

Request for Bids

For

2019 Raytown South Middle Large Practice Room Audio Equipment Purchase

Raytown Quality Schools

Raytown, Missouri

November 8, 2019

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Raytown Quality Schools is seeking sealed bids for audio equipment to satisfy New Raytown South Middle Large Practice Room requirements.

Sealed bid should be submitted in the form of two-sealed copies with title “**2019 Raytown South Middle Large Practice Room Audio**” – (1) marked “Original”, (1) marked “Copy”. Original sealed submission to include an electronic copy of bid. All submissions must be received at the address above by the date and time listed. Attendance at bid opening is not required.

All documents will be considered the property of Raytown Quality Schools. The request for proposal does not commit the District to any specific course of action.

School District:

Raytown Quality Schools
6608 Raytown Road
Raytown, Missouri 64133

District Contact:

Bryan Casey, Systems Administrator
Raytown Quality Schools
10750 E. 350 Highway
Raytown, Missouri 64138
816-268-7120
bryan.casey@raytownschools.org

Submit Sealed Proposal:

December 6, 2019 – 1:30 PM

Melissa Tebbenkamp, Director of Technology
Raytown Quality Schools
10750 E. 350 Highway
Raytown, Missouri 64138

A formal opening will take place at this time. Attendance is NOT required.

Overview

Raytown Quality Schools ("District, RQS") requests sealed bids from interested vendors ("Provider", "Contractor", "Vendor") for the purpose of acting as an authorized vendor and Installer of Audio equipment purchases as listed in Appendix A through July 1, 2020.

Providers submitting multiple solutions should provide each as a separate complete proposal. The Bid Submitted By signature page shall be completed and submitted with each Provider's proposal.

Proposal Due Date and Time

In order to be considered, two (2) sealed copies (8 ½ x 11" paper 3-hole punched, tab separated by section in a 3-ring binder) of the proposal, one marked as "Original", one marked as "Copy", must be received by Raytown Quality Schools at the address stated by the following date and time:

December 6, 2019, 1:30 PM

District Terms

Vendor Requirements

1. Vendor bids shall conform to the requirements listed in this RFB.
2. The selected vendor shall have the responsibility to ensure that the products that are delivered to the District match the bid and the specifications listed on the Purchase Order.
3. The vendor shall have responsibility for any damage incurred during transit.
4. The selected vendor shall not increase the pricing listed in this RFB through March 31, 2020, with exception given to Top Seller products bid. If vendor sources reduce pricing, it is expected that this price reduction be passed on to the District.
5. The vendor must provide assurance that items ordered will be received within two weeks of purchase order release.
6. Vendor must provide shipping information and projected delivery dates for all orders placed. Tracking information will be required in advance of delivery, as soon as possible to accommodate District warehousing requirements.
7. The vendor should accommodate invoice billing, allowing the district to call, fax or email in an order without a generated PO.

Vendors may withdraw their bids at any time prior to the closing for receipt of the bids. If withdrawing, notify Melissa Tebbenkamp, in writing (or email), as soon as possible. New bids received after the closing date shall not be considered.

Delivery

1. All materials and equipment quoted shall be delivered as agreed upon and directed by the Raytown Quality Schools Technology Support Services department.
2. All services provided shall be conducted as agreed upon and directed by the Raytown Quality Schools Technology Support Services department. No service shall be conducted prior to authorization.
3. The selected provider shall have the responsibility to ensure that the products that are delivered to the District match the bid and the specifications listed on the Purchase Order.

4. During the time between delivery and acceptance, Raytown Quality Schools cannot be held liable for any damages to or theft of any components. It will, therefore, be the responsibility of the provider to obtain insurance against loss, theft and damage.
5. The provider shall deliver the products directly to the building(s) specified. District shall notify the chosen provider as to the location.
6. Raytown Quality Schools does not allow smoking or the use of any tobacco products within its facilities or any Raytown Quality Schools grounds. This applies to contractors and sub-contractors and their employees as well as Raytown Quality Schools personnel.

District's Responsibilities Regarding Service Requirements

1. Provider must identify the exact tasks and/or equipment requirements that Raytown Quality Schools must satisfy and/or be responsible for in regards to service and delivery of equipment.

Subcontractors

Subcontracting of any services requested under this RFB is prohibited, unless those services requested exceed the scope of this proposal and are required to effect timely completion of requested service and are agreed to by the District in advance of service initiation and start of work.

Proposal Requirements

1. Purchasing and payments shall be in accordance with Board policy DJF as outlined in administrative procedure DJF-AP1. This procedure can be found on the District website.
2. Proposals will be date and time stamped upon receipt by the Raytown Quality Schools.
3. The District will select the lowest or best bid. The District reserves the right to design the evaluation criteria to be used in selecting the best bid, including, but not limited to: price, value, quality of product, history of performance, recommendations and other qualities important to the district.
4. The District reserves the right to waive minor technical defects in a bid, reject any and all bids, reject any part of a bid, advertise for new bids, or make the purchase on the open market if the product or service can be obtained at a better price.
5. The District reserves the right to provide the final contract for mutual consideration and agreement.
6. If the scope of the purchase changes substantially, the district will rebid the product or service unless otherwise provided in this procedure.
7. The Raytown School District reserves the right to separate, accept, or eliminate any item(s) listed under the Request for Proposal that it deems necessary to accommodate budgetary and/or operational requirements.
8. The District also reserves the right to not select any vendor or purchase any goods and services resulting from this Request for Bid.
9. If the District elects to reduce the number of items from your original bid, please state your pricing conditions. Also it is expected that prices quoted in the response to this RFB not increase if additional product is purchased through July 1, 2020, with exception given to Top Seller products bid.
10. Any bid may be withdrawn prior to the scheduled time for the opening of bids. Any bid received after the time and date specified shall not be considered.
11. Contractor proposals shall conform to the requirements listed in this RFB, any amendments thereto, agreed upon documented exceptions and schedules, and the final contract.
12. If the contractor takes exception to any of the requirements, describe the exception and give the details of any alternative offered. The School District shall judge the acceptability of any such alternatives.

13. Should any differences arise as to the meaning or intent of specifications in this document and amendments thereto, the School District's decision shall be final and conclusive.
14. Federal and State laws, Local ordinances and Board policies apply to contracted services. No portion of any master service agreement or contract may defy these laws, ordinances, and policies. Any such portion of a master service agreement or contract that does defy these laws, ordinances, and policies will be considered null and void.

Payment and Retainage

The District is exempt from sales tax and use taxes. Taxes shall not be listed in a bid/proposal/quote or on invoices. A copy of the letter exempting the District from paying these taxes is available from the District upon request by the contractor/provider.

A payment schedule shall be decided on with the chosen contractor/provider. Said schedule shall be part of the contract between the contractor/provider and District. There shall be no hidden costs associated with this proposal. If the contractor/provider foresees any additional or unexpected costs or charges to be made, these charges need to be explained in the proposal.

Purchasing and payments shall be in accordance with Board policy DJF as outlined in administrative procedure DJF-AP1. This procedure can be found on the District website.

There shall be no hidden costs associated with district orders. If you foresee any additional or unexpected costs or charges to be made, these need to be explained in your bid.

Selection Process and Minimum Requirements

Each company must meet the following minimum qualifications (company may not use sub-contractors to fulfill any obligations within its contract).

- Contractor shall conform to the requirements listed in this request.
- The selected contractor(s) shall assign a project manager/point of contact to this project. This person shall become the central contact person for the contractor once the project begins.
- The selected contractor shall have the responsibility to ensure that the products that are delivered to District match the request and the specifications listed.
- If the contractor source reduces pricing, it is expected that this price reduction be passed on to the School District.
- Contractor must provide seven (7) total references.

Required Proposal Format and Content

Two bound copies should be submitted on 8 1/2" by 11" paper, with consecutive page numbers. Please mark one copy as "original" and one as "copy". The proposal should contain the following sections in the order presented below. Proposals that do not include these sections may be considered non-responsive and as such may not be considered.

- Proposal Cover Sheet
- Bid Acknowledgement and Exceptions
- Letter of Interest

- Profile and Experience
- Staff
- Project Budget
- Additional Requirements
- Litigation
- References
- Signature Page

Section 1: Proposal Cover Sheet

Fill out completely the Bid Cover Sheet which is the last page of this document. Place said cover sheet as the first page of the proposal that has been prepared for consideration.

Section 2: Bid Acknowledgement and Exceptions

The Contractor shall acknowledge compliance with the requirements listed in this RFB and any amendments thereto. If the contractor takes exception to any of the requirements, describe the exception and give the details of any alternative offered. The School District shall judge the acceptability of any such alternatives.

Section 3: Letter of Interest

The proposal should be introduced with a letter of interest that includes a synopsis of the company's services and highlight the capacity to perform the work. The letter should be signed by the individual with contract signature authority for the company.

Section 4: Profile and Experience

Outline company history, scope of services offered, size of the vendor, and location. Give additional detail that the company feels may elaborate on profile and experience. List out in a matrix format experience.

Section 5: Staff

List the experience and qualifications of any staff that will be assigned to the project. Name the person who will fill the role of Project Manager/Sales Manager. Note any additional personnel that will be responsible for onsite activities once the project begins.

Section 6: Project Budget

1. Complete in its entirety, the price table provided in this RFB (Specifications: South Middle Large Practice Room Pricing Table). Explain any blank areas. Submit the company's total project budget to fulfill the requirements of this bid. The proposed budget response shall be listed in the same format and order as provided below.
2. Vendors should complete the attached pricing sheet and also include information on how prices will be calculated for items not on the sheet in the **COMMENT** section below. The items selected for the pricing sheet reflect anticipated purchase volumes for the 2019-2020 school year.
3. The unit price should reflect the price the district should expect to pay if a single unit is purchased. If a discount or price savings is offered for larger quantities in an order, or if purchased within a specific time frame (i.e. end of March 2020), describe the discount/savings and conditions in the **COMMENT** section below.

4. Bids must identify all costs as presented in the pricing table. Note if 3-year warranty is not included with purchase of part number.
5. Product/part number alternatives are allowed only if audio / network specifications are met or exceeded. Additionally, alternatives will be required if part numbers listed are approaching “end-of-life.” (Within the next 6-months).
6. Pricing should be guaranteed through July 1, 2020, with exception given to Top Seller products bid. The below quantities represent the desired order, but, any minimum order or further quantity discount should be listed.
7. Vendors should outline process for return, for instances where defective or “DOA” items have been received, giving details of how credits are made and what restrictions are placed on returns in the **COMMENT** section below.
8. The vendor must provide assurance that items ordered will be received within two weeks of purchase order release. Please state expected delivery time in the **COMMENT** section below.

Specifications: South Middle Large Practice Room Audio Pricing Table

Quantity	Part#	Description	List Price	Discount%	Item Cost	Total
Sound Systems / Cable and Connectors / Equipment Racks, Cabinets, and Accessories / AC Power / Installation – See Appendix A and B for specific equipment listing and Maps.						

COMMENT (Specifications: Audio / Cable / Equipment / Power Pricing Table):

Section 7: Additional Requirements

Provider must provide the following information:

- The Service Level Agreement (SLA) for your proposal.
- Indicate any options available.
- Trouble reporting and escalation procedures (DOA equipment).
- Hours of operation for help or trouble reporting.
- Describe maintenance and trouble notification procedures.
- Please show applicable discounts separately, if any will be included.

Section 8: Litigation History

Provider must state whether they have been involved in any litigation during the last five years, and if so, describe the litigation.

Section 9: References

Two financial references must be provided from either financial institutions or suppliers using the format below.

Reference	Contact Name	Phone Number
1.		
2.		

Five project references must be provided of which three must be entities where you have provided comparable projects (overlaps acceptable). These projects must have been engaged during the last two years. These references must be for services provided by the proposing company, not by individuals within the company who may have worked on projects while at another company. The Project Scope must include the quantity of product provided, level of service provided and if OEM or Remanufactured product is purchased. Use the format below. Reference contact information must be current and include working phone numbers.

Reference Organization	Contact Name	Phone Number	Project Scope:	Project Completion Date
1.				
2.				
3.				
4.				
5.				

Requests for Information

Any questions about the Request for Bid process must be received in writing by November 1, 2019.

