**SECTION 27 51 23**

**DETENTION AUDIO INTER-COMMUNICATION SYSTEM OVER INTERNET PROTOCOL**

1. GENERAL
   1. SUMMARY:
      1. Section Includes:
         1. Furnish and Install a complete and operable Detention Grade Audio Inter-Communication System Over Internet Protocol as shown on the drawings and herein after described. The system shall be capable of high quality, reliable, and satisfactory operation as herein described.
         2. Furnish and Install all required Data Network Interfaces, Personal Computers, Software, and Associated Accessories required for a complete and operable system as herein described.
         3. One complete and operable system shall be provided and defined as all conduit, raceways, cables, back boxes, contacts, software, etc. to achieve a complete and functional system. Also included are all power supplies, hardware, and interfaces to equipment supplied by others. Documents do not show or list every item to be provided. When an item not shown or listed is clearly necessary for proper installation and operation of the equipment and systems, provide, install, and test/certify, the item at no increase in contract price.
      2. RELATED SECTIONS:
         1. Drawings and General Provisions of Contract including General and Supplemental Conditions and Division 1 Specification Section, apply to the work of this Section.
         2. Section 27 05 00 – Common Work Results for Communications Systems.
   2. SYSTEM DESCRIPTION:
      1. Furnish and install a Detention Grade Audio Inter-Communication System Over Internet Protocol. The system shall be of modular design operating completely over Internet Protocol and be capable of high quality, reliable and satisfactory operation as hereinafter described. The system shall implement industry standard professional components such as speakers, microphones, and mounting assemblies. Systems requiring custom field components and enclosures will not be acceptable under these specifications.
      2. One (1) complete and independent system shall be provided and defined as all conduit, raceways, cables, back boxes contacts, software, etc, to achieve a complete and functional system. Also included are all required power supplies, battery backup, phone line monitoring, and interfaces to equipment furnished by others. Documents do not show or list every item to be provided. When an item not sown or listed is clearly necessary for proper installation and operation of the equipment and systems, provide, install and test/certify the item at no increase in contract price.
      3. Components of the system shall be:
         1. The Detention Grade Audio Inter-Communication System Over Internet Protocol shall be of one manufacture regarding software, Power Supplies, Call Stations, Annunciators and Staff Communication devices.
         2. All components required for a complete and operable system as described shall be included whether or not specifically described here in.
         3. Wiring will be in accordance with the manufacture of the Detention Grade Audio Inter-Communication System Over Internet Protocol.
         4. Provide all software, hardware, and system programming for complete and functional system.
         5. Provided installation, testing, adjustment, and initial programming for all equipment. Include written documentation and instructions for system as installed.
         6. The contractor shall be responsible for fully implementing the functions described in the Specifications and shown on the Drawings.
         7. The Contractor shall possess all applicable licenses.
         8. Provided training to the Owner in the operation, adjustment, servicing and repair of the systems
         9. Connect all systems and equipment to emergency generator power.
         10. Co-ordinate all telephone and telecom connections, network connections, programming and requirements with building Owner’s representative.
   3. REFERENCES
      1. Published Codes, Standards, Tests, or Recommended Standards of the Trade, Industry, or Government Organizations apply to these sections include but are not limited to:
         1. NFPA - National Fire Protection Association
         2. NEC- National Electrical Code - NFPA 70
         3. UL - Underwriter’s Laboratories, Inc.
         4. ADA – Americans with Disabilities Act
         5. EIA – Electronic Industry Association
         6. NEMA – National Electrical Manufacturers Association
         7. NSCA – Nation Systems Contractors Association – Best Practices
         8. ASCII – American Standard Code for Information Interchange
         9. ASTM - American Society for Testing and Materials
   4. QUALITY ASSURANCE
      1. Qualifications:
