SECTION 275115 - SOUND REINFORCEMENT SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section pertains to the sound reinforcement system to be furnished and installed as part of the Robert W. Plaster Center Sound Reinforcement System Refresh project (C2099.a).

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 Owner for review.

D. Unless noted otherwise on the drawings, the work shall include everything necessary or incidental to complete the installation EXCEPT wire raceway, conduit, cable trays, 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 serving as a subcontractor to the Systems 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 furnish all loudspeaker back boxes (loudspeaker enclosures) and, where such enclosures are shown to be connected directly to conduit, the Systems Contractor shall furnish the enclosures to the Electrical Contractor for installation under the electrical contract.

F. The Systems Contractor shall cooperate with all other contractors engaged in this project and shall coordinate the installation of the sound reinforcement systems so that all work will proceed in a manner which is in the best interests of the Owner.

1.2 ALLOWANCE

A. Include an allowance for the following items:

1. Replacement of two (2) amplifiers (in addition to those with known issues as noted on the drawings).
2. Replacement of two (2) of each type of source cluster loudspeaker component drivers.

1.3 EXISTING CONDITIONS

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

B. The Systems Contractor shall verify the location, the operating conditions, and the conditions affecting the proposed work. Items to be verified by the Systems Contractor shall include, but not be limited to, reuse of existing equipment and access requirements to install all concealed components of the work. Bids submitted shall account for and include, but not be limited to, any and all work associated with providing concealed components (such as cable or conduits) and the complete restoration of all existing building components that are disturbed, modified, or dismantled in the process of installing the concealed components of the work.

C. The existing sound reinforcement system shall remain operational in occupied areas throughout the installation, testing, and equalization of the new or reused/relocated components associated with this project. The Systems Contractor shall coordinate the installation of the new and reused/relocated sound reinforcement system components with the Owner to provide complete and operational systems for all operational facilities during and after each phase of the project and minimize disruption to occupants.

D. Unless specifically noted on the drawings, existing sound reinforcement system components and wiring shall not be damaged or disturbed. Any such damage to the existing system shall immediately be reported to the Owner and Acoustical Consultant, and if caused by the Systems Contractor, shall be repaired or replaced by the Systems Contractor as approved by the Acoustical Consultant at no additional cost to the Owner. The Systems Contractor shall notify the Owner prior to conducting installation work within the existing audio equipment rooms and racks.

E. Existing sound reinforcement system conduit in the facility may be reused where appropriate for the sound reinforcement system refresh, subject to the following stipulations: 1) the existing conduit is installed in locations and using methods consistent with the drawings and these specifications; 2) existing circuits can remain installed and operational until no longer required as indicated in these specifications; and 3) the conduit permits segregation of circuits according to type per these specifications.

F. Any existing equipment described in these specifications or shown on the drawings to be removed and not reused shall be turned over, undamaged, to the Owner.

G. As indicated on the drawings or defined herein, some existing sound reinforcement system equipment shall remain in place and/or reused as part of the system refresh. Prior to reuse of this equipment, the Systems Contractor shall verify that the equipment is in proper operating condition and shall provide brackets or shelf units as required for rack-mounting existing equipment. The Systems Contractor shall report to the Acoustical Consultant any existing equipment problems and shall also provide pricing to repair or replace the inoperable existing equipment. Existing equipment to remain in place and/or reused includes, but is not limited to, the following:

1. Plaster Center Field and Ancillary System
    a. Wireless Microphones
        1) One (1) AKG DSR800 Dual Channel Receiver with associated transmitters.
    b. Audio Source Equipment
        1) One (1) Denon DN-300Z Media Player.
    c. Audio Mixers
        1) One (1) Soundcraft Performer 1.
        2) One (1) Soundcraft Mini Stagebox 16.
    d. Power Amplifiers
        1) One (1) Crown DCi 8|600.
        2) Eight (8) Vue Audiotechnik V6.
        3) Three (3) Vue Audiotechnik V4.
    e. Loudspeakers
        1) Twenty-eight (28) Vue Audiotechnik al-8.
        2) Twenty (20) Vue Audiotechnik al-4.
        3) Four (4) Audiotechnik al-8SB.
        4) Ceiling loudspeakers serving ancillary spaces.
2. Plaster Center Strength and Conditioning System
    a. Audio Source Equipment
        1) One (1) Denon DN-300Z Media Player.
    b. Power Amplifiers
        1) Seven (7) Dynacord DSA 8209.
    c. Loudspeakers
        1) Vue Audiotechnik i-6.
        2) Vue Audiotechnik is-26.