Scope of Services

Services will include but not necessarily be limited to the below services:

- Sale of Shure, Sennheiser, Ashley Audio, Crown, JBL, Beldon, Neutrik, Cowell, Atlas Sound, Audio-Technica
- Installation & Warranty of hardware/components/materials required in the Audio / Cabling / AC Power / Rack table

Bid Submitted By

Company Name

Authorized Name/Title (printed)

Authorized Signature

Contact Person for the Bid/Quote/Proposal process

Date

Telephone

Fax

Email

Appendix A

SECTION 1 – Sound Systems

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This section pertains to the sound system to be furnished and installed in Raytown South Middle School Large Practice Room.
- B. It is the purpose of this specification to require the furnishing of highest quality materials, equipment, and workmanship. The work shall be in accordance with this specification and in conformity with the designs, layouts, and descriptions shown on the drawings.
- C. Any and all structural, mounting, or rigging details on the drawings are shown for concept only. It shall be the responsibility of the Systems Contractor to employ the services of a qualified Structural Engineer to be responsible for the design of the details to be employed. Stamped shop drawings and calculations of all such details shall be submitted to the Architect for review.
- D. Unless noted otherwise on the drawings, the work shall include everything necessary or incidental to complete the installation EXCEPT wire raceway (including conduit), raceway fittings, outlet boxes, pull boxes, terminal cabinets, 120 volt AC power circuits, and insulated ground cables. Such excluded equipment shall be furnished and installed by the project Electrical Contractor. The Systems Contractor shall furnish all necessary information to the Electrical Contractor to ensure that a proper audio conduit system will be installed.
- E. The Systems Contractor shall cooperate with all other contractors engaged in this project and shall coordinate the installation of the sound systems so that all work will proceed in a manner which is in the best interests of the Owner.

1.2 EXISTING CONDITIONS

- A. This facility is an existing structure being renovated and added on to. It shall be the responsibility of each bidder to verify all conditions and dimensions which pertain to this work.

1.3 DEFINITION OF TERMS

- A. The term "Owner" shall refer to Raytown Quality Schools; 6608 Raytown Road; Raytown, MO 64133; phone (816) 268-7000.
- B. The term "Architect" shall refer to Hollis+Miller Architects; 1828 Walnut St #922; Kansas City, MO 64108; phone (816) 442-7700.
- C. The term "Acoustical Consultant" shall refer to AVANT ACOUSTICS, LLC; 14827 W. 95th Street; Lenexa, KS 66215; phone (913) 888-9111; facsimile (913) 888-9193.
- D. The term "Systems Contractor" shall refer to the person, persons, or company who or which contracts for the performance of the sound system work specified herein.

1.4 CONTRACTOR QUALIFICATIONS

- A. The Systems Contractor must be a "Systems Contractor" who regularly engages in the furnishing and installation of commercial and industrial sound systems.

1. The Systems Contractor shall have completed at least three (3) projects in the last five (5) years of similar

size and scope.

- B. The Systems Contractor must maintain a suitably staffed and equipped service organization and must regularly offer maintenance services for systems of this type and size.
- C. The Systems Contractor shall be able to respond to on-site maintenance service requests within 24 hours during the warranty period described in section 3.07 System Warranty and Maintenance at the end of these specifications.
- D. As part of the bid submittal, Systems Contractor shall submit appropriate information to demonstrate to the satisfaction of the Owner, Architect, and Acoustical Consultant that the Systems Contractor has
 - 1. Completed similar projects as described above;
 - 2. Adequate plant and equipment to pursue the work properly and expeditiously;
 - 3. Ability to provide maintenance visits in the time window described above;
 - 4. Adequate staff with the required technical experience;
 - 5. Suitable financial status to meet the obligations of the work.
- E. Any other contractor, who intends to bid on this work as the prime contractor and does not otherwise meet the requirements of the "Contractor Qualifications" paragraph(s) above, shall employ the services of a "Systems Contractor" who does meet the requirements noted above and who shall furnish the audio and video equipment; shop fabricate the equipment racks and subassemblies; make all audio, video and control connections to equipment and equipment racks in the AV equipment room; make all connections to remote mixer controls and microphone connection panels; and continuously supervise the installation and connections of all sound system cable and equipment.
- F. A subcontractor so employed as the "Systems Contractor" must be acceptable to the Architect and the Acoustical Consultant and shall be identified on the Bid Proposal Form.

1.5 SUBMITTALS

- A. The Systems Contractor shall submit a minimum of four (4) suitably bound sets, or electronic documents, of the following Shop Drawings per the schedule listed below for review by the Architect and the Acoustical Consultant. Refer to the General and Special Conditions for additional set(s) which may be required.
 - 1. Prior to proceeding with the work
 - a. A complete list of ALL equipment and materials which are to be furnished. Accompanying the list shall be equipment quantities and manufacturers' specification or cut sheets for all sound system equipment (e.g. microphones, audio program source equipment, power amplifiers, loudspeakers), audio-visual equipment (e.g. projectors, program source equipment, monitors, video processing equipment), AV control equipment (e.g. touchpanels, system controllers, interface/control cards), and any other MAJOR items of equipment.
 - 2. Prior to proceeding with respective portions of work
 - a. Artwork, drawings, and listings indicating proposed nameplate nomenclature and arrangements for control panels, patch panels, connection plates, floor boxes and nameplates prior to fabrication as described elsewhere in these specifications.
 - b. Details of proposed loudspeaker suspension including attachment methods, weights, and suspension locations approved by the Systems Contractor's Structural Engineer.
 - c. Details showing projector/television/plasma display mounting.
 - d. Front panel layouts for all equipment racks and AV lecterns, prior to installation, reflecting equipment and labels to be used.
 - e. Mounting schemes for all external input/output transformers, potentiometers, and control switches.
 - f. Diagrams for AC power low voltage control switching, indicating distribution and sequencing of AC circuits for both on and off cycles.
 - g. Control system layout.
 - h. Custom furniture and/or custom millwork.
 - i. Details and descriptions of any other aspect of the sound system which must differ from the drawings due to field conditions or due to the selected equipment to be furnished.

3. As otherwise noted on the drawings and/or as noted herein.
- B. Approved shop drawings and equipment instruction brochures, including schematic diagrams for all amplifiers and other electronic devices, shall be present at the job site during the period set aside for final system test and equalization.
- C. Notebooks of operating instructions shall be prepared as described elsewhere in the specifications.

PART 2 - PRODUCTS

2.1 GENERAL

- A. It is the intention of these specifications to provide a complete and properly operating sound system. The major items of equipment shall be furnished in the quantity indicated by the sound system diagrams on the drawings or in the quantity as specified herein. (Refer to the Portable Equipment Quantity list at the end of the specifications.) However, any minor item of equipment or hardware that may not be specifically shown on the drawings or specified herein but required for proper sound system operation or installation shall be furnished by the Systems Contractor.
- B. All equipment and material shall be new and shall be suitable for continuous operation.
- C. The latest version of all specified equipment shall be furnished by the Systems Contractor.
- D. In any case, where a specific specification has not been included herein or shown on the drawings for any item that is required, the Systems Contractor shall furnish only the best quality equipment or material consistent with the quality of other specified equipment and material.
- E. Where the specifications list several manufacturers for a particular major item of equipment such as power amplifiers or loudspeakers, the Systems Contractor shall supply all of that item of equipment from one manufacturer.

2.2 SUBSTITUTIONS

- A. Where a specific piece of equipment has been discontinued and/or replaced by a new model, submission of the new model or a suitable item as applicable may be required by the Acoustical Consultant for evaluation prior to acceptance.
- B. If substitute equipment is allowed by written consent, the Systems Contractor shall be completely responsible for the use of such equipment. The Systems Contractor shall replace all such equipment with equipment listed by type number in the specifications if there is any evidence of equipment instability or unsuitability.
- C. Costs of any required evaluation and testing of substitute equipment shall be paid by the Systems Contractor.
- D. Any use of substitute equipment shall be at no extra cost to the Owner.
- E. Proposed substitute equipment shall be specifically noted in submittals as "substitution" with a footnote stating the reason for the substitution.
- F. Offerors proposing to furnish an "or equal" product must furnish all descriptive material necessary to demonstrate the acceptability of such product. The Acoustical Consultant shall be the sole determiner as to whether the proposed "or equal" product is suitable for use in work based upon review of the descriptive materials furnished.

2.3 SYSTEM DESCRIPTIONS AND SUMMARIES

A. Large Practice Room

1. The Large Practice Room will include an audio playback system for supporting practice and rehearsal.
2. Two (2) two-way, full-range loudspeakers will be wall-mounted in the room in a stereo configuration for audio playback.
3. An audio input connection will be installed at the front of the room to allow for playback from personal audio devices such as laptops or phones.
4. An audio input will be installed at the room projector (by others) for audio playback from the in-room AV system.
5. Audio levels for the system will be controllable over the building network via a mobile device app or a computer application.
6. All rack-mounted equipment, including the power amplifiers and recording devices, will be installed in the same equipment rack as the Band Room.

2.4 SOUND SYSTEMS

A. Microphones

1. Hanging Microphone, condenser cardioid, 30-foot cable, with 1-gang plate power module, with connector to mate with the power module and mounting accessories as required.
 - a. Shure Microflex MX202BP/C, color as indicated on the drawings.
2. Wireless Microphone System, UHF, true diversity operation, with bodypack transmitter, no gain control on the outside of the case, metal body, with LCD information screen, IR sync, with black lapel microphone with 4-foot cable, with rack mount kit, and with power supply as required.
 - a. Audio-Technica 3000 Series units listed below; or
 - 1) ATW-R3210 receiver.
 - 2) ATW-T3201 body-pack transmitter.
 - 3) AT831cH cardioid lapel microphone.
 - 4) Provide two sets of alkaline batteries with each wireless microphone transmitter furnished.
 - b. Sennheiser ew100 G4 Series units listed below in Band-A:
 - 1) EM 100 G4 receiver.
 - 2) SK 100 G4 belt-pack transmitter.
 - 3) ME 2 lapel microphone.
 - 4) Provide two sets of alkaline batteries with each wireless microphone transmitter furnished.

- c. For all wireless microphones listed above, furnish and install manufacturer's remote antennas with coaxial cable as required for permanently mounted receivers. Provide a different operating frequency for each wireless microphone transmitter/receiver pair, free from interference, in the UHF Band on an unused channel per FCC regulations. Assist the Owner in licensing these transmitter(s) as required.

B. Microphone Accessories

1. Cable strap, Velcro type, with length as required for securing cable.
 - a. Hosa Center-Pass Gap Velcro Cable Organizer; or
 - b. KAJO Company CTB series; or
 - c. Velcro One-Wrap straps.

C. Audio Source Equipment

1. Audio Input Device, with stereo analog inputs on RCA and 3.5mm TRS connectors, with passive transformer balanced stereo output with mono summing option, and with level control knob.
 - a. Radial SB-5W; or
 - b. Approved equal.
2. Audio Recorder, with balanced XLR output connectors, recording to USB, and memory card media, compatible with WAV and mp3 file formats, rack mount, with network control app.
 - a. Tascam SS-CDR250N.

D. Audio Processing Equipment

1. Digital Signal Processor (DSP), multiple balanced switchable mic/line level inputs and outputs as shown on the drawings, with drag and drop type software configurable processing enabling parametric broadband and narrowband filters, audio delays, gain control, and mixing of audio signals, with multiple configurable logic inputs and outputs, fixed I/O architecture, with multiple configurable logic connections; with Dante or AES67 digital audio compatibility, ability to store program on DSP and connected computer, ability to download stored and current programming from DSP, manufacturer's programming shall allow manipulation of signal processing entities by use of computer keyboard without mouse.
 - a. QSC Q-SYS Core 110f with UCI license compatible with Control Touchpanel below.
 - b. As part of the final system tests and equalization services, the Acoustical Consultant will provide initial digital signal processor files to the AV Contractor.
 - 1) Microphone equalization.
 - 2) Audio routing and mixing.
 - 3) Loudspeaker equalization.
 - 4) ON/OFF presets including standby mode triggering of the power amplifiers.
2. Control Touchpanel, rack-mounted, nominal 5" diagonal touchscreen, black, PoE compatible, compatible with Digital Signal Processor specified.
 - a. QSC TSC-55w-G2, mounted to blank rack panel.
 - b. The following programming functions will be provided as part of the touchpanel interface:
 - 1) System ON/OFF (standby mode triggering of the power amplifiers).
 - 2) Audio level control for both the Band Room and the Practice Room.

E. Power Amplifiers

1. Power Amplifier, 2 channels at 300 watts per channel at 8 ohms, maximum 20A mains connector, with self-protection for shorted circuits and current limiting, with rackears.
 - a. Ashly Audio nX 4002; or
 - b. Crown DCi 2|300.
2. Audio input connections to all power amplifiers shall be made with 3-pin microphone type connectors, with spade lugs on barrier terminal strips, or with screw actuated pressure type terminal strips. Audio output connections to all power amplifiers shall be made with spade lugs on barrier strips, with double banana plugs, or with Neutrik "SpeakON" type connectors. Connections with ¼-inch phone plugs will not be permitted.

