MINNESOTA
SPORTS FACILITIES
AUTHORITY

Minnesota Sports Facilities Authority
1005 4th Street South, Minneapolis, MN 55415

2025 Clubs and Suites AV Controls System Project
REQUEST FOR PROPOSALS (RFP) – ADDENDUM 1 – MAY 7, 2025
Revised Specifications

The following addendum shall become part of the construction documents for the construction of the 2025 Clubs and Suites AV Controls System Project. The addendum supersedes and supplements all previous references to similar items.

Changes to Drawings

1. AV Drawing Set Reissued in its entirety and identified with Addendum 1 revisions in the title block. Please email Samantha Thompson Samantha.thompson@usbankstadium.com for a link to the drawings.

Changes to Specifications

1. Section 27 41 16
    a. Item 1.7 System Description and Requirements
        i. Additional detail added to the Suite and Club scope of work
    b. Item 2.3 Digital Signal Processing (DSP) System
        i. Clarification added for the DSP care and Dante Cards

Attachments

1. Specifications section 27 41 16 integrated Audio Video Systems (Addendum 1)

WJHW

ADDENDUM

TO:	MSFA	FROM:	David Peterson
COMPANY:	US Bank Stadium	DATE:	05-05-2025
PROJECT:	US Bank Stadium Club and Suite Controls	SUBJECT:	Addendum 1

The following addendum shall become part of the construction documents for the construction of the above reference project. The addendum supersedes and supplements all previous reference to similar items.

CHANGES TO DRAWINGS

1. AV Drawing Set Reissued in its entirety and identified with Addendum 1 revision in the title block.

CHANGES TO SPECIFICATIONS

1. Section 27 41 16
    a. Item 1.7 System Descriptions and Requirements
        i. Additional detail added to the Suite and Club scope of work.
    b. Item 2.3 Digital Signal Processing (DSP) System
        i. Clarifications added for the DSP core and Dante Cards

ATTACHMENTS

1. AV Drawing set with floor plans, reflected ceiling plans, functional diagrams and rack elevations.
2. Specifications section 27 41 16 Integrated Audio Video Systems (Addendum 1)

END OF ADDENDUM

SECTION 27 41 16 – INTEGRATED AUDIO VISUAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Integrated Audio-Video Systems and Equipment as part of the Work.

1.2 SECTION INCLUDES

A. Project instruction for the Contractor, and Sound System description details

B. Club and Suite Controls product description

C. Project completion instruction for the Contractor

1.3 RESPONSIBILITY

A. This is a renovation project. Computer based CAD drawings are very limited and available for only the main and section plans with significant level of detail variations on each and as such the documents may not depict every detail or existing condition needed to complete this work. The Contractor is responsible for reviewing all existing site conditions that may affect the installation of this work with any exclusions clearly noted within RFP response. If a specific task implied or described within the drawings and specifications is not listed as excluded, it is assumed to be included and to be provided as part of this work.

B. As a renovation project, existing conditions both physical and related to electronic systems, are present. Reasonable effort to identify conditions prior to bid is expected. Notify Owner immediately of any items or issues discovered during construction which prevent or obstruct progress or completion of scope. Provide a solution or remedy to the issue with a rough order of magnitude cost for workable solution.

C. Existing pathways may be reused if suitable for this work. Existing loudspeaker cabling (and its associated conduit) is intended for reuse. For new loudspeaker circuits, new conduit and cabling is shown and included as part of this work for loudspeakers where existing conduit appears to not be sufficient for new design. If existing conduit provides adequate fill capacity, it may be reused. All unused conduit and cabling must be removed as part of this work. If existing cabling that is not needed for the new system and is run in conduit with cabling being reused, the unused cabling may be abandoned in place, tagged, and capped for future use to prevent any inadvertent connections or short circuits. Any existing cable trays needed for new cabling that do not allow for proper separation of cabling are to be brought the attention of the Owner immediately.

D. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Contractor to supply all materials, equipment, transportation, engineering, and labor necessary to provide a fully working, tested, and calibrated system. Supply accessories and equipment (such as, but not limited to: power strips, adapters, connectors, mounting hardware, etc.) needed for a complete system, even if not specifically mentioned in these Specifications.

Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification, supply items and quantities according to the intent of the Specification and Drawings, without claim for additional payment.

E. Specifications and drawings are complementary. Work called for by one is binding as if called for by both. Any discrepancies between specifications and drawings will be brought to the attention of the Owner for clarification during the bidding period. No allowance will subsequently be made to the Contractor by reason of their failure to have brought said discrepancies to the attention of the Owner.

