

SECTION 27 51 25 – SOUND REINFORCEMENT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall furnish and install all materials, labor, and equipment, as herein specified, a locally controlled sound reinforcement system including wire, loudspeakers, console, etc. all ready for operation. The sound reinforcement systems shall provide all components necessary to pick-up, process, amplify, and reproduce both voice and music sources.
- B. Systems shall be installed in the Cafeteria and Gymnasium.
- C. Provide interconnections as listed in Part 2.
- D. Provide demonstration, training and commissioning as listed in Part 3.
- E. A vendor capable of meeting all requirements of these specifications is Sage Technology Solutions of Mount Joy, PA.

1.2 SUBMITTALS

- A. Submit manufacturer's product literature and installation instructions for all of the major components required for a complete and fully operational system. Submit system wiring diagrams for approval.
- B. Submit manufacturer's printed instructions for maintenance of all installed components, including methods for maintaining proper conditions and environment to provide optimum performance. Provide three complete sets of operating instructions including wiring and circuit diagrams.
- C. Submit dimensioned drawing showing location and height of speakers, and aiming angles for review. Care shall be taken in locating speakers to respect the architecture of the space, as well as acoustics. Drawings shall also show locations of all permanently installed devices (i.e. racks, jacks, power needs, etc.)

1.3 QUALIFICATIONS

- A. Firms regularly engaged in the manufacture of professional and commercial sound system components with a minimum of five years' experience in the design and installation of systems equal in size and type required by this project shall be accepted.
- B. The equipment supplier must maintain a local service organization within a hundred (100) mile radius of the installation with spare service replacement components and accessories as needed to ensure a potential down time of no more than twenty-four (24) hours.
- C. The supplier must be an authorized representative of the equipment specified with authority to provide warranty rights and rebates. Full-time technicians shall be trained and certified in the installation and service of the equipment. A minimum NICET level 2 or EST Level 2 certification in Low Voltage Communication Systems is required for each full-time technician. Qualified installer must provide twenty-four (24) hours a day seven (7) days a week, as needed for system service and instructional procedures.

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- D. The system supplier must provide a minimum of three (3) completed project references identifying project names with contacts for sound system installations similar in scope to this project that have been completed within the last two years.
- E. The supplier must provide a summary of capabilities, which satisfactorily demonstrates that the sound system vendor maintains the physical plant, personnel, and equipment necessary to provide the specified systems. The supplier must provide evidence of their test equipment inventory as of the submittal date. This inventory at a minimum must include:
 - 1. 1/3 Octave Spectrum Analyzer with Calibrated Microphone
 - 2. Dual Channel 20mHz. Oscilloscope
 - 3. Calibrated SPL Meter
 - 4. SmaartLive V8 Audio Measurement Software and related computer
 - 5. Audio Test Generator with Pink Noise
 - 6. Impedance Meter
 - 7. Cable Polarity Tester
- F. The supplier must utilize acoustic simulation modeling software in order to accurately model the space. This software shall be used to accurately position and aim the speakers in the space. Software similar to E.A.S.E. shall be utilized, where indicated.
- G. All of the qualification information shall be reviewed by the Owner's representative to verify that the Sound System Supplier maintains the capabilities and experience necessary to ensure that a satisfactory system installation is accomplished. Should the Owner determine that the submitted qualifications do not meet the specified requirements, the bidding Contractor shall be required, at no additional cost to the Owner, subcontract the services of a sound system vendor whose qualifications meet the specified requirements.

1.4 MANUFACTURER

- A. The naming of the manufacturer or item is not intended to be restrictive, but rather to establish criteria for system design and quality. Other manufacturers shall be considered for use if submitted for substitution request per non-technical specifications prior to the bid date. The substitution submission shall include all catalog cut sheets and a line-by-line comparison of the specified product, including inter-panel wiring diagrams and schematics. In addition, samples may be required to perform proper evaluation of the proposed alternate at no additional charge.