F. Loudspeakers and Accessories

1. Two-Way Loudspeaker, with dual 8-inch low frequency drivers and high frequency compression driver, with internal rigging points, 90 dB 1W/1m sensitivity @ 1kHz, 100W RMS power rating, nominal 8 ohms, nominal 90x60 coverage pattern, nominal -6dB frequency response of 90Hz-16kHz, with mounting hardware as required, white in color, with integral transformer.
 - a. Community V2-28W or V2-28WT where a transformer is indicated; or
 - b. JBL AC28/95-WH, with outboard 100W 70V transformer where indicated; or
 - c. Loudspeaker and mounting hardware color shall be white.
 - d. Provide mounting hardware as required to mount the loudspeakers in the locations shown on the drawings.
 - e. Rotate horn as required.
2. Only the latest versions of the loudspeakers in the above paragraphs shall be furnished. The manufacturer and Systems Contractor shall ascertain that each loudspeaker furnished does not "squawk" or "rattle" when energized with one-third octave bands of pink noise at a nominal input power of two watts.

G. Audio Accessories

1. Line Level Extension Cable, factory fabricated units using Neutrik connectors from Horizon, ProCo, Whirlwind, or Wireworks; black flexible cable.
 - a. Type 1, 1/8-inch stereo phone plug to dual RCA phono plugs, 12 feet.
 - b. Type 2, 1/8-inch stereo phone plug to 1/8-inch stereo phone plug, 12 feet.
2. Balancing Transformer, unbalanced stereo to balanced stereo.
 - a. RDL TX-J2 (two required where stereo outputs shown); or
 - b. Approved equal.

H. Software Applications

1. Assist the Owner with installation and setup of Tascam SS250 Control software/app on an Owner furnished computer(s) and mobile device(s).
2. Assist the Owner with installation and setup of QSC UCI Viewer/Q-SYS Control app on an Owner furnished computer(s) and mobile device(s).

2.5 CABLE AND CONNECTORS

A. All cabling is to be plenum-rated.

B. Audio Cable

1. Microphone, intercom, and line-level audio circuits, where installed exposed in spaces which are used as return air plenums; #22 AWG, 2-conductor, stranded, aluminum polyester shielded.
 - a. Belden 9451P; or
 - b. Covid CSP 3200 22; or
 - c. Extron STP22P; or
 - d. Liberty 22-2C-PSH-WHT; or
 - e. Gepco IP222AL; or
 - f. West Penn 25291; or
 - g. Windy City Wire 994320-11S; or
 - h. Approved equal.
2. Loudspeaker circuits, where installed exposed above ceilings in spaces which are used as return air plenums; 2-conductor, stranded, unshielded.
 - a. #18 AWG
 - 1) Belden 6300UE; or
 - 2) Covid CVA 3200 18; or
 - 3) Extron SPK18P; or
 - 4) Gepco IP182BA7; or
 - 5) West Penn 25224; or

- 6) Windy City Wire 992360-11S; or
 - 7) Approved equal.
 - b. #16 AWG
 - 1) Belden 6200UE; or
 - 2) Covid CVA 3200 16; or
 - 3) Extron SPK16P; or
 - 4) Gepco IP162BA19; or
 - 5) West Penn 25225; or
 - 6) Windy City Wire 991360-S; or
 - 7) Approved equal.
 - c. #14 AWG
 - 1) Belden 6100UE; or
 - 2) Covid CVA 3200 14; or
 - 3) Extron SPK14P; or
 - 4) Gepco IP142BA19; or
 - 5) West Penn 25226; or
 - 6) Windy City Wire 997960-S; or
 - 7) Approved equal.
 - d. #12 AWG, 2-conductors
 - 1) Belden 6000UE; or
 - 2) Approved equal.
 - e. 10 AWG, 2-conductors
 - 1) Belden 6T00UE; or
 - 2) Approved equal.
3. RF hearing assistance transmitter antenna cable, when antenna is remotely mounted, if length is less than 50 feet, and UHF wireless microphone receiver antenna cable when antenna is remotely mounted, if length is less than 25 feet, RG58/U 50ohm coaxial, plenum rated.
- a. Belden 82240; or
 - b. Windy City Wire RG8P; or
 - c. Approved equal.
4. RF hearing assistance transmitter antenna cable when antenna is remotely mounted and length is greater than 50 feet, and UHF wireless microphone receiver antenna cable when antenna is remotely mounted and length is greater than 25 feet, polyfoam type RG8/U 50 ohm coaxial, plenum rated.
- a. Belden 7733A; or
 - b. Approved equal.

C. Data Communication Cable

- 1. Category 6 UTP Patch Cable, length as required, for digital audio, video, and data network connections.
 - a. Belden 10GX UTP CMP; or
 - b. Approved equal.
 - c. All cable shall be yellow in color.
 - d. Factory-made and certified Category 6 cable shall be used for all UTP patch cables installed within equipment racks. No field-fabricated patch cables shall be used.

D. Audio Connectors

- 1. XLR cable connectors, metal shell with strain relief, with solder cups.
 - a. Neutrik X series; or
 - b. Switchcraft AAA Series.
- 2. XLR receptacles, metal, with solder cups. Panel mounting receptacles shall be square in shape, except as noted.
 - a. Neutrik DLX series; or
 - b. Switchcraft E Series.
- 3. Phono RCA connectors, cable mounting, metal shell, with solder cups.
 - a. Canare; or
 - b. Rean; or
 - c. Switchcraft.

4. Phono RCA receptacles, metal shell, insulated from panel.
 - a. Canare; or
 - b. Rean; or
 - c. Switchcraft.
5. Loudspeaker Connectors, number of conductors as required, twist-lock action, panel or cable mounting.
 - a. Neutrik SpeakON series; or
 - b. Switchcraft HPC series.

2.6 EQUIPMENT RACKS, CABINETS, AND ACCESSORIES

A. Equipment Racks and Cabinets

1. Wall-Mounted Equipment Rack, wall mounted swing-out rack, with top knockouts for exhaust fans, with locking perforated front door.
 - a. Lowell LWSR series with LFD series front door; or
 - b. Middle Atlantic DWR series LVFD series front door.
 - c. Furnish and install exhaust fans in top of rack rated at a total of 50cfm.
2. Exhaust Fan, with rigid screen guard, 120V operation; with mounting hardware and power supply as required to mount fans in the top of each Equipment Rack with rubber grommets or other vibration isolation mounts.
 - a. Chief Raxxess FAN/QUIET series; or
 - b. Lowell FW Series; or
 - c. Middle Atlantic QFAN series; or
 - d. Approved equal.
3. All racks shall be keyed alike if possible. Furnish three sets of rack keys to be turned over to the Owner.
4. All standard sized rack panels used to mount controls or connectors shall have formed edges. Rack panel mounting screws shall be as short as practical for equipment to be mounted (Middle Atlantic HPQ or similar).
5. Any rack front panel details shown on the drawings are for concept only. Shop drawings are required indicating the exact equipment to be furnished. The exact size (larger or taller racks) and quantity of equipment racks is to be determined by the Systems Contractor based upon the exact equipment to be furnished. Verify all audio equipment room dimensions and conditions.
6. Except as noted on the drawings, include a 1RU panel at the top of one equipment rack engraved with the logo and contact information of the Acoustical Consultant and the Systems Contractor as shown on the drawings.
7. Except as noted on the drawings, allow 1¾-inch blank panel space at the top of each rack, minimum 3½-inch vent panel space at the bottom of each rack, and ventilation space (vent panels) between all equipment. Fill any empty rack space that is not near equipment with blank panels. Except as noted on the drawings or for mounting switches or LED indicators, blank panels shall not be used between equipment.
8. Where applicable, install a brush grommet panel directly above equipment such as an Ethernet Switch to allow cables to pass from the back of the equipment rack to the front panel of equipment (Middle Atlantic BR1 or similar).
9. Where applicable, mount small components behind vent panels on sub-chassis shelves or component panels (BUD CB series chassis or similar). Mount components with connections visible from rear of equipment rack using barrier strip terminal blocks for connections.
10. The following guidelines concerning equipment rack layouts shall be followed unless otherwise noted on the drawings. Submit shop drawings illustrating proposed equipment rack layouts, indicating equipment labels
 - a. Equipment Rack Layouts shall be grouped according to function; audio, network, and control.
 - b. Heavy equipment such as audio amplifiers and large video matrix switches shall be placed near the bottom of equipment racks.
 - c. Control equipment shall be located near the top of equipment racks.

- d. Equipment that requires operator interface (e.g. sound reinforcement system AC power pushbuttons, sound reinforcement system mode select switches, power amplifier monitor/test system, monitor loudspeaker, computer monitor and keyboard, patch panels, audio mixers, program source and/or audio-visual equipment) shall be installed in one or adjacent equipment racks. Operator interface equipment shall also be installed at heights that permit ease of operation and viewing. Such equipment shall be placed in equipment rack(s) closest to the audio equipment room entrance.
11. Furnish small clip-on or magnetic reflector type portable work light with 60-watt bulb in each equipment rack.

B. Hardware and Accessories

1. Type 1 Barrier Strip, for termination of audio circuits in equipment rack
 - a. TRW-CINCH 140 series; or approved equal.
2. Type 2 Barrier Strip, high density, for termination of loudspeaker circuit in junction box
 - a. Phoenix Contact High Density UK series; or approved equal.
3. Spade Tongue Terminal, brazed seam, uninsulated type only.

2.7 AC POWER

- A. Furnish an isolation transformer for the Auditorium Sound Reinforcement System as shown on the drawings. Coordinate with the project Electrical Contractor for service.
- B. Furnish modular or rack mounted power distribution in each rack as indicated on the drawings. Each rack shall have at least four spare always-on receptacles. Furnish additional power distribution equipment as required for all equipment racks for accessories and minor equipment.
- C. Furnish power conditioning and surge suppression for all major video, audio, and network equipment not served by a UPS.
- D. Sequencing control of AC power for all the sound system components (excluding projectors and flat panel displays) not connected to a UPS shall be provided through the control system. Configure the control system such that equipment turns on in the following order:
 1. Audio and Video Source Equipment.
 2. Audio Mixers and other miscellaneous equipment.
 3. Audio Amplifiers.
 4. Adjust the sequencing time so that all equipment startup cycles are complete before the next AC power circuit is energized.
 5. Power off sequencing shall occur in reverse order.
- E. Connect power amplifiers to 120V 20A AC power circuits so that maximum rated input power can be delivered to each power amplifier without exceeding the power handling capacity of any AC power circuit.
- F. Any power distribution details shown on the drawings are for concept only. Shop drawings are required indicating the exact equipment to be furnished by the Systems Contractor.

G. AC Power Equipment

1. Power Conditioner, 15A, rack mount, with unswitched front panel convenience outlet, with surge suppression and power conditioning.
 - a. Atlas Sound AP-S15; or
 - b. Furman PL-8 C; or
 - c. Lowell ACSPR-RPC1-1509; or
 - d. Middle Atlantic PDC-915R-6 or PD-915RV-RN; or
 - e. SurgeX SX-1115.

PART 3 - EXECUTION

3.1 GENERAL

- A. Installation and connection of sound system equipment, materials, cable and cable fittings shall be performed only by experienced sound system installers. Each installer shall have access to a complete copy of the specifications at the job site.
- B. All materials and equipment are to be installed in accordance with all applicable standards of the National Electrical Code, the Electrical Code of the governing local municipality, all other applicable local codes, and all safety codes and ordinances.