F. Execute all work in accordance with the National Electrical Code (NEC), the National Electrical Safety Code, the Occupational Safety and Health Act (OSHA) and all applicable State and Local codes, ordinances, and regulations. If a conflict develops between the contract documents and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform Work.

G. Required licenses, insurance, and permits including payment of charges and fees.

H. Verification of dimensions and conditions at the job site.

I. Demolition of existing systems

J. Coordinate location and installation of equipment, power, grounding, and raceways with other building elements.

K. Preparation of submittal information.

L. Pick-up of Owner Furnished Equipment (OFE) and incorporation into project if applicable.

M. Development and implementation of AV control system software code and control panel layouts, which will become the property of the Owner.

N. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction (AHJ).

O. Final tests and adjustments, written report, and documentation.

P. Instruction of operating personnel.

Q. Provision of manuals.

R. Maintenance services and warranty.

1.4 RELATED WORK

A. Coordination between disciplines is required to achieve a proper system installation.

B. Networks

1. Provide network switches, cable plant, and interfaces as required for audio systems in the venue.

1.5 REFERENCES

A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:

1. American National Safety Institute (ANSI)
2. American Society of Testing and Materials (ASTM)
3. Electronics Industries Association (EIA)
4. Federal Communications Commission (FCC)
5. National Electrical Manufacturer's Association (NEMA)
6. National Electrical Code (NEC)
7. Underwriters Laboratories (UL)
8. Occupational Safety and Health Administration (OSHA)
9. Society of Motion Picture and Television Engineers (SMPTE)
10. Building Industry Consulting Service International (BICSI)
11. Americans with Disabilities Act (ADA)
12. AVIXA published standards
13. Davis and Davis, Sound System Engineering (3rd Edition) (SSE), Howard W. Sams, 2006
14. Giddings, Audio System Design and Installation (ASDI), Howard W. Sams, 2013
15. AV Installation Handbook Second Edition: The Best Practices for Quality Audiovisual Systems, Infocomm (AVIH), 2009
16. Middle Atlantic – Thermal Management White Paper

1.6 DEFINITIONS

A. In addition to those Definitions of Division 1, the following list of terms as used in this specification will be defined as follows:

1. Furnish: To purchase, procure, acquire, and deliver complete with related accessories.
2. Install: To set in place, join, attach, link, set up, or otherwise connect together and test until complete before turning over to the Owner. All parts, items, or equipment supplied by Contractor.
3. Provide: To furnish and install.

1.7 SYSTEMS DESCRIPTIONS AND REQUIREMENTS

A. The following is intended to provide an overview of the required work details, system features, and design concepts for the Work as shown on the project drawings and is not intended to be an exhaustive description of the systems.

B. The Work includes provision of a complete and working Sound System, providing sound to Suites, Clubs and related Corridors and Restrooms.

1. This is a renovation project.
2. Suite Scope of work
   a. DSP System
      1) Decommissioning of the existing London Blue DSP system and programming.
      2) Incorporation of the existing Qsys DSP system and expanded programming.
      3) Existing Core110f v2 is located in the Audio Control Room and to provide building wide and bowl audio sources.
      4) A new Core to be established for the suites, refer to the Club Scope of Work.
      5) Existing suite IPAD touch panels to remain.
      6) Existing suite 2 channel amplifiers to be removed and new network based amplifiers installed at existing system racks.
      7) New loudspeaker circuits/cabling are provided to serve the existing suite loudspeakers as referenced on the plan.
      8) Existing “Mini” suites to be fed from new network based amplifiers and existing circuits/cabling to be reused.
   b. Programming
      1) All existing features and operations of the existing Suite IPAD touch panels to be incorporated into the Q-sys system
   c. Demolition
      1) Removal of the existing in-room amplifiers.
      2) Remove existing amplifiers, Digital Signal Processor (DSP) system, and specific Control System components.
      3) Palletize removed equipment and coordinate disposal with the Owner.
      4) Remove cabling not intended for re-use.
   d. Infrastructure
      1) Re-use existing conduit infrastructure to the extent possible.
      2) Re-use existing network infrastructure.
   e. Commissioning
      1) Tuning of each BOH system will be part of this work.
      2) Utilize existing DSP information as the basis for the new Qsys parameters
3. Club Scope of work
   a. DSP System
      1) Decommissioning of the existing London Blue DSP system and programming.
      2) Incorporation of the existing Qsys DSP system and expanded programming.
      3) Existing Core110f v2 is located in the Audio Control Room and to provide building wide and bowl audio sources.
      4) A new Core to be provided at the Valhalla Club and will provide the base program for all the suites and clubs. This new core to establish core to core communication with the Audio Control Room Core.
      5) Each club will include a Core that will operate in Frame Mode.
      6) New touch panels will be included for Clubs
         a) Exceptions
            (1) Vikings Club touch panels are to remain (recently upgraded to QSC 10” touch panel).
            (2) Club Purple touch panel is to remain (recently upgraded to QSC 10” touch panel).
      7) New network based amplifiers installed at existing system racks.
      8) All existing loudspeaker circuits/cabling to be reused.
   b. Programming
      1) All existing features and operations of the existing Suite IPAD touch panels to be incorporated into the Q-sys system