         1. The systems shall be the product of a manufacturer or an agency experienced in such work. The authorized representative of the manufacturer or aforementioned agency shall make the installation and connections of all equipment and test of the operation of the system.
         2. All items of a given type shall be the product of the same manufacturer.
         3. All items shall be of the latest technology, no discontinued models or products are acceptable.
         4. Installers shall have a minimum of 5 years experience in the installation of similar systems on at least 10 projects of similar scope.
         5. The Manufacturer or the Authorized Representative shall provide proof that within 60 miles of the project they maintain:
            1. A full complement of parts to support the installation.
            2. Offer service by fully trained and qualified technicians during normal working hours.
            3. Will supply parts and service without delay and at a reasonable cost.
      2. Substitutions:
         1. All materials and equipment shall conform to these specifications. No substitute materials may be used unless previously accepted in writing by the Architect.
      3. Regulatory Requirements:
         1. Comply with NEC as applicable to construction and installation of system components and wiring.
         2. Conform to NFPA 70
         3. Conform to HIPAA regulations relating to paging and public address systems.
      4. SUBMITTALS
         1. Refer to Section General Conditions and Related Sections for full details of submittal requirements.
         2. Provide full service contact information including company name, address, contact name, and phone number of authorized representative. Provide written proof from the Manufacturer of major system components affirming that the representative is duly authorized and trained to supply, support, and service the equipment.
         3. Provide a complete list of all equipment to be furnished.
         4. Provide Product Data: For each equipment component shown on the riser and or wiring diagram.
         5. Provide complete written sequence of operation for all factions of all systems.
         6. Provide dimensioned detail drawings of all special assemblies including custom panels, mounting assemblies, and location.
         7. Provide System Riser Diagram including:
            1. Annunciator / Master Stations
            2. Corridor Lights
            3. Zone Lights
            4. Call Stations
            5. Data Collection Modules
            6. Data Interface Modules
            7. Personal Computers
            8. Power Supplies
         8. Provide Wiring Details of all connections between all systems components.
         9. Manufacturer Instructions: Provide manufacturer’s written installation instructions.
         10. Proposed training program, including name and qualification of trainer(s), schedule of training, curricula, and written training materials.
         11. Closeout Submittals
             1. Refer to Section General Conditions and Related Sections for full details of closeout requirements
             2. As-Built Drawings indicating actual location and connection of components.
             3. Operation and maintenance manuals for each system and equipment component.
             4. Executed warranty documentation.
         12. DELIVERY, STORAGE AND HANDLING
             1. Refer to Section General Conditions and Related Sections for full details.
             2. Deliver materials and components in manufacturer’s original, unopened, undamaged containers with identification labels intact.
             3. Store materials as recommended by manufacturer.
             4. During construction all products must be protected from dust, dirt, and construction foreign matter including dents, bumps, and scratches.
   5. WARRANTY
      1. Refer to Section General Conditions and Related Sections for full details.
      2. The installing manufacturer’s representative shall guarantee all labor, parts, and installation for a period of 1 year from substantial completion or first beneficial use of the system.
      3. Provide manufacturer 3-year warranty for the intercommunication and program system.
      4. Upon written notification of unacceptable work or warrantee request the installing manufacturer’s representative shall provide qualified technicians and parts within 24 hours of notification.
2. PRODUCTS
   1. MANUFACTURERS
      1. The following manufacturers are known to provide products that meet or exceed these specifications.
         1. Tech Works, Inc., Henderson, Nevada, 800-813-1080, [www.techworks-usa.com](http://www.techworks-usa.com)