3.2 INSTALLATION

- A. Equipment rack sheet metal ground shall only be via the insulated ground cable(s) noted on the drawings. Racks shall not otherwise connect to building steel or electrical conduit which is grounded to the building electrical system. Adjacent equipment racks shall be connected by an insulated #6 AWG ground cable which is bonded to each equipment rack.
- B. All adjacent equipment racks shall be ganged together if applicable.
- C. All equipment racks shall be restrained and seismic rated as required by local code.
- D. Racks shall be thoroughly cleaned prior to turn over to the Owner.
- E. Rear rack rails shall be installed as required to support heavy or deep equipment.
- F. Lacing bars shall be installed to assist in organizing cable. Lacing bars shall not interfere with access to any terminations or connectors.
- G. Cable within equipment racks shall be separated and routed in groups according to function: microphone circuits, intercom circuits, line level audio circuits, loudspeaker circuits, video circuits, control circuits, and 120 volt AC power circuits. Cable shall be neatly arranged, but tight bundling which makes modifications difficult shall be avoided. Plastic or Velcro cable ties shall be used for grouping of circuits. Unless otherwise noted on the drawings, all cables shall enter the equipment racks in one of the following manners:
 1. Through conduit landed directly to the equipment rack.
 2. Through rack knock-outs on the top or back of the equipment rack with plastic or rubber grommets.
 3. Directly into the back of wall mounted equipment racks. The rack shall be installed over flush mounted junction boxes allowing all cables to pass directly from the junction box into the back of the rack.
 4. Directly into an open side of floor standing equipment racks without side panels.
 5. Directly into the bottom of floor standing equipment racks through access floor holes or conduit in the floor. The rack shall be installed above the conduit stub or hole allowing all cables to pass directly into the bottom of the rack. All conduit stubs or access floor holes shall also have a plastic or rubber bushing to protect the cables.

- H. Cable in conduit or other raceway shall be separated according to function: microphone circuits and intercom circuits, line level audio circuits, loudspeaker circuits, video circuits, control circuits, and 120 volt AC power circuits. Control circuits may be installed in line level audio conduit where separate control conduit is not indicated on the drawings. Control circuits for loudspeaker volume control priority override relays may be installed with loudspeaker circuits. Intercom circuits may be installed in line level audio conduit where microphone level conduit is not installed.
- I. Any grouping of cables left exposed in a room, such as those associated with a movable equipment rack, shall be bundled together into a single bunch using black, flexible and expandable sleeving such as Techflex Flexo Wrap or equivalent.
- J. At all connection points for all types of cable, self-laminating or heat shrink printed labels of appropriate letters and/or numbers shall be installed near each termination point and be clearly visible. The labels shall be consistent on both ends of the same cable. These cable numbers and/or letters shall be given to the Acoustical Consultant for inclusion on the one-line diagrams of record.
- K. Care shall be exercised in wiring so as not to damage cables and equipment. Circuits shall not be spliced except as approved on shop drawings.
- L. Where conduit connects between equipment rack locations, or between sound console and equipment racks, at least two spare circuits of each type in the conduit (microphone level, line level, control, or data communications) shall be installed in each conduit used. All spare circuit conductors shall be connected to chassis ground at the downstream (e.g. power amplifier) end of the cable.
- M. All field cabling shall have service loops to allow for at least two (2) re-terminations.
- N. All crimp type connectors, including insulated butt connectors for inline loudspeaker circuit connections, shall be crimped with a Thomas & Betts model WT111M tool. Spade tongue terminals shall be crimped with the notch on the barrel opposite the seam.
- O. Unless otherwise noted, all audio circuits shall be two wire with shield, with the red or white wire used for the "high" side of the line and connected to pin 2 of microphone connectors or to the "tip" of patch panel and other phone jacks. The black wire shall be used for the "low" side of the line and shall connect to pin 3 of microphone connectors or to the "ring" of phone jacks. The shield (drain) wire shall connect to pin 1 of microphone connectors or to the sleeve of phone jacks.
- P. All audio circuits (red or white and black conductors) shall be ungrounded except as provided by single ended amplifier inputs and where grounding of unbalanced circuits is directed during system tests. Shields for line level audio circuits shall be grounded to rack sheet metal at each cable termination. Where line level audio circuits connect to audio transformers, shields shall connect to transformer electrostatic shields and case grounds. At each cable termination shield or shield drain, wire length shall be approximately equal to the length of the insulated conductors. Shield drain wires shall be sheathed in green PVC sleeving. Circuit shields shall not otherwise connect to each other nor ground to electrical conduit at wall boxes, etc. Microphone circuit shields shall be grounded only at mixer inputs.
- Q. Where resistors are indicated to terminate an audio circuit, install each resistor at the end of the line at the input to the following transformer or amplifier.
- R. All wire joints and connections in the audio system shall be made with rosin core solder and a small soldering iron; or with approved mechanical connectors. Soldering shall be neat and shall not exhibit "cold" solder joints. Connections to screw type terminals shall be made with mechanically connected, uninsulated, spade type lugs selected for the particular wire size in use.
- S. Connections made with miniature screw actuated, phoenix type connectors shall be made by stripping approximately ¼-inch of insulation from stranded conductor, inserting the untinned wire into the pressure terminal, and tightening the terminal screw using a small screwdriver which securely fits the screw head.
- T. High impedance unbalanced audio circuits shall not extend more than 20 feet.
- U. Loudspeaker connections within loudspeaker enclosures (and at other in-line locations where necessary) shall be made with crimped insulated butt connectors. Wire nuts and/or electrical tape will not be allowed.

- V. Loudspeakers shall be installed so there are no obstructions to the loudspeaker coverage pattern. Loudspeakers shall be connected "in phase" and proper impedance matching shall be maintained between amplifiers and loudspeakers.
- W. Tie-wrap and secure all loudspeaker line matching transformer leads and loudspeaker cable away from loudspeakers to prevent "rattling" when loudspeakers are energized.
- X. All loudspeakers, projectors, and other mounted equipment shall be installed with wire rope safety ties.
- Y. All analog video circuits, except as indicated otherwise, shall be shielded 75-ohm coaxial cable. Shields for video circuits shall be grounded only at the connected equipment and shall not ground at electrical conduit at wall boxes, etc.
- Z. No field terminated digital video connectors will be permitted unless otherwise noted in these specifications or drawings (HDMI, DVI, DisplayPort).
- AA. No soldering of video connectors will be permitted.
- BB. All non-locking video connectors shall be secured to the installed equipment such that the connectors cannot be easily disturbed or disconnected.
- CC. All HDMI, DisplayPort and DVI cables shall not exceed 25 feet in length without the installation of an active HDMI or DVI Cable Equalizer, with the exception of cables terminating or originating at equipment which features integral cable equalization. These cables shall be limited in length as indicated by the equipment manufacturer's recommendations.

3.3 NAMEPLATES

- A. All nameplate nomenclature shall be reviewed by the Architect and Acoustical Consultant prior to panel or plate engraving; or Metal-photo processing.
- B. All control panels, all patch panels, and all controls, jacks, microphone receptacles, switches, etc. (except for controls, etc., on audio equipment which are properly identified by the manufacturer) shall be suitably identified by metal or plastic engraved labels or Metal-photo labels. Engraved panels or plates shall be filled with a suitable contrasting color as approved on shop drawings.
- C. Room numbers shown on drawings and indicated on control panel details, patch panels, etc., are architectural room numbers for identification only during the construction phase. Fabricated labels shall reflect the room numbers to be later assigned by the Owner and/or as designated by the Architect.
- D. All installed and portable equipment shall be identified on front and rear panels by nameplate labels as indicated on the drawings and approved in the shop drawings, or as directed on-site by the Owner, Architect, and/or Acoustical Consultant.
- E. Unless noted otherwise, standard gang connection panels shall be Sierra stainless steel wall plates, or color as selected by Architect.
- F. Unless noted otherwise, NEMA size connection panels shall be clear anodized brushed aluminum, or color as selected by Architect.
 1. 12-inches or smaller: 1/8-inch thick.
 2. Larger than 12-inches: 3/16-inch thick.
 3. Field-verify mounting conditions for each box. Flush mounted plates shall have a minimum 1/2-inch flange on all sides.
- G. All connection panels shall have countersunk screw holes and Phillips countersunk or oval-head screws finished to match panel. All lettering shall be engraved and filled directly on the panel. Regardless of panel color, all panel mounted connectors should match the finish color of the panel wherever possible.

- H. All standard sized rack panels used to mount controls or connectors shall have formed edges, with all lettering engraved and filled directly on the panel.
- I. Verify all dimensions and spacing for panel-mounted components and engraving. Unless noted otherwise, engraved text shall be 3/16-inch high. Spacing between panel-mounted components shall be sufficient to enable front cable connections to be made easily.
- J. Connection panel layouts shall be according to function with all connections of one type located together. Labels shall be located above the corresponding connector or component. All connection panels and nameplates on the project shall be uniform in layout and nomenclature. Microphone multipin connectors shall be placed at the bottom of connection panels.
- K. No wall or floor mounted connection panels shall carry the logo of the contractor's firm.
- L. All nameplates and patch panel labels shall reflect Alternates accepted or rejected.
- M. Submit a shop drawing for each connection panel with all connections, devices, labels, colors and sized clearly indicated.

3.4 PAINTING

- A. Paint all exposed hardware, loudspeakers, baffles, grille cloth, wall plates, and any other item furnished under this contract not specifically noted otherwise on the drawings, color and method as approved by the Architect.

3.5 PRELIMINARY SYSTEM TESTS AND ADJUSTMENTS

- A. The Systems Contractor shall be responsible for preliminary field tests and adjustments of the completed sound systems prior to the time reserved for system equalization. Circuits containing equalizers and resistors to be installed later may be strapped across to permit preliminary system testing. Such tests shall be made in conformance with the recommendations of the equipment manufacturer and Acoustical Consultant.
- B. Preliminary system tests and adjustments shall include but not be limited to the following
 1. Verification that all loudspeakers are properly installed, tapped, and circuited as indicated on the drawings.
 2. Measurement of each loudspeaker line impedance to verify that no short/open circuits exist (including shorts to conduit/ground) and proper/expected loads are connected.
 3. Testing of each loudspeaker to ascertain that none of the units "squawk" or "rattle" when energized with one-third octave bands of pink noise at a nominal input power of two watts.
 4. Phasing of all microphones, microphone cables, and microphone inputs.
 5. Alignment, convergence and source input settings for each video projector and flat panel display.
 6. Qualification of all Category-type field cabling.
 7. Functional tests of all individual audio and video equipment
 8. Functional tests of all control equipment and custom user interfaces. All control communication shall be verified and tested to perform the functions listed in these specifications and detailed in the custom touchpanel interface.
 9. Setup of all network devices on the Owner's network.
 10. Unbox, assemble, test, and all store portable equipment where appropriate.
 11. Installation of the latest product firmware and software.

12. Functional tests of the installed system(s) as required to assure that the system(s) are ready for final tests and adjustments.

C. The Systems Contractor shall be responsible for notifying the Acoustical Consultant of any unresolved malfunctions encountered during preliminary system tests and of any equipment not at the site sufficiently prior to system equalization.

D. Most of the final tests and adjustments will be performed concurrently with system equalization. However, if troubles are encountered, preliminary tests and adjustments shall continue until the system operates in a satisfactory manner.

3.6 FINAL SYSTEM TESTS AND EQUALIZATION (COMMISSIONING SERVICES)

A. Sound Systems

1. The process is termed system "tuning" or "equalization" and is accomplished after the completion of the system installation, but prior to any use of the sound system. At this time, it is possible to measure the acoustic response of the system and to determine the feedback frequencies that actually exist. The broadband and narrowband filters are then tuned to these specific conditions.

2. To achieve proper acoustic levels and aiming, select loudspeaker transformers may require re-tapping and select loudspeakers or loudspeaker clusters may require reorientation as directed by the Acoustical Consultant.

3. After the sound reinforcement system(s) has received its preliminary testing and is found to be operating correctly, without hum, distortion, oscillations, radio frequency interference, etc., all equipment is fully functioning, and all circuits and connections have been examined, the system shall be commissioned and configured, including, but not limited to, the following adjustments:

- a. Adjustment of all gain controls to proper levels.
- b. Equalization of the loudspeaker systems using broadband graphic or parametric equalizers, delays, and compressors/limiters.
- c. Equalization of each installed wired and wireless microphone using broadband graphic or parametric equalizers and any applicable dynamics.
- d. Proper setup of any automatic mixer processing.
- e. Proper setup of all wireless microphone systems, including coordination of all wireless microphone frequencies.
- f. Configuration of the mixing console with input from the Owner.
- g. Configuration of narrowband equalizers to minimize microphone feedback in the system.
- h. Proper setup of any acoustic echo cancellation processing.

B. Networking and Control Systems

1. After the networking and control system(s) has received its preliminary testing and is found to be operating correctly, all control interfaces are fully operational, all equipment is functioning properly, and all circuits and connections have been examined, the system shall be commissioned and configured, including, but not limited to, the following adjustments:

- a. Verification of all specified control operations.
- b. Verification and adjustment of all user control interfaces for proper operation, with input from the Owner for custom interfaces.
- c. Verification of all control software installations.
- d. Verification of a proper Ethernet network configuration.

