL (Structured Query Language).
  25. The system shall provide 2-way handsfree communication in each classroom.
  26. System Classroom and Common Zone network interfaces shall be capable of utilizing standard Cat 6/6a infrastructure for installation from the Telecommunications Closets only to the classroom and/or zone, thus allowing for only one type of wiring infrastructure within the school. Distribution of all voice signaling shall utilize a shared or dedicated network. Systems that require homerun, dedicated, 18 gauge shielded wiring shall not be acceptable.
  27. The system shall provide a flexible and robust event engine. In addition to pre-programmed events and actions, the event engine shall be capable of accepting Java-based programming to accomplish advanced integrations and functions.
  28. The system shall automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions shall be preprogrammed and require no user intervention. The system shall provide redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
  29. The system shall provide the ability for the school to upload their own recorded files for both Bell Tones, and Notifications
  30. The system shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone within the facility or outside the facility to any other location within the facility or district.
  31. IP-enabled two-way voice communication shall be available from any provided telephone or administrative console through any speaker in the system. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A pre-announce tone shall sound immediately before the intercom path is opened.
  32. The system shall provide for a complete personal alert function for each teacher. The alert functionality shall be an integrated part of the administrative head end software and shall not require any separate application or hardware to support this functionality.
  33. The teacher personal alert functionality shall be integrated into the classroom microphones and the teacher web screen.
  34. The system shall be capable of displaying on the map the location of the alert in the case of a microphone that is within range of its paired receiver, or from the teacher's web access screen. The system shall also be capable of approximately locating the location of the alert in the case of a microphone that is not in range of its paired receiver. A system, either the microphone system, or the administrative system that is not capable of receiving an alert from a microphone that is not within range of its paired receiver shall not be considered.
  35. Upon alert, the system shall have the ability to provide notification on the dedicated console at the front office, or on any other computer which is currently logged into the administrative interface and has the appropriate credentials. The system shall provide



- both an audible tone, and a change on the screen that clearly indicates that an emergency alert has been received.
36. Upon alert, the system shall also be capable of sending e-mail and SMS Text messages to the designated school personnel. These alerts shall include a web link to the administrative console.
  37. If cameras are installed in the classrooms, the system shall be capable of showing a live video from the classroom that received an alert. This shall only be shown in the case of an alert where the microphone is within range of its paired receiver.
  38. The system shall have the ability to acknowledge the receipt of the alert by changing the indicators on the classroom microphone receiver in the room where the alert was received from. In the case of an alert received from a microphone not in range of its paired receiver, no acknowledge shall be sent.
  39. The system shall have the capability of maintaining a record of all alerts that are received and provide appropriate school personnel the capability to enter information about the alert, which shall be maintained in the systems database. That information shall also be made available to appropriate school personnel in the form of a report that shows all alerts that have occurred, their date, time, and the end alert information.
  40. The system shall contain a rules-based integration engine that allows for input of TCP, HTTP, or Serial Data and allows for the parsing of data for actions or triggering other systems via TCP, HTTP or Serial.
  41. The system shall support digital message displays that provide visual feedback in the form of scrolling messages via an LCD or LED display all controlled from the network.
  42. The system shall allow for integration into classroom audio system including teacher microphone as required by design. This includes integration to ensure that system notifications, pages and intercom calls take priority over classroom audio sources.
- B. Intercom Paging System Network Intercom Interface:
1. Shall allow users to install intercom paging systems spanning multiple building or facilities connected through a VLAN.
  2. Network Requirements:
    - a. 100/1000 Ethernet switch port configured on a dedicated VLAN.
- C. Intercom Paging System Power:
1. All Network interfaces used in the classroom and for the common zones shall be powered via PoE from the district provided network switches.
    - a. PoE switches and network cabling from MDF (Main Distribution Frame) and IDF (Intermediate Distribution Frame) to devices provided by others.
  2. All network switches shall include an uninterruptable power source to provide adequate runtime. In the event the school has a generator the UPS systems shall hold the switches long enough until generator power can be provided. Customer to provide all necessary UPS for network switches.
- D. Intercom Paging System Administrative Console:
1. The administrative console shall be customizable, flexible and provide full access to the intercom paging system.
  2. Console shall be micro-computer based running a Linux OS and run in a Kiosk mode locking the user into the intercom screen.
  3. The supplier is required to provide a dedicated touch screen console for the front office, with a minimum size of 22" Diagonally. The Console shall not require the district to provide any additional hardware, software or licensing. The Console shall also provide a boom microphone attached via USB to the console for paging/intercom use.
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4. Administrative access to the system shall be browser based and shall also be capable of being any administrative computer.
5. Functionality to provide full access to all features such as all call, paging groups, emergency tones, control music, WAV file distribution, test rooms, crisis mode, schedules, etc...