         2. No known equal.
   2. DETENTION GRADE AUDIO INTER-COMMUNICATION SYSTEM OVER INTERNET PROTOCOL
      1. System Description:
         1. The Detention Grade Audio Inter-Communication System Over Internet Protocol shall provide two-way audio communication between Master or Operator Locations and other Master or Operator Locations as well as Remote Intercom station locations indicated on the plans. Intercom communication control shall be provided by the icon-based touch screen control and fully integrated with the audio over internet protocol. Communication shall be automatic Listen for the Master from any station selected. A Push to Talk button shall allow the Master station to control the direction of communication from listen to talking to the Remote station.
         2. Master to Master calling shall be from any Master to any other Master if programming allows. Each Master Operator Desk Console (ODC) shall be programmable as to whether it can be called and how calls to it will be processed. A Privacy Tone Option shall be programmable to alert any station that it is being listened to and a light shall light on the ODC to alert the operator that the microphone is active. There shall be no restriction on the number of simultaneous calls active at any time.
         3. Call Forwarding and Call Relaying shall be fully programmable for all Master Operator Desk Console (ODC) stations. Each station whether it is an ODC or a Remote shall be programmable as to where it rings and for how long and where it them forwards the call to. Any ODC can Forward all of its calls to any other ODC if that location is unavailable to answer. When calls are Forwarded or Relayed the call can be allowed to ring at the primary answering location while ringing at the Relay location until either station answers the call and then the ringing shall stop at both locations.
         4. Call Annunciation: The Detention Grade Audio Inter-Communication System Over Internet Protocol shall provide Call-In buttons on all Remote stations to call a Master. When the intercom Remote Call-In button is pressed, the related Remote station select button at the Master shall blink On and Off and have a repeating tone to alert the Operator that a Remote station wants to speaker to them.
         5. Call Answering: When a flashing Remote station button is pressed by the Master the light shall change from flashing to On steady and the call tone shall be silenced. Once answered or selected the call light shall remain On steady until another station is selected or the station select button is pressed again to terminate the call.
         6. Call Privacy: When a call is answered or placed to inmate areas including cells, the intercom may provide audio Privacy Tone and/or visual indication at the Remote station to indicate that the Master is listening to the cell. Remote station indication shall be programmable on a station by station basis as designated by the owner. However if a call is placed to non-inmate areas such as another Master or a public area, an audio tone shall be sent periodically, every 20-30 seconds, to indicate that the Remote station is being monitored.
         7. Paging: The Detention Grade Audio Inter-Communication System Over Internet Protocol shall provide both Zone and All Page to both Remote Intercom Stations, Master Stations, and general area speakers.
         8. All user interfaces shall employ moisture and electrostatic resistance to provide reliable yet friendly operation.
         9. Device quantities and locations shall be as shown on the plans. Any device not shown on the plans but required for full operation of the system as specified shall be included.
         10. The Detention Grade Audio Inter-Communication System Over Internet Protocol shall be Tech Works, Modular Communication over Internet Protocol, MC-IP-Series.
      2. EQUIPMENT
         1. The Integrated Detention Grade Audio Inter-Communication System Over Internet Protocol Operator Desk Console shall be a vandal resistant metal enclosure including a microphone, a speaker, control push buttons, and a 10 inch Touch Screen. The console shall have a powder coated metal base with a stainless-steel faceplate. The face shall be Laser Engraved to prevent wear and destruction of labeling. One button shall be labeled “Talk” (PTT) and the other 2 buttons are “Listen” gain Up and Down to control the listening sensitivity. The Listen Gain control must control the remote amplifier input (microphone) gain to allow the operator to clearly hear the conversation at the distant location. Products providing only a local console speaker volume control will not be considered under this specification.