1.5 PERFORMANCE AND OPERATION

- A. Following are general performance and operation requirements for all systems:
 - 1. Each system shall be locally controlled sound reinforcement systems that operate independently from the main intercommunications system. Each system shall be provided with a tie into the intercommunications for priority override paging.
 - a. Programming of the override shall be verified with the owner. There may be a desire to bypass this override at the time of installation; however, the override relays shall be part of the system, and identified on the as-builts and O&M manuals.
 - 2. All amplification and signal processing equipment components shall be located in equipment cabinets with locking front doors per products section. The manufacturer's rack mounted products of suitable hardware shall securely fasten all equipment in the equipment cabinet. A remote on/off keyed switch with an LED indicator lamp shall be included on a custom two-gang plate to show the status of the system operation.

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3. Each system shall provide a high threshold of gain before feedback and shall accurately reproduce and amplify all voice and music signal without feedback, oscillation, distortion, or other unwanted effects or interference.
4. Remote antennas shall be provided for wireless microphones and assistive listening systems if required for a fully functioning system whether or not specifically specified in part 2.
5. Each system shall accept microphone and stereo line-level inputs, and faithfully and accurately amplify those signals uniformly to all seated occupants. The audio shall be monaural.

PART 2 - PRODUCTS

2.1 SIGNAL PROCESSING, AMPLIFICATION, AND CONTROL EQUIPMENT

- A. The following equipment shall be provided in the Cafeteria.
 1. The Cafeteria shall be provided with a new locally controlled sound reinforcement system with equipment as follows. The system shall be provided with a dedicated 20-amp power circuit.
 2. Provide one (1) BSS Audio Soundweb London BLU-100 Networked Signal Processor with a fixed configuration of 12 analog inputs and 8 analog outputs, configurable signal processing and a high bandwidth, fault tolerant digital audio bus. The signal processor shall feature low latency, fault tolerant digital audio bus of 48 channels which uses standard Category 5e cabling giving a distance of 100m between compatible devices. The signal processor shall include 12 Control Inputs and 6 Logic Outputs for GPIO Integration for sending or receiving logic signals. The programming of the GPIO ports shall be software configurable. The signal processor shall include RS232 connection for control data transmission into or out of the processor for and shall be capable to integrate to third party control systems. Available system components shall include, but not be limited to, various forms of mixers, equalizers, filters, crossovers, dynamics/gain controls, routers, delays, remote controls, meters, generators, and diagnostics.
 - a. Provide BSS Audio EC8-WHT Ethernet Controller. The control panel shall be a PoE network appliance with a one push/rotary encoder, one encoder ring, eight buttons, and two LCD screens. The buttons, encoder ring, and LCD screens are multi-color backlit, capable of eight different colors with adjustable intensity. The push/rotary encoder can be rotated for continuous parameter control (e.g. volume). The push/rotary encoder can also be pressed for binary parameter control (e.g. mute) or preset recall.
 - 1) Provide one (1) controller adjacent to the sound rack and one (1) controller in space, where directed in the field.
 - 2) Provide additional controllers where identified on the drawings.
 - b. Provide support for iPad and PC integration for mixing controls during performances. Provide all accessories and programing as required, and include training of the settings as part of the project.
 3. Power amplifiers shall be supplied and allocated as follows:
 - a. One (1) Crown model CDi 2/300BL two-channel amplifier, each channel providing 300 watts at 8 ohms 300 watts at 70 volts.
 - b. All power amplifiers shall have the following minimum performance characteristics: less than 0.35% THD at rated power; frequency response of 20Hz to 20kHz +/- .25dB; input sensitivity for rated output 1.4Vrms. The unweighted signal to noise ratio over the range of 20 Hz to 20 kHz shall exceed 105 dB, reference to full output.