2) Existing IP Based control functionality to video and miscellaneous devices is not shown on the functional diagrams but is part of this scope of work.

c. Demolition
1) Removal of the existing amplifiers.
2) Remove existing amplifiers, Digital Signal Processor (DSP) system, and specific Control System components.
3) Palletize removed equipment and coordinate disposal with the Owner.
4) Remove cabling not intended for re-use.

d. Infrastructure
1) Re-use existing conduit infrastructure to the extent possible.
2) Re-use existing network infrastructure.

e. Commissioning
1) Tuning of each BOH system will be part of this work.
2) Utilize existing DSP information as the basis for the new Qsys parameters

C. Club and Suite systems to include the following:

1. L1 – EVENT LEVEL
   a. Field Suites
   b. Field Mini Suites
   c. Associated corridors and restrooms
2. L2 – EXECUTIVE SUITE LEVEL
   a. Valhalla Club (Medtronic)
   b. Executive Suites
   c. Associated corridors and restrooms
3. L3 – LOWER CLUB LEVEL
   a. Vikings Club (Polaris)
   b. Associated corridors and restrooms
4. L4 – MAIN CONCOURSE LEVEL
   a. Main Suites
   b. Associated corridors and restrooms
5. L5 – UPPER CLUB LEVEL
   a. Ice Club (Little Six)
   b. Fire Club (Sukup)
   c. Associated corridors and restrooms
6. L6 – UPPER SUITE LEVEL
   a. Upper Suites
   b. Club Purple (Mystic Lake)
   c. Associated corridors and restrooms

D. Finishes and Repair

1. Paint new conduit and other new pathways to match surroundings
2. Provide sheetrock repair and painting where needed as part of your base bid

E. DSP Control System:

1. The DSP Control System and Graphic User Interface (GUI) will be programmed by the QSC Applications Team, or a QSC Approved Independent Q-Sys Programmer.
   a. Provide this programming service as part of your base bid.
2. The Graphic User Interface (GUI) to be designed using the existing touch panels as the basis of design. Include all existing features

F. New DSP Features

1. The following features to be added to the existing programming

a. Administration Level Power Down
   1) Provide programming to shut down suite and club displays at a specific time each day.
   2) The time of day to be selectable
   3) Club LED Displays to video mute as directed by the display manufacturer.

b. Fire Club (Sukup) Room Combine
   1) Provide controls to provide room combine/divide features to allow a common presentation or individual presentations per display, audio to also combine/divide.
   2) Provide ability to recall content format based on event needs. Recalls to include:
      a) Welcome to Stadium
      b) Team Welcome
      c) Match Up
      d) Next Game
      e) Team Wins
      f) Quad Split
      g) Dual Split
      h) Primary Game with 3 smaller PIP
      i) Single Game with LBAR
      j) Local input at 16 x 9 with replaceable graphical panel
      k) Replaceable AD panel.

c. Ice Club (Little Six) Room Combine
   1) Provide controls to provide room combine/divide features to allow a common presentation or individual presentations per display, audio to also combine/divide.
   2) Provide ability to recall content format based on event needs. Recalls to include:
      a) Welcome to Stadium
      b) Team Welcome
      c) Match Up
      d) Next Game
      e) Team Wins
      f) Quad Split
      g) Dual Split
      h) Primary Game with 3 smaller PIP
      i) Single Game with LBAR
      j) Local input at 16 x 9 with replaceable graphical panel
      k) Replaceable AD panel.

d. Viking Club (Polaris)
   1) Provide ability to recall content format based on event needs. Recalls to include:
      a) Welcome to Stadium
      b) Team Welcome
      c) Match Up
      d) Next Game
      e) Team Wins
      f) Quad Split
      g) Dual Split
      h) Primary Game with 3 smaller PIP
      i) Single Game with LBAR
      j) Local input at 16 x 9 with replaceable graphical panel
      k) Replaceable AD panel.