1.4 DEFINITION OF TERMS

A. The term "Owner" shall refer to Pittsburg State University; 1701 South Broadway Street; Pittsburg, KS 66762; phone (620) 231-7000.

B. The term "Acoustical Consultant" shall refer to AVANT ACOUSTICS, LLC; 14827 W. 95th Street; Lenexa, KS 66215; phone (913) 888-9111.

C. The term "Systems Contractor" shall refer to the person, persons, or company who or which contracts for the performance of the sound reinforcement system work specified herein.

1.5 CONTRACTOR QUALIFICATIONS

A. The Systems Contractor must be a "Systems Contractor" who regularly engages in the furnishing and installation of commercial and industrial sound reinforcement 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 3.7 System Warranty and Maintenance at the end of these specifications.

D. The Systems Contractor is required to employ staff, to be engaged in this project, with the following certifications:

1. Certified Technology Specialist - Installation.

E. As part of the bid submittal, Systems Contractor shall submit appropriate information to demonstrate to the satisfaction of the Owner 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 and certifications described above;
5. Suitable financial status to meet the obligations of the work.

F. 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 reinforcement system cable and equipment.

G. A subcontractor so employed as the "Systems Contractor" must be acceptable to the Owner and the Acoustical Consultant and shall be identified on the Bid Proposal Form.

1.6 SUBMITTALS

A. The Systems Contractor shall submit electronic documents of the following Shop Drawings per the schedule listed below for review by the Owner and the Acoustical Consultant. Refer to the General and Special Conditions for additional requirements such as physical submittal copies.

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. Drawings 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. Detail drawings of proposed loudspeaker suspension including attachment methods, weights, suspension locations, and calculations approved by the Systems Contractor’s Structural Engineer.
   c. Detail drawings showing projector/projection screen/flat panel display/LED display mounting.

d. Detail drawings showing front panel layouts for all equipment racks and AV lecterns, prior to installation, reflecting equipment, and labels to be used.
e. Diagram drawings for AC power low-voltage control switching, indicating distribution and sequencing of AC circuits for both on and off cycles.
f. Control system layout.
g. Custom furniture and/or custom millwork.
h. Details and descriptions of any other aspect of the sound reinforcement 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 reinforcement system. The major items of equipment shall be furnished in the quantity indicated by the sound reinforcement 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 reinforcement 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. Field and Ancillary Areas Sound Reinforcement System

1. Reuse of all existing source cluster loudspeakers as currently installed.
2. Complete testing of all source cluster loudspeaker drivers to ensure good working order.
3. Complete testing and cleaning of all existing amplifiers to ensure good working order.
4. Reuse of all loudspeakers and associated amplifier serving the ancillary spaces.
5. New digital audio processor installed in the existing equipment rack in the control booth to provide audio source routing and appropriate bandpass and equalization for the existing loudspeaker systems.
6. New touchpanel controller located in the control booth for system on/off and setup control.
7. Integration of the existing Dante digital network audio transport and routing to the Broadcast and Arena systems.
8. New button panel style controller for the meeting room and locker rooms to provide local audio source selection and level control.
9. Reuse of the existing digital mixing console located in the control booth.
10. New headset announcer microphone and push-to-talk base.
11. Reuse of the existing wireless microphone system, with new remote antennas in lieu of the front panel connected antennas.
12. New radio-frequency hearing assistance system to meet ADA guidelines for hard of hearing patrons.
13. Replacement or repair to good working order all wiring associated with the equipment racks, mixing console, and connection panels throughout the track facility.
14. Relocation of the existing source cluster amplifiers from the touring cases to a new equipment rack in the closet at the north side of the field.
15. New Uninterruptible Power Supplies (UPS) in each equipment rack to provide the ultimate power protection for computerized equipment in the equipment racks.

B. Strength and Conditioning Sound Reinforcement System

1. New digital audio processor installed in the existing equipment rack to provide audio source routing and appropriate bandpass and equalization for the existing loudspeaker systems.
2. New button panel style controller to provide system on/off and source selection/volume control.
3. Reuse of all existing amplifiers and loudspeaker as currently installed.