The Operator Audio Desk Console shall operate over Internet Protocol and include all circuitry for the clear amplification of spoken voice communication and conversation control over a single TCP/IP connection using standard CAT6 cabling. Station selection and system control shall be provided by the integral touch screen. Products that do not operate over Ethernet exclusively using Internet Protocol for both audio and audio control will not be acceptable under these specifications.

The power source shall be 24 VDC 3 Amp universal AC source type.

The Operator Desk Console microphone and speaker shall be Tech Works MC-IP-ODC-TS

Or

The Operator Desk Console shall be a vandal resistant metal enclosure including a microphone, a speaker, and control push buttons. The console shall have a powder coated metal base with a stainless-steel faceplate. The face shall be Laser Engraved to prevent wear and destruction of labeling. One button shall be labeled “Talk” (PTT) and the other 2 buttons are “Listen” gain Up and Down to control the listening sensitivity. The Listen Gain control must control the remote amplifier input (microphone) gain to allow the operator to clearly hear the conversation at the distant location. Products providing only a local console speaker volume control will not be considered under this specification.

The Operator Audio Desk Console shall operate over Internet Protocol and include all circuitry for the clear amplification of spoken voice communication and conversation control over a single TCP/IP connection using standard CAT6 cabling. The building control touch screen Logic Control (PLC) system specified separately shall provide individual station selection and interface to the Operator Desk Console via text API commands to the MC-IP-HOST. Products that do not operate over Ethernet exclusively using Internet Protocol for both audio and audio control will not be acceptable under these specifications.

The power source shall be POE from any standard 1 Amp POE Switch.

The Operator Desk Console microphone and speaker shall be Tech Works MC-IP-ODC-POE

* + - 1. The station select panel and control module shall be a 19-inch rack mount metal enclosure including all electronics for Internet Protocol communication, amplification, and control of up to 16 industry standard 25-volt remote intercom speakers. 20 Watts of audio power amplifier shall be built in for paging applications. Additional audio power shall be available via a simple CAT 6 connection to Tech Works PA-Buss products when required for higher loads. Each remote speaker connection shall have a discrete call in connection. The Listen Gain control must control the remote amplifier input (microphone) gain to allow the operator to clearly hear the conversation at the distant location. Products providing only a local console speaker volume control will not be considered under this specification.

The Station Selection Control Module shall operate over Internet Protocol and include all circuitry for the clear amplification of spoken voice communication and conversation control over a single TCP/IP connection using standard CAT6 cabling. Products that do not operate over Ethernet exclusively using Internet Protocol for both audio and audio control will not be acceptable under these specifications.

The power source shall be 24 VDC 3 Amp universal AC source type.

The 16-Channel Audio Intercom Control Module shall be Tech Works MC-IP-116

Or

The station select panel and control module shall be a 19-inch rack mount metal enclosure including all electronics for Internet Protocol communication, amplification, and control of up to 16 industry standard 25-volt remote intercom speakers. 20 Watts of audio power amplifier shall be built in for paging applications. Additional audio power shall be available via a simple CAT 6 connection to Tech Works PA-Buss products when required for higher loads. Each remote speaker connection shall have a discrete call in connection with call confirmation light output. The Listen Gain control must control the remote amplifier input (microphone) gain to allow the operator to clearly hear the conversation at the distant location. Products providing only a local console speaker volume control will not be considered under this specification.

The Station Selection Control Module shall operate over Internet Protocol and include all circuitry for the clear amplification of spoken voice communication and conversation control over a single TCP/IP connection using standard CAT6 cabling. Products that do not operate over Ethernet exclusively using Internet Protocol for both audio and audio control will not be acceptable under these specifications.

The power source shall be 24 VDC 3 Amp universal AC source type.

The 16-Channel Audio Intercom Control Module shall be Tech Works MC-IP-116-L

* + - 1. The Program and Paging Audio Amplifier shall be a professional quality unit with separate transformer balanced inputs for two audio sources. All switching of audio inputs shall be solid state logic controlled with static electricity protection. The amplifier shall be 1.75” High, 8.5” Wide, and 6” deep producing 40 watts at 25 Volt balanced line with less than 0.1% distortion. The input shall be industry standard 0dBm at 10K ohms and terminations shall be “Euro” style screw terminals modular connectors. The amplifier shall include Tech Works PA-BUSS interface connectors for integration with other PA-BUSS products. Products not fully compatible with Tech Works PA-BUSS technology will not be acceptable under these specifications.

The power source shall be 24 VDC 3.5 Amp universal AC source type.

