**SECTION 27 51 23.70**

**CLEAN ROOM INTERCOMMUNICATIONS SYSTEM**

1. GENERAL
	* + 1. 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. SECTION INCLUDES
				1. Furnish and Install a complete and operable Full Duplex, Open Voice Intercommunications System between the Clean Room Facilities and the associated Work and Ante Rooms. The system shall be capable of high quality, reliable, and satisfactory operation as herein described.
				2. Furnish and Install all required Speakers, Microphones, 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.
			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:

NFPA - National Fire Protection Association

NEC- National Electrical Code - NFPA 70

UL - Underwriter’s Laboratories, Inc.

ADA – Americans with Disabilities Act

EIA – Electronic Industry Association

NEMA – National Electrical Manufacturers Association

NSCA – Nation Systems Contractors Association – Best Practices

ASCII – American Standard Code for Information Interchange

ASTM - American Society for Testing and Materials

* + - 1. QUALITY ASSURANCE
				1. Qualifications:

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.

All items of a given type shall be the product of the same manufacturer.

All items shall be of the latest technology, no discontinued models or products are acceptable.

Installers shall have a minimum of 5 years experience in the installation of similar systems on at least 10 projects of similar scope.

The Manufacturer or the Authorized Representative shall provide proof that within 60 miles of the project they maintain:

A full compliment of parts to support the installation.

Offer service by fully trained and qualified technicians during normal working hours.

Will supply parts and service without delay and at a reasonable cost.

* + - * 1. Regulatory Requirements:

Comply with NEC as applicable to construction and installation of system components and wiring.

Conform to NFPA 70

Conform to HIPAA regulations relating to paging and public address systems.

Systems may be subject to inspection and require accreditation from agencies such as OSHPOD and JCAHO if mandated by the owner. Suppliers of all systems must include all documentation and staff to support the owner during these inspections and certifications.

* + - 1. 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.
				3. 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.
				4. Provide a complete list of all equipment to be furnished.
				5. Provide Product Data: For each equipment component shown on the riser and or wiring diagram.
				6. Provide complete written sequence of operation for all factions of all systems.
				7. Provide dimensioned detail drawings of all special assemblies including custom panels, mounting assemblies, and location.
				8. Provide System Riser Diagram including:

Main Audio processor

Amplifiers

Ancillary items (microphone, switches)

Speakers

Interconnection to ancillary systems

* + - * 1. Provide Wiring Details of all connections between all systems components.
				2. Manufacturer Instructions: Provide manufacturer’s written installation instructions.
				3. Proposed training program, including name and qualification of trainer(s), schedule of training, curricula, and written training materials.
				4. Closeout Submittals

Refer to Section General Conditions and Related Sections for full details of closeout requirements

As-Built Drawings indicating actual location and connection of components.

Operation and maintenance manuals for each system and equipment component.

Executed warranty documentation.

* + - 1. 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.
			2. 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 2-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.
1. PRODUCTS
	* + 1. MANUFACTURERS
				1. The following manufacturers are known to provide products that meet or exceed these specifications.

Tech Works, Inc., Henderson, Nevada, 800-813-1080, [www.tech4people.com](http://www.tech4people.com)

No known equal.

* + - 1. INTERCOM
				1. System Description:

The system shall allow open voice, full duplex, handsfree, audio communication between the Clean Room areas and the staff in the Workroom.

An Operator Desk Console (ODC) with gooseneck microphone and speaker shall be provided for the Workroom area. The ODC shall include a professional cardioid, condenser, gooseneck microphone, and a speaker. Buttons and indicators provide control to allow the operator to just listen to the communication or to talk in each of up to 4 clean rooms, and collaborate hands free. A headset jack on the side of the console allows connection of a local operator headset (Optional) without modification or additional hardware.

A highly directional Shotgun microphone shall be provided in the Procedure Room. The microphone shall be a wide-range condenser microphone with a hyper-cardioid polar pattern. It shall be designed for surface-mounted applications in high-quality sound reinforcement.

A Clean Room flush Ceiling mounted loudspeaker shall be provided in the Procedure room so that staff around the procedure table can hear the communication clearly.

Wireless Headsets shall be provided for participants in the conversation. Wireless headsets shall have charging bases which act as the receiving antenna for each headset. A minimum of 4 headsets shall be provided for each Operating Room and/or Procedure Room shown on the plans.

* + - * 1. Components

The Clean Room Intercommunication System shall be a hands-free open voice communication system capable of clear, high quality audio with no distortion or acoustic feedback under normal operating conditions. The Intercommunication system shall be capable of including Microphones, Speakers, Wireless Headsets, Operator Desk Consoles and Background Music reproduction and control. All system components must plug together using standard CAT6 computer patch cables for ease of installation.

The Intercommunication System shall be Tech Works CI-BUSS Series

A Microphone, Speaker Interface must be provided for this project to have hands-free full duplex communication in the Procedure Room. The Microphone, Speaker Interface must be capable of articulate voice pickup from a professional cardioid condenser microphone and clear listening from an industry standard 25 volt speaker without feedback. The system shall include band pass filters, narrow band notch filters and adjustable ducking for tuning the system to the room acoustics while maintaining full duplex communication. The system must include Automatic Level Control and the Collaboration Intercom interface for connection to other Tech Works CI-BUSS devices for a complete and operable system. System connections must be via industry standard CAT-6 patch cords. The Microphone, Speaker Interface shall operate from a separate UL Listed 24 VDC 1 Amp power source.