2.4 SOUND SYSTEMS

A. Microphones and Accessories

1. Sports Announce Headset Microphone, dynamic headworn microphone, with cable terminating in 3-pin XLR connector.
   a. Audio-Technica Pro 8Hex; or
   b. Shure SM-10A.

2. Sports Announce Microphone Base, weighted base, with XLR in/out connectors, with push-to-talk switch, matte black finish, for use with sports announce headset microphone specified above.
   a. ProCo SAS1; or
   b. Approved equal.

3. Directional Remote Antenna, wideband frequency response, active operation, directional, with surface-mounting hardware, compatible with existing Wireless Microphone Receiver.
   a. AKG SRA2 B/W.

4. Microphone Extension Cable, factory fabricated units; male XLR to female XLR connections, black cable with color-coded strain relief on male connector only.
   a. Type 1, 25 feet long (coded red).
   b. Type 2, 50 feet long (coded blue).
   c. Type 3, 75 feet long (coded white)
   d. Type 4, 15 feet long (no color).

B. Audio Source Equipment

1. Network Bluetooth (BT) Audio Interface, dual gang Decora style wall plate, Dante digital audio network, with front panel pairing button and connection status LED indicator, with Bluetooth input and stereo analog audio input/output connections, faceplate color as selected by architect.

a. Q-sys Atterotech unD6IO-BT; or
b. RDL DD-BTN44; or
c. Approved equal.

C. Audio Processing Equipment

1. Digital Audio Processor (DAP), computer appliance, 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, expandable architecture, with multiple configurable logic connections; with 32x32 Dante digital audio compatibility, ability to store program on DSP and connected computer, ability to download stored and current programming from DSP, all components from the same manufacturer.
   a. Type 1:
      1) QSC Q-sys Core 110f, with UCI, scripting, and Dante 32x32 licenses; or
      2) Symetrix Prism 16x16 Dante.
   b. Type 2:
      1) QSC Q-sys Core 8 Flex; or
      2) Symetrix Prism 4x4.
   c. As part of the final system tests and equalization services, the Acoustical Consultant will provide initial digital audio processor files to the Systems Contractor to include the following functions for the Field and Strength & Conditioning systems.
      1) Microphone narrowband equalization.
      2) Audio routing and mixing.
      3) Loudspeaker matrix mixing.
      4) Loudspeaker equalization.
      5) Loudspeaker time-alignment.
      6) Integral user interface controls.
   d. The Systems Contractor shall provide system programming and/or scripting incorporating all the above functions, with input from the Owner and the Acoustical Consultant during commissioning. As part of the final system tests and equalization services, the Acoustical Consultant will provide initial digital audio processor files, including user interface touch panel screen and remote-control unit layouts to the Systems Contractor for use in the system programming.

2. DAP Output Expander, Dante digital audio compatibility, with number of analog line level outputs as indicated on the drawings, compatible with Digital Audio Processor specified.
   a. QSC Q-sys QIO-L4o, number of units as required, with QIO-RMK rack mount kits, and with QIO-PSU daisy-chained DC power supplies as required; or
   b. Symetrix Prism xOut 12, number of units as required.

3. Relay Control Expander, configurable dry contact control inputs/outputs, PoE powered, rack mounted.
   a. Global Cache iTach IP2CC-P; or
   b. Approved equal.

4. Control Touchpanel, tabletop mounted, nominal 7” diagonal touchscreen, black, PoE compatible, compatible with Digital Audio Processor specified.
   a. QSC TSC-70-G3 with TSC-710t-G3 tabletop stand; or
   b. Symetrix T-7 Glass with tabletop stand.

5. Network Control Interface, wall mounted, single/dual gang Decora style, with OLED display and rotary encoder, black, PoE powered, for selection and level control of up to six audio sources, compatible with Digital Audio Processor specified.
   a. QSC Attero Tech Axon C1; or
   b. Symetrix W4.

D. Wireless Hearing Assistance Systems – Radio Frequency

1. Radio frequency wireless hearing assistance systems, all components of the same manufacturer.
   a. Listen Corporation; or
   b. Williams Sound Corporation.

2. Hearing Assistance Base Station Transmitter, frequency selectable, with antenna as required, coaxial cable, power supply and rack mount kit as required.
   a. Listen LT-800 with LA-122 remote antenna; or
   b. Williams PPA T55 with ANT 024 remote antenna.