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4. One (1) digital diversity wireless microphone combination system shall be provided. The systems shall utilize Automatic Frequency Selection that allows the unit to scan for open channels across the UHF band for clear operation. The unit shall provide frequency and volume lockout features to prevent accidental setting changes. The receiver shall be constructed of a durable, metal chassis with rack mount hardware. The unit shall utilize $\frac{1}{2}$ wave antennas to allow for optimum antenna placement to enhance signal reception. Both $\frac{1}{4}$ " line level and XLR microphone level output signals shall be provided. The digital wireless microphone receiver shall be Shure model SLX-D systems. Provide one (1) Shure model SLXD124/85 Combination Systems each equipped with one (1) SLXD2/58 Handheld Transmitter and one (1) SLXD1 Bodypack Transmitter with WL185 Lavalier Microphone.
 - a. Provide remote antennas for the wireless receivers to ensure good coverage.
 5. Provide one (1) SurgeX Surge Eliminator and Power Conditioner, model SX1120RT. The unit shall be in a magnetic shielding enclosure, operate from 120VAC, and have a 9-foot grounded, 3-wire #12-line cord. The unit shall have a load rating of 20 amps at 120VAC, a self-test circuit with visual indicator, and provide EMI/RFI filtering, inrush current elimination, and catastrophic over/under voltage shutdown.
 6. The above equipment shall be contained in a fully welded wall-mount equipment cabinet with locking front door. The cabinet shall be constructed using 16-gauge steel with triple-formed side-to-bottom and side-to-top wrapped construction to achieve strength equivalent to 3/16" thick steel. The mounting section shall attach to the backbox from the inside using two heavy-duty, spring-loaded L-pins that are self-seating and positive locking. The rack shall contain a minimum of twenty-four (24) rack units and shall be at least twenty (20) inches deep. Provide vent panels at the top and bottom of the rack for additional ventilation. Provide matching blank panels for all unused spaces. Provide Middle Atlantic Products model DWR-24-22 with VFD-21 25% Perforated Front Door. The equipment cabinet shall be equipped with a 4-space locking security drawer.
 - a. Equal by Atlas Sound or Lowell Manufacturing shall be acceptable.
 7. Provide all necessary connectors, hardware, wire management, power supplies, combiners, switch panels, power panels, etc. to enable complete system functions. Include passive summing devices for stereo connections to the system mixers as required for auxiliary and projector inputs.
 8. Provide audio input at the Owner furnished television, and connect into the sound system. Provide interface, wiring and programming as required.
- B. The following equipment shall be provided in the Gymnasium.
1. The Gymnasium shall be provided with a new locally controlled sound reinforcement system with equipment as follows. The system shall be provided with a dedicated 20-amp power circuit.

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2. Provide one (1) BSS Audio Soundweb London BLU-100 Networked Signal Processor with a fixed configuration of 12 analog inputs and 8 analog outputs, configurable signal processing and a high bandwidth, fault tolerant digital audio bus. The signal processor shall feature low latency, fault tolerant digital audio bus of 48 channels which uses standard Category 5e cabling giving a distance of 100m between compatible devices. The signal processor shall include 12 Control Inputs and 6 Logic Outputs for GPIO Integration for sending or receiving logic signals. The programming of the GPIO ports shall be software configurable. The signal processor shall include RS232 connection for control data transmission into or out of the processor for and shall be capable to integrate to third party control systems. Available system components shall include, but not be limited to, various forms of mixers, equalizers, filters, crossovers, dynamics/gain controls, routers, delays, remote controls, meters, generators, and diagnostics. Provide one (1) BLU-BOB1 8-channel Output Expander and one (1) BLU-BIB 8-channel Input Expander, to provide 8 additional analog inputs and 8 additional analog audio outputs with the system.
 - a. Provide BSS Audio EC8-WHT Ethernet Controller. The control panel shall be a PoE network appliance with a one push/rotary encoder, one encoder ring, eight buttons, and two LCD screens. The buttons, encoder ring, and LCD screens are multi-color backlit, capable of eight different colors with adjustable intensity. The push/rotary encoder can be rotated for continuous parameter control (e.g. volume). The push/rotary encoder can also be pressed for binary parameter control (e.g. mute) or preset recall.
 - 1) Provide one (1) controller adjacent to the sound rack and one (1) controller in space, where directed in the field.
 - 2) Provide additional controllers where identified on the drawings.
 - 3) Where controllers are locate din gymnasium, provide with protective cover.
 - b. Provide support for iPad and PC integration for mixing controls during performances. Provide all accessories and programing as required, and include training of the settings as part of the project.
3. Provide one (1) D&M Professional model DN-500BD MKII Universal Digital Media Player. The digital media player shall support Blu-Ray Disc, DVD, CD, SD, and USB device (mass storage class) AVCHD playback format. Features shall include: Blu-Ray, DVD, CD and SD/USB media playback; supported Blu-Ray disc formats: BD25, BD50, BD-RE, BD-ROM, and BD-R; supported DVD formats: DVD, DVD+R, DVD+RW, and DVD-RW; SD/USB supported video, audio, and picture file formats: .3gp, .asf, .avi, .dat, .divx, .mkv, .mov, .mp4, .mpg, .m2ts, .ogm, .rmvb, .tp, .ts, .wmv, .ass, .smi, .srt, .ssa, .sub, .ape, .flac, .mp4 (AAC), .mp3, .wav, .gif, .jpg (or jpeg), and .png; panel lock and IR remote lock.
4. Power amplifiers shall be supplied and allocated as follows:
 - a. Two (2) Crown model CDi 2/1200BL two-channel amplifiers with BLU link input, each channel providing 1200 watts at 8 ohms 1200 watts at 70 volts. The amplifiers will drive the main speakers.
 - b. One (1) Crown model CDi 2/300BL two-channel amplifier, each channel providing 300 watts at 8 ohms 300 watts at 70 volts. This amplifier will drive the stage monitors.
 - c. All power amplifiers shall have the following minimum performance characteristics: less than 0.35% THD at rated power; frequency response of 20Hz to 20kHz +/- .25dB; input sensitivity for rated output 1.4Vrms. The unweighted signal to noise ratio over the range of 20 Hz to 20 kHz shall exceed 105 dB, reference to full output.
5. Two (2) digital diversity wireless microphone combination systems shall be provided. The systems shall utilize Automatic Frequency Selection that allows the unit to scan for open channels across the UHF band for clear operation. The unit shall provide frequency and volume lockout features to prevent accidental setting changes. The receiver shall be constructed of a durable, metal chassis with rack mount hardware. The unit shall utilize ½ wave antennas to allow for optimum antenna