e. Club Purple (Mystic Lake)

1) Provide ability to recall content format based on event needs. Recalls to include:
   a) Welcome to Stadium
   b) Team Welcome
   c) Match Up
   d) Next Game
   e) Team Wins
   f) Quad Split
   g) Dual Split
   h) Primary Game with 3 smaller PIP
   i) Single Game with LBAR
   j) Local input at 16 x 9 with replaceable graphical panel
   k) Replaceable AD panel.

f. Valhalla (Medtronic)
   1) Provide ability to recall content format based on event needs. Recalls to include:
      a) Welcome to Stadium
      b) Team Welcome
      c) Match Up
      d) Next Game
      e) Team Wins
      f) Quad Split
      g) Dual Split
      h) Primary Game with 3 smaller PIP
      i) Single Game with LBAR
      j) Local input at 16 x 9 with replaceable graphical panel
      k) Replaceable AD panel.

g. Audio Only Source
   1) Fire Club (Sukup) and Ice Club (Little Six) feature HDMI input plates with 3.5mm audio inputs. Provide control to allow user to select this audio input as a source.

h. Fire Alarm over-ride
   1) Provide Fire Alarm over-ride programming as necessary to mute signals from the Audio System, and route any emergency audio signals as directed by Owner
      a) Provide a bold indicator in DSP Graphic User Interface (GUI) on all computers and Touch Panels to indicate that the Sound System is in an Alarm condition.

G. DSP GUI Review

1. After receiving Notice to Proceed, coordinate monthly DSP Graphic User Interface (GUI) review sessions with the Owner, Architect, and A/V Consultant.
   a. Review should include signal flow diagrams, screenshots of control GUI's for computers, wired Touch Panels, and wireless iPads as they are developed.
   b. 60 days prior to final system commissioning, the Review should include a working demonstration of all computers, Touch Panels, wireless iPad controllers, and networked Volume/Source selectors.

H. Electrical

1. Include electrical work as part of the proposal response.
2. General
   a. Existing electrical power is provided "as is".
   b. Identify at time of proposal if AC power is not sufficient.

c. Existing power transformers and panelboards shall remain operational during demolition and may be reused by the contractor.
d. If existing transformers, receptacles, or other components will be re-used to meet the requirements listed below, Contractor to test and certify these devices function as new.
e. Provide additional circuits required (including circuit breakers, conduits, wiring, and receptacles etc.) as required for a complete installation.
f. Provide electrical safety grounding for all equipment in accordance with local codes and standards specified herein.

3. Signal Cabling and Conduit
   a. Install signal cabling in existing conduit, raceway, and cable tray. Provide additional conduit if required.
   b. In the event of damage, notify the Owner in writing and propose an acceptable repair.

1.8 SUBMITTALS

A. Provide submittals in accordance with Conditions of the Contract and Division 1, Submittal Procedures section, unless otherwise indicated.

B. Submittals will contain sufficient information to describe the Work to be performed. Reviewed shop drawings are to be used for final coordination and construction.

C. Shop drawings must be original work produced by the Contractor responsible for performing the work defined in this specification. Scanning, photographic copying, materially copying, or any other reproducing the contents of the drawings or specifications contained within the Contract Documents will be marked as unacceptable and not reviewed for any content. No claim will be made for delay, undue burden, or additional costs for the effort to produce shop drawings, schedules, and equipment lists addressing this specification or the overall project manual.

D. Supplementary submittal requirements:

1. Provide each of the following in one submission for approval within thirty days of issuance of Notice to Proceed (NTP) and prior to commencement of Work:
   a. Complete schedule of submittals.
   b. Chronological schedule of Work in bar chart form.
   c. Product Data Sheets:
      1) Submissions that do not follow the format and configuration described will be returned without review.
      2) Provide a complete table of contents with the following information:
         a) Project title.
         b) Submittal number. In the case of a resubmittal, use the original submittal number immediately followed by the suffix “R” immediately followed by a unique number and be numbered in consecutive order.
         c) Date of submission.
         d) Provide a list of and Manufacturer's data sheets on products to be incorporated with the Work. Arrange data sheets in the same order they appear in this specification. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
         e) Submit manufacturer’s product literature for each type of firestop material to be used. Literature will include documentation of UL

classifications or approved third party testing. Manufacturer's name and number for each part will be included. Submit drawings of through penetrations, which include the system to be utilized for the firestopping application. Drawing will indicate construction of wall or floor assembly; size, number and material of penetrating items; firestop system designation; required F-rating, T-rating and remarks.