3. Hearing Assistance Personal Receiver, frequency selectable, headphone output, with volume control, compatible with Base Station Transmitter chosen.
   a. Listen LR-4200 receiver, with rechargeable batteries; or
   b. Williams PPA R38N receiver, with rechargeable batteries.

4. Lightweight Earloop Headphones.
   a. Listen LA-401; or
   b. Williams EAR 022.

5. Neck Loop Transductors.
   a. Listen LA-430; or
   b. Williams NKL 001.

6. Charging/Storage Case, metal or molded shell, with integrated charger, with foam padded inserts, for housing Hearing Assistance System Receivers, Headphones, and Neck Loops.
   a. Listen LA-380; or
   b. Williams Sound CHG 3512 PRO.

7. Provide a different operating frequency for each wireless hearing assistance transmitter system, free from interference, per FCC regulations Part 74, Subpart H. If required, assist the Owner in licensing these transmitter(s).

E. Audio Accessories

1. Audio Extension Cable, black flexible cable, with metal connectors and molded strain relief, factory fabricated from Horizon, ProCo, Whirlwind, or Wireworks.
   a. Type 1: 1/8-inch stereo phone plug to dual RCA phono plugs, 6 feet.
   b. Type 2: 1/8-inch stereo phone plug to 1/8-inch stereo phone plug, 6 feet.

2. Stereo Headphones, dynamic dual headset, closed-back, reference quality, with coiled cord and 3-conductor phone plug.
   a. Audio-Technica ATH-M50x; or
   b. Sennheiser HD 280 PRO; or
   c. Sony MDR-7506.

2.5 ETHERNET NETWORKS

A. Network Equipment

1. Ethernet Switch, managed 10/100/1000Base-T switch, number of ports as required, with POE+ capability, with SFP 10Gbps uplink port with multi-mode fiber transceiver, with capability to control fans, with DSCP QoS support with four queues with strict priority queuing, with multicast filtering, with non-blocking backplane, IGMPv2, fully compatible with all equipment provided, rack-mounted.
   a. Cisco Catalyst 9300 Series; or
   b. Netgear M4250 Series; or
   c. Ubiquity Edgeswitch Series; or
   d. Approved equal.
   e. The Systems Contractor shall provide any and all mounting hardware and shall assist with proper configuration of switches to ensure a properly operating AV network.
   f. The network shall be configured with the appropriate IGMP Snooping, QoS, and other settings as recommended by the manufacturer of the Digital Audio Processor for networking protocols used. Coordinate with the Owner’s IT department for IP address table and integration into the building network.

2. Patch Panel, flat style, 24 modular ports, rack mounted.
   a. Panduit CPPL24WBLY with modules as required; or
   b. Approved equal.
   c. Provide printed labels for all patch panel ports.

3. All UTP field circuits shall terminate to appropriately labeled punchdown terminations (patch panels or biscuit jacks) installed in the equipment racks. Use factory fabricated patch cables between all punchdown terminations and the switches, and between all rack mounted equipment and switches.

2.6 CABLE AND CONNECTORS

A. 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. Microphone and intercom extension cables, where cable is exposed on audio console; 2-conductor, #24 AWG nominal, stranded, braid shielded, with black flexible jacket.
   a. Belden 8413; or
   b. Canare L-2T2S; or
   c. Carol Cable 743704; or
   d. Gepco MP1022; or
   e. Mogami W2791; or
   f. RapcoHorizon Mic3; or
   g. Approved equal.

3. 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.

4. Loudspeaker circuits installed in conduit, equipment rack, or exposed interior benign environment (except return air plenums); stranded, unshielded, jacketed. Cable color to approximately match ceiling color in exposed locations.
   a. #18 AWG, 2-conductors
      1) Belden 9740; or
      2) Covid CVA 0200 18; or
      3) Extron SPK18; or
      4) Liberty 18-2C-GRY; or
      5) Gepco IR182BA7; or
      6) West Penn 224; or
      7) Windy City Wire 427100-11S; or
      8) Approved equal.
   b. #16 AWG, 2-conductors
      1) Belden 8471; or
      2) Covid CVA 0200 16; or
      3) Extron SPK16; or
      4) Liberty 16-2C-GRY; or
      5) Gepco IR162BA19; or
      6) West Penn 225; or
      7) Windy City Wire 8160219-02S; or
      8) Approved equal.
   c. #14 AWG, 2-conductors
      1) Belden 8473; or
      2) Covid CVA 0200 14; or
      3) Extron SPK14; or
      4) Liberty 14-2C-GRY; or
      5) Gepco IR142BA19; or
      6) West Penn 226; or
      7) Windy City Wire U029100-11S; or