The Audio Paging Amplifier shall be Tech Works Model PA-402.

* + - 1. The MC-IP-HOST shall be an Internet Protocol Control Module that connects to the network and builds tables of all devices, commands, and functions that are required for the operation of the system. If a device fails or is removed from the system the MC-IP-HOST shall log that device out of service until a new device with the same credential is installed. As soon as a new device appears, the MC-IP-HOST will automatically download all stored settings to the new device to assure that it functions just like the unit that was replaced. A standard SD card shall store all system programming and communication tables. The MC-IP-HOST shall arbitrate all connections on the system by monitoring all communication connections and upon any request to establish a new conversation, the MC-IP-HOST shall check the system table and sees if that station is available. If not, the requesting station shall be sent a “Busy Signal”. If the station is available an audio and control connection will be established between the two devices and they shall be in full control of the conversation. If special commands for establishing communication are required by third party software a translation table will be created to handle the special commands. Any system that does not allow Automatic full functional replication of any component swapped on the system will not be considered under this specification.

The power source shall be POE from any standard 1 Amp POE Switch or 24 VDC 1 Amp universal AC source type.

The Internet Protocol System Controller / Host shall be Tech Works MC-IP-HOST

Or

The MC-IP-SERVER shall be an Internet Protocol Control Module that connects to two networks; a local network for stand-alone local communication and a second campus network to connect with other Servers for over 17,000 stations and over 1,000 simultaneous conversations in a single system. The MC-IP-Server local Host builds tables of all local devices, commands, and functions that are required for the operation of the system. If a device fails or is removed from the system the MC-IP-SERVER shall log that device out of service until a new device with the same credential is installed. As soon as a new device appears, the MC-IP-SERVER will automatically download all stored settings to the new device to assure that it functions just like the unit that was replaced. A standard SD card shall store all system programming and communication tables. The MC-IP-SERVER shall arbitrate all connections on the system by monitoring all communication connections and upon any request to establish a new conversation, the MC-IP-SERVER shall check the system table and sees if that station is available. If not, the requesting station shall be sent a “Busy Signal”. If the station is available an audio and control connection will be established between the two devices and they shall be in full control of the conversation. If special commands for establishing communication are required by third party software a translation table will be created to handle the special commands. Any system that does not allow Automatic full functional replication of any component swapped on the system will not be considered under this specification.

The power source shall be 24 VDC 1 Amp universal AC source type.

The Internet Protocol System Controller / Host shall be   
Tech Works MC-IP-SERVER

* + - 1. The Integrated Detention Grade Audio Inter-Communication System Over Internet Protocol shall include an Ethernet LAN switch of adequate design and speed to support 100 Megabit ethernet communication to up to 16 ports per unit. At least one of the LAN switches in a system shall include a WAN port for routing of messages between the Integrated Detention Grade Audio Inter-Communication System Over Internet Protocol and other networks that may want to share information with the audio intercom system. At no time shall the Integrated Detention Grade Audio Inter-Communication System Over Internet Protocol share an Ethernet LAN switch with other systems to insure the best possible performance and audio quality. The router shall be programmed to restrict access to the audio intercom system from outside interruptions.

The LAN switch shall include a power supply of universal AC source type.

The Internet Protocol System Controller / Host shall be Tech Works MC-IP-SWR-16-RM or MC-IP-SWR-16-POE-RM

* + - 1. The Integrated Detention Grade Audio Inter-Communication System Over Internet Protocol shall be supplied with a 24-Volt Direct Current power supply capable of powering all devices, as shown on plans, simultaneously with a minimum of 25% reserve power. The power supply shall have isolated ground from DC power common and be UL/CSA Listed for use with alarm and signaling systems. A surface mounting metal bracket shall be included to house the power supply. This unit shall operate from an input of 100 to 240 Volts AC and supply a minimum of 3.75 Amps at 24-Volts DC.