E. SAFE SYSTEM & NETWORK PAGING INTERFACE - Audio Enhancement, MS-300

1. Provide a Network Interface with performance as follows:
  - a. Full-Duplex, Hands Free communications on Intercom Call
  - b. Amplifier powered only by the PoE power source for emergency paging applications
  - c. Mounting Bracket as required
  - d. Connections – The following connections shall be available:
    - i. Line Output for connecting to auxiliary amplifiers
    - ii. 2 External I/O Connections – Terminal Block
      1. Ability to support relay output for interface into other systems.
    - iii. RJ45 for PoE Network Connection
    - iv. Serial interface for connecting to other equipment or SAFE Compatible equipment.
  - e. 1 speaker connection
    - i. The system shall provide a speaker connection which is powered exclusively by the PoE power from the network
    - ii. Can power up to 2 speakers per device.
  - f. Network Connection
    - i. The system shall have a network connection with PoE power.
    - ii. PoE shall be present on the system in order to provide power for the amplifier during a power emergency
  - g. Integrated Network Based Communications
    - i. The System shall support the following protocols:
      1. Directed UDP (User Datagram Protocol)
      2. Unicast Audio
      3. Multicast Audio
      4. SIP
      5. TCP Control
    - h. Integrated Serial Tunnel over TCP
    - i. The system shall have integrated SIP communications and be able to communication bi-directionally with any VoIP communications system that follows the standard SIP protocols.
    - j. The system shall also have the ability to operate with multi-cast IP messages as well.
  2. Serial Gateway for Control via the network

F. Analog Intercom System Cabling:

1. West Penn
2. Belden
3. General Cable
4. Mohawk
5. Accepted substitute

G. Intercom Paging System Volume control:

1. Volume control shall be capable of controlling the volume of up to one hundred-fifty (150) 1-way speakers.

2. Volume control shall be mounted on a brushed stainless-steel single gang wall plate with the plate being embossed with a dial scale of "0 through 10."
3. Volume control shall be equipped with a skirted black knob with white position indicator.
4. Volume control shall include a stainless-steel mounting box and hardware.

H. Intercom Paging System Lay-In Ceiling Speaker.

1. Lay-In Specifications

- a. Lay-in ceiling speaker shall consist of a white 1'x2' perforated grille, a speaker and integral back box or equivalent ceiling speaker with appropriate backbox, grille and tile bridge.
- b. The volume control shall be accessible above the grid
- c. The speaker shall be capable of handling minimum 35 watts continuous power.
- d. Sound pressure level at 1 meter on axis with a 1 Watt input shall be 95 dB.
- e. The frequency response shall be 70 Hz to 17 kHz.
- f. The baffle shall be constructed with a single piece of perforated steel with a white baked on acrylic enamel finish.
- g. The back box shall meet or exceeds UL 2043 for installation in a plenum space
- h. Maximum dimensions of the grill shall be 2' x 2' (60.96 cm x 60.96 cm).
- i. Approximate weight shall be 5.5 lbs. (2.49 kg).