8) Approved equal.

d. #12 AWG, 2-conductors
1) Belden 8477; or
2) Covid CVA 0200 12; or
3) Liberty 12-2C-GRY; or
4) Gepco IR122BA19; or
5) West Penn 227; or
6) Windy City Wire U023100-11S; or
7) Approved equal.

5. 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.
3) 10 AWG, 2-conductors
4) Belden 6T00UE; or
5) Approved equal.

B. Antenna Cable

1. Hearing Assistance System antenna cable, when antenna is remotely mounted, if length is less than 50 feet, braid and foil shield, RG-59/U, 75 ohms.
a. Belden 1505A; or
b. Covid CVD 1100 95F; or
c. Liberty AV 20-CMR-VIDEO; or
d. Sheerwire SVHD59R; or
e. West Penn 819; or
f. Windy City Wire 9659113-09S.

2. Hearing Assistance System antenna cable, when antenna is remotely mounted and length is greater than 50 feet, type RG-6/U, 75 ohms.
a. Belden 1695A; or
b. Covid COV 3100 CQ; or
c. Liberty AV RG6-QUAD-CMP; or
d. West Penn 25Q841; or
e. Windy City Wire 606224-S; or
f. Approved equal.

C. Control Cable

1. Control System Cable, twisted pair, compatible with control system equipment chosen.
   a. Belden 1502P; or
   b. Covid COM 1400; or
   c. Crestron Crestnet-NP; or
   d. Extron CTL; or
   e. Gepco 18/22CRT; or
   f. Liberty AXLINK; or
   g. West Penn 77350.

D. Data Communication Cable

1. Category 6 UTP Cable, unshielded twisted pair, where installed in conduit or exposed interior benign environment (except return air plenums) for digital audio, video, and data network connections.
   a. Belden 3632, or MediaTwist 1872A; or
   b. Berk-Tek LANmark 2000 CAT6 or LANmark 1000 CAT6; or
   c. Carol Cable CR6; or
   d. CommScope 6ECMR.
   e. Superior Essex NextGain Category 6eX CMR; or
   f. Windy City Wire SmartWire 7756 Series; or
   g. Approved equal.

2. Category 6 UTP Cable, unshielded twisted pair, where installed return air plenums, for digital audio, video, and data network connections.
   a. Belden 3633, or MediaTwist 1874A; or
   b. Berk-Tek LANmark 2000 CAT6 or LANmark 1000 CAT6; or
   c. Carol Cable CP6; or
   d. CommScope 6ECMP.
   e. Superior Essex NextGain Category 6eX CMP; or
   f. Windy City Wire SmartWire 5566 Series; or
   g. Approved equal.

3. Category 6 Patch Cables, factory-made, with molded connectors, selected from the manufacturers as noted for premise cable above.
   a. Certified Category 6 cable shall be used for all UTP patch cables installed within equipment racks. No field-fabricated patch cables shall be used.

E. Fiber Optic Cables

1. Fiber Optic Cable, 50-/125-micrometer multimode, OM4, multi-fiber assembly, PVC outer jacket, for use in conduit and equipment racks.
   a. Six fibers, for use where four fibers are required terminated;
      1) Belden FI4D006R9 or M9C039; or
      2) Commscope N-006-DS-5K; or
      3) Panduit FODRZ06; or
      4) Superior Essex 43006PG; or
      5) Approved equal.
      6) Fiber Optic Cable pulls shall include at least two spare fibers.

2. Fiber Optic Patch Cables, factory-made, with molded connectors, selected from the manufacturers as noted for cable above.
   a. Certified OM4 patch cables shall be used for all fiber patch cables installed within equipment racks. No field-fabricated patch cables shall be used.

