SECTION 274100 - SOUND REINFORCEMENT & AUDIO/VIDEO SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. These specifications and the associated SV-series drawings describe the sound reinforcement systems (also referred to herein as the “sound systems”; the “systems”; or the “system”) to be furnished and installed at the new IUP Convocation Center, Indiana University of Pennsylvania, Indiana, Pennsylvania. [ADG 06289]

B. The system scope includes the following general categories:

1. Arena bowl sound system.
2. Arena ancillary sound coverage for Suites & Concourses.
3. Arena in-house camera locations cabling/connections.
4. Main Lobby sound system.
5. Auditorium sound system.
6. Auditorium ancillary sound coverage for Auditorium’s small Lobby.
7. Conduit/box infrastructure only: Portion of conduit/box infrastructure for pathways/locations supporting those systems and equipment related to future video projection in the Arena (mentioned for information only; no work by the Technical System Contractor is required). Certain of this infrastructure and other related infrastructure is shown on the Electrical drawings such as: AC power outlets; show power; broadcast truck power; IT and/or TV outlet boxes; cable tray network; and related conduit.
8. Future (or concurrent) systems by Owner (or others designated by Owner), such as: in-house video production; in-house television distribution system; campus cable (including associated receiving device(s) and routing to and within the building); and any other equipment or system not included in the design of the sound systems.

C. System design philosophy is based on straight forward, flexible systems suitable for reinforcement and reproduction of both speech and music and/or comfortable viewing/presentation applications, primarily using professional, high-quality, "off-the-shelf" equipment. Systems are designed to serve the primary functions of each space, to include:

1. The Arena bowl’s athletic events, such as basketball and volleyball, with secondary uses including sports instruction, convocations/graduations, and small entertainment venues. The Arena sound system is not intended to support touring acts (road shows).
2. The Main Lobby’s receptions and group-tour orientations.
3. The Auditorium’s seminars, large group instruction, and small entertainment venues. The Auditoriums’s sound system is not intended to support touring acts (road shows).

D. All requirements and instructions listed in the “Instructions to Bidders,” General and Supplementary Conditions, and Division One Specifications, apply to work specified in this section.

E. Work under this section of the specifications includes all labor, equipment, and installation as required to provide complete sound systems in compliance with the contract documents.

F. The Technical System Contractor shall employ the services of a qualified structural engineer to review all overhead mounting, suspension, and rigging details of the system equipment. All mounting and rigging schemes indicated on the drawings are shown for concept only. The Technical System Contractor shall submit shop drawings stamped by his structural engineer of all details and weights for review by the project’s Architect, Structural Engineer, and Acoustical Consultant.

G. The sound system installation itself does not include conduit, outlet boxes, junction boxes, pull boxes, terminal cabinets, 120-volt AC power circuits, or insulated ground cables, which shall be furnished and installed by the project Electrical Contractor. The Technical System Contractor shall provide low-voltage “on/off" control system wiring, low-voltage "on/off" control switches, related power verification devices, and certain AC power/ground requirements internal to the equipment racks, as specifically noted herein and/or on the drawings.

H. The Technical System Contractor shall provide loudspeaker enclosures to the Electrical Contractor for installation where such enclosures are connected directly to conduit.

1.02 EXAMINATION OF SITE

A. This project is a new facility currently under construction.

B. During the course of project construction, the Technical System Contractor shall personally examine the site of the proposed work and verify the conditions which involve his work.

C. By the act of submitting a bid, the Technical System Contractor will be deemed to have made reasonable allowances for site examinations and site conditions, and included all costs in his proposal. Failure to verify site conditions will not be considered a basis for the granting of additional compensation.

1.03 MATERIAL AND WORKMANSHIP

A. All equipment shall be new and in proper operating condition. All workmanship shall be of the finest quality by experienced installation technicians.

B. The Technical System Contractor shall contact the Architect, in writing, regarding the selection of colors for all equipment such as loudspeaker grilles, exposed loudspeaker boxes, wall plates, millwork, laminate, and other items specific to the project.

C. In addition to a complete set of the system project drawings and specifications, the Technical System Contractor shall maintain at the job site a complete set of manufacturer's original operation, instruction, installation, and service manuals for each equipment item, for reference.

1.04 ORDINANCE AND CODES

A. The Technical System Contractor shall comply with all applicable national and local codes, ordinances, and obtain all required permits. The Technical System Contractor shall be held responsible for any violations of the law within the scope of his work.

1.05 DEFINITIONS

A.	Owner:	Indiana University of Pennsylvania (IUP) Facilities Engineering & Construction Group Indiana, Pennsylvania (724) 357-2289 Fax (724) 357-6480
B.	Architect:	L. Robert Kimball and Associates, Inc. (LRK) 615 West Highland Avenue Ebenburg, Pennsylvania 15931 (814) 472-7700 Fax (814) 472-7712
C.	Acoustical Consultant:	Acoustical Design Group, Inc. (ADG) 5799 Broadmoor, Suite 108 Mission, Kansas 66202 (913) 384-1261 Fax (913) 384-1274
D.	Technical System Contractor:	Individual or company who contracts for the supply and installation of the sound reinforcement and audio/video systems specified herein.

1.06 CONTRACTOR QUALIFICATIONS

A. Work in this section shall be performed by an Technical System Contractor who:

1. complies with the requirements of Division 1, and
2. is licensed to perform work of this type in the project jurisdiction, and
3. has at least five (5) years of verifiable direct experience with the devices, equipment and systems of the type and scope specified herein, and
4. has a minimum of one full-time staff member who has attended technical system engineering courses taught by Syn-Aud-Con in the past 10 years, and
5. has an active membership in the National Systems Contractors Association (NSCA), and
6. has a minimum of one full-time NICET certified Level II audio systems technician or one full-time NSCA Certified Electronic Systems Technician (C-EST) or one Infocomm CTS-I (Certified Technology Specialist - Installation) systems technician, and
7. has a fully staffed and equipped maintenance and repair facility.

B. The Technical System Contractor shall include, with his bid, a list of credentialed staff who will be actively involved in this project including specific tasks each will perform. Include all continuing education for each individual.

C. The Technical System Contractor shall use sufficient numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this section. These personnel shall have at least three (3) years direct experience in similar work, evidence of which shall be verified in writing with appropriate references.

D. The Technical System Contractor shall appoint a designated supervisor who shall have at least five (5) years direct experience in similar work. The supervisor shall be present and in responsible charge of all work in the fabrication shop and on the project site during all phases of the installation and testing of the system(s). To assure continuity, this supervisor shall be the same individual throughout the execution of the work unless illness, loss of personnel, or other reasonable circumstances intervene.

E. The Technical System Contractor shall have a minimum of one full-time staff member, who has a minimum of three (3) years direct experience, and who is factory-certified on the most recent version of the selected Integrated Processing System (IPS) and technology. This individual shall be responsible for the implementation of the system including software. This individual shall be the same throughout the execution of the work unless illness, loss of personnel, or other reasonable circumstances intervene.

F. The Technical System Contractor shall be a factory-authorized dealer for the major components specified including items such as loudspeakers, power amplifiers,

integrated processing systems, and audio console mixers.

G. The Owner may request a prospective Technical System Contractor to provide additional information as desired for review by the Owner, Architect, and Acoustical Consultant to make a determination of the Technical System Contractor's acceptability.

H. Other contractors bidding this work who cannot meet the above qualifications must employ the services of a qualified Technical System Contractor who meets the above qualifications. This Technical System Contractor shall supervise the installation and perform all wiring connections.

1.07 SUBSTITUTIONS

A. The project shall be bid based on the equipment/materials listed in these specifications and on the drawings. After award of a sound & AV system contract, the Technical System Contractor may wish to substitute equipment/materials other than that specified, subject to approval. The Technical System Contractor shall bear the “burden of proof” for demonstrating substitute equipment/materials equivalency and suitability.

B. Information regarding substitution of equipment/materials shall be presented in writing to the Owner, Architect, and Acoustical Consultant for review. This written request shall contain copies of complete manufacturer's literature regarding the proposed substitute item(s), specifications, and front/rear views (if applicable).

C. Submission of substitute equipment/materials (including any associated software) may be required for evaluation by the Acoustical Consultant, at his discretion, prior to acceptance, and subject to evaluation fees. The Technical System Contractor shall be responsible for the substituted equipment/materials and for all related shipping costs and evaluation fees.

D. The Technical System Contractor shall be required to replace such installed substitute equipment/materials if an unforeseen defect appears, or if operational characteristics do not fulfill the design intent of the sound & AV systems.

1.08 SUBMITTALS

A. Comply with the requirements of the project General Conditions. Verify with the Architect, the quantity of copies required for each submittal package to allow copies to be: retained by the Acoustical Consultant (and, as applicable, any other reviewing party); distributed to the Architect (and, as applicable, the Owner, Design Team members, and General Contractor or Construction Manager); and returned to the Technical System Contractor. Quantity shall be minimized by limiting distribution only to persons having a need-to-know.

B. Submittals shall comply with the overall project schedule. Failure to make timely, complete submittals is considered to be a lack of substantial progress of the work in the section.

C. Each submittal package noted below shall be submitted independently and each under its own transmittal clearly stating the contents of the submittal (i.e. “Equipment List & Literature”; “Loudspeaker Mounting/Suspension”; etc.).

D. For the **first** submittal, the Technical System Contractor shall provide the following:

1. A complete list of all equipment and materials intended for the project, and with the list arranged in the same order as in the specifications. The material and equipment lists shall be submitted and reviewed before any equipment and material is purchased.
2. The equipment list shall be accompanied by manufacturer's specification sheets on all MAJOR pieces of equipment, including: amplifiers, mixers, program source equipment, signal processing, loudspeakers, and other MAJOR components of the sound systems. Unless directed otherwise in the front-end portion of the contract documents, cut sheets for minor items such as headphones, audio adapters, and audio connectors need not be included. However, complete cut sheets shall be required for all substitute or other equipment not specified herein.
3. Substitute equipment/materials shall be so noted as a “Proposed Substitute,” along with a <u>footnote briefly stating the reason for the proposed substitution</u>.
4. A progress schedule shall be included with this first submittal, and shall include duration and milestones for at least the following: completion of equipment buy-out, completion of shop fabrication, projector installation, projection screen installation, loudspeaker installation, rack installation, preliminary field testing of system, system commissioning, and system first use.
5. All information in this first submittal shall be bound as one complete package or booklet. Three-ring binders will <u>not</u> be accepted.

E. For **subsequent** submittals, sufficiently prior to installation of each respective portion of work, the Technical System Contractor shall submit the following:

1. Loudspeaker, suspension, and rigging details, including weights of supported equipment and mounting/suspension materials, approved and stamped by the Technical System Contractor's structural engineer.
2. All panel, plate and patch panel layouts (such as for wall boxes and for rack or console turret mounting) indicating locations of connectors, engraving, nomenclature, panel material, and finish. Labeling for the power amplifier test/monitor panel shall be included in this category.
3. Equipment rack front elevation showing equipment and panel layout.
4. Sound console millwork details, and related equipment and panel layout.
5. Multi-conductor cable system details, including a detailed pin number and wire color schedule.

6. For any permanent exposed cable applications, written authorization from the Architect (or Architect's designated Engineer) as to which locations do and do not require plenum-rated cable.
7. Shop drawings as indicated elsewhere in these specifications and/or on the project drawings.

F. Copies of all reviewed submittals shall be kept at the project site during the construction of the project, for reference.

1.09 ELECTRONIC FILE SHARING

A. Electronic files of the technical system SV series drawings, in Adobe Acrobat (.pdf) or AutoCAD (.dwg) formats, will be made available to the Technical System Contractor of record, when requested. Upon receipt of a request, the Acoustical Consultant will a) verify electronic distribution procedures/policies with the Architect, b) prepare the drawings for distribution, and c) send an Electronic File Sharing Agreement for signature (.dwg files only). The .dwg drawings are intended to assist the Contractor with project design and coordination. They are not intended to be used as submittals (except where specifically required within these specifications or on the drawings. By transfer of the .dwg files, Technical System Contractor shall take responsibility for the preparation of the final system drawings of record.

1.10 PROTECTION OF WORK

A. The Technical System Contractor shall protect all work, materials and equipment from damage due to any cause. He shall provide for the safety and new condition of the equipment and materials until final acceptance by the Owner. The Technical System Contractor will replace all damaged or defective materials and/or equipment as directed by the Architect or Acoustical Consultant.

B. Equipment racks, console turrets, counter-mounted equipment, and other exposed equipment shall be kept covered and protected from airborne contaminates. The Technical System Contractor shall clean all debris from the equipment room(s) and control room area, and shall clean all equipment and the interior rack floor, prior to system commissioning activities.

1.11 TEMPORARY SOUND SYSTEM(S)

A. The Technical System Contractor shall provide and operate a temporary sound system(s) of reasonably equivalent function as determined by the Acoustical Consultant if the work in this section, as a failure of the Technical System Contractor, is incomplete or found not in conformance with the contract documents. The temporary system(s) shall remain in use until acceptance of the permanent system(s).

PART 2 - PRODUCTS

2.01 GENERAL

A. Unless otherwise designated, the Technical System Contractor shall provide all of one type of equipment from one manufacturer; for example, power amplifiers of one type to be provided by one manufacturer; all loudspeakers of one type by one manufacturer.

B. All major components of the system equipment shall be provided and installed by a qualified Technical System Contractor as outlined in Part 1 of this section.