I. Intercom Paging System Surface Wall Speaker:

1. Wall speaker shall consist of a speaker, volume settings and sloped baffle.
  2. The speaker, housing and hardware shall be electrically and acoustically matched for a frequency response of 60 Hz to 12 kHz.
  3. The speaker shall be 8" (20.32 cm) in diameter and have a ceramic magnet weighing 5 ounces.
  4. The voice coil shall be .75" (1.91 cm) in diameter.
  5. Voice coil impedance shall be 45 ohm.
  6. Operating temperature shall be -20 to + 55 °C (-4 to + 131 °F).
  7. The baffle shall be constructed of gray painted steel with a black cloth grille.
  8. Maximum dimensions of the housing shall be 10.13" (25.73 cm) H x 12.31" (31.27 cm) W x 4.63" (11.75 cm) D.
  9. Approximate weight shall be 4.25 lbs (1.91 kg).
- J. Intercom Paging System Paging Horn:
5. The paging horn shall be a weather-resistant, high efficiency reentrant type horn speaker.
  6. The paging horn shall be equipped with an amplifier and externally accessible volume control.
  7. The paging horn shall include an adjustable swivel base.
  8. The frequency response shall be 275 Hz to 14 kHz.
  9. Dispersion shall be 90° horizontal and 90° vertical.
  10. Sound pressure level shall be 121 dB measured at 4 feet (1.22 m) on axis with an input to the amplifier module being -10 dBm at 1 kHz.
  11. Distortion shall be less than 2.0% at rated output of 15 watts RMS.
  12. Input impedance shall be 600 ohms nominal.
  13. The amplifier shall operate on a -24 Vdc nominal, positive ground power supply.
  14. Operating current shall be 900 mA at -24Vdc
  15. Operating temperature shall be -20 to 55 °C (-4 to 131 °F).
  16. Operating humidity shall be 0-95% noncondensing.
  17. Dimension of the horn shall be 8" (20.3 cm) W x 8" (20.3 cm) H x 9:" (22.9 cm) D.
  18. Approximate weight shall be 4.0 lbs (1.8 kg).
- K. Classroom Sound Reinforcement System:
1. Audio Enhancement – Optimum System
  2. A classroom sound reinforcement system shall be installed in all areas of the building as shown on the drawings and as listed in the specifications.
  3. Classroom sound reinforcement system shall be fully interfaced to the intercom paging system.
  4. The output of the intercom paging system shall directly interface to the classroom sound reinforcement system.
  5. The sound reinforcement system shall be capable of integration with the facility intercom/paging system. All sound reinforcement systems shall allow the facility intercom/paging system to directly mute them. The Receiver Module shall have the capability to sense a paging signal from the facility communications system. When a page has been sensed, the classroom sound system shall mute local audio to facilitate hearing the facility page.
  6. This integration shall give positive control when interfaced to the classroom sound reinforcement system within the system as to cut off or duck all sources within the

classroom when an intercom or page announcement is made from anywhere within the school.

7. The classroom sound reinforcement speakers shall be used as the intercom paging system speakers.
8. The intercom paging system speakers shall be connected to receive audio from any of the in-room sources and receive audio from the intercom paging system.
9. The classroom sound reinforcement system shall be mounted in a wall mount enclosure, specifically designed which allows the microphone receiver to remain visible through the door of the enclosure
10. The DECT (Digital Enhanced Cordless Telecommunications) based microphone receiver shall be capable of being mounted directly to the enclosure and connecting to the amplifier utilizing Cat. 6/6a cable.
11. Each microphone input shall have a carrier detect indicator to verify the input is active.
12. The classroom sound reinforcement system shall have a secondary line level output to connect to self-amplified speakers or other audio equipment if needed.
13. The classroom sound reinforcement system shall have an emergency cut-off input that when interfaced to the fire alarm relay contact output shall silence all audio devices within the room in the event of a fire as to help lower the overall decibels levels to help the students and staff hear the audible fire alarm tones / instructions within that room.
14. The classroom sound reinforcement system shall be capable with interfacing to future classroom cameras to capture lesson video and audio together on one recording.
15. The Wireless Microphone shall be capable of adjusting the volume of external audio sources that are connected to the Main Control Unit. The Wireless Microphone shall be powered by a single rechargeable LiON (Lithium-ion) battery which can be charged inside the microphone via a standard USB cable. The Wireless Microphone shall be able to operate for up to a typical eight (8) hour workday on a single charge.
16. Each classroom sound reinforcement system shall include but not limited to the following components:
  - a. DECT Based receiver
  - b. Amplifier & Network Interface
  - c. One wireless microphone with rechargeable LiON batteries
  - d. Four (4) FS-17 Flat panel ceiling speakers (S2)