F. 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.

G. Miscellaneous Connectors

1. PowerCON Jack, 20A rated, panel mount, pass through RJ45 jacks, field terminable, with latch lock, different keyed input and output connectors, square in shape, compatible with PowerCON Connector below.
   a. Input: Neutrik NAC3MPXXA (Blue).
   b. Output: Neutrik NAC3MPXXB (Gray).

2. PowerCON Connector, 20A rated, field assembled, plastic locking shell, different keyed input and output connectors, compatible with PowerCON Jacks above.
   a. Input: Neutrik NAC3FCA-1 (Blue).
   b. Output: Neutrik NAC3FCB-1 (Gray).

2.7 EQUIPMENT RACKS, CABINETS, AND ACCESSORIES

A. Equipment Racks and Carts

1. Floor Standing Equipment Rack, 40RU, floor standing, nominal 32 inches deep, gangable, black in color, with locking perforated front door, locking solid rear door, side panels, and with top opening for mounting exhaust fans, and with fan panel with 4 quiet fans.
   a. Lowell LGR Series with LFD-FV series front door and FW4-7T fan top; or
   b. Middle Atlantic WRK Series with LVFD series front door and MW-4QFT-FC fan top.

2. Equipment Rack Storage Drawer, size as indicated on the rack layout drawings, steel, with key lock, black to match equipment racks.
   a. Lowell UDP Series; or
   b. Middle Atlantic D Series with keylock; or
   c. Install drawers in the equipment racks as shown on the rack layout drawings.

3. Sliding Shelf, 1RU, steel, ball bearing slides, minimum 50-lbs capacity, black to match equipment racks
   a. AtlasIED VTD1-16; or
   b. Legrand SLS-1; or
   c. Lowell RSD-116.
   d. Install shelves as shown on the rack layout drawings.

4. Furnish small magnetic portable work light with LED bulb and gooseneck in each equipment rack.
   a. Middle Atlantic LT-GN-WL; or
   b. Approved equal.

5. USB LED work light.
   a. Middle Atlantic LT-GN-PL.

6. Configure adjustable rack rails inside equipment racks as necessary for proper clearance for cable routing and front mounted controls.

7. All racks shall be keyed alike if possible.

8. 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).

9. 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.

10. 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.

11. 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.

12. 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).

13. Equipment with deep front panel connectors or controls (such as Ethernet Switches) that interfere with a front door or pose a potential hazard shall be installed on rack rail recess adapters (Middle Atlantic RR2-3RCN or similar).

14. 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.

15. The following guidelines concerning equipment rack layouts shall be followed. Submit shop drawings illustrating proposed equipment rack layouts, indicating equipment labels.
    a. Equipment Rack Layouts shall be grouped according to function; audio, video, and control.
    b. Heavy equipment such as audio amplifiers, large video matrix switches, and UPSs 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.

B. Hardware and Accessories

1. Table Connection Box, number (#) of gangs as required, with sloped face and cable exit at back.
    a. Ace Backstage 147G#; or
    b. Extron SMB 11#; or
    c. FSR Inc. DSKB-#G.
    d. Coordinate mounting conditions with existing conditions, millwork, and as determined during commissioning. Where left loose, provide rubber feet for the box.

2. Surface Mounted Wallboxes, standard gang size, used as the backbox for connection plates where standard electrical boxes cannot be flush mounted in wall, steel construction, paintable.
    a. Extron EWB 10#; or
    b. FSR Inc. SMWB-#G.

3. Surface Mounted Raceway, steel construction, paintable, with surface mounted boxes, raceway, and fitting sizes as required.
    a. Legrand Wiremold; or
    b. Equal.

4. Surface Mounted Wireway, plastic construction, with cover, size as shown on the drawings.
   a. Panduit PANDUCT; or
   b. Equal.

5. Threaded Pipe, cold rolled steel, 1.5 inch NPT size.
   a. Provide length as required to mount devices as shown on drawings.