C. All equipment shall be of professional quality. All electronic audio devices shall have electronic or transformer balanced inputs and outputs except for specific program source equipment and specific mixing console inputs and/or outputs. If an electronic device specified or furnished has an unbalanced input and/or output, the Technical System Contractor shall make provisions to balance said input/output (i.e., outboard line-level transformer as approved) unless other arrangements have been agreed upon with the Acoustical Consultant.

D. Some items listed in these specifications are custom-made products. Ensure when pricing and ordering equipment that the exact part number called out is used. If there is a discrepancy, the Technical System Contractor shall contact the Acoustical Consultant for clarification.

E. **Each** software programmable device furnished (i.e. integrated processing system, AV control system , etc.) shall include most recent software on CD-ROM and appropriate computer interface cable - minimum 25' (device to PC). Cable, software, source (uncompiled) code, binary code, and all related aspects of all software-controlled equipment shall become the property of the Owner and will be furnished by the Technical System Contractor as a portion of the Operation & Maintenance (O&M) manuals (see Operation & Maintenance Manuals near the end of Part 3).

F. The quantities of each item of portable or mobile equipment (and other portable or loose accessories), as well as those items associated with Alternates, are indicated in **bold type** and listed under the paragraph entitled “Portable Equipment & Accessories”. Such equipment is intended to be shared between rooms having sound & AV systems, except where noted for use in one specific room. In some cases, **bold type** may be used to note total quantities of an item of both mounted and portable equipment, to eliminate any ambiguity as to total project quantity.

2.02 WIRELESS MICROPHONE SYSTEM (UHF)

A. Furnish complete UHF diversity wireless microphone system(s) including the following components (select components from one manufacturer listed below):

1. Arena:

   a. Electro-Voice REV series
      (1) REV-D dual channel receiver with UCC-1 USB to CAN bus adapter and REV-Link software for frequency coordination between multiple receivers and computer
      (2) REV-BP bodypack (beltpack) transmitter (**two required**)
      (3) REV-HD9 handheld microphone transmitter (**two required**)
      (4) CLA-X 1/2-wave remote antennas ("X" indicates frequency range, Technical System Contractor shall coordinate for best RF reception) (quantity as shown on the drawings)
      (5) Antenna Distribution for up to six receivers internal to receivers, external distribution not required; or

   b. Sennheiser Evolution G3 300 series
      (1) EM 300 G3 single channel receiver with GA3 rack adapter (quantity as shown on drawings)
      (2) SK 300 G3 bodypack (beltpack) transmitter (**two required**)
      (3) SKM 300-845 handheld microphone transmitter (**two required**)
      (4) A1031-U Omni-directional antennas
      (5) ASA1/NT Antenna Distribution System; or

2. Auditorium:

   a. Electro-Voice REV series
      (1) REV-D dual channel receiver with UCC-1 USB to CAN bus adapter and REV-Link software for frequency coordination between multiple receivers and computer
      (2) REV-BP bodypack (beltpack) transmitter (**two required**)
      (3) REV-HD9 handheld microphone transmitter (**two required**)
      (4) CLA-X 1/2-wave remote antennas ("X" indicates frequency range, Technical System Contractor shall coordinate for best RF reception) (quantity as shown on the drawings)
      (5) Antenna Distribution for up to six receivers internal to receivers, external distribution not required; or

   b. Sennheiser Evolution G3 300 series
      (1) EM 300 G3 single channel receiver with GA3 rack adapter (quantity as shown on drawings)
      (2) SK 300 G3 bodypack (beltpack) transmitter (**two required**)
      (3) SKM 300-845 handheld microphone transmitter (**two required**)
      (4) A1031-U Omni-directional antennas
      (5) ASA1/NT Antenna Distribution System; or

3. Main Lobby:

a. Electro-Voice REV series
   (1) REV-D dual channel receiver with UCC-1 USB to CAN bus adapter and REV-Link software for frequency coordination between multiple receivers and computer
   (2) REV-BP bodypack (beltpack) transmitter (**two required**)
   (3) REV-HD9 handheld microphone transmitter (**two required**)
   (4) CLA-X 1/2-wave remote antennas ("X" indicates frequency range, Technical System Contractor shall coordinate for best RF reception) (quantity as shown on the drawings)
   (5) Antenna Distribution for up to six receivers internal to receivers, external distribution not required; or

b. Sennheiser Evolution G3 300 series
   (1) EM 300 G3 single channel receiver with GA3 rack adapter (quantity as shown on drawings)
   (2) SK 300 G3 bodypack (beltpack) transmitter (**two required**)
   (3) SKM 300-845 handheld microphone transmitter (**two required**)
   (4) A1031-U Omni-directional antennas
   (5) ASA1/NT Antenna Distribution System; or

B. Provide one set of alkaline batteries to operate each transmitter, plus six sets of replacement alkaline batteries for each transmitter.

C. Where remote 1/4 wavelength antennas are used, and mounting conditions allow, mount each remote antenna on a standard metal wall plate to serve as a ground plane.

D. Provide all connections and components necessary for proper operation of the wireless systems described above.

E. Coordinate the selection of transmitter/receiver frequencies to be free of interference from outside sources or interference between wireless systems. Select the frequency from an unused channel between (470 - 698 MHz) per FCC regulations Part 74, subpart H.

F. Label each receiver/transmitter combination as noted on the drawings. See Part 3 of this specification for additional labeling requirements.

2.03 PROGRAM SOURCE EQUIPMENT

A. Some of the program source equipment specified is consumer-grade equipment. Upon award of a contract, the Technical System Contractor shall endeavor to procure these items as soon as possible to avoid delays caused by searching for discontinued product(s).

B. Rack-mount kit for equipment that requires rack mounting but is not provided with rack mount ears or optional rack mount kit:

1. Lowell RMK series; or
2. Middle Atlantic Products RSH series; or
3. Raxxess CFP-S series.

C. CD Playback Deck, single-disc player, single rack space, with XLR balanced ouput connectors, IR and RS-232 control:

1. Denon DN-C620; or
2. Tascam CD-01U Pro.

D. Compact Flash Record/Play Deck, records mp3 or wav to CF cards, single rack space, balanced inputs and unbalanced outputs:

1. Marantz Professional PMD570; or
2. Tascam SS-R1.

E. Chime, callback chime with multiple sound selections and momentary contact closure triggers:

1. Radio Design Labs FP-CH8 chime generator with external PS-24A power supply. Set the chime to playback sound number 6 when button is pressed; or
2. Approved equal.

2.04 AUDIO MIXING CONSOLE

A. The drawings show representative mixing console functions and connections. If the mixing console furnished differs from the console shown on the drawings, shop drawings are required indicating proposed wiring configuration, patch panel configuration, patch panel labeling, and any modifications to associated console/cart/rack layout or millwork. All of the features shown for the mixing console on the drawings shall be maintained with the substitute console.

B. 24-Input Mixing Console, minimum 24 balanced inputs and balanced outputs, 4-bus, six aux groups and with optional lamp (Arena Control Booth):

1. Allen & Heath GL2400-24; or
2. APB DynaSonics ProDesk-424; or
3. Midas Venice 320; or
4. Soundcraft GB2-24.

C. 16-Input Mixing Console, minimum 16 balanced inputs and balanced outputs, 4-bus, six aux groups and with optional lamp (Auditorium Sound Booth):

1. Allen & Heath GL2400-16; or
2. APB Dynasonics ProDesk-416; or
3. Midas Venice 240; or
4. Soundcraft GB2-16.

2.05 MODULAR AUDIO PROCESSING DEVICES

A. PGM Source Line Amp, with left/right line-level inputs and left/right/mono line-level outputs:

1. Radio Design Labs ST-UBA2 unbalanced to balanced amplifier with optional DTB Detachable Terminal Block.

B. Power supplies; furnish power supply(ies) quantity and size as required for amplifier load and for each amplifier's floating (bipolar) ground vs. ground-referenced connections (Caution: Do not connect "floating-ground" modules and "ground-referenced" modules to same power supply):

1. Radio Design Labs PS-24A, 400mA.
2. Radio Design Labs PS-24K, 1000mA.

C. Individual mounting method for line amplifiers:

1. Mount amplifier high inside of rack at accessible location to allow adjustments and access to connections when rack is open; provide sufficient wire length to allow removal of operating amplifier from rack for close examination and servicing; and clearly label amplifier input and output wiring and the amplifier itself as to function.

2.06 AUDIO TRANSFORMERS - LINE-LEVEL

A. All transformers furnished with socket pins shall have a matching socket with screw-type interface connections. Where Sescom transformers are furnished, add labeling to each transformer reflecting: pin-out information, jumpering options, and primary/secondary portions.

B. Matching (600/600) ohms:

1. Jensen DIN-LO-11FL; or
2. Approved equal.

2.07 SELF-POWERED AUDIO DISTRIBUTION AMPLIFIER

A. Self-powered, one balanced line-level input, multiple balanced line-level outputs, with individual level adjustments (verify quantity of outputs and/or quantity of amplifiers to fulfill system requirements):

1. Rane DA216 with SC1.7 security cover; or
2. Symetrix 581E (1x16).

2.08 INTEGRATED PROCESSING SYSTEM (IPS)

A. The Technical System Contractor shall provide Integrated Processing Systems (IPS) for the following spaces, to include: 1) Arena and 2) Auditorium.

B. Integrated Processing Systems shall be programmed so that both systems can be controlled from a single location and audio can be routed between systems.

C. The AC power cord of the IPS shall be connected to a rack-mounted uninterruptible power supply (UPS). Refer to the AC Power section for specific models. The UPS shall be connected to an unswitched (unsequenced) AC power circuit.

D. The system has been designed around the Biamp Audia product with the BSS Soundweb London as an alternative. The Acoustical Consultant has assembled preliminary schematics in the Audia software for the IPS to determine the needed equipment and processing power required for the project. After award of the contract, the Technical System Contractor shall contact the Acoustical Consultant for a copy of the files. The Technical System Contractor shall embellish the software to represent the final product for the client.

E. One stand-by laptop computer with mouse attachment, windows-capable, CD-ROM drives, interface cables, and screen able to display the maximum resolution available from the system shall be provided by the Technical System Contractor for commissioning services and shall remain the property of the Technical System Contractor. The laptop computer and features shall be as recommended by the manufacturer of the IPS system.

F. The Technical System Contractor shall furnish a CAT5 cable of sufficient length, or wireless 802.11g router to allow a computer to be located in the listening space to control the IPS during initial testing and commissioning. Cable/router shall remain property of the Technical System Contractor and shall remain on site until the system is completely signed off by the Acoustical Consultant.

G. The IPS shall consist of the following hardware and software as required to provide a fully-functional system:

1. Arena

a. * Biamp AudiaFLEX system:
(1) AudiaFLEX with CobraNet with included CAT5 crossover cable:
(2) IP-2 Input Module (**5 required**)
(3) OP-2e Output Module (**4 required**)
(4) AudiaEXPO (**3 required**)

(5) Logic Box
(6) Most recent Audia software; or

b. BSS Soundweb London system:
(1) BLU-160 processor with
(2) BLUCARD-IN Input Module (**2 required**)
(3) BLUCARD-OUT Output Module (**2 required**)
(4) BLU-BOB2 (**3 required**)
(5) MC-1 Fiber Optic Media Converter (instead of CobraNet and UTP to Fiber Ethernet Converter)
(6) Most recent London Architect software.

2. Auditorium & Main Lobby

a. * Biamp AudiaFLEX system:
(1) AudiaFLEX with CobraNet with included CAT5 crossover cable:
(2) IP-2 Input Module (**12 required**)
(3) AudiaEXPO (**three required**)
(4) Logic Box
(5) Most recent Audia software; or

b. BSS Soundweb London system:
(1) BLU-160 processor with
(2) BLUCARD-IN Input Module (**4 required**)
(3) BLU-120 Expander
(4) BLUCARD-IN Input Module (**2 required**)
(5) BLU-BOB2 (**3 required**)
(6) MC-1 Fiber Optic Media Converter (instead of CobraNet and UTP to Fiber Ethernet Converter)
(7) Most recent London Architect software.

H. The Technical System Contractor shall allow time during the commissioning process for the implementation of any software modifications and for entering values for the internal components (equalizers, delays, etc.).

I. The Technical System Contractor shall verify that the equipment rack is of sufficient height and depth to contain the IPS components and associated UPS, and shall verify that the rack shall not be physically challenged within the room where the rack is mounted. Equipment rack shop drawings shall include these IPS and UPS considerations.

2.09 ETHERNET SWITCHES

A. Ethernet Switch - 8U, 8 port (minimum) 10/100baseT Ethernet switch, unmanaged, no PoE, no rack mount:

1. Belkin F5D5131-8; or
2. Cisco SF 100D-08; or
3. D-Link DES-1108; or
4. HP ProCurve Switch 408; or
5. Netgear ProSafe FS108; or
6. Approved equal.

B. UTP to Fiber Ethernet Converter and Fiber to UTP Ethernet Converter, converts 10/100 base-T Ethernet from standard UTP cable to Multi-Mode fiber with ST fiber connectors:

1. Black Box LPD501A; or
2. EtherWAN EL150T; or
3. StarTech.com ET90110ST; or
4. TRENDnet TFC-110MST; or
5. Approved equal.

2.10 POWER AMPLIFIERS

A. Power amplifiers in this section shall be operated in the dual-channel (stereo) mode to provide two amplifiers within one chassis, unless noted otherwise. All power amplifiers shall have either electronic or transformer balanced inputs, and shall have stepped input level controls. Select 8-ohm or 70-volt version as required for each application shown on the drawings.