L. Classroom Sound Amplification System (CSAS) EQUIPMENT:

AMPLIFIER - Audio Enhancement MS-500 Amplifier/Network Interface:

1. Provide a fully PoE Powered Receiver/Amplifier with ability to provide functions described above with performance as follows:
  - a. Audio Power: 30 watts RMS mains powered amplifier
  - b. 92% Efficient Class D Amplifier
  - c. 1% percent THD across full frequency range of amplifier
  - d. Frequency Response: 20 Hz to 20 kHz
  - e. Power Requirements: PoE 802.3af/at 25.5W Maximum
  - f. Signal-to-noise: >89dB
  - g. Integrated mounting tabs
  - h. Thermal and short circuited protected
2. Controls:
  - a. The primary control of the system shall be done through the teacher microphone.
  - b. The following functions shall be available via USB connection for setup during installation:
    - i. Input Control for multi-media sources and mixed IR source
    - ii. Equalizer Controls
    - iii. Discreet Output volume controls for each input
  - c. RS-232 Control
    - i. Provide RS-232 control of the amplifier, and an additional RS-232 port which provides pass through control of a downstream device such as a projector
    - ii. RS-232 processor shall be capable of differentiating between commands destined for the amplifier, and responding to those commands, and commands intended for the downstream and passing those commands through to the secondary RS-232 port
    - iii. Command pass through shall be bi-directional
  - d. Connections – The following connections shall be available:
    - i. Four (4) Multi-Media inputs
    - ii. Dedicated Line output – for Assistive Listening Device Connection
    - iii. Color Coded Connection
    - iv. 8P8C RJ45 Connection for Intercom Paging Wall plate
    - v. Support for Touch Based Wall Controller on Remote Port
    - vi. General Purpose I/O Output on 8P8C RJ45

M. DECT Technology RF Receiver – Audio Enhancement SRC-14

1. The Receiver shall utilize DECT technology. DECT is a radio technology for voice applications. DECT is ideal for the classroom because the use of both frequency and time domain is ideally suited to smaller areas with a large number of users. In each classroom, it will be an independent system, with all necessary electronics to support the receiving & pairing functionality mounted on the wall near the amplifier or in the ceiling. The receiver will be connected to the amplifier through a universal twisted pair

cable, using balanced audio connections. Power for the receiver shall be provided through the same cable as the balanced audio connections.

2. The receiver shall provide the following functionality. These features shall be included on board the receiver, and not require any external support to perform these functions.
  - a. Three Channel DECT based reception
  - b. The receiver shall provide both a low and high-power mode selectable via a DIP (Dual In-line Package) switch
  - c. Pairing Button for Linking microphone to the receiver
  - d. External contacts to allow for a remote pairing button
  - e. Stereo Auxiliary Input
  - f. Auxiliary Line Level Output – Un-Balanced
  - g. Remote control of both microphone channels, and the auxiliary input from the teacher microphone
  - h. Public address system mute terminals – This is a contact closure connection when closed, it mutes the audio output from the receiver
  - i. Advanced Feedback Blocker
    - i. The system shall have the ability to actively control feedback. This shall be done via an analog circuit that provides up to five active filters to control specific frequencies,
    - ii. The Feedback Blocker shall also have the ability to lower the overall of the system by up to 6dB, during a user error situation where the overall system gain is manually turned up too high
    - iii. The Feedback Blocker system shall automatically remove the filtering upon resolution of the user-initiated error condition
    - iv. The Feedback Blocker shall be of an analog design – in order to avoid the detrimental effects of digital sampling, only analog systems shall be considered in order to implement this feature.
  - j. Audio Output
    - i. The system shall have the ability to provide both three (3) independent audio signals (Ch 1, Ch 2, and Aux) or with the change of a DIP switch, provide a mixed signal
    - ii. The system shall provide an audible tone when the remote volume control on the teacher microphone is used. It will also provide a low & high output level, and an on/off selection via a DIP switch setting
    - iii. The system shall have the capability of attenuating its output level by -10 dB with a DIP switch setting
  - b. Emergency Alert Contacts
    - i. The system shall provide a trigger signal when the teacher presses and holds a button on her transmitter for more than two (2) seconds.
    - ii. The system shall be capable of providing a visual indication of three (3) red LED's when the teacher initiates a trigger signal
    - iii. The system shall also be capable of receiving a trigger acknowledgement signal back from an external source, and altering the visual indicator from three (3) red LED's to two (2) Green and one (1) red LED
  - c. Recording Contacts
    - i. The system shall provide for a secondary notification that can be used for future applications such as signaling an NDVR (Network Digital Video Recorder) to start a recording
  - d. Control System Integration
    - i. The system shall have on board the capability of being controlled