The Power Supply shall be Tech Works Model PS-2437B.

* + - 1. The Passive Intercom Speaker Station shall be a two-gang moisture resistant design employing three steel barriers and a 12-gauge stainless steel faceplate with special mounting hardware to protect it from tampering and vandalism. The integral "Call-In" switch shall be hermetically sealed and utilize a limited travel actuator to protect it from excessive force or moisture. A 2-Watt, 25 Volt speaker shall deliver clear loud audio as both a microphone and a speaker.

The Voice Communication System Intercom Speaker Station shall be Tech Works Model VPSS.

Or

The Passive Intercom Speaker Station shall be a two gang moisture resistant design employing three steel barriers and a 12 gauge stainless steel faceplate with special mounting hardware to protect it from tampering and vandalism. The integral "Call-In" switch shall be hermetically sealed and utilize a limited travel actuator to protect it from excessive force or moisture. An ultra-bright LED call confirmation light built into the button lets the caller know that their call has been placed. A 2 Watt, 25 Volt speaker shall deliver clear loud audio as both a microphone and a speaker.

The Voice Communication System Intercom Speaker Station with call confirmation shall be Tech Works Model VPSS-L

* + - 1. The ceiling mounted loudspeaker shall be a 12-inch round white ceiling panel with perforated steel grille. The ceiling speakers shall include an eight inch cone loudspeaker with one inch voice coil, a 25 volt audio transformer with taps at 6dB increments from ¼ to 5 watts, a composite fire rated enclosure, ceiling blind mounting rails, and be covered with a white epoxy finished grill. The unit shall provide a frequency response of at least 60 Hz to 17,000 Hz, ± 1.5dB with a sensitivity of at least 102dB, 5 watts, 1 meter.

The Ceiling Mounted Loudspeaker shall be Tech Works System 21.

* + - 1. Weatherproof and Yard Area Paging Loudspeakers shall be double re-entrant horn, compression type loudspeaker with an integrated 16W-25V rotary select transformer and an adjustable mounting base, with a baked enamel finish. The unit shall provide average sensitivity of 110 dB SPL, 1W/ 1M, power rating of 16W RMS, frequency response of 450 Hz - 15 kHz, coverage angle of 110° included angle, -6 dB / 2 kHz, half space per EIA standard 426A. Wiring connection shall be screw terminals to a 25 transformer with rotary switch selectable taps at 16W, 8W, 4W, 2W, 1W.

The Yard Area Paging Loudspeaker shall be Tech Works Model PA-16HT

* + 1. ACCESSORIES
       1. Wire and Cable
          1. System Network Wire shall be CAT6 twisted pair cable with overall jacket. Wire shall meet or exceed ANSI/TIA 568. Jacket material shall be compliant with NFPA and NEC codes for the type of location in which the cable is installed. Connectivity shall be as shown on the plans and detailed in the structured cabling section of these specifications.
          2. All patch Cords shall be CAT6 type ANSI/TIA 568 standard network patch cords.
          3. Station Cable shall be a twisted shielded pair with integral drain wire plus one call in conductor outside the shield with overall jacket. All conductors must be 22 Awg or larger and the twisted pair must be at least one twist per inch.

Or

For station hardware with call confirmation lights CAT6 twisted pair cable with overall jacket. Wire shall meet or exceed ANSI/TIA 568. Jacket material shall be compliant with NFPA and NEC codes for the type of location in which the cable is installed. Connectivity shall be bare end to connect to the Intercom equipment specified herein.

* + - * 1. All Adapters, Plugs, and connectors shall be included as required.
      1. Cable Management
         1. Cable management shall be as shown on the plans.
         2. Where not shown on the plans wire shall be open run through concealed spaces and dressed using tie-wraps and screw mount tie-wrap holders on all exposed open runs.
         3. In all cases wire routing and cable management shall be compliant with NEC and all Codes, Standards, and Best Practices applicable.