C. The Systems Contractor shall furnish the services of a competent technician, one having knowledge of the system, to adjust the sound system equipment and connections as requested by the Acoustical Consultant during the time reserved for system equalization. It is estimated that this technician should be available for approximately two (2) 8-hour days for the Base Bid.

D. These periods of time will be used for equalization and final system tests and adjustments. They will not, however, include the time that might have to be expended in the correction of system wiring errors, improper system performance due to noise, oscillations, etc. The Systems Contractor shall make his own assessment of the total time required for the technician referenced above.

- E. If, in the opinion of the Acoustical Consultant, the system does not appear to be functioning properly, the Systems Contractor may be required to perform tests on any individual item of equipment to determine its operational status. Any measurements deemed necessary shall be made for frequency response, distortion, etc.
- F. If after maximum effort by all concerned, it should prove impossible to complete the equalization within the stipulated period, the technician shall be made available for additional hours at no additional cost to the Owner if the Acoustical Consultant feels such assistance is necessary.
- G. The commissioning services shall be provided for the Owner by AVANT ACOUSTICS, the Acoustical Consultant. The cost of these services shall, as a convenience to the Owner, be included by the Systems Contractor as a portion of the total cost of the sound system work. This commissioning fee shall be requested from the Acoustical Consultant prior to submitting any bid proposal. The Systems Contractor shall execute a letter of agreement concerning this service with the Acoustical Consultant prior to the review of shop drawings.

3.7 SYSTEM WARRANTY AND MAINTENANCE

- A. The Systems Contractor shall warrant the sound system against defects in materials and workmanship, including any required parts and labor, during a one-year warranty period from date of final acceptance or first beneficial use, whichever occurs first, of the completed sound system at no cost to the Owner.
- B. The Systems Contractor shall make at least two visits to the job site to determine that all equipment is functioning satisfactorily, and to perform any maintenance services that may be required. The first of these visits shall occur approximately six months after the commencement of the warranty period, and the second visit shall occur approximately six months thereafter, but prior to the end of the warranty period.
- C. Maintenance services requiring additional visits shall also be performed at no charge. Maintenance services shall consist of, but not be limited to, operational tests and checks of all equipment.
- D. Any defective equipment discovered during any maintenance visit shall be repaired or replaced under the terms of the warranty. The Systems Contractor shall not be liable for equipment damaged by improper use, negligence, or accidental acts of nature.
- E. Warranty and maintenance services shall be restricted to normal working hours unless the Owner agrees to pay the difference in labor rates for overtime work.

3.8 NOTEBOOK OF OPERATING INSTRUCTIONS

- A. The Systems Contractor shall assemble notebooks for each sound system listed and as described below, and forward accurate field drawings of all wire numbers and control panel and patch panel engraving (for use in record drawing revisions) together with the notebooks to the Acoustical Consultant for review.
- B. The Acoustical Consultant will insert simplified operating instructions, warranty information, and one-line diagrams of record for the sound system into the notebooks. The Acoustical Consultant will then forward the notebooks to the Owner through the Architect.
- C. The information described below shall be placed in standard 8½-inch by 11-inch, 3-ring stiff covered notebooks having a clear plastic label holder on the spine. Notebooks shall have one inch of extra capacity for the one-line diagrams of record, to be added later. Name each notebook by room and as follows

RECORD/PLAYBACK SYSTEMS OPERATING
INSTRUCTIONS AND MANUALS
RAYTOWN SOUTH MIDDLE SCHOOL
RAYTOWN, MISSOURI

- D. Notebook contents shall include the following sections, each with binder dividers and labels:
 1. Table of Contents.
 2. System Operating Instructions, to be provided by the Acoustical Consultant.
 3. System Warranty information, to be provided by the Acoustical Consultant.

4. One-line Diagrams of Record, to be provided by the Acoustical Consultant.
5. Shop/As-Built Drawings.
6. Equipment Manuals, including manufacturer's warranty information, manufacturers' operating instructions, manufacturers' service manuals having schematic diagrams and parts lists, and any other information pertaining to the operation and routine maintenance of each major item of electronic equipment. This documentation shall be organized and divided into the equipment type categories used in this specification; with binder dividers and labeled tabs for each category.
7. Equipment software and configuration files, control system code and configuration files, and any software licenses.
8. Video archive of the training session(s), described below.
9. Any other documentation deemed pertinent to the operation and maintenance of the sound reinforcement system.

- E. Documentation for each major item of equipment shall be an electronic version printed in color and three-hole punched, or the original manufacturer provided manual three-hole punched or inserted into clear binder pockets where appropriate. Each manual shall be placed into the appropriate category section.
- F. Oversized drawings shall be neatly folded to approximately 8½-inch by 11-inch size and inserted individually into binder pockets and placed in the appropriate binder category.
- G. An electronic version of all the binder contents shall be provided on a USB drive with each manual. The documents shall be separated in appropriately named individual PDF files. All software files shall be included on each USB drive.

3.9 SYSTEM OPERATING ASSISTANCE

- A. After the sound system has received its final testing and equalization and is fully operational, the Systems Contractor and Acoustical Consultant shall instruct designated representatives of the Owner in the proper methods of system operation.
 1. The Acoustical Consultant, as part of the System Commissioning agreement, will perform end user training on the systems as a whole, which shall be video-recorded by the Systems Contractor for inclusion in the Notebook of Operating Instructions.
- B. The Systems Contractor shall provide system operating assistance for the first two major uses of the completed sound system. This assistance shall be provided at the times required by the Owner and there shall be no extra charge for work during this time prior to or after the normal working day.

PART 4 - EQUIPMENT SCHEDULES

4.1 STANDBY EQUIPMENT

- A. The Systems Contractor shall have the following standby equipment on hand at the job site during the period set aside for system equalizing for the possible replacement of defective components. All unused standby equipment and any replaced equipment shall remain the property of the Systems Contractor

4.2 BASE BID PORTABLE EQUIPMENT QUANTITIES

- A. Quantities shown below are only for portable equipment not permanently mounted and/or not permanently connected to the sound system. Refer to the drawings for other equipment quantities, or as noted, for additional requirements. Systems Contractor shall unbox, assemble, test, and store portable equipment where appropriate.
- B. Provide Cable straps for all portable cables.
- C. Audio Accessories

1. Two (2) of each Type of Line Level Extension Cable.
2. One (1) 32 GB USB Flash Drive.

END OF SECTION 274116

SECTION 274116 - SOUND SYSTEMS

PART 1 - GENERAL

1.6 DESCRIPTION OF WORK

- A. This section pertains to the sound system to be furnished and installed in Raytown South Middle School (B8137).
- B. It is the purpose of this specification to require the furnishing of highest quality materials, equipment, and workmanship. The work shall be in accordance with this specification and in conformity with the designs, layouts, and descriptions shown on the drawings.
- C. Any and all structural, mounting, or rigging details on the drawings are shown for concept only. It shall be the responsibility of the Systems Contractor to employ the services of a qualified Structural Engineer to be responsible for the design of the details to be employed. Stamped shop drawings and calculations of all such details shall be submitted to the Architect for review.
- D. Unless noted otherwise on the drawings, the work shall include everything necessary or incidental to complete the installation EXCEPT wire raceway (including conduit), raceway fittings, outlet boxes, pull boxes, terminal cabinets, 120 volt AC power circuits, and insulated ground cables. Such excluded equipment shall be furnished and installed by the project Electrical Contractor. The Systems Contractor shall furnish all necessary information to the Electrical Contractor to ensure that a proper audio conduit system will be installed.
- E. The Systems Contractor shall cooperate with all other contractors engaged in this project and shall coordinate the installation of the sound systems so that all work will proceed in a manner which is in the best interests of the Owner.

1.7 EXISTING CONDITIONS

- A. This facility is an existing structure being renovated and added on to. It shall be the responsibility of each bidder to verify all conditions and dimensions which pertain to this work.

1.8 DEFINITION OF TERMS

- A. The term "Owner" shall refer to Raytown Quality Schools; 6608 Raytown Road; Raytown, MO 64133; phone (816) 268-7000.
- B. The term "Architect" shall refer to Hollis+Miller Architects; 1828 Walnut St #922; Kansas City, MO 64108; phone (816) 442-7700.
- C. The term "Acoustical Consultant" shall refer to AVANT ACOUSTICS, LLC; 14827 W. 95th Street; Lenexa, KS 66215; phone (913) 888-9111; facsimile (913) 888-9193.
- D. The term "Systems Contractor" shall refer to the person, persons, or company who or which contracts for the performance of the sound system work specified herein.

1.9 CONTRACTOR QUALIFICATIONS

- A. The Systems Contractor must be a "Systems Contractor" who regularly engages in the furnishing and installation of commercial and industrial sound systems.
 - 1. The Systems Contractor shall have completed at least three (3) projects in the last five (5) years of similar size and scope.

- B. The Systems Contractor must maintain a suitably staffed and equipped service organization and must regularly offer maintenance services for systems of this type and size.
- C. The Systems Contractor shall be able to respond to on-site maintenance service requests within 24 hours during the warranty period described in section 3.07 System Warranty and Maintenance at the end of these specifications.
- D. As part of the bid submittal, Systems Contractor shall submit appropriate information to demonstrate to the satisfaction of the Owner, Architect, and Acoustical Consultant that the Systems Contractor has
 - 1. Completed similar projects as described above;
 - 2. Adequate plant and equipment to pursue the work properly and expeditiously;
 - 3. Ability to provide maintenance visits in the time window described above;
 - 4. Adequate staff with the required technical experience;
 - 5. Suitable financial status to meet the obligations of the work.
- E. Any other contractor, who intends to bid on this work as the prime contractor and does not otherwise meet the requirements of the "Contractor Qualifications" paragraph(s) above, shall employ the services of a "Systems Contractor" who does meet the requirements noted above and who shall furnish the audio and video equipment; shop fabricate the equipment racks and subassemblies; make all audio, video and control connections to equipment and equipment racks in the AV equipment room; make all connections to remote mixer controls and microphone connection panels; and continuously supervise the installation and connections of all sound system cable and equipment.
- F. A subcontractor so employed as the "Systems Contractor" must be acceptable to the Architect and the Acoustical Consultant and shall be identified on the Bid Proposal Form.

1.10 SUBMITTALS

- A. The Systems Contractor shall submit a minimum of four (4) suitably bound sets, or electronic documents, of the following Shop Drawings per the schedule listed below for review by the Architect and the Acoustical Consultant. Refer to the General and Special Conditions for additional set(s) which may be required.
 - 1. Prior to proceeding with the work
 - a. A complete list of ALL equipment and materials which are to be furnished. Accompanying the list shall be equipment quantities and manufacturers' specification or cut sheets for all sound system equipment (e.g. microphones, audio program source equipment, power amplifiers, loudspeakers), audio-visual equipment (e.g. projectors, program source equipment, monitors, video processing equipment), AV control equipment (e.g. touchpanels, system controllers, interface/control cards), and any other MAJOR items of equipment.
 - 2. Prior to proceeding with respective portions of work
 - a. Artwork, drawings, and listings indicating proposed nameplate nomenclature and arrangements for control panels, patch panels, connection plates, floor boxes and nameplates prior to fabrication as described elsewhere in these specifications.
 - b. Details of proposed loudspeaker suspension including attachment methods, weights, and suspension locations approved by the Systems Contractor's Structural Engineer.
 - c. Details showing projector/television/plasma display mounting.
 - d. Front panel layouts for all equipment racks and AV lecterns, prior to installation, reflecting equipment and labels to be used.
 - e. Mounting schemes for all external input/output transformers, potentiometers, and control switches.
 - f. Diagrams for AC power low voltage control switching, indicating distribution and sequencing of AC circuits for both on and off cycles.
 - g. Control system layout.
 - h. Custom furniture and/or custom millwork.
 - i. Details and descriptions of any other aspect of the sound system which must differ from the drawings due to field conditions or due to the selected equipment to be furnished.

3. As otherwise noted on the drawings and/or as noted herein.
- B. Approved shop drawings and equipment instruction brochures, including schematic diagrams for all amplifiers and other electronic devices, shall be present at the job site during the period set aside for final system test and equalization.
- C. Notebooks of operating instructions shall be prepared as described elsewhere in the specifications.