B. Type 800 Amplifier:

1. Electro-Voice CPS2.4 8-ohm bridged mono mode (one chassis per amplifier); or
2. QSC CX702, 8-ohms bridged mono mode (one chassis per amplifier); or QSC CX1202V, 70-volt; or
3. QSC PowerLight 4.0, 8-ohm. Note: PowerLight 4.0 requires dedicated 30 amp service. If this amplifier is selected the Technical System Contractor shall be responsible for any changes (circuit breaker size, receptacle type, etc.) to the AC power system to accommodate this product; or
4. Yamaha PC9501N.

C. Type 500 Amplifier:

1. Electro-Voice CPS2.8 8-ohm; or
2. QSC CX902, 8-ohm; or QSC CX602V, 70-volt; or
3. Yamaha PC6501N; or

4. any Type 800 amplifier.

D. Type 400 Amplifier:

1. Electro-Voice CPS2.8 8-ohm; or
2. QSC CX702, 8-ohm; or QSC CX602V, 70-volt; or
3. Yamaha PC4801N; or
4. any Type 500 amplifier.

E. Type 300 Amplifier:

1. Electro-Voice CPS2.6 8 ohm; or
2. QSC CX502, 8-ohm; or QSC CX602V, 70-volt; or
3. Yamaha PC3301N; or
4. any Type 400 amplifier.

F. Type 200 Amplifier:

1. Electro-Voice CPS2.4 8-ohm; or
2. QSC CX302 (2-channel 8-ohm); or CX404 (4-channel 8-ohm); or CX302V (2-channel 70 volt); or CX204V (4-channel 70-volt); or
3. Yamaha PC2001N (2-channel 8-ohm); or
4. any Type 300 amplifier.

G. Type 50 Amplifier:

1. Ashly SRA-2150; or
2. Crest CKi100S; or
3. QSC CX168.

H. Provide perforated metal security cover (type as specified under the equipment rack paragraph herein) for each amplifier, to cover all front panel controls and AC power switches. Security cover shall not block air-flow for amplifier internal cooling system. Manufacturers' security covers which conceal attenuator settings from direct view are <u>not</u> acceptable.

2.11 POWER AMPLIFIER MONITOR PANEL

A. Power amplifier monitor panel, for audible and visual troubleshooting assistance, 12-input or 16-input, each input accepts line-level, 8-ohm, or 70-volt signal, individual trim potentiometers for each input, with output volume control, Vu meter(s), loudspeaker, and headphone jack; self-contained, rack mountable:

1. Lowell model MP16 (16 inputs); or
2. Radio Design Labs model RM-MP12A (12 inputs) with PS-24K power supply.

B. For the above monitor panels:

1. Furnish panel quantity as required to accommodate number of power amplifier outputs (and any other monitor test points) as indicated on the drawings.
2. Initially set each input's level switch as indicated on the drawings, and re-set as required to allow suitable meter readings for normal system operating level. Re-set if requested later during system commissioning.
3. Furnish custom labeling (reflecting the labeling shown for each power amplifier) located on a blank panel directly above the monitor panel, and aligned with respective pushbutton selector switches (or respective meters).

2.12 LOUDSPEAKER VOLUME CONTROLS

A. Autotransformer-type stepped attenuators, sized for loudspeaker load, with engraved mounting plate and knob:

1. 35 watt:
   a. Atlas Sound AT-35; or
   b. Lowell 50LVC.

2. 75 watt:
   a. Atlas Sound AT-100; or
   b. Lowell 100LVC.

3. 100 watt:
   a. Atlas Sound AT-100; or
   b. Lowell 100LVC

B. Autotransformer-type stepped attenuators, sized for loudspeaker load, with dial scale on escutcheon plate and knob for custom panel mounting:

1. 35 watt:
   a. Atlas Sound AT-35-RM; or
   b. Lowell 50LVC-RM.

2.13 LOUDSPEAKERS - Installed Equipment

A. General loudspeaker requirements:

1. Where manufacturer's logo is visible, paint out the logo with semi-gloss black paint or remove the logo.
2. Loudspeaker, and related mounting bracket(s) where appropriate, color shall be as selected by the Architect from the available color selection offered from each loudspeaker manufacturer.
3. The Technical System Contractor shall submit shop drawings for support of all loudspeakers. The loudspeakers shall be supported from the building

structure or from the ceiling system as designed by the Technical System Contractor's structural engineer and approved by the Architect.

4. For portable loudspeakers specified (such as stage floor monitors), refer to the Portable Equipment & Accessories paragraphs.

B. Type 6-70C, Six-inch ceiling loudspeaker, coaxial, complete with 70-volt transformer and enclosure/baffle for flush-mounting (for ceilings in Suites and Auditorium Lobby):

1. Community Cloud 6; or
2. Martin Audio C6.8T; or
3. Tannoy (select model below based on ceiling conditions at each mounting location:
   a. CMS601-BM (blind-mount version) with integral back-can, for mounting in accessible ceilings.
   b. CMS601-PI with CMS601-PI-BackCan (pre-install version), for prior mounting the back-can in inaccessible ceilings and/or where connected to conduit, allowing later installation of loudspeaker.

C. Type 8-8, Two-Way Loudspeaker assembly, 8-inch, for surface mounting, nominal 90x90 coverage pattern with mounting bracket (for Auditorium Control Room Monitors):

1. Electro-Voice Zx1i-100 with included QuickSam bracket; or
2. QSC AD-S82 with AD-ID8 Intellidock mount or AD-YM8 yoke mount as required for each application; rotate waveguide 90-degrees when loudspeaker is to be mounted horizontally; or
3. Tannoy DI8 DC with K-Ball mount.

D. Type 8-70, Two-Way Loudspeaker assembly, single 8-inch, for surface mounting, nominal 90x90 coverage pattern, 70-volt transformer, and with mounting bracket (for Arena Concourse):

1. Electro-Voice Zx1i-100t with included QuickSam bracket; or
2. QSC AD-S82 with optional ID-8T Intellidock mount (with transformer) <u>or</u> YM-8T mount (with transformer) as required for each application; rotate waveguide 90-degrees when loudspeaker is to be mounted horizontally; or
3. Tannoy DI8 DCt with K-Ball mount.

E. Type 12-70C, Twelve-inch ceiling loudspeaker, coaxial, with 60-watt 70-volt transformer (for Main Lobby ceiling):

1. Electro-Voice EVID C12.2 (round enclosure/baffle); or
2. JBL Control 321CT with square ported baffle and optional MTC-300BB12 enclosure; or
3. Tannoy CMS12 TDC with TEQ 1200 back can and TEQ 1200T 150 W transformer.
4. For the above specified enclosures:

a. For enclosures flush-mounted in accessible ceilings, the Architect's approval is required for the mounting arrangement and to verify any requirement for a safety tie-off to the structure above.
b. Where field conditions prevent enclosure depth as specified, the Technical System Contractor shall furnish enclosures of a reduced depth only at those locations where so required and as approved on shop drawings.

F. Type 12-8, Twelve-inch, front-loaded, two-way loudspeaker assemblies with factory-supplied or factory-recommended suspension hardware as required for each application, 8-ohm, 60x60 dispersion:

1. Community iHP1266; or
2. EAW MK2366; or
3. Electro-Voice EVF1122S/66.

G. Type 118, Single Sub-Bass (Extended Low-Frequency) Loudspeaker, single 18-inch driver (for Auditorium proscenium):

1. Community i118S; or
2. EAW SB180zP; or
3. Electro-Voice EVF-1181S.

H. Type 218, Dual Sub-Bass (Extended Low-Frequency) Loudspeaker, dual 18-inch drivers, provide separate external connection for each driver to allow each driver to be driven separately (for Arena):

1. Community iLF218; or
2. Electro-Voice Xi-2181AF; or
3. Renkus Heinz DRS18-2B-UMH.

2.14 ASSISTIVE-LISTENING SYSTEM

A. Provide separate independent assistive listening systems, operating at different frequencies, for the Arena and for the Auditorium. System equipment shall be from one manufacturer only.

B. The transmitter shall be installed in the audio equipment racks and the transmitting antenna shall be remotely mounted/suspended at the location shown on the drawings. The antenna shall be installed in a vertical orientation. The Technical System Contractor shall be responsible for the selection of interference-free frequencies corresponding to the following initial assignments, subject to revision (as approved) to avoid interference:

Transmitter channel A	"Arena"
Transmitter channel C	"Auditorium"

C. The Assistive-Listening System, under **Base Bid**, shall consist of the following

hardware and software as required to provide a fully-functional system:

1. Arena:

   a. Listen Technologies Corporation
      (1) Part Number LT-800-072-1-14-3, includes Stationary Transmitter with rack mount brackets, power supply, and remote dipole antenna
      (2) Part Number LR-400-072-0-M-0, includes portable receiver and NiMH rechargeable batteries (**fourteen required**)
      (3) Part Number LR-200-072-0-M-0, includes portable three channel receiver and NiMH rechargeable batteries (**one hundred forty-five required**)
      (4) LA-164, Ear-Clip earphone (**fourteen required**)
      (5) LA-165, Stereo Headset (**fourteen required**)
      (6) LA-161, Single Earbud (**one hundred forty-five required**)
      (7) LA-166, Neck Loop for use with telecoil equipped hearing aids (**forty required**)
      (8) LA-311, 16-slot Charging/Carrying Case (**ten required**)
      (9) LA-304, ADA Compliance Kit (**four required**)

   b. Telex
      (1) ST-300 with RM-S rack mount kit and HGA-1 remote dipole antenna
      (2) SR-400, multi-channel receiver (**fourteen required**)
      (3) SR-50, single channel receiver (**one hundred forty-five required**)
      (4) Provide NiMH rechargeable batteries (**two required for each receiver if not included with receiver**)
      (5) ES-1, Single Side Ear Speaker (**fourteen required**)
      (6) HED-2, Lightweight Headphone (**fourteen required**)
      (7) SEB-1, Single Earbud (**one hundred forty-five required**)
      (8) NL-4S, Neck Loop for use with telecoil equipped hearing aids (**forty required**)
      (9) BC-100, Charging Station for two receivers (**twenty required**)
      (10) SM-C, Carrying Case for six receivers (**twenty-seven required**)
      (11) WP-1, ADA Wall Plaque (**four required**)

   c. Williams Sound
      (1) PPA T35 with RPK 005 rack mount kit and ANT024 remote dipole antenna
      (2) PPA R35-8N, eight-channel receiver (**fourteen required**)
      (3) PPA R35N, single channel receiver (**one hundred forty-five required**)
      (4) BAT 026 NiMH batteries (**two for each receiver if not included with receiver**)

(5) EAR 022, Ear-Clip Earphone (**fourteen required**)
(6) HED 021, Folding Headphone (**fourteen required**)
(7) EAR 013, Single Earbud (**one hundred forty-five required**)
(8) NKL 001, Neck Loop for use with telecoil equipped hearing aids (**forty required**)
(9) CHG 3512 mounted in CCS 029 case, to charge up to twelve receivers (**fourteen required**)
(10) IDP 008, ADA Wall Plaque (**four required**)

2. Auditorium:

a. Listen Technologies Corporation
(1) Part Number LT-800-072-1-14-3, includes Stationary Transmitter with rack mount brackets, power supply, and remote dipole antenna
(2) Part Number LR-400-072-0-M-0, includes portable receiver and NiMH rechargeable batteries (**eight required**)
(3) Part Number LR-200-072-0-M-0, includes portable three channel receiver and NiMH rechargeable batteries (**fourteen required**)
(4) LA-164, Ear-Clip earphone (**eight required**)
(5) LA-165, Stereo Headset (**eight required**)
(6) LA-161, Single Earbud (**fourteen required**)
(7) LA-166, Neck Loop for use with telecoil equipped hearing aids (**six required**)
(8) LA-321, 8-slot Charging/Carrying Case (**one required**)
(9) LA-311, 16-slot Charging/Carrying Case (**one required**)
(10) LA-304, ADA Compliance Kit (**two required**)

b. Telex
(1) ST-300 with RM-S rack mount kit and HGA-1 remote dipole antenna
(2) SR-400, multi-channel receiver (**eight required**)
(3) SR-50, single channel receiver (**fourteen required**)
(4) Provide NiMH rechargeable batteries (**two required for each receiver if not included with receiver**)
(5) ES-1, Single Side Ear Speaker (**eight required**)
(6) HED-2, Lightweight Headphone (**eight required**)
(7) SEB-1, Single Earbud (**fourteen required**)
(8) NL-4S, Neck Loop for use with telecoil equipped hearing aids (**six required**)
(9) BC-100, Charging Station for two receivers (**two required**)
(10) SM-C, Carrying Case for six receivers (**four required**)
(11) WP-1, ADA Wall Plaque (**two required**)

c. Williams Sound
(1) PPA T35 with RPK 005 rack mount kit and ANT024 remote dipole antenna

(2) PPA R35-8N, eight-channel receiver (**eight required**)
(3) PPA R35N, single channel receiver (**fourteen required**)
(4) BAT 026 NiMH batteries (**two for each receiver if not included with receiver**)
(5) EAR 022, Ear-Clip Earphone (**eight required**)
(6) HED 021, Folding Headphone (**eight required**)
(7) EAR 013, Single Earbud (**fourteen required**)
(8) NKL 001, Neck Loop for use with telecoil equipped hearing aids (**six required**)
(9) CHG 3512 mounted in CCS 029 case, to charge up to twelve receivers (**two required**)
(10) IDP 008, ADA Wall Plaque (**two required**)

2.15 INTERCOM SYSTEM

A. Provide a separate independent intercom system for the Arena and for the Auditorium. Technical System Contractor shall be responsible to ensure that power supply can operate all intercom equipment without interruption:

1. Arena:

a. Clear-Com System
(1) MS-702, Intercom two-channel main station (with built-in power supply), for rack-mounting at sound console turret in Arena Control Room.
(2) RS-601, Single-channel Belt Pack (**eight required**)
(3) RS-602 with YC-36 Adapter Cable, Two-channel Belt Pack (**one required**)
(4) CC-95, Single-muff Headset (**six required**)
(5) CC-260, Dual-muff Headsets (**four required**)
(6) CC-26, Lightweight Headset (**four required**)
(7) HS-6, Handset, with Cradle, mount cradle at location as later directed (**one required**)
(8) FL-7, Call Signal Flasher (**one required**)
(9) KB-702 mounted in V-box enclosure, two channel portable speaker station. Technical System Contractor shall install a <u>second pair</u> of male and female XLR receptacles at the side of the enclosure, labeling the original and added receptacle pairs respectively as “ICA” and “ICB”, and wiring the receptacle pairs accordingly (**one required**)

2. Auditorium:

a. Clear-Com System
(1) MS-702, Intercom two-channel main station (with built-in power supply), for rack-mounting at sound console turret in Arena Control Room and in Auditorium Sound Booth.