f) Provide high quality copies with all text legible and illustrations of adequate resolution and sharpness for review. Internet web pages, faxed copies or copies with portions of the information missing or smeared not acceptable.

d. Shop Drawings:
   1) Functional Diagrams/Schematics:
      a) Detailed wiring diagrams showing interconnection of components and products, wiring and cabling diagrams depicting cable types and cable designators, and device designators. Provide connector designations and terminal strip identification, along with color codes for cables connecting to these devices. Give each component a unique designator and use this designator consistently throughout the project.
   2) Coordination Drawings:
      a) Prepare and submit a set of coordination drawings showing major elements, components, and devices of the AV Systemin relationship with other building components. Prepare drawings to an accurate scale of 1/8" =1'-0" or larger on suitable sized media.
      b) Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all equipment. Indicate locations where space is limited, and where sequencing and coordination of installations is of importance to the efficient flow of the work including but not necessarily limited to the following:
         (1) Equipment housings
         (2) Ceiling and wall mounted devices
         (3) Raceways
         (4) Cabling
   3) Equipment housing: Location of equipment in racks, consoles position on tables or counters. Details to include dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
   4) Patch panel layouts and labeling strips, including color schemes.
   5) Full fabrication details of custom enclosure and millwork indicating size, material, finish and openings required for equipment and enclosures.
   6) Structural rigging and mounting details:
      a) Loudspeaker rigging, suspension, and mounting detail drawings will be signed and sealed by a professional engineer licensed to practice in the state in which the project is located. The signed and sealed drawings noted above to include the following:
      b) Analysis of all components in the load path and attachment method to building structure for suspended loudspeakers.
      c) Attachment method for mounting brackets at ceilings, walls, or other building features.
      d) Detail the product manufacturer, part numbers, and load capacity of the hardware fittings and materials selected for suspended or mounted loudspeakers.
      e) A copy of the design calculations.
      f) Secondary steel required for attachment to the building structure.
      g) Custom brackets, mounts, suspension grids or trusses, loudspeaker cabinet frames, or loudspeaker brackets.

h) Loudspeaker brackets or mounts provided by the specific loudspeaker manufacturer being installed that do not include traceability data.

7) Traceability data and/or ANSI standard compliance data for loudspeaker mounting brackets or rigging provided by the loudspeaker manufacturer.
8) Risk analysis data as referenced in Part 3.2, F
9) Stamping Engineer post-installation sign-off as described in Part 3.2, F
10) Proof of ETCP certification for on-site rigging crew.
11) Fabricated Plates and Panels
12) Provide complete drawings on custom fabricated plates or panels. Drawings will include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material. Provide samples of plate color options for review.
13) Labeling
    a) Equipment and cabling labeling scheme. Include font sizes and styles, explanation of scheme, and designator schedule.
14) Schedules
    a) Wiring schedule showing source and destination of wiring and indicating which wiring is in conduit. Junction box schedule showing type of box, size, mounting and location. Include this information with remainder of wiring diagrams.
15) Control System Software
    a) Provide electronic copies of proposed control system user interfaces within sixty (60) days of issuance of Notice to Proceed (NTP).
16) IP Addresses
    a) Coordinated with the venue IT Adminstrator, provide a list of IP addresses, by device, used in the project.

E. Submittal format:

1. Consultant's project documents in electronic format will not be supplied to the Contractor for their use as part of submittals.
2. Standards:
    a. Floor plan drawings executed at an appropriate scale, not less than 1/8" = 1'-0".
    b. Detail drawings executed at an appropriate scale, not less than 3/8" = 1'-0".
    c. Plate and panel drawings executed at an appropriate scale, not less than 1/2" = 1".
    d. Rack, enclosure, and millwork detail drawings executed at an appropriate scale, not less than 1" = 1'-0".
3. Electronic Submittals: Submit in non-proprietary PDF format. Combine product literature into a single file for each Part 2 subheading (i.e.: 2.3 Microphones and Accessories, 2.4 Input Sources, etc.). Shop drawings may be combined into logical sections such as legend, floor plan, section, detail, functional, etc.

F. Resubmission requirements:

1. Make all requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
2. Indicate all changes that have been made by clouding and noting with a revision marker. Drawing title block to track all revisions.
3. Also indicate all changes that have been made other than those requested.