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placement to enhance signal reception. Both ¼" line level and XLR microphone level output signals shall be provided. The digital wireless microphone receiver shall be Shure model SLX-D systems. Provide two (2) Shure model SLXD124/85 Combination Systems each equipped with one (1) SLXD2/58 Handheld Transmitter and one (1) SLXD1 Bodypack Transmitter with WL185 Lavalier Microphone.

- a. Provide remote antennas for the wireless receivers to ensure good coverage.
6. Provide one (1) SurgeX Surge Eliminator and Power Conditioner, model SX1120RT. The unit shall be in a magnetic shielding enclosure, operate from 120VAC, and have a 9-foot grounded, 3-wire #12-line cord. The unit shall have a load rating of 20 amps at 120VAC, a self-test circuit with visual indicator, and provide EMI/RFI filtering, inrush current elimination, and catastrophic over/under voltage shutdown.
7. The above equipment shall be contained in a fully welded wall-mount equipment cabinet with locking front door. The cabinet shall be constructed using 16-gauge steel with triple-formed side-to-bottom and side-to-top wrapped construction to achieve strength equivalent to 3/16" thick steel. The mounting section shall attach to the backbox from the inside using two heavy-duty, spring-loaded L-pins that are self-seating and positive locking. The rack shall contain a minimum of twenty-four (24) rack units and shall be at least twenty (20) inches deep. Provide vent panels at the top and bottom of the rack for additional ventilation. Provide matching blank panels for all unused spaces. Provide Middle Atlantic Products model DWR-24-22 with VFD-21 25% Perforated Front Door. The equipment cabinet shall be equipped with a 4-space locking security drawer.
 - a. Equal by Atlas Sound or Lowell Manufacturing shall be acceptable.
8. Provide all necessary connectors, hardware, wire management, power supplies, combiners, switch panels, power panels, etc. to enable complete system functions. Include passive summing devices for stereo connections to the system mixers as required for auxiliary and projector inputs.

2.2 LOUDSPEAKERS

A. The following equipment shall be provided in the Cafeteria.

1. Provide JBL model Control 26C/CT 6.5-inch coaxial speaker systems, as detailed on the drawings. Key features shall include extraordinary clarity for speech and vocals with extended frequency response for music, 110° conical coverage angle, advanced high-slope crossover network for constant coverage and smooth, natural midrange, and integrated low saturation 60 watt multi-tap line-matching transformer. Performance characteristics shall meet or exceed: Frequency Response (+/- 3dB) 75Hz. to 20kHz; Power Handling 150W Cont. program power. Provide appropriate JBL back box, tile bridge, grille for each ceiling speaker shown on the drawings.
 - a. Provide quantity as indicated in the space.