(2) HB-702, Intercom two-channel wall-mount remote headset station, two-gang size, for mounting at Auditorium stage wing wall
(3) KB-701, Intercom single-channel wall-mount remote speaker station with built-in push-to-talk microphone, four-gang size, for mounting at Box Office wall
(4) RS-601, Single-channel Belt Pack (**four required**)
(5) RS-602 with YC-36 Adapter Cable, Two-channel Belt Pack (**one required**)
(6) CC-95, Single-muff Headset (**four required**)
(7) CC-26, Lightweight Headset (**two required**)
(8) HS-6, Handset, with Cradle, mount cradle at location as later directed (**one required**)
(9) FL-7, Call Signal Flasher (**one required**)
(10) KB-702 mounted in V-box enclosure, two channel portable speaker station. Technical System Contractor shall install a second pair of male and female XLR receptacles at the side of the enclosure, labeling the original and added receptacle pairs respectively as “ICA” and “ICB”, and wiring the receptacle pairs accordingly (**one required**)

2.16 SWITCHES AND CONTROLS

A. Sequencer switch set, for LynTec AC power sequencer additional on/off locations:

1. LynTec SS-2, panel-mounting.

B. Lever-action audio/control switch with features as noted on the drawings and within these specifications; verify number of contacts and configuration for each application:

1. Switchcraft 41000 series.

C. Green Illuminated momentary-action pushbutton switch. Green LED with white filter configured for 24V operation with integrated resisitor:

1. NKK Switches model number LB15SKW01-5F24-JB; or
2. Approved equal.

2.17 PATCH PANELS - Installed Equipment

A. Patch panels, audio, with 24 positions per row (48 positions per assembly), punch down connectors on the rear, enclosed assembly for dust/dirt protection, and impact punch down tool. Paint mounting flange and associated mounting screw heads semi-gloss black to match face of panel:

1. With normals for tip and ring brought out to punch down connector;
   a. ADC ProPatch PPA3-14MKIINO; or
   b. Audio Accessories WQP-01-E-C-24-N-2 with all normals brought to the rear panel.

   Technical System Contractor shall add any and all additional normal-thru patch panel connections requested by the Owner or Acoustical Consultant.

B. Audio patch panel hole plugs, for unused jack panel spaces, black:

1. ADC PJ29; or
2. Audio Accessories PHP-1.

2.18 CONNECTORS

A. XLR Cable Connector, cable mounted connector for line-level, microphone level, and intercom circuits:

1. Neutrik X-series; or
2. Switchcraft E Series Q-G.

B. XLR Panel Connector, panel mounted audio connector for line-level, microphone level, and intercom circuits, color shall match plate color where possible:

1. Neutrik D-Series; or
2. Switchcraft standard AAA Series Q-G with metal handle.

C. XLR Combo Connector, female XLR and 1/4" TRS receptacle in one chassis-mount connector:

1. Neutrik NCJ6FI-S.

D. 1/4" TRS Cable Connector, three conductor (Tip Ring Sleeve) connector with a metal barrel and solder lugs:

1. Canare F-16; or
2. Neutrik NP3C; or
3. Switchcraft 267.

E. 1/4" TRS Panel Connector, three conductor (Tip Ring Sleeve) connector with the sleeve contact isolated from the panel or plate to which it is mounted:

1. Neutrik NJ3FP6C; or
2. Switchcraft E112BL.

F. 1/8" TRS Cable Connector, 1/8" (3.5mm) three-conductor mini-plugs which have a metal barrel and solder lugs:

1. Canare F-12; or
2. Neutrik NTP3RC; or
3. Switchcraft 35HDNN plug.

G. RCA Cable Connector, phono style connector with metal barrel:

1. Canare F-10; or
2. Neutrik NF2C-B/2; or
3. Switchcraft 3502.

H. RCA Panel Connector, phono style connector with jacks that isolate the ground contact from the panel or plate to which it is mounted:

1. Neutrik NF2D (black chrome or nickel color as approved by the Architect), socket color as required for application); or
2. Switchcraft 3501FP jack with S2207 and S1564 insulating washers.

I. Locking LS Cable Connector, twist-lock loudspeaker connector, minimum 2-conductor:

1. Neutrik speakON NL4FC.

J. Locking LS Panel Connector, twist-lock loudspeaker connector, minimum 2-conductor:

1. Neutrik speakON NL4MP.

K. BNC Cable Connector, 75-ohm BNC, compression fitting for coaxial cable furnished:

1. Liberty CM-RG-BNC series; or
2. West Penn CN-CS-BNC and CN-FS-BNC series.

L. BNC Panel Connector, 75-ohm BNC, pass-through, D-style mounting:

1. Neutrik NBB75DFI; or
2. Approved equal.

M. Triax Cable Connector, 75-ohm connector:

1. Winchester Electronics (formerly Kings Electronics) TRI-LOC part number 7705-1 plug (RG-11)
2. Winchester Electronics (formerly Kings Electronics) TRI-LOC part number 7703-1 plug (RG-11)

N. Triax Panel Mount Kit, mounts up to 10 triax connectors at 45-degree angles on a 2 RU panel:

1. ADC Proax TRP-2-BK rack mount kit with TCM45-BH-KIT-BK (as required) and TRP-2BLANK-BK (as required); or
2. Approved Equal.

O. Triax Panel Connector-45, bulkhead mount connector which mounts to the plate at a 45 degree angle:

1. ADC Proax Female Triax jack part number TCJ-D38 with the 45 degree panel mounting kit part number TCJ45-KIT-* (color as directed by Architect); or
2. ADC Proax Male Triax plug part number TCP-D38 with the 45 degree panel mounting kit part number TCP45-KIT-* (color as directed by Architect).

P. Hybrid Fiber Panel Jack, SMPTE 311M compliant panel mounted fixed receptacle:

1. LEMO PEW series.

Q. Hybrid Fiber Panel Plug, SMPTE 311M compliant panel mounted fixed plug:

1. LEMO FMW series.

R. Hybrid Fiber Cable Connector, SMPTE 311M compliant cable mounted free receptacle:

1. LEMO PUW series.

S. Hybrid Fiber Rack Panel, eight position rack with SMPTE fiber connections at an angle for strain relief.

1. Gepco HBPA-*U (* designates number of holes); or
2. Approved equal.

T. DT-12 male, panel mounted multipin audio connector, with panel secured connector cover:

1. Gepco International, Inc. VKC020GS (gold solder), VKC020GC (gold crimp), or VKC020SS (silver solder); or
2. Approved equal.

2.19 HARDWARE AND ACCESSORIES

A. Barrier strips (audio/control):

1. TRW-Cinch 140 Series; or
2. USD Products TB100 series.

B. Captive Screw Terminal Block, modular terminal blocks for mounting on DIN rails:

1. Entrelec Screw Clamp Series; or
2. Approved equal.

C. Spade lugs (audio/control), brazed seam, un-insulated non-locking type:

1. Thomas & Betts A18-6F, B14-6F and/or C10-6F or approved equal.

D. Gooseneck Lamp - Desk, counter mounted halogen lamp, with dimmer:

1. Littlite L-3/12 (12") with CWB weighted-base accessory (**two required for Arena Control Room, two required for Auditorium Control Room**)

E. Gooseneck Lamp - Rack, rack mounted halogen lamp:

1. Littlite RL-10-S (refer to equipment rack elevations).

F. Cable Storage Brackets: The Technical System Contractor shall fabricate and furnish a cable storage bracket consisting of one 8-foot 2x4 wooden board with eight 1-inch diameter wooden dowels each 12-inch long installed on one-foot centers. Paint color to match equipment racks if located in the same room, otherwise color as selected by the Architect. Mount bracket(s) at wall location shown on drawings (**two required for Arena, two required for Auditorium**).

1. Custom by Technical System Contractor.

2.20 EQUIPMENT RACKS

A. Furnish complete equipment racks including all necessary items including top, bottom, sides, and any other components not specifically addressed (unless noted otherwise).

B. Floor Rack - Open Sides, open rack style with open sides, rear locking door, height as required (xx denotes rack height in part number), standard depth. Furnish one side panel at each end of each row of equipment racks:

1. Atlas Sound FMAxx-25G series; or
2. Lowell L277-xx series; or
3. Middle Atlantic Products WRK-xx-27 series; or
4. Raxxess GAR-xx-26 series.

C. Floor Rack - SA, stand alone floor rack rear locking door, height as required (xx denotes rack height in part number), standard depth:

1. Atlas Sound FMAxx-25SA series; or
2. Lowell L267-xx series; or
3. Middle Atlantic Products WRK-xxSA-27 series; or
4. Raxxess KAR-xx-28 series.

D. Rotating Rack - SA, stand-alone rack with integrated sides and back, and with slide-out internal mechanism that extends beyond the front of the rack and can then rotate up to 90 degrees in either direction for installation/servicing, height as shown on drawings (xx denotes rack height in part number). Use good cable management techniques to control the many conductors attached to the equipment:

1. Middle Atlantic Products WR-xx-32 series; or
2. Approved Equal.

E. Security cover, perforated steel (1/8" diameter holes), size as required, for covering rack-mounted equipment having accessible front-mounted controls and/or power switches:

1. Atlas Sound SEC1 (1.75"), SEC2(3.5"), SEC3 (5.25"); or
2. Lowell L9-191 (1.75"), L9-193 (3.5”), L9-195 (5.25"), L9-197 (7"); or
3. Middle Atlantic S-1 (1.75"), S-2 (3.5”), S-3 (5.25"), S-4 (7"); or
4. Raxxess SEC-1(1.75"), SEC-2 (3.5"), or SEC-3 (5.25").

F. Furnish quiet cooling exhaust fan with screen guard in the top of each rack where shown on the drawings. Use rubber grommets to isolate fan mounts from the equipment rack. Block all ventilation louvers located at the top of the side panels and rear door of all floor-mounted racks containing exhaust fans.

1. Type 1 (for power amplifier racks): EBM Industries 4800X (60cfm/32dB max) with screen guard; or approved equal.
2. Type 2 (for control room racks or turrets): Middle Atlantic Products QFAN (50cfm/<30dB) with screen guard; or approved equal.

G. Storage Drawer - 4L, pull-out storage drawer, locking (specify key same as rack rear door, where available), rack-mounting, 7" high, approximately 16" deep, color to match adjacent rack-mounting panels, as shown per rack details and/or console/cart details:

1. Atlas Sound SD4-14 with optional SD-LOCK installed; or
2. Lowell L18-197-L; or
3. Middle Atlantic TD4-LK; or
4. Raxxess SDR-4 with optional installed lock.

H. Equipment rack rails, tapped at standard EIA spacing, for mounting equipment in console turret millwork. Rails will have to be ordered length as required to match millwork vertical dimension opening. Technical System Contractor shall coordinate rail dimensions with millwork as some rails have different widths, impacting the millwork. Framework will have to be custom-assembled.

1. Atlas Sound 230 series; or
2. BGW RR series; or
3. Lowell L212 series; or
4. Middle Atlantic RRF series; or
5. Raxxess RKRL series.

I. Logo rack panel, single vertical rack space, labeled with contact information for the contractor and Acoustical Consultant. Panel specified is custom and already has the information for the Acoustical Consultant; the Contractor shall coordinate their logo/information with the panel manufacturer (shop drawing required). **One required** to be installed at the top of **each** bank of equipment racks and each **bank of turrets:**

1. Liberty Wire and Cable model ADGRP-24908-RHIM-04.

J. Provide blank panels (or vent panels where required) with formed edges for all rack space not occupied with equipment.

K. Technical System Contractor shall verify equipment layout, size, and number of equipment racks required for equipment furnished. Whereas the rack layout shown on the drawings illustrates the design-intent of the layout, it is for concept only and may vary with equipment sizes furnished.

L. Equipment racks and all associated blank panels located in the audio equipment room out of public view, shall be factory finished semi-gloss black. Equipment racks and associated blank panels located in control booths or other visible locations shall be factory-finished color as selected by the Architect.