- via RS-232 protocol.
  - ii. The system shall also have the capability of broadcasting RS-232 commands when the teacher presses the up/down volume controls on their microphone
  - e. Power Requirements: 24Vdc, Power Supplied from the amplifier.
  - f. Operating Frequency – 1.9 GHz Band
  - g. Receiver Type: DECT
  - h. Mounting Bracket as required
    - i. The receiver shall be capable of being mounted on the ceiling or a wall
    - ii. Bracket shall provide mounting to standard electrical boxes
    - iii. Controls: System shall have available the following controls
      - 1. Channel 1 Volume Control – Fully controllable from the teacher microphone remotely through the DECT system
      - 2. Channel 2 Volume Control – Fully controllable from the teacher microphone remotely through the DECT system
      - 3. Auxiliary Input Volume Control – Fully controllable from the teacher microphone remotely through the DECT system
      - 4. Alert Controls on Teacher Microphone – Two (2) buttons on the sides of the microphone
      - 5. Recording Control on Teacher Microphone – One (1) button on the front of the microphone
- N. Teacher Body Pack Transmitter Audio Enhancement STD-14
- 1. Provide a body pack transmitter with performance as follows:
    - a. Operating frequency – 1.9 GHz - DECT
    - b. Audio distortion: <1.0% ( $\pm 40$ kHz deviation @ 1kHz)
    - c. Integrated microphone
    - d. Internal charger circuit
    - e. Micro USB Charging Port – shall be capable of being charged from a standard USB port – including a port on a computer
    - f. Power button functionality
    - g. Power on – turns the microphone on when microphone is off and button is pressed
    - h. Mute – mutes the microphone when pressed and released once microphone is turned on
    - i. Power Off – push and hold to turn power off
  - 2. Additional Function (F) Button Features
    - a. SAFE Alert Functionality – Provides security alert when the two (2) buttons on the sides of the microphone are pressed and held for more than two (2) seconds
    - b. Recording Functionality – Provides simple logic signal when the REC button is pressed on the face of the microphone which activates terminals on the receiver
  - 3. External Inputs
    - a. Provide an input for an external microphone
    - b. Provide an input for a stereo auxiliary input (Mixed to Mono in microphone)
  - 4. Microphone Element – The teacher microphone shall utilize a 10mm microphone element to insure optimum frequency response and maximum pickup of teacher's voice.
  - 5. Power 1 - LiON Long Life Battery (Systems using two (2) batteries will not be considered)
    - a. Battery style shall be common between handheld microphone and teacher transmitter. Systems that use different batteries in the handheld vs teacher microphone shall not be considered.
  - 6. Provide remote volume control for the system from the teacher's transmitter
    - a. Volume control via the wireless microphone system to allow the teachers to remotely adjust their own volume level.
    - b. Volume control for the other channel from the teacher's microphone
-