1.9 CONTRACT CLOSE-OUT DOCUMENTS:

A. Provide close-out submittals in accordance with Conditions of the Contract and Division 1, Submittal Procedures section unless otherwise indicated, after substantial completion but prior to final observation:

B. Supplementary submittal requirements:

1. Provide the following in one electronic submission for review.
2. Equipment Manuals:
   a. Manufacturer's owner/instruction manual for each type of Product by manufacturer and model or part number unless specified otherwise herein
   b. Supply manufacturer’s serial numbers for each Product
   c. For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item
   d. Separately bind list by manufacturer and model or part number of Products incorporated within the Work, arranged in alpha numeric order. When applicable, bind Manufacturer's warranty statements separately.
3. Test Reports: Recorded findings of Commissioning.
4. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.
   a. This procedure should describe the operation of system capabilities.
   b. Assume the intended reader of the manual to be technically inexperienced but unfamiliar with the components and the facility.
5. Service Information, including service phone number(s) and hours; service schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
6. Any other pertinent data generated during the Project or required for future service.
7. Within three weeks of final observation, submit the following in one electronic submission for review. Upon Owners and/or Consultant’s request, provide hard copy files of the following:
   a. Record drawings: Final rendition of Shop Drawings depicting what is actually incorporated within the Work.
   b. Record drawings in AutoCAD editable DWG format and Adobe PDF format. Resolution to be sufficient to permit Owner’s technicians to be able to clearly read all notes and text on screen.
   c. One set of signed proof-of-training documents.
8. Submittal Format:
   a. Record Drawings: Drawings executed at an appropriate scale, but not smaller than 1/8 inch = 1’-0”.
   b. Segregate documents into separate folders containing data relevant to operational, maintenance, and warranty issues. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in a maintenance folder.
   c. Project Record Manual
      1) Provide product data submittal in a single PDF file.
      2) Provide an indexed list of major groupings.
      3) In the index, provide clickable hyperlinks that lead to the page of that major grouping.
      4) Organize index and major groupings in logical signal-flow order.
9. Resubmission requirements:
   a. Make all requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
   b. Indicate all changes that have been made other than those requested.

1.10 CUSTOM SOFTWARE

A. Introduction:

1. Proprietary software provided for the Technical Systems will be subject to this software license between the Contractor and the Owner as an essential element of the system as defined in the system specification and associated documents, drawings and agreement.
2. Contractor will agree that 3rd party proprietary software provided with the system will be subject to this agreement.
3. Contractor and Owner agree that this software license is deemed to be part of, and subject to, the terms of the Agreement applicable to both parties; and will supersede any standard manufacturer or Contractor's standard license agreement.
4. Proprietary software will be defined to include, but not be limited to, device and system specific software and firmware designed to run on conventional computer based operating platforms as well as all micro-processor based hardware used to program, setup, or operate the system or its components.
5. For sake of this agreement, MS Windows® will not be considered "proprietary" software, unless a non-public version of Windows® or any of its components are critical to the operation of the system in which case it will be deemed proprietary.

B. License Grant and Ownership:

1. Contractor hereby grants to Owner a perpetual, non-exclusive, site license to all software for Customer's use in connection with the establishment, use, maintenance and modification of the system implemented by Contractor. Software will mean executable object code of software programs and the patches, scripts, modifications, enhancements, designs, concepts or other materials that constitute the software programs necessary for the proper function and operation of the system as delivered by the Contractor and accepted by the Owner.
2. Except as expressly set forth in this agreement, Contractor will at all times own all intellectual property rights in the software. Any and all licenses, product warranties or service contracts provided by third parties in connection with any software, hardware or other software or services provided in the system will be delivered to Owner for the sole benefit of Owner.
3. Owner may supply to Contractor or allow the Contractor to use certain proprietary information, including service marks, logos, graphics, software, documents and business information and plans that have been authored or pre-owned by Contractor. All such intellectual property will remain the exclusive property of Owner and will not be used by Contractor for any purposes other than those associated with delivery of the system.

C. Copies, Modifications, and Use:

1. Source code will be available to Owner for a period of not less than 10 years.
2. Owner may make copies of the software for archival purposes and as required for modifications to the system. All copies and distribution of the software will remain within the direct control of Owner and its representatives.
3. Owner may make modifications to the source code version of the software, if and only if the results of all such modifications are applied solely to the system. In no way does this Software License confer any right for Owner to license, sublicense, sell, or otherwise authorize the use of the software, whether in executable form, source code or otherwise, by any third parties.
4. All express or implied warranties relating to the software will be deemed null and void in case of any modification to the software made by any party other than Contractor.