B. The following equipment shall be provided in the Gymnasium.

1. Provide two (2) JBL model CBT 1000 high-output two-way line array column with adjustable vertical coverage and tapered horizontal waveguide, (Left/Right) as detailed on the drawings. The loudspeaker system shall be comprised of twenty-four (24) 25mm power soft dome tweeters and six (6) 165mm high-excursion LF drivers arranged coaxially. The array column shall provide vertical pattern coverage individually adjustable with four (4) "Pattern Up" coverage angles and four (4) "Pattern Down" coverage angles for a total of sixteen (16) different coverage combinations, all without the use of external DSP processing. The array column shall be able to produce very high sound levels up to 131 dB (137dB peaks), depending on the settings. The array column shall have a nominal impedance of 4 ohms. Performance characteristics shall meet or exceed: Frequency

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Response 45Hz. to 20kHz; Power Capacity: 1500W (6000W peak), 2 hrs.; 1000W (4000W peak) 100 hrs.; Sensitivity (2.83V @ 1m)102dB (at highest sensitivity setting: "Point" pattern up, "Point" pattern down. "Speech" voicing, in free space), 95dB (at lowest sensitivity setting: "Medium" pattern up, "Downfill" pattern down, "Music" voicing in free space); The array columns will be wall-mounted and therefore must be properly secured using factory recommended hardware designed for the specific speaker unit and the surface/material being fastened to.

2. Provide two (2) JBL model CBT 1000E Purpose-Designed Extension Line Array Column Speakers designed for use in the CBT 1000 + 1000E system. The loudspeaker system shall be comprised of six low frequency drivers and a crossover network designed for use in the CBT 1000 + 1000E System. When connected to a CBT 1000 line array column speaker, the CBT 1000E Extension provides extended bass response, extended pattern control, and increased sound output levels. The CBT 1000E shall attach to the bottom of the CBT 1000 utilizing the included coupler plate, or to the top of the CBT 1000 when adding the optional MTC-CBT-OSB3 off-set bracket to align the front grilles.
 - a. Provide custom guard over all speakers to protect from balls.

2.3 ACCESSORIES

A. The following equipment shall be provided in the Cafeteria.

1. Provide one (1) Shure model SM58S or AKG model D5 cardioid vocal microphones with an on/off switch.
2. Provide one (1) Atlas/Soundolier MS-12CE microphone stands.
3. Provide one (1) twenty-five (25) foot microphone cables.
4. All microphone receptacles shall utilize RCI Custom WP series with XLR connectors where indicated on the drawings. All microphone and auxiliary input plates shall be engraved with permanent lettering and numbering. Engraved characters shall be filled with black acrylic paint or color approved by the Owner.
5. At auxiliary input locations indicated on the drawings, provide 3.5mm (1/8") and left/right RCA inputs audio inputs in a single gang box and plate for auxiliary inputs.
 - a. Provide an additional aux. input at the rack in a blank panel.
6. Provide one (1) ProCo iFace Portable Audio Player Interface to allow simple and reliable connection of stereo -10dBV audio devices such as MP3 players, iPods, laptop computers, and consumer-type CD and DVD players to the balanced microphone inputs located on the drawings.

B. The following equipment shall be provided in the Gymnasium.

1. Provide two (2) Shure model SM58S or AKG model D5 cardioid vocal microphones with an on/off switch.
2. Provide two (2) Atlas/Soundolier MS-12CE microphone stands.
3. Provide two (2) twenty-five (25) foot microphone cables.
4. All microphone receptacles shall utilize RCI Custom WP series with XLR connectors where indicated on the drawings. All microphone and auxiliary input plates shall be engraved with permanent lettering and numbering. Engraved characters shall be filled with black acrylic paint or color approved by the Owner.
5. At auxiliary input locations indicated on the drawings, provide 3.5mm (1/8") and left/right RCA inputs audio inputs in a single gang box and plate for auxiliary inputs.
 - a. Provide an additional aux. input at the rack in a blank panel.

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6. Provide one (1) ProCo iFace Portable Audio Player Interface to allow simple and reliable connection of stereo -10dBV audio devices such as MP3 players, iPods, laptop computers, and consumer-type CD and DVD players to the balanced microphone inputs located on the drawings.