2.21 MULTI-CONDUCTOR CABLE ASSEMBLIES

A. Multi-conductor equipment, including multi-pin panel-mount and cable-mount connectors, stage box, and associated cabling, shall be custom factory-fabricated to include all necessary cabling, connectors, and plates as described below, and as shown on the drawings as a portion of the Arena sound system.

B. The Technical System Contractor shall employ the services of one of the following to manufacture the multi-conductor cables according to the specifications herein; allow for production time:

1. Clark Wire and Cable assembly using the Whirlwind MASS multi-pin connector and MASS hinged angle adaptor for panel mounts. Size connector appropriately for specified quantity of channels; or
2. ProCo Sound ConcertMaster series. Size connector appropriately for specified quantity of channels; or
3. Wireworks Corporation Multi-pin Connector or 160i series connectors as appropriate for specified number of channels.

C. Shop drawings shall be submitted indicating the exact multi-conductor system to be furnished, and shall include a detailed physical diagram and pin-out and wire color schedule of each multi-pin connector.

D. Panel-Mount Connector: Female multi-pin panel-mount connector (coordinate panel-mount connector with box size, box location, and pin quantity required).

E. Mixer Fan-Out Cable Assembly Microphone Cable Snake: Male multi-pin cable-mount connector to XLR fan-out multi-conductor cable assembly, minimum 50-foot length. Cable shall be fabricated with a durable jacket. Engrave and back-fill designator on all connectors (or as otherwise approved). Each shield wire shall have its own contact, and shall not be tied to other shield wires at the connectors. Cable-mount multi-pin connector shall have adequate strain-relief for the contacts and shall have the cable jacket captured by the strain relief mechanism. At the multi-pin end of the cable, install a Kellums-Grip or similar over-all strain relief method having a disconnect to allow attachment to an eye-bolt at the wall-mounted connection panel. Fan tails shall be of sufficient length for connectors to reach any of a typical intermediate-size console mixer's inputs or outputs, and shall include 18 male XLR cable connectors (labeled M1 through M16, ICA, ICB) and four female XLR cable connectors (labeled L9 through L12. **(One required for use at Arena west-end mixer audio connection panel, using Owner's portable mixer.)**

F. Multi-Conductor Cable Assembly Stage Microphone Cable Snake: Portable multi-conductor extension cable assembly, minimum 75-foot length. Cable shall be fabricated with a durable jacket. Cable configuration shall be a male multi-pin connector on each end (containing individual circuits M1 through M16, ICA and ICB), coordinated with the selected female multi-pin connector model (both the panel-mounted or stage box person version). Cable-mounted male multi-pin connectors shall have adequate strain relief for the contacts and shall have the cable jacket captured by the strain relief mechanism. At one multi-pin end of the cable, install a Kellums-Grip or similar over-all strain relief method having a disconnect to allow attachment to an eye-bolt at the wall-mounted connection panel. **(One required for use at Arena east-end stage or center stage audio connection panel.)**

G. Multi-Conductor Cable Assembly Stage Break-Out Box: Portable multi-receptacle stage break-out box to mate with one end of the stage multi-conductor cable (listed above). Provide a box having a side-mounted female multi-pin receptacle, and top-mounted individual audio receptacles to include: 16 female XLR receptacles (labeled M1 through M16), and two male XLR receptacles (labeled ICA and ICB). Exact arrangement of receptacles on box surface as approved. **(One required for use with Arena stage cable snake.)**

H. Protectors for each male multi-pin cable connector and each female panel-mount connector:

1. Type 1 Multi-Conductor Cable Assembly Pin Protector: Using a chain to prevent loss, provide a spare female multi-pin connector or manufacturers's metal dust cover for protection of each male multi-pin cable connector when not in use (**one required on <u>each</u> male multi-pin end of <u>each</u> cable assembly furnished**).
2. Type 2 Multi-Conductor Cable Assembly Pin Protector: Using a chain to prevent loss, provide a spare male multi-pin connector or manufacturers's metal dust cover for protection of each female multi-pin panel-mount

connector when not in use (**one required on <u>each</u> female panel-mount multi-pin connector**).

I. Test each conductor connection from the end of each cable with the multi-pin connectors assembled.

J. The Technical System Contractor shall furnish, as a portion of the O&M manuals (notebooks) described elsewhere, a detailed physical diagram and pin-out and wire color schedule of each multi-pin connector.

2.22 CABLE

A. AWG wire size indicated herein or on the drawings are the minimum size conductor required. Larger size conductors (<u>i.e.</u>, smaller AWG number) are permitted assuming no impact on the project will occur (such as the resulting need for larger or additional conduit, cable trays, chases, etc.) to accommodate such cable.

B. Where cable is run exposed (such as in ceiling plenums, cable trays, chases, or below accessible floors), the Technical System Contractor shall be responsible for:

1. Verifying which locations do and do not require plenum-rated cable.
2. Furnishing the appropriate cable type.
3. Obtaining <u>written authorization</u> from the Architect (or the Architect's designated Engineer) in this regard.

C. Microphone, intercom, or line-level circuits in conduit or equipment racks, No. 22 AWG, 2-conductor, shielded, PVC jacket:

1. Belden 8451 or 9451 or 5500FE; or
2. Covid CSP 1200 22; or
3. Liberty 22-1P-EZ; or
4. West Penn 291 or 452 or 454.

D. Microphone, intercom, or line-level circuits where installed in a return-air plenum without conduit, No. 22 AWG, 2-conductor, shielded, plenum-rated jacket:

1. Belden 82761 or 6500FC; or
2. Covid CSP 3200 22; or
3. Liberty 22-1P-CMP-EZ-color; or
4. West Penn 25291B.

E. Microphone, intercom, or line-level multiconductor cables in conduit (not for interconnection within equipment racks), No. 22 AWG individually shielded pairs, color coded, PVC jacket:

1. 24 pair: Belden 1414R or West Penn WP45424
2. 16 pair: Belden 1412R or West Penn WP45416
3. 12 pair: Belden 9768 or 1411R; or West Penn D434 or WP45412

4. 8 pair: Belden 1410R; or West Penn WP4548
5. 6 pair: Belden 8778 or 1409R; or West Penn D432 or WP4546
6. 4 pair: Belden 1408A
7. 3 pair: Belden 8777; or West Penn D431
8. 2 pair: Belden 8723; or Covid CSP 1400 22; or Liberty 22-2P-SHEX; or West Penn D430.

F. Microphone, intercom, or line-level multiconductor cables in plenum (not for interconnection within equipment racks), No. 22 AWG individually shielded pairs, color coded, PVC jacket:

1. 6 pair: Belden 82778
2. 3 pair: Belden 82777
3. 2 pair: Belden 82723.

G. Microphone, intercom, or line-level extension-type cables (for portable extension cables or where exposed at rear of the console mixer), not in conduit or equipment racks, No. 22 or No. 24 AWG, 2-conductor, shielded, rubber or neoprene jacket:

1. Mogami 2552; or
2. Pro Co 424BK.

H. Loudspeaker circuits in conduit, exposed interior locations, equipment racks, or above ceiling spaces not used as return-air plenums:

1. No. 10 AWG:
   a. Belden 1313A; or
   b. West Penn HA210.

2. No. 12 AWG:
   a. Belden 8477 or 5000UE; or
   b. Covid CVA 0200 12; or
   c. Liberty 12-2C-color; or
   d. West Penn 227, or C207.

3. No. 14 AWG:
   a. Belden 8473 or 5100UE; or
   b. Covid CVA 0200 14; or
   c. Liberty 14-2C-color; or
   d. West Penn 226.

4. No. 16 AWG:
   a. Belden 8471 or 5200UE; or
   b. Covid CVA 0200 16; or
   c. Liberty 16-2C-color; or.
   d. West Penn 225.

5. No. 18 AWG:
   a. Belden 9740 or 5300UE; or
   b. Covid CVA 0200 18; or
   c. West Penn 224.

I. Loudspeaker circuits where installed in a return-air plenum without conduit, Teflon and/or fluoropolymer jacketed:

1. No. 12 AWG:
   a. Belden 1860A or 6000UE; or
   b. Covid CVA 3200 12; or
   c. Liberty 12-2C-P-color; or
   d. West Penn 25227B.

2. No. 14 AWG:
   a. Belden 1861A or 6100UE; or
   b. Covid CVA 3200 14; or
   c. Liberty 14-2C-P-color; or
   d. West Penn 25226B.

3. No. 16 AWG:
   a. Belden 1862A or 6200UE; or
   b. Covid CVA 3200 16; or
   c. Liberty 16-2C-P-color; or
   d. West Penn 25225B.

4. No. 18 AWG:
   a. Belden 1863A or 6300UE; or
   b. Covid CVA 3200 18; or
   c. West Penn 25224B.

J. Loudspeaker circuits for portable loudspeaker extension cables, stranded, unshielded, rubber/neoprene jacket, (SJ/SO type cable):

1. No. 14 AWG:
   a. Alpha 1936; or
   b. Belden 19202.

K. RG-6/NP, single 75-ohm precision coax cable, RG-6/U, installed in conduit, equipment racks, or other non-plenum spaces, not plenum rated:

1. Belden 1694A; or
2. Liberty 18-CMR-SD-color; or
3. West Penn 6350.

L. RG-6/P, single 75-ohm precision coax cable, RG-6/U, installed in return-air plenum without conduit, plenum rated:

1. Belden 1695A; or

2. Liberty 18-CMP-VID-COAX-color; or
3. West Penn 256350.

M. RG-11/Triax-NP, triaxial cable for permanent installation in conduit, equipment racks, or other non-plenum spaces, RG-11, not plenum rated:

1. Belden 8233A; or
2. Gepco VT61811; or
3. West Penn 3811.

N. RG-11/Triax-P, triaxial cable for permanent installation in return-air plenum, RG-11, plenum rated:

1. Belden 1859A; or
2. Gepco VT61811TK; or
3. West Penn 253811.

O. Fiber MM/R, multi mode fiber optic cable, riser rated, six strands, 62.5 micron:

1. Belden B9B039T; or
2. Approved equal.

P. Fiber MM/P, multi mode fiber optic cable, plenum rated, six strands, 62.5 micron:

1. Belden B9B045T; or
2. Approved equal.

Q. Fiber SM/R, single mode fiber optic cable, riser rated, six strands:

1. Belden M9W039; or
2. Approved equal.

R. Fiber SM/P, single mode fiber optic cable, plenum rated, six strands:

1. Belden M9W045; or
2. Approved equal.

S. Hybrid Fiber 2/2/4, SMPTE 311M compliant composite cable with two SM fibers (125/900 Micron), two 24 AWG copper cables, and four 20 AWG copper cables:

1. Belden 7804R; or
2. Gepco HDC920R (for install) or HDC920 (for connection to camera).

T. Power amplifier test/monitor circuits (between power amp outputs and test/monitor panel inputs): No. 20 AWG minimum, stranded, paired, unshielded, with PVC jacket.

U. Control circuits, low-voltage, standard DC control (for switching, VCA, etc.): No. 20 AWG minimum, stranded, unshielded, with PVC jacket, number of conductors as required.

V. RG-58/NP, single 50-ohm coax, installed in conduit or other non-plenum interior locations, not plenum rated:

1. Belden 7806R; or
2. Liberty RG58-CMR-color; or
3. West Penn 812.

W. RG-58/P, single 50-ohm coax, installed in return-air plenum, plenum rated:

1. Belden 88240; or
2. Liberty RG58-CMP-color; or
3. West Penn 25812.

2.23 PORTABLE EQUIPMENT & ACCESSORIES

A. Microphone - Wired Dynamic, handheld microphone, dynamic, supercardioid. Furnish wired microphones from the same manufacturer as wireless microphones (**six required for Arena, six required for Auditorium**):

1. Electro-Voice N/D967; or
2. Sennheiser e845.

B. Microphone - Sports Announce Desk, dynamic, stand-mounted omnidirectional microphone (**one required for Arena**):

1. Audio-technica AT8004; or
2. Electro-Voice RE50N/D-B; or
3. Shure SM-63.

C. Microphone - Sports Announce Headset, dynamic microphone element with earphones (**one required for Arena**):

1. Sennheiser HMD25-1.

D. Microphone - Choir Stand, condenser microphone boom stand assembly, minimum overall height of 7', cardioid pattern (**three required for Auditorium**):

1. Audix MicroBoom MB1250B (furnish additional weighted base mic stand); or
2. Earthworks FlexWand FW730.

E. Microphone - Gooseneck 18", gooseneck cardioid condenser microphone, 18 inches long minimum, with integrated male XLR connector (**one required for Owner furnished lectern in Auditorium**):

1. AKG GN50E with CK31 capsule; or
2. Audio-technica ES 915C18: or
3. Earthworks FM500; or
4. Shure MicroFlex MX418/C.

F. Microphone - Single Ear Headworn, headworn omnidirectional microphone, condenser, for wireless microphone system beltpacks, lightweight, single over-the-ear style. Technical System Contractor shall coordinate the proper connector to mate with the wireless beltpack (**one required for each wireless beltpack specified, <u>except</u> for beltpack used with sports-instructor headworn microphone in following paragraph**):

1. Ansr Audio AM-17T (tan color); or
2. Audio-technica BP892cT (beige color); or
3. Countryman E6OW6 light beige color. Install “flat”-response protective cap on each microphone.