PART 2 - PRODUCTS

2.8 GENERAL

- A. It is the intention of these specifications to provide a complete and properly operating sound system. The major items of equipment shall be furnished in the quantity indicated by the sound system diagrams on the drawings or in the quantity as specified herein. (Refer to the Portable Equipment Quantity list at the end of the specifications.) However, any minor item of equipment or hardware that may not be specifically shown on the drawings or specified herein but required for proper sound system operation or installation shall be furnished by the Systems Contractor.
- B. All equipment and material shall be new and shall be suitable for continuous operation.
- C. The latest version of all specified equipment shall be furnished by the Systems Contractor.
- D. In any case, where a specific specification has not been included herein or shown on the drawings for any item that is required, the Systems Contractor shall furnish only the best quality equipment or material consistent with the quality of other specified equipment and material.
- E. Where the specifications list several manufacturers for a particular major item of equipment such as power amplifiers or loudspeakers, the Systems Contractor shall supply all of that item of equipment from one manufacturer.

2.9 SUBSTITUTIONS

- A. Where a specific piece of equipment has been discontinued and/or replaced by a new model, submission of the new model or a suitable item as applicable may be required by the Acoustical Consultant for evaluation prior to acceptance.
- B. If substitute equipment is allowed by written consent, the Systems Contractor shall be completely responsible for the use of such equipment. The Systems Contractor shall replace all such equipment with equipment listed by type number in the specifications if there is any evidence of equipment instability or unsuitability.
- C. Costs of any required evaluation and testing of substitute equipment shall be paid by the Systems Contractor.
- D. Any use of substitute equipment shall be at no extra cost to the Owner.
- E. Proposed substitute equipment shall be specifically noted in submittals as "substitution" with a footnote stating the reason for the substitution.
- F. Offerors proposing to furnish an "or equal" product must furnish all descriptive material necessary to demonstrate the acceptability of such product. The Acoustical Consultant shall be the sole determiner as to whether the proposed "or equal" product is suitable for use in work based upon review of the descriptive materials furnished.

2.10 SYSTEM DESCRIPTIONS AND SUMMARIES

A. Large Practice Room

1. The Large Practice Room will include an audio playback system for supporting practice and rehearsal.
2. Two (2) two-way, full-range loudspeakers will be wall-mounted in the room in a stereo configuration for audio playback.
3. An audio input connection will be installed at the front of the room to allow for playback from personal audio devices such as laptops or phones.
4. An audio input will be installed at the room projector (by others) for audio playback from the in-room AV system.
5. Audio levels for the system will be controllable over the building network via a mobile device app or a computer application.
6. All rack-mounted equipment, including the power amplifiers and recording devices, will be installed in the same equipment rack as the Band Room.

2.11 SOUND SYSTEMS

A. Microphones

1. Hanging Microphone, condenser cardioid, 30-foot cable, with 1-gang plate power module, with connector to mate with the power module and mounting accessories as required.
 - a. Shure Microflex MX202BP/C, color as indicated on the drawings.
2. Wireless Microphone System, UHF, true diversity operation, with bodypack transmitter, no gain control on the outside of the case, metal body, with LCD information screen, IR sync, with black lapel microphone with 4-foot cable, with rack mount kit, and with power supply as required.
 - a. Audio-Technica 3000 Series units listed below; or
 - 1) ATW-R3210 receiver.
 - 2) ATW-T3201 body-pack transmitter.
 - 3) AT831cH cardioid lapel microphone.
 - 4) Provide two sets of alkaline batteries with each wireless microphone transmitter furnished.
 - b. Sennheiser ew100 G4 Series units listed below in Band-A:
 - 1) EM 100 G4 receiver.
 - 2) SK 100 G4 belt-pack transmitter.
 - 3) ME 2 lapel microphone.
 - 4) Provide two sets of alkaline batteries with each wireless microphone transmitter furnished.

- c. For all wireless microphones listed above, furnish and install manufacturer's remote antennas with coaxial cable as required for permanently mounted receivers. Provide a different operating frequency for each wireless microphone transmitter/receiver pair, free from interference, in the UHF Band on an unused channel per FCC regulations. Assist the Owner in licensing these transmitter(s) as required.

B. Microphone Accessories

1. Cable strap, Velcro type, with length as required for securing cable.
 - a. Hosa Center-Pass Gap Velcro Cable Organizer; or
 - b. KAJO Company CTB series; or
 - c. Velcro One-Wrap straps.

C. Audio Source Equipment

1. Audio Input Device, with stereo analog inputs on RCA and 3.5mm TRS connectors, with passive transformer balanced stereo output with mono summing option, and with level control knob.
 - a. Radial SB-5W; or
 - b. Approved equal.
2. Audio Recorder, with balanced XLR output connectors, recording to USB, and memory card media, compatible with WAV and mp3 file formats, rack mount, with network control app.
 - a. Tascam SS-CDR250N.

D. Audio Processing Equipment

1. Digital Signal Processor (DSP), multiple balanced switchable mic/line level inputs and outputs as shown on the drawings, with drag and drop type software configurable processing enabling parametric broadband and narrowband filters, audio delays, gain control, and mixing of audio signals, with multiple configurable logic inputs and outputs, fixed I/O architecture, with multiple configurable logic connections; with Dante or AES67 digital audio compatibility, ability to store program on DSP and connected computer, ability to download stored and current programming from DSP, manufacturer's programming shall allow manipulation of signal processing entities by use of computer keyboard without mouse.
 - a. QSC Q-SYS Core 110f with UCI license compatible with Control Touchpanel below.
 - b. As part of the final system tests and equalization services, the Acoustical Consultant will provide initial digital signal processor files to the AV Contractor.
 - 1) Microphone equalization.
 - 2) Audio routing and mixing.
 - 3) Loudspeaker equalization.
 - 4) ON/OFF presets including standby mode triggering of the power amplifiers.
2. Control Touchpanel, rack-mounted, nominal 5" diagonal touchscreen, black, PoE compatible, compatible with Digital Signal Processor specified.
 - a. QSC TSC-55w-G2, mounted to blank rack panel.
 - b. The following programming functions will be provided as part of the touchpanel interface:
 - 1) System ON/OFF (standby mode triggering of the power amplifiers).
 - 2) Audio level control for both the Band Room and the Practice Room.

E. Power Amplifiers

1. Power Amplifier, 2 channels at 300 watts per channel at 8 ohms, maximum 20A mains connector, with self-protection for shorted circuits and current limiting, with rackears.
 - a. Ashly Audio nX 4002; or
 - b. Crown DCi 2|300.
2. Audio input connections to all power amplifiers shall be made with 3-pin microphone type connectors, with spade lugs on barrier terminal strips, or with screw actuated pressure type terminal strips. Audio output connections to all power amplifiers shall be made with spade lugs on barrier strips, with double banana plugs, or with Neutrik "SpeakON" type connectors. Connections with ¼-inch phone plugs will not be permitted.

F. Loudspeakers and Accessories

1. Two-Way Loudspeaker, with dual 8-inch low frequency drivers and high frequency compression driver, with internal rigging points, 90 dB 1W/1m sensitivity @ 1kHz, 100W RMS power rating, nominal 8 ohms, nominal 90x60 coverage pattern, nominal -6dB frequency response of 90Hz-16kHz, with mounting hardware as required, white in color, with integral transformer.
 - a. Community V2-28W or V2-28WT where a transformer is indicated; or
 - b. JBL AC28/95-WH, with outboard 100W 70V transformer where indicated; or
 - c. Loudspeaker and mounting hardware color shall be white.
 - d. Provide mounting hardware as required to mount the loudspeakers in the locations shown on the drawings.
 - e. Rotate horn as required.
2. Only the latest versions of the loudspeakers in the above paragraphs shall be furnished. The manufacturer and Systems Contractor shall ascertain that each loudspeaker furnished does not "squawk" or "rattle" when energized with one-third octave bands of pink noise at a nominal input power of two watts.

G. Audio Accessories

1. Line Level Extension Cable, factory fabricated units using Neutrik connectors from Horizon, ProCo, Whirlwind, or Wireworks; black flexible cable.
 - a. Type 1, 1/8-inch stereo phone plug to dual RCA phono plugs, 12 feet.
 - b. Type 2, 1/8-inch stereo phone plug to 1/8-inch stereo phone plug, 12 feet.
2. Balancing Transformer, unbalanced stereo to balanced stereo.
 - a. RDL TX-J2 (two required where stereo outputs shown); or
 - b. Approved equal.

H. Software Applications

1. Assist the Owner with installation and setup of Tascam SS250 Control software/app on an Owner furnished computer(s) and mobile device(s).
2. Assist the Owner with installation and setup of QSC UCI Viewer/Q-SYS Control app on an Owner furnished computer(s) and mobile device(s).

2.12 CABLE AND CONNECTORS

A. All cabling is to be plenum-rated.

B. Audio Cable

1. Microphone, intercom, and line-level audio circuits, where installed exposed in spaces which are used as return air plenums; #22 AWG, 2-conductor, stranded, aluminum polyester shielded.
 - a. Belden 9451P; or
 - b. Covid CSP 3200 22; or
 - c. Extron STP22P; or
 - d. Liberty 22-2C-PSH-WHT; or
 - e. Gepco IP222AL; or
 - f. West Penn 25291; or
 - g. Windy City Wire 994320-11S; or
 - h. Approved equal.
2. Loudspeaker circuits, where installed exposed above ceilings in spaces which are used as return air plenums; 2-conductor, stranded, unshielded.
 - a. #18 AWG
 - 1) Belden 6300UE; or
 - 2) Covid CVA 3200 18; or
 - 3) Extron SPK18P; or
 - 4) Gepco IP182BA7; or
 - 5) West Penn 25224; or

- 6) Windy City Wire 992360-11S; or
 - 7) Approved equal.
 - b. #16 AWG
 - 1) Belden 6200UE; or
 - 2) Covid CVA 3200 16; or
 - 3) Extron SPK16P; or
 - 4) Gepco IP162BA19; or
 - 5) West Penn 25225; or
 - 6) Windy City Wire 991360-S; or
 - 7) Approved equal.
 - c. #14 AWG
 - 1) Belden 6100UE; or
 - 2) Covid CVA 3200 14; or
 - 3) Extron SPK14P; or
 - 4) Gepco IP142BA19; or
 - 5) West Penn 25226; or
 - 6) Windy City Wire 997960-S; or
 - 7) Approved equal.
 - d. #12 AWG, 2-conductors
 - 1) Belden 6000UE; or
 - 2) Approved equal.
 - e. 10 AWG, 2-conductors
 - 1) Belden 6T00UE; or
 - 2) Approved equal.
3. RF hearing assistance transmitter antenna cable, when antenna is remotely mounted, if length is less than 50 feet, and UHF wireless microphone receiver antenna cable when antenna is remotely mounted, if length is less than 25 feet, RG58/U 50ohm coaxial, plenum rated.
- a. Belden 82240; or
 - b. Windy City Wire RG8P; or
 - c. Approved equal.
4. RF hearing assistance transmitter antenna cable when antenna is remotely mounted and length is greater than 50 feet, and UHF wireless microphone receiver antenna cable when antenna is remotely mounted and length is greater than 25 feet, polyfoam type RG8/U 50 ohm coaxial, plenum rated.
- a. Belden 7733A; or
 - b. Approved equal.

C. Data Communication Cable

- 1. Category 6 UTP Patch Cable, length as required, for digital audio, video, and data network connections.
 - a. Belden 10GX UTP CMP; or
 - b. Approved equal.
 - c. All cable shall be yellow in color.
 - d. Factory-made and certified Category 6 cable shall be used for all UTP patch cables installed within equipment racks. No field-fabricated patch cables shall be used.

D. Audio Connectors

- 1. XLR cable connectors, metal shell with strain relief, with solder cups.
 - a. Neutrik X series; or
 - b. Switchcraft AAA Series.
- 2. XLR receptacles, metal, with solder cups. Panel mounting receptacles shall be square in shape, except as noted.
 - a. Neutrik DLX series; or
 - b. Switchcraft E Series.
- 3. Phono RCA connectors, cable mounting, metal shell, with solder cups.
 - a. Canare; or
 - b. Rean; or
 - c. Switchcraft.

4. Phono RCA receptacles, metal shell, insulated from panel.
 - a. Canare; or
 - b. Rean; or
 - c. Switchcraft.
5. Loudspeaker Connectors, number of conductors as required, twist-lock action, panel or cable mounting.
 - a. Neutrik SpeakON series; or
 - b. Switchcraft HPC series.