2.4 ASSISTIVE LISTENING SYSTEMS

- A. A Listening Assistive System shall be provided with each of the specified sound systems to comply with ADA requirements. Provide one (1) rack mounted base station transmitter model Listen Technologies LR-3200-072 at each sound system rack, or equal by Williams Sound. Provide additional base stations for sound systems that are specified to function as two systems with closed dividers. The transmitter shall operate at 72MHz range. The unit shall be equipped with 17 wide band channels and 40 narrow band channels. Include a remote antenna with each base station to be installed in the actual space served. Field verify exact location with architect before rough-in. Provide LR-3200-072 receiver complete with Channel and Seek features to allow automatic operation with other ADA systems within the school district. Provide each receiver with a LA-404 earbud and alkaline battery. Provide an additional six (6) earbud cushion covers for each receiver with the system. Provide hearing aid neckloops, model LA-430 to meet ADA requirements with the system. Provide a quantity of receivers and neckloops as indicated below:
 1. Cafeteria: Provide (7) receivers and (2) neckloops.
 2. Gymnasium: Provide (11) receivers and (3) neckloops.

2.5 VIDEO SYSTEM

- A. The following equipment shall be provided in the Gymnasium.
 1. Video Distribution
 - a. Video Distribution and Control System:
 - 1) Provide one (1) Crestron TSW-770 series 7-inch Touch Screen Control Panel user interface controllers for use with the audio/video and projection system.
 - a) One touch screen control panel shall be located on stage adjacent to the lighting control stage manager panel. Provide wall mount kit to install touch screen.
 - b) The other touch screen control panel shall be provided with table kits to install touch screens. Jacks shall be located throughout the room as indicated on the plans.
 - c) Provide wiring as required at each location.
 - b. Provide audio/video input locations as indicated on the drawings. Each input location shall have (1) HDMI input and (1) USB power. Provide Crestron model HD-TX-101-C-1G-E-W-T Wall Plate DM Lite Transmitter. Each location shall be provided with additional mic jack.
 - 1) In addition to the input locations on the drawings, provide inputs at the following locations:
 - a) At the main sound rack.
 - b) At the remote sound rack.
 - c) At DVD/Blue-ray players indicated above.
 - c. Provide Crestron processor model RMC4 and video switcher model HD-MD421.
 - d. Provide Crestron model HD-RX-101-C-E transmitter at projector to connect video sources.

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- e. Provide additional accessories as required to allow all inputs to be managed.
- f. Provide all additional accessories, wiring and programming as required to interface the touch screen with the following:
 - 1) Simplified control of the sound system when in 'PA' mode. The controller shall control the different inputs, etc. The controlled inputs shall include the 'PA' mics and Blu-ray player at a minimum.
 - 2) Control of the projector.
 - 3) Control of the projection screen.
 - a) Provide wiring and accessories to control the existing screen.
- g. Provide all Interface Cables and accessories necessary for a complete and operational system.

2. Video Projection System

- a. Provide one (1) Panasonic model PT-MZ16KLBU7 3LCD laser WUXGA projector with a **White** finish. Provide appropriate lens to fill the existing projection screen. The projector shall meet these minimum specifications at the time of installation.
 - 1) Resolution: WUXGA 1,920 x 1,200).
 - 2) Brightness: 16,000 ANSI lumens.
 - 3) Aspect Ratio: 16:10.
 - 4) Light source life: 20,000 hours (normal mode).
 - 5) Motorized lens shift and power zoom/focus.
 - 6) I/O Port: HDMI, DVI-D, BNC, VGA-In, 3G HD-SDI-In, RJ45, RS-232c, 12V Trigger, Wired Remote.
- b. Chief ceiling mount and pipe in required length for the projector at the indicated location. Mount projector at back wall, supporting as required to the block wall. Provide additional Extra Large Projector Security Cage, sized to fit project projector. All mounting equipment shall be provided with a **White** finish. Contractor shall ensure project will fit in security cage

2.6 INTERCONNECTIONS

- A. Provide necessary components, wiring, etc. to interconnect all sound systems with the master intercom system so that during a general page, the remote system will mute.
 - 1. Verify each space with the owner. Should the owner request that the system not be muted, the wiring shall remain in place, with the system programmed to ignore the input, so that the system can be programmed to must upon page in the future.
- B. Provide necessary components, wiring, etc. to interconnect all sound system with the Fire Alarm System so that during an alarm the remote system will mute.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with installation instructions provided by system manufacturer. Provide type of cables as shown on plans and schedules.