6. Unistrut, slotted metal framing, steel construction, member sizes and fittings as required.
   a. All channel members shall be fabricated conforming to one of the following ASTM specifications:
      1) Plain Carbon Steel: ASTM 1011 SS Grade 33
      2) Pre-Galvanized Carbon Steel: A 653 Grade 33
   b. All fittings shall be fabricated conforming to one of the following ASTM specifications:
   c. Carbon Steel: All carbon steel fittings shall be fabricated from steel that meets/exceeds the physical requirements of ASTM A1011 SS Grade 33 and conforms to one of the following ASTM specifications:
      1) ASTM 575.
      2) ASTM 576.
      3) ASTM 36.
      4) ASTM 635.
      5) ASTM1059.
      6) ASTM 1046.
   d. Finishes
      1) Factory painted with rust inhibiting thermoset acrylic enamel paint applied by electro-deposition after cleaning and phosphating, and thoroughly baked.
      2) Polyester powder coat after cleaning and phosphating, and thoroughly baked.
      3) Electro-galvanized per ASTM B 633 Type III SC 1.
      4) Pre-galvanized per ASTM A653.
      5) Hot-dipped Galvanized per ASTM A123 or A153.

7. Type 1 Barrier Strip, for termination of audio circuits in equipment rack where shown on the drawings and/or needed for transition between cable types.
   a. TRW-CINCH 140 series; or approved equal.

8. Type 2 Barrier Strip, high-density, for termination of loudspeaker circuits where shown on the drawings and/or needed for transition between cable types.
   a. Phoenix Contact High-Density UK series; or approved equal.

9. Spade Tongue Terminal, brazed seam, uninsulated type only.

2.8 AC POWER

A. Furnish modular vertical power strip in each Equipment Rack with number of circuits and corresponding color-coded always-on and sequenced outlets as required. Each rack shall have at least four spare always-on receptacles. Furnish additional power distribution equipment as required for all equipment racks.

B. Furnish an Uninterruptible Power Supply for the following equipment.

   1. Digital Audio Processors.
   2. Digital Mixing Consoles.
   3. Ethernet Switches.
   4. Control Systems and accessories.

C. Furnish power conditioning and surge suppression for all major video, audio, and network equipment not served by a UPS. Video Projectors may be excluded; the branch circuits serving this equipment will be conditioned and protected by centralized equipment provided by others.

D. 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.

E. 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.

F. AC Power Equipment

1. Modular Vertical Power Strip, single or multiple 20A circuits, with isolated ground, with surge suppression modules, remote control modules, and standard outlet modules as indicated on the drawings and as specified below.
   a. Legrand Middle Atlantic MPR Series.
   b. Provide large external junction box to house surge suppression modules.

2. AC Power Modules, compatible with Modular Vertical Power Strip above.
   a. In-line Surge Suppression (transient voltage).
      1) Legrand Middle Atlantic MA-MPR-SS.
   b. 20A with Remote Control.
      1) Legrand Middle Atlantic RLM-20A.
   c. 20A Standard.
      1) Legrand Middle Atlantic M-20A.

3. Power Sequencer, rackmount, with minimum six sequenced steps, with defeatable front panel control, with remote control input.
   a. Legrand Middle Atlantic USC-6R.

4. Power Module, 15A, rackmount, with unswitched front panel convenience outlet, with surge suppression and power conditioning, with front mounted lights.
   a. Furman PL-8 C; or
   b. Juice Goose RP 200; or
   c. Approved equal.

5. Uninterruptible Power Supply, sized to provide a minimum of 10 minutes run time for connected load, line-interactive, rack or shelf mount as required.
   a. Middle Atlantic; or
   b. Tripp Lite SmartPro Series; or
   c. SurgeX.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation and connection of sound reinforcement system equipment, materials, cable, and cable fittings shall be performed only by experienced sound reinforcement 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 any other equipment suspended overhead shall be installed by a qualified rigging technician following manufacturer’s installation guidelines for all rigging components and as indicated on the approved shop drawings. Any changes made to the rigging design during installation shall be updated on the project record as-built drawings and re-approved by the Systems Contractor’s structural engineer.

Y. All loudspeakers, projectors, and other equipment suspended overhead shall be installed with wire rope safety ties connected to the building structure as shown and approved on the submitted shop drawings.

Z. 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.

AA. All analog video connections shall be made with a specified BNC type connector. The BNC plug center pin shall be crimped with a Trompeter 010-0055 or Buchanan 613439 crimp tool.

BB. No field terminated digital video connectors will be permitted unless otherwise noted in these specifications or drawings (HDMI, DVI, DisplayPort).

CC. No soldering of video connectors will be permitted.

DD. All non-locking video connectors shall be secured to the installed equipment such that the connectors cannot be easily disturbed or disconnected.