D. Warranties and Representations:

1. Contractor represents and warrants to Owner that:

a. It has all necessary rights and authority to execute and deliver this Software License and perform its obligations hereunder and to grant the rights granted under this Software License to Owner;
b. The goods and services provided by contractor under this Software License, including the software and all intellectual property provided hereunder, are original to Contractor or its subcontractors or partners; and
c. The software, as delivered as part of the system, will not infringe or otherwise violate the rights of any third party, or violate any applicable law, rule or regulation.

2. Contractor further represents and warrants that, throughout the System Warranty Period, the executable object code of software and the system will perform substantially in accordance with the System Specifications and Agreement. If the software fails to perform as specified and accepted all remedies are pursuant to the policies set forth in the Specification and in the Agreement. No warranty of any type or nature is provided for the source code version of the software which is delivered as is.
3. Except as expressly stated in this Agreement, there are no warranties, express or implied, including, but not limited to, the implied warranties of fitness for a particular purpose, of merchantability, or warranty of no infringement of third party intellectual property rights.

1.11 QUALITY ASSURANCE

A. Qualifications: Contractor to be experienced in the provision of systems similar in complexity to those required for this project, and meet the requirements listed below. Provide documentation at the time of bid to support these qualifications:

1. Form of corporation.
2. No less than three years' experience with equipment and systems of the specified types.
3. Experience with at least three comparable scale projects within the last three years.
4. Be a franchised dealer and service facility for the manufacturer's products furnished.
5. Maintain a fully staffed and equipped service facility with full-time field technicians.
6. Have at least one supervisory on-site employee who has completed and has been certified CTS-I by Infocomm.
7. Supervision of all rigging by an ETCP certified rigger for all work associated with suspension or mounting of overhead equipment.
8. Adequate plant capacity and equipment to complete the Work.
9. Adequate staff with commensurate technical experience.
10. Suitable financial status (i.e., bonding and materials purchase capacity) to meet the obligations of the Work.
11. Adequate regional service organization to meet warranty response requirements of the Project.
12. Provide listing with appropriate explanation regarding the status of Contractor's resolved or unresolved legal disputes within the last six calendar years.
13. Provide listing with appropriate explanation regarding any projects within the last 3 years where the Contractor has failed to meet construction schedules due to Contractor's cause.
14. Completed current version of the AIA Contractor's Qualification Form.

B. Subcontractors: at the time of bid, the Contractor will provide a list of structural, electrical, sound, or any other subcontractors intended to do the Work, or are being retained as local service providers throughout the warranty period. Subcontractors will be appropriately state licensed in their specialty and must provide the same qualification documents as the Contractor.

C. Work: Perform Work in compliance with the applicable standards listed herein and governing codes and regulations of the authorities having jurisdiction and the Contract Documents.

1. Drawings and specification requirements govern where they exceed Code and Regulation requirements.
2. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
3. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

D. Coordinate exact location and installation of equipment, power, grounding, and raceway requirements with the Architect.

1.12 DELIVERY, STORAGE & HANDLING

A. Ship Products in its original container, to prevent damaging or entrance of foreign matter.

B. Handling and shipping in accordance with Manufacturer's recommendation.

C. Provide protective covering during construction of all installed devices, to prevent damaging or entrance of foreign matter.

D. Replace, at no expense to Owner, Products damaged during storage, handling, or through the course of construction.

1.13 PROJECT CONDITIONS

A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

1.14 WARRANTY

A. Warrant labor and equipment for one year following the date of substantial completion to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or equipment within the Warranty period without charge.

B. This warranty is in addition to any specific warranties issued by manufacturers for greater periods of time.

C. Within the warranty period, answer service calls within twenty-four (24) hours during normal working hours and correct the deficiency within forty-eight (48) hours.

D. Provide Owner with the name and telephone number of the person to call for service. This information to be part of Project Closeout Documents.

E. Thirty days prior to the end of the warranty period provide a complete checkout of all system components. Repair or replace any defective equipment discovered during the testing. Correct any defects in wiring or other functional problems reported by Owner. Warranty replacement and service of equipment will not apply to Owner furnished equipment (OFE). Coordinate an observation visit with the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. Products quantity is as required. If a quantity is given, provide at least the given amount. Some product listed may not be required to fulfill the obligations of the Work.

B. Equipment and materials will be new and conform to applicable UL or ANSI provisions.

C. Regardless of the length or completeness of the descriptive paragraph herein, provide Products complying with the specified manufacturer's published specifications.