G. Microphone - Dual Ear Headworn, sports-instructor headworn microphone, for use with wireless beltpack transmitter, dual ear band. Technical System Contractor shall coordinate connector to mate with beltpack **(one required for Arena)**:

1. Ansr Audio AM-14T (tan); or
2. AKG HC 577; or
3. Sennheiser HSP 2; or
4. Approved equal.

H. Microphone Stand - SB/SHA, microphone floor stand, with solid base, single hand height adjustment (**two required for Arena, two required for Auditorium**):

1. Quiklok A-498; or
2. Ultimate Live-SB.

I. Microphone Stand - SB, microphone floor stand with solid base, black (**four required for Arena, six required for Auditorium**):

1. Atlas MS-20E (ebony); or
2. K&M 260 (black); or
3. QuikLok A-399 (black) with fully filled base; or
4. Ultimate Pro-SB (stackable).

J. Microphone Stand Boom, telescoping boom attaches to microphone stand (**six required for Arena, eight required for Auditorium**):

1. Atlas PB21XEB (ebony); or
2. K&M 21140; or

3. Ultimate Ulti-Boom - Telescoping.

K. Microphone Table Stand, height adjustable (**four required for Auditorium**):

1. Atlas DS7E (ebony); or
2. K&M 233; or
3. Ultimate JS-DMS50.

L. Microphone Cable - 15', fifteen foot microphone extension cable. Microphone cables shall be black with yellow boot or ring on the male connector as a code to identify length. Custom print facility name and cover with clear heat shrink tubing approximately 6-inches from the male connector or use custom engraving on the male connector (**twenty-two required for Arena, sixteen required for Auditorium**):

1. ProCo AQ-15M4F0PLM ***(facility name)***; or
2. Whirlwind MKQ15-WSR-YEL ***(facility name)***; or
3. Custom made using cable and connectors listed in this specification.

M. Microphone Cable - 25', twenty-five foot microphone extension cable. Microphone cables shall be black with red boot or ring on the male connector as a code to identify length. Custom print facility name and cover with clear heat shrink tubing approximately 6-inches from the male connector or use custom engraving on the male connector (**eight required for Arena, eight required for Auditorium**):

1. ProCo AQ-25M2F0PLM ***(facility name)***; or
2. Whirlwind MKQ25-WSR-RED ***(facility name)***; or
3. Custom made using cable and connectors listed in this specification.

N. Microphone Cable - 50', fifty foot microphone extension cable. Microphone cables shall be black with blue boot or ring on the male connector as a code to identify length. Custom print facility name and cover with clear heat shrink tubing approximately 6-inches from the male connector or use custom engraving on the male connector (**six required for Arena, six required for Auditorium**):

1. ProCo AQ-60M6F0PLM ***(facility name)***; or
2. Whirlwind MKQ50-WSR-BLU ***(facility name)***; or
3. Custom made using cable and connectors listed in this specification.

O. Microphone Cable - 75', seventy-five foot microphone extension cable. Microphone cables shall be black with green boot or ring on the male connector as a code to identify length. Custom print facility name and cover with clear heat shrink tubing approximately 6-inches from the male connector or use custom engraving on the male connector (**ten required for Arena, eight required for Auditorium**):

1. ProCo AQ-75M5F0PLM ***(facility name)***; or
2. Whirlwind MKQ75-WSR-GRE ***(facility name)***; or
3. Custom made using cable and connectors listed in this specification.

P. Microphone windscreens (**one required for <u>each</u> handheld microphone furnished - wired or wireless**):

1. Audio-technica AT8101 (for AT8004).
2. Electro-Voice 379-1 (for N/D967 and RE50N/D-B).
3. Sennheiser MZW-1 (for e845).
4. Shure RK229WS (for SM-63).

Q. Microphone Cable Tester, cable tester with ability to test each individual wire in a microphone cable. Furnish batteries for test (**one required for Arena, one required for Arena**):

1. Ebtech Swizz Army 6-in1 Cable Tester; or
2. Hosa CBT-277; or
3. Sescom CT-7; or
4. Wireworks Corporation TE-3-Plus.

R. Microphone Case - 12, carrying case sized to hold a minimum of twelve handheld microphones (**one required for Arena, one required for Auditorium**):

1. Gator Cases GM-15; or
2. Odyssey FZMIC12; or
3. SKB 1SKB-1200; or
4. Approved equivalent.

S. Announce Stand - Gooseneck, wired announce stand for the omni-directional announce microphone, weighted base, gooseneck XLR microhone mount, and momentary press-to-talk pushbutton switch (**one required for Arena**):

1. ProCo SAS3.

T. Announce Stand - Intercom, announce stand for the headset microphone, direct interface with the production intercom system, allows announcer to converse on production intercom or make announcements (**one required for Arena**):

1. ClearCom model AB-120 custom modified for live announcing in a sports facility. The stand and associated modification shall be ordered from:
   a. Big Sky Engineering, reference modification # 720210 and to include two pushbutton labels “Intercom” and “Announce” and to include one loose 6-pin male XLR connector for the headset. Contact: mike@bigskyengineering.com.

2. The Technical System Contractor shall wire the loose 6-pin connector to the microphone headset to mate with the announce stand.

U. Portable Mixing Console -16CH, 16-input mixing console, minimum 16 balanced inputs and balanced outputs, 4-bus, six aux groups and with optional lamp (**one required for Arena**):

1. Allen & Heath GL2400-16; or
2. APB Dynasonics ProDesk-416; or
3. Midas Venice 240; or
4. Soundcraft GB2-16.

V. Console dust cover, black pack cloth nylon dust cover tailored to fit the mixer with connectors inserted, for mixers specified without a manufacturer supplied cover (**one required for <u>each</u> permanently-installed and portable console mixer**):

1. Cloud 9 Covers, 1-800-599-7429 (www.cloud9covers.com); or
2. Le Cover Company, 1-800-228-3878 (www.lecover.com); or
3. Custom by contractor.

W. Isolation transformer, inline, 600/600 ohms, female XLR input to male XLR output (**two required**):

1. ProCo ITX; or
2. Sescom ISO-1.

X. Self-powered portable press distribution box, one balanced mic and/or line-level input, multiple balanced transformer-isolated line-level outputs, in a rugged, portable suitcase-style case (**one required for Arena**):

1. RCI BM-30M.

Y. Portable Monitor Loudspeakers, two-way with 12-inch low frequency driver and horn and high frequency driver, with stand mount adapter and speakON connectors (**two required for Arena, two required for Auditorium**):

1. Electro-Voice SX300 with included F200 Monitor Feet; or
2. JBL MRX512M; or
3. Renkus Heinz CFX121M; or
4. Approved Equal.

Z. Portable Powered Loudspeaker, small (**one required for Arena Control Room**):

1. Anchor AN-1000 with SS-750 Speaker Stand and mounting plate; furnish audio extension cable nominal 6-feet long with cable connector type(s) to connect speaker to console mixer output.

AA. Audio patch panels, punch-down tool (**one required for Arena, one required for Auditorium**):

1. ADC QB-2 impact punch down tool; or
2. Audio Accessories QB-2 impact punch down tool.

BB. Audio patch panel patch cords, color-coded lengths, nickel plated plugs(brass plugs will not be accepted:

1. 12-inch (**fourteen required for Arena, ten required for Auditorium**):
   a. ADC R1 (red); or
   b. Audio Accessories 621A (red).

2. 24-inch (**twenty-two required for Arena, twelve required for Auditorium**):
   a. ADC G2 (green); or
   b. Audio Accessories 622D (green); or
   c. Bittree LPC 24 05 - 110 (green).

3. 36-inch (**four required for Arena, four required for Auditorium**):
   a. ADC B3 (blue); or
   b. Audio Accessories 623C (gray); or
   c. Bittree LPC 36 06 - 110 (blue).

CC. Wall-mount patch cord holder to be mounted at location shown on the drawings (**one required for Arena, one required for Auditorium**):

1. ADC PPH; or
2. Audio Accessories Patch Cord Holder; or
3. Middle Atlantic CLAW.

DD. Gooseneck lamps, high-intensity tungsten-halogen (**four required**):

1. Littlite spare Q5 tungsten-halogen bulbs.

EE. Clip-on work light (**one required for <u>each</u> equipment rack and <u>each</u> sound console turret**):

1. Lowell RL-1; or
2. Middle Atlantic model WL-60; or
3. Hardware store style with small (nominal 6-inch diameter) aluminum reflector, 60-watt "rough service" bulb, and 6-foot cord.

FF. Keys for equipment rack doors and other locking items:

1. Furnish all <u>like</u> racks for this project with locking doors keyed alike.
2. Furnish all other <u>like</u> items for this project with locks keyed alike (such items as locking drawers, storage cabinets, etc.).
3. Furnish key for each <u>like</u> locking item, and for any other locking item furnished for this project (**six sets of <u>each</u> of these keys required**).

GG. Audio adapters, HOSA (Cerritos, CA) (H), Markertek (M), Neutrik (N), ProCo (P), Rapco), or Switchcraft (S), or approved equal:

1. (S) 386A or (N) NA3FP or (P) NA3FP or (H) GXP-143 - female XLR connector to 3 conductor phone plug (**two required for Arena, two required for Auditorium**).
2. (S) 387A or (N) NA3MP or (P) NA3MP/W or (H) GXP-246 - male XLR connector to phone plug (**two required for Arena, two required for Auditorium**).
3. (M) 482/XM-3 Male XLR to patch panel plug, 36" long (**two required for Arena, two required for Auditorium**).
4. (M) 482/XF-3 Female XLR to patch panel plug, 36" long (**two required for Arena, two required for Auditorium**).
5. (S) 389 or (N) NA3FF or (P) NA3FF/W or (H) GXX-145 - female to female XLR connector (**two required for Arena, two required for Auditorium**).
6. (S) 390 or (N) NA3MM or (P) NA3MM/W or (H) GXX-144 - male to male XLR connector (**two required for Arena, two required for Auditorium**).
7. (P) DKRR-3 (H) CRA-201 - double phono plugs to double phono plugs with 3-foot cable (**two required for Auditorium**).
8. (P) IPMB2XM-5 (H) CYX-402 - 3 conductor stereo miniature plug to dual male XLR with 6-foot cable (**one required for Arena, one required for Auditorium**).

All unbalanced adapters requiring assembly shall be wired pin 2/tip "hot" and pin 3/ring tied to the shield. XLR adapters shall <u>not</u> have pin 1 connected to case ground.

HH. Audio in-line adjustable attenuator, provides up to nominal 25 dB attenuation in 3 steps, compatible with phantom power applications (**one required for Arena, one required for Auditorium**):

1. Audio-technica AT8202; or
2. Shure A15AS.

II. Audio in-line attenuator, line-level to mic-level pad, provides 50 dB attenuation, female XLR input to male XLR output (**one required for Arena, one required for Auditorium**):

1. Shure A15LA; or
2. Approved equal.

JJ. Recording medium, blank:

1. CD-R Audio Recordable Compact Discs, blank, 700MB, 80-minute (**one package of 50 required** for **<u>each</u>** CD record/play deck furnished):

a. Fujifilm CD-R Audio; or
b. Imation CD-R Audio; or
c. Sony CD-R Audio.

KK. Stereo audio headphones, 75-ohms impedance minimum each receiver, noise-isolating, coiled cord, and 1/4-inch stereo phone plug (**one required for Arena, one required for Auditorium**):

1. AKG K-271; or
2. Audio-technica ATH-M40fs; or
3. Sennheiser HD25 SP II.

LL. Audio line adapter box (**one required for Arena, one required for Auditorium**):

1. Emtech Electronics (Linden, UT) model EJ-8.

MM. Audio musical instrument direct box, line and loudspeaker inputs, ground lift, and transformer output (**two required for Arena, two required for Auditorium**):

1. ProCo model DB-1; or
2. Whirlwind model IMP2.

NN. Audio Instrument cable, 1/4" unbalanced, 25 foot length (**four required for Arena, four required for Auditorium**):

1. ProCo Excellines series model LC-25.

OO. Cable Storage Brackets, one 2x4 wooden board eight feet long with eight 1-inch diameter wooden dowels, each 12-inches long, installed on one-foot centers. Paint color to match equipment racks if located in the same room, otherwise, color as selected by the Architect. Mount bracket(s) at wall location if shown on drawings, otherwise, mount later as directed by the Owner (**two required for Arena, two required for Auditorium**).

1. Custom by Technical System Contractor.

PP. Lockable Steel Storage Cabinet, nominal 36"W x 18"D x 72"T combination cabinet with 4 half-width adjustable shelves, full length top shelf, and half-width vertical cavity (for microphone stands). Glue and screw a rubber mat to the bottom of the cavity for microphone stands to prevent slippage. Color to match equipment racks if located in the same room, otherwise color as selected by the Architect. Mount cabinet at location shown on the drawings (**one required for Arena, one required for Auditorium**):

1. Global Industries Equipment WG894113BK; or
2. Lockers.com model 9274 Combination Storage Cabinet; or
3. Approved equivalent.