2.13 EQUIPMENT RACKS, CABINETS, AND ACCESSORIES

A. Equipment Racks and Cabinets

1. Wall-Mounted Equipment Rack, wall mounted swing-out rack, with top knockouts for exhaust fans, with locking perforated front door.
 - a. Lowell LWSR series with LFD series front door; or
 - b. Middle Atlantic DWR series LVFD series front door.
 - c. Furnish and install exhaust fans in top of rack rated at a total of 50cfm.
2. Exhaust Fan, with rigid screen guard, 120V operation; with mounting hardware and power supply as required to mount fans in the top of each Equipment Rack with rubber grommets or other vibration isolation mounts.
 - a. Chief Raxxess FAN/QUIET series; or
 - b. Lowell FW Series; or
 - c. Middle Atlantic QFAN series; or
 - d. Approved equal.
3. All racks shall be keyed alike if possible. Furnish three sets of rack keys to be turned over to the Owner.
4. All standard sized rack panels used to mount controls or connectors shall have formed edges. Rack panel mounting screws shall be as short as practical for equipment to be mounted (Middle Atlantic HPQ or similar).
5. Any rack front panel details shown on the drawings are for concept only. Shop drawings are required indicating the exact equipment to be furnished. The exact size (larger or taller racks) and quantity of equipment racks is to be determined by the Systems Contractor based upon the exact equipment to be furnished. Verify all audio equipment room dimensions and conditions.
6. Except as noted on the drawings, include a 1RU panel at the top of one equipment rack engraved with the logo and contact information of the Acoustical Consultant and the Systems Contractor as shown on the drawings.
7. Except as noted on the drawings, allow 1¾-inch blank panel space at the top of each rack, minimum 3½-inch vent panel space at the bottom of each rack, and ventilation space (vent panels) between all equipment. Fill any empty rack space that is not near equipment with blank panels. Except as noted on the drawings or for mounting switches or LED indicators, blank panels shall not be used between equipment.
8. Where applicable, install a brush grommet panel directly above equipment such as an Ethernet Switch to allow cables to pass from the back of the equipment rack to the front panel of equipment (Middle Atlantic BR1 or similar).
9. Where applicable, mount small components behind vent panels on sub-chassis shelves or component panels (BUD CB series chassis or similar). Mount components with connections visible from rear of equipment rack using barrier strip terminal blocks for connections.
10. The following guidelines concerning equipment rack layouts shall be followed unless otherwise noted on the drawings. Submit shop drawings illustrating proposed equipment rack layouts, indicating equipment labels
 - a. Equipment Rack Layouts shall be grouped according to function; audio, network, and control.
 - b. Heavy equipment such as audio amplifiers and large video matrix switches shall be placed near the bottom of equipment racks.
 - c. Control equipment shall be located near the top of equipment racks.

- d. Equipment that requires operator interface (e.g. sound reinforcement system AC power pushbuttons, sound reinforcement system mode select switches, power amplifier monitor/test system, monitor loudspeaker, computer monitor and keyboard, patch panels, audio mixers, program source and/or audio-visual equipment) shall be installed in one or adjacent equipment racks. Operator interface equipment shall also be installed at heights that permit ease of operation and viewing. Such equipment shall be placed in equipment rack(s) closest to the audio equipment room entrance.
- 11. Furnish small clip-on or magnetic reflector type portable work light with 60-watt bulb in each equipment rack.
- B. Hardware and Accessories
 - 1. Type 1 Barrier Strip, for termination of audio circuits in equipment rack
 - a. TRW-CINCH 140 series; or approved equal.
 - 2. Type 2 Barrier Strip, high density, for termination of loudspeaker circuit in junction box
 - a. Phoenix Contact High Density UK series; or approved equal.
 - 3. Spade Tongue Terminal, brazed seam, uninsulated type only.

2.14 AC POWER

- A. Furnish an isolation transformer for the Auditorium Sound Reinforcement System as shown on the drawings. Coordinate with the project Electrical Contractor for service.
- B. Furnish modular or rack mounted power distribution in each rack as indicated on the drawings. Each rack shall have at least four spare always-on receptacles. Furnish additional power distribution equipment as required for all equipment racks for accessories and minor equipment.
- C. Furnish power conditioning and surge suppression for all major video, audio, and network equipment not served by a UPS.
- D. Sequencing control of AC power for all the sound system components (excluding projectors and flat panel displays) not connected to a UPS shall be provided through the control system. Configure the control system such that equipment turns on in the following order:
 - 1. Audio and Video Source Equipment.
 - 2. Audio Mixers and other miscellaneous equipment.
 - 3. Audio Amplifiers.
 - 4. Adjust the sequencing time so that all equipment startup cycles are complete before the next AC power circuit is energized.
 - 5. Power off sequencing shall occur in reverse order.
- E. Connect power amplifiers to 120V 20A AC power circuits so that maximum rated input power can be delivered to each power amplifier without exceeding the power handling capacity of any AC power circuit.
- F. Any power distribution details shown on the drawings are for concept only. Shop drawings are required indicating the exact equipment to be furnished by the Systems Contractor.

- G. AC Power Equipment
 - 1. Power Conditioner, 15A, rack mount, with unswitched front panel convenience outlet, with surge suppression and power conditioning.
 - a. Atlas Sound AP-S15; or
 - b. Furman PL-8 C; or
 - c. Lowell ACSPR-RPC1-1509; or
 - d. Middle Atlantic PDC-915R-6 or PD-915RV-RN; or
 - e. SurgeX SX-1115.

PART 3 - EXECUTION

3.10 GENERAL

- A. Installation and connection of sound system equipment, materials, cable and cable fittings shall be performed only by experienced sound system installers. Each installer shall have access to a complete copy of the specifications at the job site.
- B. All materials and equipment are to be installed in accordance with all applicable standards of the National Electrical Code, the Electrical Code of the governing local municipality, all other applicable local codes, and all safety codes and ordinances.

3.11 INSTALLATION

- A. Equipment rack sheet metal ground shall only be via the insulated ground cable(s) noted on the drawings. Racks shall not otherwise connect to building steel or electrical conduit which is grounded to the building electrical system. Adjacent equipment racks shall be connected by an insulated #6 AWG ground cable which is bonded to each equipment rack.
- B. All adjacent equipment racks shall be ganged together if applicable.
- C. All equipment racks shall be restrained and seismic rated as required by local code.
- D. Racks shall be thoroughly cleaned prior to turn over to the Owner.
- E. Rear rack rails shall be installed as required to support heavy or deep equipment.
- F. Lacing bars shall be installed to assist in organizing cable. Lacing bars shall not interfere with access to any terminations or connectors.
- G. Cable within equipment racks shall be separated and routed in groups according to function: microphone circuits, intercom circuits, line level audio circuits, loudspeaker circuits, video circuits, control circuits, and 120 volt AC power circuits. Cable shall be neatly arranged, but tight bundling which makes modifications difficult shall be avoided. Plastic or Velcro cable ties shall be used for grouping of circuits. Unless otherwise noted on the drawings, all cables shall enter the equipment racks in one of the following manners:
 - 1. Through conduit landed directly to the equipment rack.
 - 2. Through rack knock-outs on the top or back of the equipment rack with plastic or rubber grommets.
 - 3. Directly into the back of wall mounted equipment racks. The rack shall be installed over flush mounted junction boxes allowing all cables to pass directly from the junction box into the back of the rack.
 - 4. Directly into an open side of floor standing equipment racks without side panels.
 - 5. Directly into the bottom of floor standing equipment racks through access floor holes or conduit in the floor. The rack shall be installed above the conduit stub or hole allowing all cables to pass directly into the bottom of the rack. All conduit stubs or access floor holes shall also have a plastic or rubber bushing to protect the cables.

- H. Cable in conduit or other raceway shall be separated according to function: microphone circuits and intercom circuits, line level audio circuits, loudspeaker circuits, video circuits, control circuits, and 120 volt AC power circuits. Control circuits may be installed in line level audio conduit where separate control conduit is not indicated on the drawings. Control circuits for loudspeaker volume control priority override relays may be installed with loudspeaker circuits. Intercom circuits may be installed in line level audio conduit where microphone level conduit is not installed.
- I. Any grouping of cables left exposed in a room, such as those associated with a movable equipment rack, shall be bundled together into a single bunch using black, flexible and expandable sleeving such as Techflex Flexo Wrap or equivalent.
- J. At all connection points for all types of cable, self-laminating or heat shrink printed labels of appropriate letters and/or numbers shall be installed near each termination point and be clearly visible. The labels shall be consistent on both ends of the same cable. These cable numbers and/or letters shall be given to the Acoustical Consultant for inclusion on the one-line diagrams of record.
- K. Care shall be exercised in wiring so as not to damage cables and equipment. Circuits shall not be spliced except as approved on shop drawings.
- L. Where conduit connects between equipment rack locations, or between sound console and equipment racks, at least two spare circuits of each type in the conduit (microphone level, line level, control, or data communications) shall be installed in each conduit used. All spare circuit conductors shall be connected to chassis ground at the downstream (e.g. power amplifier) end of the cable.
- M. All field cabling shall have service loops to allow for at least two (2) re-terminations.
- N. All crimp type connectors, including insulated butt connectors for inline loudspeaker circuit connections, shall be crimped with a Thomas & Betts model WT111M tool. Spade tongue terminals shall be crimped with the notch on the barrel opposite the seam.
- O. Unless otherwise noted, all audio circuits shall be two wire with shield, with the red or white wire used for the "high" side of the line and connected to pin 2 of microphone connectors or to the "tip" of patch panel and other phone jacks. The black wire shall be used for the "low" side of the line and shall connect to pin 3 of microphone connectors or to the "ring" of phone jacks. The shield (drain) wire shall connect to pin 1 of microphone connectors or to the sleeve of phone jacks.
- P. All audio circuits (red or white and black conductors) shall be ungrounded except as provided by single ended amplifier inputs and where grounding of unbalanced circuits is directed during system tests. Shields for line level audio circuits shall be grounded to rack sheet metal at each cable termination. Where line level audio circuits connect to audio transformers, shields shall connect to transformer electrostatic shields and case grounds. At each cable termination shield or shield drain, wire length shall be approximately equal to the length of the insulated conductors. Shield drain wires shall be sheathed in green PVC sleeving. Circuit shields shall not otherwise connect to each other nor ground to electrical conduit at wall boxes, etc. Microphone circuit shields shall be grounded only at mixer inputs.
- Q. Where resistors are indicated to terminate an audio circuit, install each resistor at the end of the line at the input to the following transformer or amplifier.
- R. All wire joints and connections in the audio system shall be made with rosin core solder and a small soldering iron; or with approved mechanical connectors. Soldering shall be neat and shall not exhibit "cold" solder joints. Connections to screw type terminals shall be made with mechanically connected, uninsulated, spade type lugs selected for the particular wire size in use.
- S. Connections made with miniature screw actuated, phoenix type connectors shall be made by stripping approximately ¼-inch of insulation from stranded conductor, inserting the untinned wire into the pressure terminal, and tightening the terminal screw using a small screwdriver which securely fits the screw head.
- T. High impedance unbalanced audio circuits shall not extend more than 20 feet.
- U. Loudspeaker connections within loudspeaker enclosures (and at other in-line locations where necessary) shall be made with crimped insulated butt connectors. Wire nuts and/or electrical tape will not be allowed.

- V. Loudspeakers shall be installed so there are no obstructions to the loudspeaker coverage pattern. Loudspeakers shall be connected "in phase" and proper impedance matching shall be maintained between amplifiers and loudspeakers.
 - W. Tie-wrap and secure all loudspeaker line matching transformer leads and loudspeaker cable away from loudspeakers to prevent "rattling" when loudspeakers are energized.
 - X. All loudspeakers, projectors, and other mounted equipment shall be installed with wire rope safety ties.
 - Y. All analog video circuits, except as indicated otherwise, shall be shielded 75-ohm coaxial cable. Shields for video circuits shall be grounded only at the connected equipment and shall not ground at electrical conduit at wall boxes, etc.
 - Z. No field terminated digital video connectors will be permitted unless otherwise noted in these specifications or drawings (HDMI, DVI, DisplayPort).
- AA. No soldering of video connectors will be permitted.
- BB. All non-locking video connectors shall be secured to the installed equipment such that the connectors cannot be easily disturbed or disconnected.
- CC. All HDMI, DisplayPort and DVI cables shall not exceed 25 feet in length without the installation of an active HDMI or DVI Cable Equalizer, with the exception of cables terminating or originating at equipment which features integral cable equalization. These cables shall be limited in length as indicated by the equipment manufacturer's recommendations.