The Microphone, Speaker Interface shall be Tech Works Model CI-MSI-22

Mounting – The Amplifiers shall be located under the counter in the Observation Area. Mounting shall be an all steel bracket which is an integral part of the amplifier assembly.

The amplifier mounting assembly shall be Tech Works WM-1.

Operator Desk Console - An Operator Desk Console must be provided for this project to have hands-free full duplex communication from an observation control location to up to 4 separate areas. The Operator Desk Console must be capable of articulate voice pickup from a professional cardioid condenser gooseneck microphone and clear listening from an integral speaker without feedback. The system must include Automatic Level Control and the Collaboration Intercom interface for connection to other Tech Works CI-BUSS devices for a complete and operable system. System connections must be via industry standard CAT-6 patch cords. The Operator Desk Console shall operate from a separate UL Listed 24 VDC 1 Amp power source.

The Operator Desk Console shall be Tech Works Model CI-ODC-4

Procedure Room Microphone - A wall mounting broadcast quality Shot Gun Microphone system shall be provided for audio pick up employing a hyper cardioid pickup pattern and 100-20,000 Hz frequency response. The microphone shall include a swivel mount with positive position locking, an 18” microphone cable and XLR connectors shall be included with all wiring accessories needed for a complete installation. All microphone components shall be in a rugged housing with low-reflectance black finish. The system shall mount to a standard 1-gang white plastic Decora wall plate with matching cover.

The miniature boundary microphone shall be Tech Works PRO SGM.

Speaker- The ceiling mounted loudspeaker shall be a 12-inch round white ceiling panel with perforated steel grille designed for clean room applications. The ceiling speakers shall include an eight-inch cleanable moisture-proof 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 loudspeaker assembly must include gaskets to seal all joins to assure no dust or particulate matter gets into the room. 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 Clean Room Loudspeaker shall be Tech Works CRS-RC.

A 4 headset wireless communication system must be provided for this project to have hands-free communication without the use of fixed location microphones and speakers or hardwired headset connections. The Headset Combiner must be capable of connecting at least 4 industry standard telephone headsets and expandable to 24 headsets. The system must include Automatic Level Control and the Collaboration Intercom interface for connection to other Tech Works CI-BUSS devices for a complete and operable system. System connections must be via industry standard CAT-6 patch cords. The Headset Combiner shall operate from a separate UL Listed 24 VDC 1 Amp power source.

The Collaborative Intercom Headset Combiner shall be Tech Works Model CI-HSI-41

A wireless headset must be included for the operator to have hands-free communication without the use of fixed location microphone and speaker. When the headset is installed in conjunction with fixed microphones and speakers, a headset interface must be included to mute the fixed devices when the headset is in use. The headset must be a rechargeable ultra-light weight unit with a charging base and noise-canceling microphone. A 7 foot line cord must be included for connection of the associated equipment.

The wireless headset shall be Tech Works CS-540

Power Supply - The Audio System 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 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 Audio System Power Supply shall be Tech Works Model PS-2437A

* + - 1. ACCESSORIES
				1. Wire and Cable

Microphone and line level audio wire shall be 20 AWG stranded tinned copper type twisted pair cable with overall foil shield and jacket. Wire twist shall be industry standard audio twist per foot or greater. Jacket material shall be compliant with NFPA and NEC codes for the type of location in which the cable is installed.

Speaker audio wire shall be 18 AWG stranded twisted pair cable with overall jacket. Wire twist shall be industry standard audio twist per foot or greater. Jacket material shall be compliant with NFPA and NEC codes for the type of location in which the cable is installed.

* + - * 1. Cable Management –

Cable management shall be as shown on the plans.

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.

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.
				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.
				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 torques per NEC specification.
				9. The following circuit types shall be installed in their own conduits:

Microphone

Control lines

AC power lines

* + - * 1. Provide a #6 AWG insulated copper ground wire from the main equipment to the building main ground bus.
				2. Install in accordance with NFPA 70 and manufacturer recommended installation procedures.
			1. FIELD QUALITY CONTROL
				1. CLEANING

Clean all devices, cabinets, and housings as recommended by electronic industry manufacturer.

* + - * 1. Labeling

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.

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.

* + - * 1. Site Tests/Inspection

Post Occupancy testing: Test inputs and outputs of all devices to verify compliance with functionality of designed system.

Verify installed cable is free of opens grounds and shorts.

Verify ventilation for equipment is adequate for installed units.

* + - 1. 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.
			2. 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.
			3. SYSTEM GUARANTEE:
				1. The Contractor shall provide the following regarding warranties and guarantees.

Extend the manufactures warranty to the owner. The owner understands that manufactures warranties will vary from manufacture to manufacture.

Provide one year of free maintenance on the system from date of substantial completion or the owner’s first beneficial use of the system which ever occurs first.

END OF SECTION