QQ. Loudspeaker Cable 10', portable loudspeaker cables with speakON 4-conductor connectors on each end of rubber/neoprene (SO) jacketed 14 AWG minimum two conductor cable, minimum length of ten feet (**four required for Auditorium**):

1. Hosa SKT-410; or
2. Custom made using cable and connectors listed in this specification.

RR. Loudspeaker Cable 25', portable loudspeaker cables with speakON 4-conductor connectors on each end of rubber/neoprene (SO) jacketed 14 AWG minimum two conductor cable, minimum length of twenty-five feet (**four required for Arena, four required for Auditorium**):

1. Hosa SKT-425; or
2. Custom made using cable and connectors listed in this specification.

SS. Loudspeaker Cable 50', portable loudspeaker cables with speakON 4-conductor connectors on each end of rubber/neoprene (SO) jacketed 14 AWG minimum two conductor cable, minimum length of fifty feet (**four required for Arena, two required for Auditorium**):

1. Hosa SKT-450; or
2. Custom made using cable and connectors listed in this specification.

TT. Loudspeaker cable coupler, adapts two speakON type plugs (allows mating of two loudspeaker extension cables):

1. Neutrik NL4MM (**four required for Arena, four required for Auditorium**).

UU. BNC to BNC Patch Cable, 75 Ohm RG-6 patch cable, three-foot length (**ten required for Truck Dock**):

1. Gepco VSD2001 series with 3' length; or
2. Custom cables using coax and connectors specified.

VV. Hybrid Fiber Patch Cable, SMPTE fiber cable, five-foot length (**ten required for Truck Dock**):

1. Gepco HDC920 series with 5' length; or
2. Custom cables using hybrid fiber and connectors specified.

WW. Audio Patch Cable, six-foot length with XLR connectors (**twelve required for Truck Dock**):

1. ProCo AQ series; or
2. Whirlwind MKQ series; or
3. Custom cables using rubber jacketed audio cable and connectors specified.

XX. Cable Ties, cable ties with velcro type fastener for cable storage. Technical System Contractor shall place one on each portable cable furnished (including microphone cables, loudspeaker cables, instrument cables, and adapter cables more than 4' in length) (**one hundred twenty required**):

1. Toleeto Fasteners International Cord Lox 307-O, 1"x7"; or
2. Hosa WTI-148G (pkg of 5); or
3. Rip-Tie EconoWrap Slip-on 1" wide.

YY. Portable, padded, roll-around chair for use at reinforcement mixing console location, with foot rest, arm rests, and minimum height adjustment from 20" to 28". The Technical System Contractor shall verify chair height adjustability limits so as to coordinate with counter height(s) at the assigned room location(s) and, if required, shall furnish chairs having revised height adjustability limits. Color as approved by Architect (**two required for Arena, three required for Auditorium**):

1. Safco model Trenton 3421 (19" to 26") or model Highland 3441 (19" to 26") each with optional 3499 T-Pad Arm Kit; or
2. Approved equal.

ZZ. Miscellaneous items:

1. Compact disc with audio test signals including pink noise, 1-KHz tone, and pure 1/3-octave band-limited pink noise: Japan Audio Society model CD-1 available from DB Systems, www.dbsystemsaudio.com (**one required for Arena, one required for Auditorium**).
2. White labeling tape, 1-inch wide, semi-sticky adhesion for easy removal to temporarily label mixing console inputs/outputs:
   a. 3M #256, (60 yards) (**one roll required**); or
   b. Approved Equal
3. Permanent marker, Sanford Ultra Fine point (**four required**),

AAA. Standby equipment. The following equipment shall be on-hand at the time of system commissioning for possible replacement of defective equipment or for field conditions noted. This standby equipment is the property of the Technical System Contractor. However, if any item of this standby equipment is used to replace defective equipment, that installed item of standby equipment becomes Owner property, and the defective equipment becomes the property of the Technical System Contractor.

1. **One** Type 800 power amplifier.
2. **One** Type 500 power amplifier.
3. **Two** six-inch loudspeakers.
4. **One** twelve-inch loudspeaker.
5. Backup software CD-ROMs for programmable devices.

2.24 AC POWER

A. The Technical System Contractor shall furnish a multi-receptacle power strip for each AC circuit within the equipment rack(s). Furnish a minimum of 2 spare receptacles (beyond that required for connected equipment, rack fan, etc.) within each equipment rack. Each equipment rack shall contain a minimum of 2 un-switched (non-sequenced) AC power receptacles. All AC circuits shall be connected via the LynTec MSLC sequencing load center as noted on the drawings and as described herein.

B. Uninterruptible Power Supply, single rack space UPS with 750 VA power rating, 15A input with minimum of four output receptacles:

1. APC Smart-UPS 750VA part number SUA750RM1U; or
2. Eaton (Powerware) 5115 RM part number 103003269-6591; or
3. TrippLite SmartPro part number SMART750RM1U.

C. Surge Suppressed Power Distribution, single rack space 20 Amp power distribution with non-MOV based surge suppression, minimum of eight receptacles:

1. Furman P-8 PRO SERIES II; or
2. SurgeX SX1120RT.

D. Rack Mounted AC Power Sequencer, stand alone single rack space AC power sequencing device. 15 Amp supply:

1. Furman PS-8R; or
2. Middle Atlantic Products PDS-615R; or
3. Juice Goose CQR-1500.

E. All equipment shall be connected so that maximum rated performance can be obtained without exceeding the AC circuit capability.

2.25 LOW-VOLTAGE CONTROL OF AC POWER

A. Low-voltage "ON/OFF" control of AC power shall be by pushbutton momentary-contact switches located at the top panel of each system's designated equipment rack and, where designated, at the control booth turret.

B. AC power circuits shall be switched via the sequencer to turn the power amplifiers on last and off first.

C. See the drawings for detailed information on the sound & AV system AC power sequential switching system. The project Electrical Contractor shall furnish and connect all 120VAC wiring to the switching system. The Technical System Contractor shall make all low-voltage connections.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate with the project Electrical Contractor for required location of junction boxes, outlets, and conduit.

B. Carefully inspect areas where equipment will be installed. Notify the Architect of any conditions that would adversely affect the installation and subsequent operation of the system.

3.02 PHYSICAL INSTALLATION

A. Each conduit shall include a minimum of one spare cable or 10%, whichever is greater for each type of cable pulled including line-level, microphone-level, intercom, loudspeaker, and control. Neatly bundle a minimum of 10-feet of cable at each end of each spare circuit. All spare circuits shall be labeled and noted on the Technical System Contractor's field drawings for inclusion into the record drawings. Spare cabling requirements do not apply to the production camera cabling.

B. Install any floor-mounted receptacles so that release buttons (for both receptacles and cable connectors) are easily accessible when cable connectors are installed.

C. Blank panels and/or vent panels shall be installed in unused rack spaces. Ensure that air flow within the rack is maintained (i.e. cool air can enter the rack and hot air can exit the rack).

D. Equipment racks and other exposed equipment shall be kept covered and protected from airborne contaminates. The Technical System Contractor shall clean all equipment racks and the interior rack floor, prior to system commissioning activities.

E. Where the design location requires that products, materials, or equipment are visible to the public, no manufacturer's logos shall be visible. Unless otherwise directed, neatly remove or permanently paint out such logos.

F. Furnish all equipment with factory finish where possible using the standard available factory color(s) as selected by the Architect. The Technical System Contractor shall retain responsibility for notifying the Architect regarding color options of relevant technical system and A/V equipment prior to ordering equipment from each manufacturer.

3.03 CABLE MANAGEMENT AND TERMINATION

A. Install all rack-mounted equipment without IEC removable power cords so that the power cords are dressed using removable fasteners such as velcro and there are

no obstructions to the item being pulled out from the front of the rack.

B. When dressing cables within the rack, do not tighten tie wraps so that the cable is deformed.

C. Use Velcro tie wraps for all laced or bound UTP cables. Do not use zip ties for UTP cables.

D. Dress cables so that terminations are free from stress due to gravity acting on the cabling. Use cable supports as required depending on the size and stiffness of the cable.

E. Do not exceed the maximum cable bend radius as specified by the cable manufacturer.

F. Terminate cables with sufficient service loop to allow for at least one re-termination without having to open a cable bundle or pathway.

G. All audio circuits shall be separated according to function; e.g. microphone circuits shall be separated from line-level circuits which are separated from loudspeaker circuits. Where audio circuits are installed in conduit or other raceway, separate conduits are required for the various circuit functions.

H. Control and intercom circuits can be routed with line-level circuits, if separate conduit is not furnished for these circuits. Intercom circuits may be run with microphone circuits in limited cases where so shown on the drawings.

I. Where circuits are exposed in the equipment racks or large junction or pull boxes, the circuits shall be bundled according to function.

J. All solder connections shall be made with soldering iron and rosin core solder. All solder connections shall be checked for "cold" solder joints by the Technical System Contractor.

K. All audio circuits terminating to screw-type connectors shall be installed with non-insulated brazed seam spade lugs of the proper size for wire and screw connection.

L. Install equipment so that it can be pulled out for repair or replacement without hindrance. If there are obstructions prohibiting the disconnection of terminations on the back side of the technical equipment, there must be sufficient cabling to permit the equipment to be pulled from the front allowing for easy disconnection.

M. If equipment is removed or replaced for service, ensure that it is relatively easy to find the proper cable termination points when the equipment is re-installed.

3.04 LABELING

A. All permanent labeling of equipment shall be metal-photo plates, Lamacoid plates, or other engraved plastic laminate plates.

B. All labeling of cables within equipment racks shall be clearly legible with unambiguous identifying labels. Identify all cables clearly with permanent labels wrapped about the full circumference within one (1) inch of each connection. Assign wire or cable designations consistently throughout a given system. Each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations. Document all cable labels for record drawings.

C. Labels shall be located near both ends of the termination and shall be visible without system disassembly (i.e. not hidden within a cable bundle). Labels shall be permanent and non-slipping. Use clear heat shrink tubing if needed to protect cable labels.

D. All labeling of exposed cables, such as those found at the rear of a mixing console shall be printed to match the labels shown on the drawings. The label shall be covered with clear heat shrink tubing near the termination.

E. Embossed plastic tape labeling is not acceptable for labels in any location.

F. All equipment in equipment racks shall be labeled front and rear for ease of identification. Equipment shall be labeled as indicated within quotation marks shown on technical system drawings. Labels shall be of a contrasting color with that of equipment color to promote visibility.

G. Install permanent labeling on the front of each equipment rack in a row of racks identifying the rack designation (number).

H. Label patch panels according to the notes on technical system drawings regarding color codes.

I. All labels for input/output plates, touch panels, and other control panels shall be consistent with the final room numbering for the facility.

J. Label the plug end of each AC power cable for each device. Label shall clearly identify the equipment associated with the plug.

K. Within each rack and at other remote locations for technical system equipment, label all associated AC power receptacles reflecting the appropriate circuit breaker. Ensure that the circuit breakers are labeled as to the rack or remote equipment location.

L. Label the rear of loudspeakers in cluster with stencils spray paint of opposing color to match the labels shown on the technical system drawings. These labels should

be visible only from the back side of the cluster (for service technicians).

3.05 POWER AND GROUNDING

A. Equipment rack ground shall be only via the insulated ground wire provided by the Electrical Contractor for technical system ground. Equipment racks shall be isolated from other ground paths such as building steel and from ground via conduit.

B. Each equipment rack within a row of racks shall be electrically bonded to each other using a minimum 1/4-inch diameter unfinished bolt and nut with star washers. Bolts shall fasten to each equipment rack unpainted sheet metal. Each row of equipment racks shall be electrically bonded to adjacent row(s) via a No. 6 AWG insulated ground wire. This work shall be performed by the Technical System Contractor.

C. All technical system equipment shall be connected to the appropriate circuits of the technical power system.

D. If AC power sequencing is provided, the sequencing should be configured so that the audio power amplifiers power on last and power off first in the sequence.

E. AC power switches located on the front panel of equipment mounted in the racks shall be covered by a security covers. Exclusions from this list are items requiring user interface such as compact disc players, tuners, and wireless microphone receivers.

3.06 AUDIO EQUIPMENT INSTALLATION

A. All audio circuits shall be balanced two-wire circuits, with a separate grounding shield conductor, unless noted otherwise. All circuits shall have either the red or white wires as the "high" or “+” side of the line and connect to pin 2 of microphone-type XLR audio connectors and the tip of 3-conductor phone connectors. The black wire of the two-wire circuit shall be the "low" or “-“ side of the line and connect to pin 3 of microphone connectors and the ring of 3-conductor phone connectors. The shield conductor shall connect to pin 1 of microphone connectors or to the sleeve of phone connectors.

B. Shields shall be connected at each end of each wire to the pin 1 of each XLR, shield connection for each electronic device, etc. No shield wires shall be left unconnected except where noted on the drawings, nor shall any shield come in contact with conduit, pullboxes, or other building steel. Audio line-level circuit shield wires shall be grounded to rack sheet metal only via rack-mounted equipment. Shields shall be electrically isolated in multi-conductor cables. Shields for audio line-level circuits connected to audio transformers shall be connected to transformer electro-static shields and case ground.

C. In the case of an unbalanced source feeding into a balanced input and the cable run

is short (i.e. less than fifteen feet), connect the signal connection of the unbalanced connector to the “high” side of the balanced input. Connect the “ground” connection of the unbalanced line to the “low” side of the balanced connector. Connect the cable shield to the shield connection of the balanced input but do not connect it to the unbalanced connector. If the cable run is longer than fifteen feet, balance the line at the unbalanced source using specified balancing devices.

D. In the case of a balanced source feeding into an unbalanced input and the cable run is short (i.e. less than fifteen feet), connect the “high” side of the balanced output to the signal input of the unbalanced connection. Connect the “shield” to the “ground” of the unbalanced connection. Leave the “low” side of the balanced output floating.

E. Loudspeakers in the same acoustic space shall all be wired to produce consistent polarity with a mono input signal. They shall also be polarized such that a positive acoustic pressure on a microphone results in a positive acoustic pressure at all loudspeakers.