3.12 NAMEPLATES

- A. All nameplate nomenclature shall be reviewed by the Architect and Acoustical Consultant prior to panel or plate engraving; or Metal-photo processing.
- B. All control panels, all patch panels, and all controls, jacks, microphone receptacles, switches, etc. (except for controls, etc., on audio equipment which are properly identified by the manufacturer) shall be suitably identified by metal or plastic engraved labels or Metal-photo labels. Engraved panels or plates shall be filled with a suitable contrasting color as approved on shop drawings.
- C. Room numbers shown on drawings and indicated on control panel details, patch panels, etc., are architectural room numbers for identification only during the construction phase. Fabricated labels shall reflect the room numbers to be later assigned by the Owner and/or as designated by the Architect.
- D. All installed and portable equipment shall be identified on front and rear panels by nameplate labels as indicated on the drawings and approved in the shop drawings, or as directed on-site by the Owner, Architect, and/or Acoustical Consultant.
- E. Unless noted otherwise, standard gang connection panels shall be Sierra stainless steel wall plates, or color as selected by Architect.
- F. Unless noted otherwise, NEMA size connection panels shall be clear anodized brushed aluminum, or color as selected by Architect.
 - 1. 12-inches or smaller: 1/8-inch thick.
 - 2. Larger than 12-inches: 3/16-inch thick.
 - 3. Field-verify mounting conditions for each box. Flush mounted plates shall have a minimum 1/2-inch flange on all sides.
- G. All connection panels shall have countersunk screw holes and Phillips countersunk or oval-head screws finished to match panel. All lettering shall be engraved and filled directly on the panel. Regardless of panel color, all panel mounted connectors should match the finish color of the panel wherever possible.

- H. All standard sized rack panels used to mount controls or connectors shall have formed edges, with all lettering engraved and filled directly on the panel.
- I. Verify all dimensions and spacing for panel-mounted components and engraving. Unless noted otherwise, engraved text shall be 3/16-inch high. Spacing between panel-mounted components shall be sufficient to enable front cable connections to be made easily.
- J. Connection panel layouts shall be according to function with all connections of one type located together. Labels shall be located above the corresponding connector or component. All connection panels and nameplates on the project shall be uniform in layout and nomenclature. Microphone multipin connectors shall be placed at the bottom of connection panels.
- K. No wall or floor mounted connection panels shall carry the logo of the contractor's firm.
- L. All nameplates and patch panel labels shall reflect Alternates accepted or rejected.
- M. Submit a shop drawing for each connection panel with all connections, devices, labels, colors and sized clearly indicated.

3.13 PAINTING

- A. Paint all exposed hardware, loudspeakers, baffles, grille cloth, wall plates, and any other item furnished under this contract not specifically noted otherwise on the drawings, color and method as approved by the Architect.

3.14 PRELIMINARY SYSTEM TESTS AND ADJUSTMENTS

- A. The Systems Contractor shall be responsible for preliminary field tests and adjustments of the completed sound systems prior to the time reserved for system equalization. Circuits containing equalizers and resistors to be installed later may be strapped across to permit preliminary system testing. Such tests shall be made in conformance with the recommendations of the equipment manufacturer and Acoustical Consultant.
- B. Preliminary system tests and adjustments shall include but not be limited to the following
 1. Verification that all loudspeakers are properly installed, tapped, and circuited as indicated on the drawings.
 2. Measurement of each loudspeaker line impedance to verify that no short/open circuits exist (including shorts to conduit/ground) and proper/expected loads are connected.
 3. Testing of each loudspeaker to ascertain that none of the units "squawk" or "rattle" when energized with one-third octave bands of pink noise at a nominal input power of two watts.
 4. Phasing of all microphones, microphone cables, and microphone inputs.
 5. Alignment, convergence and source input settings for each video projector and flat panel display.
 6. Qualification of all Category-type field cabling.
 7. Functional tests of all individual audio and video equipment
 8. Functional tests of all control equipment and custom user interfaces. All control communication shall be verified and tested to perform the functions listed in these specifications and detailed in the custom touchpanel interface.
 9. Setup of all network devices on the Owner's network.
 10. Unbox, assemble, test, and all store portable equipment where appropriate.
 11. Installation of the latest product firmware and software.

12. Functional tests of the installed system(s) as required to assure that the system(s) are ready for final tests and adjustments.

C. The Systems Contractor shall be responsible for notifying the Acoustical Consultant of any unresolved malfunctions encountered during preliminary system tests and of any equipment not at the site sufficiently prior to system equalization.

D. Most of the final tests and adjustments will be performed concurrently with system equalization. However, if troubles are encountered, preliminary tests and adjustments shall continue until the system operates in a satisfactory manner.

3.15 FINAL SYSTEM TESTS AND EQUALIZATION (COMMISSIONING SERVICES)

A. Sound Systems

1. The process is termed system "tuning" or "equalization" and is accomplished after the completion of the system installation, but prior to any use of the sound system. At this time, it is possible to measure the acoustic response of the system and to determine the feedback frequencies that actually exist. The broadband and narrowband filters are then tuned to these specific conditions.

2. To achieve proper acoustic levels and aiming, select loudspeaker transformers may require re-tapping and select loudspeakers or loudspeaker clusters may require reorientation as directed by the Acoustical Consultant.

3. After the sound reinforcement system(s) has received its preliminary testing and is found to be operating correctly, without hum, distortion, oscillations, radio frequency interference, etc., all equipment is fully functioning, and all circuits and connections have been examined, the system shall be commissioned and configured, including, but not limited to, the following adjustments:

- a. Adjustment of all gain controls to proper levels.
- b. Equalization of the loudspeaker systems using broadband graphic or parametric equalizers, delays, and compressors/limiters.
- c. Equalization of each installed wired and wireless microphone using broadband graphic or parametric equalizers and any applicable dynamics.
- d. Proper setup of any automatic mixer processing.
- e. Proper setup of all wireless microphone systems, including coordination of all wireless microphone frequencies.
- f. Configuration of the mixing console with input from the Owner.
- g. Configuration of narrowband equalizers to minimize microphone feedback in the system.
- h. Proper setup of any acoustic echo cancellation processing.

B. Networking and Control Systems

1. After the networking and control system(s) has received its preliminary testing and is found to be operating correctly, all control interfaces are fully operational, all equipment is functioning properly, and all circuits and connections have been examined, the system shall be commissioned and configured, including, but not limited to, the following adjustments:

- a. Verification of all specified control operations.
- b. Verification and adjustment of all user control interfaces for proper operation, with input from the Owner for custom interfaces.
- c. Verification of all control software installations.
- d. Verification of a proper Ethernet network configuration.

C. The Systems Contractor shall furnish the services of a competent technician, one having knowledge of the system, to adjust the sound system equipment and connections as requested by the Acoustical Consultant during the time reserved for system equalization. It is estimated that this technician should be available for approximately two (2) 8-hour days for the Base Bid.

D. These periods of time will be used for equalization and final system tests and adjustments. They will not, however, include the time that might have to be expended in the correction of system wiring errors, improper system performance due to noise, oscillations, etc. The Systems Contractor shall make his own assessment of the total time required for the technician referenced above.

- E. If, in the opinion of the Acoustical Consultant, the system does not appear to be functioning properly, the Systems Contractor may be required to perform tests on any individual item of equipment to determine its operational status. Any measurements deemed necessary shall be made for frequency response, distortion, etc.
- F. If after maximum effort by all concerned, it should prove impossible to complete the equalization within the stipulated period, the technician shall be made available for additional hours at no additional cost to the Owner if the Acoustical Consultant feels such assistance is necessary.
- G. The commissioning services shall be provided for the Owner by AVANT ACOUSTICS, the Acoustical Consultant. The cost of these services shall, as a convenience to the Owner, be included by the Systems Contractor as a portion of the total cost of the sound system work. This commissioning fee shall be requested from the Acoustical Consultant prior to submitting any bid proposal. The Systems Contractor shall execute a letter of agreement concerning this service with the Acoustical Consultant prior to the review of shop drawings.

3.16 SYSTEM WARRANTY AND MAINTENANCE

- A. The Systems Contractor shall warrant the sound system against defects in materials and workmanship, including any required parts and labor, during a one-year warranty period from date of final acceptance or first beneficial use, whichever occurs first, of the completed sound system at no cost to the Owner.
- B. The Systems Contractor shall make at least two visits to the job site to determine that all equipment is functioning satisfactorily, and to perform any maintenance services that may be required. The first of these visits shall occur approximately six months after the commencement of the warranty period, and the second visit shall occur approximately six months thereafter, but prior to the end of the warranty period.
- C. Maintenance services requiring additional visits shall also be performed at no charge. Maintenance services shall consist of, but not be limited to, operational tests and checks of all equipment.
- D. Any defective equipment discovered during any maintenance visit shall be repaired or replaced under the terms of the warranty. The Systems Contractor shall not be liable for equipment damaged by improper use, negligence, or accidental acts of nature.
- E. Warranty and maintenance services shall be restricted to normal working hours unless the Owner agrees to pay the difference in labor rates for overtime work.

3.17 NOTEBOOK OF OPERATING INSTRUCTIONS

- A. The Systems Contractor shall assemble notebooks for each sound system listed and as described below, and forward accurate field drawings of all wire numbers and control panel and patch panel engraving (for use in record drawing revisions) together with the notebooks to the Acoustical Consultant for review.
- B. The Acoustical Consultant will insert simplified operating instructions, warranty information, and one-line diagrams of record for the sound system into the notebooks. The Acoustical Consultant will then forward the notebooks to the Owner through the Architect.
- C. The information described below shall be placed in standard 8½-inch by 11-inch, 3-ring stiff covered notebooks having a clear plastic label holder on the spine. Notebooks shall have one inch of extra capacity for the one-line diagrams of record, to be added later. Name each notebook by room and as follows

RECORD/PLAYBACK SYSTEMS OPERATING INSTRUCTIONS AND MANUALS RAYTOWN SOUTH MIDDLE SCHOOL RAYTOWN, MISSOURI

- D. Notebook contents shall include the following sections, each with binder dividers and labels:
 1. Table of Contents.
 2. System Operating Instructions, to be provided by the Acoustical Consultant.
 3. System Warranty information, to be provided by the Acoustical Consultant.

4. One-line Diagrams of Record, to be provided by the Acoustical Consultant.
5. Shop/As-Built Drawings.
6. Equipment Manuals, including manufacturer's warranty information, manufacturers' operating instructions, manufacturers' service manuals having schematic diagrams and parts lists, and any other information pertaining to the operation and routine maintenance of each major item of electronic equipment. This documentation shall be organized and divided into the equipment type categories used in this specification; with binder dividers and labeled tabs for each category.
7. Equipment software and configuration files, control system code and configuration files, and any software licenses.
8. Video archive of the training session(s), described below.
9. Any other documentation deemed pertinent to the operation and maintenance of the sound reinforcement system.

- E. Documentation for each major item of equipment shall be an electronic version printed in color and three-hole punched, or the original manufacturer provided manual three-hole punched or inserted into clear binder pockets where appropriate. Each manual shall be placed into the appropriate category section.
- F. Oversized drawings shall be neatly folded to approximately 8½-inch by 11-inch size and inserted individually into binder pockets and placed in the appropriate binder category.
- G. An electronic version of all the binder contents shall be provided on a USB drive with each manual. The documents shall be separated in appropriately named individual PDF files. All software files shall be included on each USB drive.

3.18 SYSTEM OPERATING ASSISTANCE

- A. After the sound system has received its final testing and equalization and is fully operational, the Systems Contractor and Acoustical Consultant shall instruct designated representatives of the Owner in the proper methods of system operation.
 1. The Acoustical Consultant, as part of the System Commissioning agreement, will perform end user training on the systems as a whole, which shall be video-recorded by the Systems Contractor for inclusion in the Notebook of Operating Instructions.
- B. The Systems Contractor shall provide system operating assistance for the first two major uses of the completed sound system. This assistance shall be provided at the times required by the Owner and there shall be no extra charge for work during this time prior to or after the normal working day.

PART 4 - EQUIPMENT SCHEDULES

4.3 STANDBY EQUIPMENT

- A. The Systems Contractor shall have the following standby equipment on hand at the job site during the period set aside for system equalizing for the possible replacement of defective components. All unused standby equipment and any replaced equipment shall remain the property of the Systems Contractor

4.4 BASE BID PORTABLE EQUIPMENT QUANTITIES

- A. Quantities shown below are only for portable equipment not permanently mounted and/or not permanently connected to the sound system. Refer to the drawings for other equipment quantities, or as noted, for additional requirements. Systems Contractor shall unbox, assemble, test, and store portable equipment where appropriate.
- B. Provide Cable straps for all portable cables.
- C. Audio Accessories

1. Two (2) of each Type of Line Level Extension Cable.
2. One (1) 32 GB USB Flash Drive.

Appendix A

SECTION 2 – Sound Systems Raytown South Middle Large Practice Room Drawings