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- B. All wiring shall be plenum rated where required by code.
- C. Install system to comply with drawings and final shop drawings in compliance with manufacturer's printed instructions.
- D. Cable identification: shall be provided on both ends of each cable and termination with the owner's room number and the wiring block or device to which it is connected. Tags shall be permanent and neat.
- E. Furnish and install necessary conduit, raceways, pull boxes, outlet boxes and wire to provide a complete system or systems as herein specified. All wiring shall be tested for continuity and freedom of all grounds and short circuits.
- F. Each cable run between the amplifiers and remote locations shall be one continuous cable.
- G. The Contractor shall use the types of wire recommended by the Sound Equipment Manufacturer. However, the size and quality shall not be less than that previously specified or indicated on the drawings. If cross talk, appreciable loss of volume or distortion occurs after installation has been completed, it shall be the mutual responsibility of the Contractor and Manufacturer to correct any such condition without cost to the owner. The Contractor in no case shall use the type of wire which he merely assumes to be the best. This recommendation shall be from the equipment manufacturer.
- H. Remote Reinforcement Sound System loudspeakers shall be connected to their local amplifiers with minimum 12awg cable when low impedance (4 or 8 ohms) and minimum 16awg cable when high impedance (70 volt line).
- I. The central control console shall be provided with a 10AWG ground wire to earth ground. Conduit ground shall not be acceptable for this purpose.
- J. All microphone wiring shall be No. 22 AWG twisted pair stranded with aluminum shield of 100% coverage and rubber or vinyl plastic jacket. Capacitance between conductors shall not exceed 30 mmf per foot. All microphone wiring shall be run in conduit with no other wiring.
- K. Provide necessary connections to the intercommunications system to must the local sound system during a page.
- L. Install remote antennas for the AM/FM tuners on the roof per manufacturer's recommendations.
- M. Install all remote antennas for assistive listening and wireless microphones as required, per manufacturer's recommendations in the spaces for fully functioning systems.

3.2 SUPERVISION

- A. Installation of these systems shall be supervised by a factory trained representative who shall accompany the Owner's representative on an inspection of the entire system and shall demonstrate the entire systems performance.
- B. A complete operational test of the entire system shall be performed to demonstrate proper system function in accordance with the specified requirements. Correct any malfunctions within the system where necessary.
- C. All remote sound reinforcement systems shall be tuned by a qualified technician. The technician shall provide printed documentation of all system settings and raw and final system equalization settings as determined by real time analyzer from a minimum of 3 averaged locations in each space. Provide reports in close-out documentation.

3.3 DEMONSTRATION AND TRAINING

- A. Once system is operational, provide a complete demonstration of the entire system to the owner showing the usage of all components of the system to allow acceptance of the system by the Owner.
- B. Upon acceptance of the system by the Owner, arrangements shall be made to provide a minimum of eight (8) hours of training for each system for the Owner's representatives in proper and full potential operation of the system. The training session shall be scheduled through the Electrical Contractor, Construction Manager, Electrical Engineer, and Architect.
- C. Provide three (3) complete sets of bound operating instructions including circuit diagrams, part numbers, names, addresses and telephone numbers of parts and equipment sources.

3.4 COMMISSIONING

- A. Once the system is installed and functioning, the installer shall set up a meeting with the owner and contractor to tune each of the specified systems. The installer shall account for a minimum of four hours to spend in each space.
- B. Provide additional commissioning as follows:
 - 1. Approximately 6-9 months after substantial completion, the installer shall contact the owner to set up a meeting. This meeting shall be used to "re-tune" the system by moving speakers, aiming the speakers and/or reprogramming the mixers to the owner's satisfaction. The installer shall also review any training that may have previously occurred if required by the owner. The installer shall account for a minimum of four (4) hours to spend in each space.
 - 2. Approximately 12 months after substantial completion, the installer shall contact the owner to set up a final meeting. This meeting shall be used for any final program changes as well as additional training. The installer shall account for a minimum of four (4) hours to spend in total.

END OF SECTION 27 51 25