F. Loudspeakers shall be installed such that they do not cause mechanical rattles in the surrounding structure. There shall be no audible vibration or noise caused by improper mechanical installation or defective components.

G. Configure the Power Amplifier Monitor Panel such that when pink noise is applied to the sound system at a nominal level, all channels show the audio at approximately the same level on the meters and the audible level from the monitor loudspeaker is approximately the same for each channel.

3.07 NETWORK DOCUMENTATION

A. All technical system devices with an Ethernet port shall be connected to the associated AV network.

B. The Technical System Contractor shall document the MAC addresses of all IP capable equipment for inclusion with the Operation & Maintenance Manuals.

C. The Technical System Contractor shall document all IP addresses used in the AV network along with the associated equipment for inclusion with the Operation & Maintenance Manuals.

3.08 CONTRACTOR'S PRELIMINARY TESTING AND ADJUSTMENT

A. At the completion of the installation, the Technical System Contractor shall perform the following tests on the system to ensure proper installation. The technical system shall be fully tested with all equipment on site, installed, connected, and fully operational. The Technical System Contractor shall record the results of all tests,

provide this information to the Acoustical Consultant prior to the time of commissioning, and provide written notice to the Acoustical Consultant that the system(s) is (are) ready. All test equipment used for these tests shall be on site during the system commissioning activities should verification of submitted measurements be required. Preliminary tests shall include the following:

1. Measure and record the impedance of all loudspeaker circuits at the output of each amplifier and at the secondary of each power amplifier output transformer (if applicable). During this process, also check each loudspeaker circuit for shorts to ground. Recommended impedance measuring equipment includes the following:

    a. Dayton Audio WT3
    b. NTI Minirator MR-PRO
    c. Sennheiser ZP-3
    d. Terrasonde/Sencore Audio Toolbox.
    e. A Digital Multimeter (DMM) is NOT an acceptable measurement device for loudspeaker impedance.

2. Verify subjectively that each loudspeaker is issuing full spectrum signal (both woofer and tweeter/horn are operating, for example), using full spectrum pink noise at sufficient level.

3. Verify each loudspeaker is connected to the respective power amplifier and supply approximately 2-watts of 1/3-octave bands of pink noise to each loudspeaker to ensure loudspeakers do not rattle. Recommended 1/3-octave band pink noise sources include:

    a. Terrasonde/Sencore Audio Toolbox
    b. Japan Audio Society CD-1 test compact disc
    c. NTI Minirator MR-PRO.

4. The Technical System Contractor shall feed a 1-KHz 0dBm (0.775 volt) sine wave signal into all system line-level input locations (with the power amplifiers turned off). The gain adjust controls for all electronic devices shall be initially set for unity gain throughout the system electronics to the inputs of all power amplifiers and all system outputs. The system electronic components shall also be tested for frequency response.

5. Verify that all microphone, line level, and production intercom cabling is installed with Pins 1, 2, and 3 wired properly and there are no shorts to ground (make sure production intercom power supply is disconnected for these tests). Recommended test equipment includes:

    a. Alphaton ACT-100 Remote Tester
    b. NTI Minirator MR-PRO with Cable Test Adapter
    c. A microphone is NOT an acceptable measurement device for cable tests.

6. Verify all coax video cables pass a DC continuity cable test. Recommended test equipment includes:

    a. Fluke MicroScanner Cable Verifier
    b. Test-Um CX200
    c. Triplett 8-Way WireMaster Coax

7. Verify all triax video cables pass a DC continuity cable test. Recommended test equipment includes:

    a. Laird LTM-TXT
    b. Approved equal

8. Verify that all UTP and STP cables (Cat 53, Cat 6, etc.) are wired correctly and all pairs match. Recommended tets eqiupment includes:

    a. Fluke MicroScanner Cable Verifier
    b. Hobbes LanSmart TDR
    c. Test-Um TP600 LanRoverPro

9. Verify that all fiber is terminated properly and not introducing unwanted loss. Record each fiber length, source reference power, optical power tested at the receive end, and optical loss. Recommended test equipment includes:

    a. Fluke FTK1450 Fiber Verification Kit
    b. Approved equal.

10. Functional tests of all equipment. The functional tests shall include operational tests of all program source equipment (record and playback), wireless microphone system, mixing consoles, system inputs and outputs, all patch panel receptacles, intercom system, operational controls, AC power sequencing, and all system electronics. Functional tests include examination for hum, buzz, hiss, oscillation, thumps, unintended reception of other signals such as AM or FM radio, TV, CB, ham radio, cell phones, or any other unwanted signals through the system.

11. Verify that all microphone connectors, extension cables, and microphones are wired properly and in polarity.

12. Ensure that all portable (not installed) equipment is on the job-site and fully operational. This would include items such as microphones, microphone stands, cable tester, microphone cables, headphones, adapters, and other loose equipment. Remove all devices from shipping or packaging containers, ready for use, and place in equipment storage cabinet.

13. Any defects or malfunctions found shall be repaired or replaced by the Technical System Contractor prior to the commencement of commissioning activities by the Acoustical Consultant.

14. The Technical System Contractor is encouraged to contact the Acoustical Consultant should problems or concerns arise during the preliminary testing activities.

B. The Technical System Contractor shall record all wire numbers, connection numbers, and any changes to the systems accurately mapping the system installation. This information shall be transmitted to the Acoustical Consultant for inclusion with the system record drawings as described later in the specifications.

C. Should the Acoustical Consultant be required to make a return trip to the job-site to re-test or re-examine the installation due to the failure of the Technical System Contractor to perform the above preliminary tests, the Technical System Contractor will compensate the Acoustical Consultant for all associated costs.

3.09 COMMISSIONING

A. After completion of the system installation, and after the Technical System Contractor's preliminary tests and adjustments have been completed, the Technical System Contractor in conjunction with the Acoustical Consultant shall perform on-site commissioning of the sound & AV systems. This process will consist of complete system check-out, and tailoring of the each sound system's frequency response to the facility's acoustical environment.

B. The Technical System Contractor shall provide the services of the designated supervisor and any other technicians, quantity as determined by the Technical System Contractor, who are familiar with the system, for approximately seven ten-hour days. Additional time may be required due to Alternates accepted by the Owner, or due to Addenda or Change Orders (if any) which modify the scope of work. The supervisor shall provide assistance during system equalization and commissioning activities. This time period does not include time for the Contractor to correct wiring errors, equipment malfunctions, or problems related to the installation of the systems. This work could occur at any time day, night, or weekends without additional claims for expense.

C. Where computer-controlled system(s) are furnished, during the commissioning period(s) the Technical System Contractor shall operate the system computer, including: loading and operation of all software functions; revising software functions as directed; and adjusting equalizers, delays and other software settings as directed. At the completion of the final commissioning period, the Technical System Contractor shall download data settings onto a CD-ROM, with copies as required for inclusion in the O&M manuals described later in these specifications.

D. In addition, the Technical System Contractor shall provide the following: hand and power tools appropriate for the type of installation, ladders and/or scaffolding as required to reach all loudspeakers, or other high-mounted devices, spare wire and cable of the types used in the installation, selection of wiring fasteners used in the

installation, complete set of the most recent reviewed shop drawings, complete set of all manufacturers' original installation/operation/maintenance manuals, and specific test equipment used during the Contractor's preliminary testing activities.

E. After the technical systems are operational, the Acoustical Consultant and the Technical System Contractor, shall provide verbal instruction to designated Owner representatives as to proper methods of system operation.

F. The Technical System Contractor shall provide operational assistance for the first major use of the completed system as directed by the Owner, including being present for: one prior rehearsal associated with the first event (if applicable); a sound-check immediately prior to the first event; and the first event itself.

3.10 OPERATION & MAINTENANCE (O&M) MANUALS

A. At the completion of the project, the Technical System Contractor shall compile a **minimum of one hard copy** (or quantity as described under the General Conditions plus two CD copies) complete, identical copies (sets) of the Operation/Maintenance manuals. O&M manuals shall be subdivided into two separate volumes (notebooks or files on CD) comprised of: 1) Arena and 2) Auditorium & Main Lobby. The manuals shall include the following

1. Complete list of all equipment supplied for the project.
2. Project specifications (this document).
3. Drawings of record (updated versions of the .dwg files shared by the Acoustical Consultant).
4. All shop drawings of physical details (corrected to take into account any submittal review notations);
5. Original copies of manufacturers' engineering data sheets on ALL supplied equipment;
6. Original copies of ALL literature supplied with each item of equipment, including Owner's Manuals, Operating Instructions and Maintenance Manuals. Manuals not routinely supplied with an item of equipment will not be required;
7. Audio Network documentation including a list of all devices connected to the Audio Network along with their respective MAC and IP addresses.
8. Multi-pin connector physical layout of pins, and a schedule of circuit assignments as to pin numbers and wire colors;
9. Other "as installed" contractor-generated or vendor-generated drawings of the system which are not otherwise reflected in the project drawings.

B. Each hard copy shall be assembled into one three-ring binder notebook with suitable capacity to contain all sheets (binder no larger than 2" thick). Each binder shall have clear plastic overlays on the front and spine for insertion of the description of the project name, contractor name, and binder contents (e.g. "Sound Systems"). Each binder shall also contain pockets on the inside flaps to accept oddly shaped materials.

C. More than one binder (or CD) may be required for each copy of the notebooks. If this is the case, each binder shall have the outside labels indicate “1 of 2", “2 of 2", etc. and shall clearly identify the contents of each binder/CD.

D. Each binder shall include a “Table of Contents” listing the following:

1. Equipment List
2. Microphones & Accessories
3. Program Source Equipment
4. Mixing Console
5. Digital Signal Processing
6. Power Amplifiers
7. Loudspeakers & Accessories
8. Assistive Listening System
9. Production Intercom
10. Other Electronics
11. Miscellaneous
12. Project Specification
13. Drawings of Record
14. * Add additional sections as appropriate

E. Index tabs shall identify each section. Provide additional tabs to divide individual documents within each section. Sections shall be grouped to avoid being excessively large (i.e., no more than approximately 3/16-inch thick = 30 pages).

F. The "Equipment List" section shall include a complete list of all equipment furnished for the project in the same general order as appearing in the specifications. The list shall include the following information:

1. Quantity
2. Manufacturer
3. Part Number
4. Serial Number

G. Literature for any Owner’s existing equipment is not required to be furnished by the Technical System Contractor. Instead, where equipment categories include Owner’s existing equipment, allow space for the Owner to insert related literature later (hard copy binders only).

H. The Technical System Contractor shall furnish Record Drawings for the project. These shall be created from either a) the original design drawings prepared by the Acoustical Consultant or b) created by the Technical System Contractor. The drawings shall be complete including all of the information shown on the original design drawings (including floor plans, ceiling plans, sections, physical details, and elevations) using the Technical System Contractor’s title block (including specific information indicating the system design was by the Acoustical Consultant). Record drawings shall also include all drawings furnished during the submittal

process and all other information to provide full detail of all documented aspects of the systems. Record Drawings shall be submitted to the Acoustical Consultant for review and comment immediately upon the completion of the project. Upon final approval of the drawings, one set of one-half size paper drawings shall be provided for each hard copy binder set provided as a part of the operation/maintenance manuals. Each drawing shall be inserted into one 8½" x 11" clear, plastic, sheet protector, suitable for insertion into the rear of the three-ring binder. The sheet protectors shall be C-line No. 62028, or Samsill No. 42295, or K&M SP119. The Technical System Contractor shall neatly fold each hard copy drawing with the drawing title facing outward, and inserted into each sheet protector in an appropriate sequence. Depending on the thickness of other literature in the notebook, a separate notebook may be required for the drawings. PDF's of each drawing shall be included with each CD with each PDF file indicating the drawing number and contents.

I. Where furnished equipment is adjusted via computer, each binder shall include one complete clearly-labeled copy of all current software, data files (including all controls system uncompiled source code) on CD-ROM(s). Each time the software, data files or control system source code is updated during the warranty period the Technical System Contractor shall provide the Owner with updated copies on CD-ROM(s). Install the CD-ROM(s) in the binders using plastic CD/DVD binder sheets, Fellowes No. 95304 or equivalent.

J. Two sets of CD's shall be provided each of which contains all of the information provided in the hard copy binders. Each item of literature shall be in PDF format, clearly bookmarked and tabbed for easy access (matching the organization and layout of the hard copy). Each CD shall be clearly and professionally labeled indicating the project name, date, and creator of the CD's.

K. The notebooks shall be delivered to the Acoustical Consultant for review at the completion of the system installation work. Notebooks not meeting the requirements of these specifications shall be rejected, and shall be resubmitted by the Contractor after corrections are made.

L. One copy of the CD's shall be retained by the Acoustical Consultant. The binders and remaining copies of the CD's will be forwarded to the Owner via the Architect.

3.11 WARRANTY

A. The Technical System Contractor shall warrant all work executed under this contract, including all in-shop and onsite material, parts and labor, for a period of twelve months after the date of final acceptance.

B. Existing or any other Owner-furnished equipment shall not be included in this warranty.

C. The warranty services are limited to normal business hours, unless additional agreements are made between the Owner and the Technical System Contractor.

D. The Technical System Contractor shall visit the job just prior to the end of the warranty period to check all equipment for proper system operation. Any defective equipment found shall be replaced or repaired under the terms of the system warranty.

E. The Technical System Contractor shall not be responsible for damage to the system resultant from improper use or adjustment by others, negligence, acts of nature, or other causes which are beyond the Technical System Contractor's control.

END OF SECTION 274100