- c. Volume control for the auxiliary inputs from the teacher's microphone
  - d. Side Alert Buttons – Provide remote control functionality that allows for enabling additional multi-use functions from the teacher microphone.
  - e. REC Button – Provide a button on the face of the microphone that can be used for multiple purposes
- O. Classroom Intercom Call Button WPA-504/502
- 1. Reference technology floor plans for device locations
  - 2. Single gang decora style call button white in color
  - 3. Black button for intercom call
  - 4. 8P8C (RJ45) connection
  - 5. Matching white decora style face plate
  - 6. WPA-502 includes red emergency button for alerting
- P. Ceiling Enclosure specifications
- 1. Provide a ceiling enclosure that is sized appropriately for the equipment being installed in each classroom
  - 2. Ceiling enclosure shall be plenum rated and UL Listed
  - 3. Overall dimensions shall be to fit in a standard drop tile ceiling.
  - 4. Enclosure shall support power and data as necessary for equipment.
  - 5. Cover of enclosure shall support mounting of Audio Enhancement XD Receiver, WPA-501 Microphone, and EduCam360 and be lockable.
  - 6. Enclosure shall be pre-assembled with equipment by the manufacture
- Q. Wall Mount Enclosure
- 1. Provide a ceiling enclosure that is sized appropriate and specific to house the Audio Enhancement amplifier, Audio Enhancement XD Receiver, AVConnect Receiver and WPA-502/504 Wall Plate. Audio Enhancement receiver shall be seen from the front of the enclosure with accessible buttons.
  - 2. Enclosure shall be wall mountable and support enclosing a single gang 120V electrical outlet.
  - 3. Enclosure shall have a swinging door and a cam or key lock.
  - 4. Enclosure shall be white in color.
- R. HDBaseT HDMI extender Wall Plate specifications (Audio Enhancement AVConnect Kit)
- OPTIONAL
- a. HDMI: 3D, Deep Color
  - b. HDMI Extender Distance: Up to 30m/100ft with
  - c. Cat5e UTP. Use Cat6 STP (shielded) if extending 30m/100ft – 70m/230ft. Plenum Rated
  - d. Provide USB connection from transmitter at teacher workstation to receiver for passing HID information to interactive technology
  - e. Provide an audio line output at the teachers work-station – audio line output shall provide all classroom program material and classroom microphone audio from the amplifier to allow connection of personal assistive listening devices
  - f. Input/Output: HDMI Type A female connector
  - g. Digital video: Up to 1080p @ 60Hz/50Hz
  - h. PC Resolution: Up to 1920x1200 WUXGA
  - i. HDCP (High-bandwidth Digital Content Protection) Compliant
  - j. HDBaseT Class B Compliant
  - k. EDID (Extended Display Identification Data) Support
-

- l. Provide for an additional VGA (Video Graphics Array) plus 3.5mm audio connection. Connection can be integrated with HDBaseT wall plate extender
  - m. resolution: Up to UXGA (1600x1200)
  - n. HDMI, VGA, USB and Audio Return shall all be transmitted over a single CAT 6 cable
- S. Classroom Intercom, Emergency Alert & A/V Touch Panel Control – Audio Enhancement – Capacitive Touch Control Module (ITC1-M) OPTIONAL
  - a. For all locations where an MS-500 Classroom Amplifier/Network Interface is specified.
  - b. Coordinate with electrical contractor to make sure a double gang electrical box is available – or use an acceptable double gang mounting ring
  - c. Provide a simple, standardized control interface for projectors, monitors, display devices, or other AV devices in a compact double-gang form factor. A CUSTOMIZABLE INTERFACE which will allow for a variety of configurations including full color graphical representations of equipment and buttons as well as multi-page capability.
  - d. Package Type: Double-Gang Back Lit Capacitive Touch Screen
  - e. Dimensions: 4.5" (L) x 4.5" (W) x 1.25" (D)
  - f. Display: 3.5" Capacitive Touch Display
  - g. Weight: 6.4 oz
  - h. Power Supply: 24Vdc – Powered from GL-300 Amplifier (External Power Supply Not acceptable)
  - i. Communications: bi-directional RS232