EE. 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 AND CONNECTION PLATES

A. All nameplate nomenclature shall be reviewed by the Owner 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 Owner.

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, Owner, and/or Acoustical Consultant.

E. Unless noted otherwise, standard gang connection panels shall be Sierra stainless steel wall plates, or color as selected by Owner.

F. Unless noted otherwise, NEMA size connection panels shall be clear anodized brushed aluminum, or color as selected by Owner.

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 the 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 shop drawings for each connection panel with all connections, devices, labels, colors and sized clearly indicated.

3.4 PAINTING

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

B. Any custom painting of loudspeakers shall be done at the factory or other controlled environment using spray or powder-coat process without damage to components or blocking grille openings. Except as otherwise noted herein, painting with brush or roller is not acceptable. Verify all finishes with Owner and indicate on shop drawings submitted for review.

3.5 PRELIMINARY SYSTEM TESTS AND ADJUSTMENTS

A. The Systems Contractor shall be responsible for preliminary field tests and adjustments of the completed sound reinforcement 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. Qualification of all Category-type field cabling.
6. Functional tests of all individual audio equipment
7. 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.
8. Setup of all dedicated networks, including assignment of appropriate IP addresses for all equipment, setup of any DHCP servers and wireless access points, and switch configuration.
9. Unbox, assemble, test, and all store portable equipment where appropriate.
10. Installation of the latest product firmware and software.
11. 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 reinforcement 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.

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 reinforcement 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 four (4) 10-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 reinforcement 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 reinforcement 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 reinforcement 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 electronic notebooks (a collection of digital files) for the sound reinforcement system 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 electronic 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 reinforcement system into the electronic notebooks. The Acoustical Consultant will then forward the electronic notebooks to the Owner through the Owner.

C. The information described below shall be neatly organized, named appropriately, and placed in a separate folder structure named by room/system type and as follows:

SOUND REINFORCEMENT SYSTEM
OPERATING INSTRUCTIONS AND MANUALS
ROBERT. W. PLASTER CENTER
PITTSBURG, KANSAS

D. Digital notebook contents shall include the following sections, each noted in the table of contents:

1. Table of Contents, with main entries for each major section and equipment category, and sub-entries for each equipment manual included.
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 (i.e. Microphones, Microphone Accessories, etc.); either as separate PDF files or as a single file with PDF bookmarks.
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. The electronic version of all the notebook contents shall be provided on a USB drive. All software files shall be included on each USB drive.

F. If additional project closeout document requirements are listed elsewhere in the project manual, those requirements shall also be followed in addition to these closeout document requirements.

3.9 SYSTEM OPERATING ASSISTANCE

A. After the sound reinforcement 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 one (1) complete end user training on the systems as a whole.

B. The Systems Contractor shall provide video recording for at least one session of each of the system overview training session(s) described above for inclusion in the Notebook of Operating Instructions.

1. Each recording shall include an introduction that identifies the system, location and equipment being demonstrated. Recordings shall be made with a high-quality camera and microphone, using a tripod where possible, and with proper lighting. Provide additional portable lighting if ambient light is insufficient for recording.

2. Recordings shall be provided in the MP4 file format, with a minimum 720P resolution, as part of the electronic notebook described above.

C. The Systems Contractor shall provide system operating assistance for the first two major uses of the completed sound reinforcement 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

1. Connectors and wiring used in equipment racks.

4.2 BASE BID PORTABLE EQUIPMENT QUANTITY

A. Quantities shown below are only for portable equipment not permanently mounted and/or not permanently connected to the sound reinforcement 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 Velcro One-Wrap cable straps, or similar, for all portable cables.

C. Microphones and Accessories

1. One (1) Sports Announce Headset Microphone.
2. One (1) Sports Announce Microphone Base.
3. Two (2) Type 4 Microphone Extension Cables.

D. Wireless Hearing Assistance System – Radio Frequency

1. Twelve 12) Personal Receivers.
2. Twelve (12) Lightweight Earloop Headphones.
3. Four (4) Neck Loop Transductors.
4. One (1) Charging/Storage Case.

E. Audio Accessories

1. Two (2) of each type of Audio Extension Cables.
2. One (1) pair of Stereo Headphones.

F. Miscellaneous

1. One (1) copy of the Notebook of Operating Instructions.
2. Four (4) sets of Equipment Rack Keys.

END OF SECTION 275115