1. EXECUTION
   1. INSTALLATION
      1. The Contractor shall furnish and install all interconnected cable, equipment, miscellaneous parts and accessories to make a complete and fully operational system as described herein and as shown on the drawings.
      2. All cables shall be sized in accordance with manufactures recommended cabling requirements. All cable and wire shall be air plenum rated even if installed in conduit.
      3. Equipment shall be installed and wired in accordance with accepted engineering and installation practices. Only the highest degree of workmanship will be accepted. Install in accordance with Electronic Systems Technician (EST) best practices.
      4. All cables shall be run continuously and no splicing may be made in any cable run.
      5. Cable and wiring routed through inaccessible spaces or spaces where there is risk of damage to conductors shall be installed in conduit or raceways supplied by other sections of this specification.
      6. All cable and wiring shall be run concealed in ceiling spaces or surface raceways, except for in wiring closets such as the Main Distribution Frame (MDF).
      7. All cable and wiring shall be securely fastened to the permanent building structure. Cable and wire not installed in raceway shall be supported at regular intervals appropriate to the cable and wire size. Cable and wiring shall not lay loose on ceiling tiles or grids and shall not be suspended from or attached to existing conduit.
      8. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer have published torque tightening values for equipment connectors. Where manufacturer’s torque requirements are not indicated, tighten connectors and terminals to comply with tightening torque per NEC specification.
      9. The following circuit types shall be installed in their own conduits:
         1. Microphone and control lines
         2. Control lines
         3. AC power lines
      10. Provide a #6 AWG insulated copper ground wire from the main equipment to the building main ground bus.
      11. Install in accordance with NFPA 70 and manufacturer recommended installation procedures.
   2. FIELD QUALITY CONTROL
      1. CLEANING
         1. Clean all devices, cabinets, and housings as recommended by electronic industry manufacturer.
         2. Labeling
            1. All wiring and connections must be clearly labeled using industry standard permanent marking devices. Contractor shall identify and tag all cables with permanent type markers to denote locations served.
            2. All user interfaces must be clearly and permanently labeled for their intended use. All front panel controls used in the normal operation of the system shall be clearly labeled using plastic laminate engraved labels or approved equal. Labels shall be firmly affixed to the panel or device. Dymo or Kroy tape adhesive backed lettering is not acceptable. Each major system component shall be labeled as to function and area served.
         3. Site Tests/Inspection
            1. Post Occupancy testing: Test inputs and outputs of all devices to verify compliance with functionality of designed system.
            2. Verify installed cable is free of opens grounds and shorts.
            3. Verify ventilation for equipment is adequate for installed units.
   3. DEMONSTRATION
      1. Provide instruction to the Owner or their appointed representative related to operation, maintenance and programming of all systems Training sessions shall be on-site, limited to 15 people maximum in any one session. Sessions shall last approximately one (1) hours each. In addition, Contractor shall provide a minimum of four (4) hours training for system administrator.
      2. Follow-up training must be provided on all systems, one (1) week after cutover.
      3. Provide demonstration and training by a staff member/trainer who is certified by the system manufacturer to provide training.
   4. FINAL CHECKOUT AND ACCEPTANCE:
      1. The Contractor shall verify that the system is complete and fully operational before requesting final approval and before scheduling system demonstration.
      2. This Contractor shall be available to demonstrate the operation and use of the system to the Architect/Engineer and to the Owner’s representatives.
      3. At the time of the demonstration, this Contractor shall furnish to the Owner one (1) complete record manuals.
      4. Substantial Completion of the system will start the warranty period for both material and labor.
   5. SYSTEM GUARANTEE:
      1. The Contractor shall provide the following regarding warranties and guarantees.
         1. Extend the manufactures warranty to the owner. The owner understands that manufactures warranties will vary from manufacture to manufacture.
         2. Provide one year of free maintenance on the system from date of substantial completion and the owner’s first beneficial use of the system.

END OF SECTION