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturers wiring diagrams and these specifications. The contractor shall furnish all conduits, cable tray, surface raceway, wiring, outlet boxes, junction boxes, cabinets etc... as well as all required miscellaneous materials and labor necessary for the complete installation of the cable support / pathway system.
  - B. Wiring may be opened wired in cable tray or "J" hooks above accessible suspended lay-in ceilings. Wiring in walls or exposed on walls shall be enclosed in EMT conduit. Cable shall be supported at a minimum of every 5'.
  - C. A nylon pull string shall be installed in each conduit / surface raceway run.
  - D. Any locations where flexible metal conduit has to be used, it shall terminate to a junction box on both ends and be securely anchored for proper support.
  - E. Conduit indications in the drawings are a minimum standard.
  - F. All equipment shall be mounted with sufficient clearance for observation, servicing, testing and accessible from either the floor or ladder. If any device is installed in a location that is deemed inaccessible by the Owner and or Architect / Engineer, it will be moved to an accessible location by the contractor at no additional cost to the Owner.
  - G. The contractor shall supply access panels where required and as defined by the Architect / Engineer. Contractor to notify the Architect / Engineer immediately if this issue arises during construction.
  - H. All penetration of floor slabs and firewalls shall be fire stopped in accordance with all Federal, State and local codes.
  - I. All wiring shall be color coded per National Electrical Code requirements and standards.
  - J. All conduit ends shall have plastic grommets to protect cable from damage due to sharp edges on the conduit.
  - K. Mounting heights and mounting requirements shall be as shown on the drawings.
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- L. All junction boxes shall be clearly marked and labeled for easy identification. Flexible connectors shall be used for all devices mounted in suspended lay-in ceiling panels. All conduits, outlet boxes, junction boxes and panels shall be securely installed and anchored with appropriate fittings and connectors to insure positive grounding throughout the entire system.
- M. No wiring except that of this system shall be installed in this systems cable support / pathway system.
- N. Wiring splices shall be made only in designated junction boxes and tagged on both sides of the junction. The junction shall be made on clearly labeled, insulated terminal strip. Transposing or changing the color-coding of the cable is not permitted. Wire nut connectors are not acceptable. System cable and the 120vac power cable shall be in separate conduits.
- O. It shall be the responsibility of the contractor to wire and connect ancillary devices to this system as listed in this specification section.
- P. Any circuits leaving the building to the outside shall be protected by the appropriate transient protection devices as required by the manufacturer to avoid damage to the system if transient surges are inducted on to these circuits (i.e., lighting strikes).
- Q. Contractor to provide in-wall bracing support for all devices that are to be wall mounted to walls that are not masonry block walls.
- R. All devices shall be protected throughout the entire project. All devices shall be kept free of construction dirt and debris during the entire project. The contractor shall be responsible for replacing at no additional cost to the Owner any devices that are deemed dirty or unsuitable for use by the Owner and or Architect / Engineer throughout the entire project.
- S. All cabling and devices shall be labeled with type written labels. Device labels and cable labels shall match the labeling information that is documented on the as-built drawings. Contractor to coordinate labeling schemes and labeling requirements with A/E prior to commencing with final labeling. Labeling system shall be by Brady or Panduit.

### **3.02 INSTALLER QUALIFICATION**

- A. Installer shall have a BICSI RCDD (Registered Communication Distribution Designer) on staff.
- B. Installer shall have an Avixa CTS (Certified Technology Specialist) on staff.
- C. Installer shall be an Authorized Audio Enhancement reseller and be certified in EPIC System.
- D. Installer shall hold an appropriate State Contracting or Electrical License as required.

### **3.03 FIELD QUALITY CONTROLL**

- A. The system shall be installed and fully tested as listed in these specifications. The system shall be demonstrated to perform all features and functions as listed in these specifications at a minimum.

### **3.04 TESTING**

- A. Reports of any field-testing during the system installation shall be forwarded to the Owner and Architect / Engineer for review and comment.

- B. Each individual system operation on a circuit-by-circuit basis shall be tested for its complete operation. Any devices that are to be connected to the system shall be tested as specified. Device locations and address / circuit numbers shall be documented on the as-built drawings as well as the wiring configuration of the device circuits. Device locations shall be field verified by the contractor and shall include any costs in the bid that is relating to all devices being connected to the system. The procedure for testing the entire system shall be set forth in these specifications and with the consent and approval of the Architect / Engineer, Owner and equipment manufacturer. Confirm testing requirements with the Owner and Architect / Engineer prior to commencing with system testing.
- C. Perform the tests and adjustments necessary to assure the satisfactory quality and level of performance of the system under normal operating conditions.
- D. Establish the normal settings for all controls and devices for all system operational and functional features and record the same for future reference. All levels shall be set and recorded in the as-built documentation for optimum system performance.
- E. The installation technician from the installer / manufacturer shall perform all system tests as specified. Perform all tests in the presence of the Owner, Architect / Engineer and any designated personnel as deemed necessary by the Owner or Architect / Engineer. This test shall be performed with the devices at their operational location and under normal operational conditions. Bench or default settings for devices are not acceptable. All test and test report costs shall be included in the contractors bid. A checkout report shall be generated by the installation technician and submitted to the Owner and Architect. The report shall include but not be limited to the following:
  - 1. A complete list of all equipment installed with corresponding serial numbers.
  - 2. Indication that all equipment is properly installed, functions and conforms to the specifications.
  - 3. Serial numbers, locations by device and model number for each installed device.
  - 4. Technicians name, specified certification credentials and date of system test.
  - 5. Any additional information as deemed necessary by the Owner and or Architect / Engineer.
- F. A substantial completion test shall be performed before the final test and acceptance of the system by the Owner and Architect / Engineer. At the time of the substantial completion system test, provide to the Owner or his representative an oral explanation of the operation and maintenance of the system. Before starting the tests and adjustments listed above, the contractor shall submit the following to the Owner and the Architect / Engineer for review during the substantial completion test:
  - 1. Preliminary as-built wiring diagrams of the entire system.
  - 2. Preliminary copy of the operation and maintenance manuals.
  - 3. Preliminary copy of the system test report form.
- G. If no system performance issues arise during the substantial completion test that need to be repaired by the installation contractor, this can be approved as the final system test by the Owner and or Architect / Engineer. If there are performance issues that arise that do need to be repaired, another complete and comprehensive system test shall be scheduled and performed to show that the necessary repairs have been properly addressed. These tests shall be performed at no cost to the Owner until a time that the system is shown to be in complete operating condition as approved by the Owner and Architect / Engineer.

- H. A commissioning report of all the tested functionality of the system shall be provided by a certified L2 technician by the manufacture or by the manufacture themselves.

### **3.05 DOCUMENTATION AND TRAINING**

- A. After the final system test and the Owner and Architect / Engineer has accepted the system to be in the proper operating condition, the contractor shall compile and provide to the Owner three (3) complete operation and maintenance manuals and three (3) sets of as-built drawings on the completed system to include but not be limited to the following:
  - 1. Operating and maintenance instruction sheets for each piece of equipment showing the proper operation and maintenance of the system component.
  - 2. Individual factory issued operation and maintenance catalog brochures of all equipment and components that were installed as part of the system. Advertising brochures, submittal data sheets and operational materials shall also be included but shall not be used in lieu of the required technical manuals.
  - 3. Complete as-built wiring diagrams and floor plan drawings of the complete system installation showing how the system was installed. These drawings shall include any devices that are connected to the system with their address / circuit number documented as well as the wiring configuration of all device circuits. The as-built drawings shall be an updated and revised copy of the submittal drawings showing all modifications made during the installation of the system. A copy of the as-built drawings in electronic format on CD/DVD generated in AutoCAD Release 2014 or higher will be forwarded on to the Owner and Architect / Engineer for archiving in the operation and maintenance manuals.
  - 4. A statement of guarantee including the date of the termination of the warranty as well as the phone number of the person to be called in the event of equipment failure.
  - 5. A cover letter, for the above mentioned tests, certifying the entire system and its components, application and installation meets or exceeds the recommendations of the manufacturer, all applicable code requirements and test specifications.
- B. The final and installed version of the system software shall be provided to the Owner on a CD/DVD for storage in the operation and maintenance manuals. These manuals shall be used for final check out of the system.

**END OF SECTION**