D. Remove or blank out all manufacturers’ names, logos, or other symbols from loudspeakers or other objects placed in view of the public. If logos are removable, remove and repaint to the color of the adjacent surface and reattach.

E. Take care during installation to prevent scratches, dents, chips, etc.

2.2 ACCEPTABLE MANUFACTURERS

A. Model numbers and manufacturers included in this specification are listed as standard of function, performance, and quality, forming the basis of design.

B. If a specified product has been discontinued by a manufacturer, provide the replacement model (as certified by the manufacturer) at no additional cost.

C. Where required, provide manufacturer’s rack mount adapter or one manufactured by Middle Atlantic or Winstead unless specified elsewhere.

2.3 DIGITAL SIGNAL PROCESSING (DSP) SYSTEM

A. Signal processing shall be performed by computer-based system.

B. The DSP system is existing and to be expanded to incorporate new and existing devices.

C. The system shall have the following capabilities:

1. Digital Signal Processing Unit:
   a. Interior configuration of signal flow and routing to be fully user configurable
   b. Unit to permit hardwire connection of external switches for recalling presets
   c. Unit to have no external user adjustable controls
   d. Dante compatible
   e. Acceptable Product to include the following:
      1) DSP (DSP, Type 1) – QSC Q_SYS Core 510i (Core Mode)
      2) DSP IO Frame (DSP FR, Type 1) – QSC Q-SYS Core 510i (Frame Mode)
      3) DSP Cards – QSC CIML4, COL4
      4) Dante Cards – QSC CDN64
      5) IO RS-232 Control (IO RS, Type 1) – QSC QIO-S4
      6) IO IR Control (IO IR, Type 1) – QSC QIO-IR1x4
      7) 10” Touch Panel (TP, Type 1) – QSC TSC-101-G3-BK

2.4 AMPLIFIERS

A. Power Amplifiers:

1. Provide protection of circuit components in the event of input over-drive, output overload, or short circuits
2. Frequency response: ±1 dB, 20 Hz to 20 kHz with less than 1 percent THD at rated output
3. Input impedance: 10k ohms balanced
4. Output regulation: 2 dB from no load to full load conditions
5. Noise generation: at least 85 dB below rated output with input shorted
6. Ventilation: variable speed fans that shut off when the amplifier is operating under light or no-load conditions
7. Acceptable Products:
   a. Type PA1 – Not used.
   b. Type PA2 Power Amplifier – 8 Channel, 125 Watts per Channel at 70V/8 Ohms:
      1) Powersoft Unica 8M | 1K8
   c. Type PA3 Power Amplifier – 8 Channel, 250 Watts per Channel at 70V/8 Ohms:
      1) Powersoft Unica 8M | 2K8
   d. Type PA4 Power Amplifier - 8 Channel, 500 Watts per Channel at 70V/8 Ohms:
      1) Powersoft Unica 8M | 4K8
   e. Type PA5 Power Amplifier - 8 Channel, 1000 Watts per Channel at 70V/8 Ohms:
      1) Powersoft Unica 8M | 8K8
   f. Type PA6 Power Amplifier – 4 Channel, 1250 Watts per Channel at 70V/8 Ohms:
      1) Powersoft Unica 4L | 5K4

2.5 EQUIPMENT HOUSING & ACCESSORIES

A. Configure equipment racks for proper airflow and cooling

B. Middle Atlantic systems listed below are approved for use on this project and are listed to set the acceptable standard of performance. Equipment housing systems from Lowell or other approved equivalents are also acceptable provided they meet the performance specifications of the approved listed equipment housing systems.

C. Blank Rack Panels:

1. Flanged construction
2. 16 Gauge steel
3. Black brushed anodized aluminum
4. Acceptable Product:
    a. Middle Atlantic BL series

2.6 PLATES AND PANELS

A. Provide plates and panels as described in Drawings. Engrave as shown on Drawings. Other Plates and Panels may be required to satisfy the requirements of the Work.

B. Custom panels will be flanged standard EIA sizes, brushed black anodized finish unless otherwise noted.

C. Plate finish will be coordinated with the Architect. Plastic plates are not acceptable.

D. Panel, plate, and label engraving will be 1/8-inch block sans serif characters unless noted otherwise. On dark panels or pushbuttons, letters will be white; on stainless steel or brushed natural aluminum pushbuttons, letters will be black.

E. Custom and/or Engraved Panels:

1. Custom panels constructed of 1/8-inch brushed aluminum
2. Finish: black anodize
3. Acceptable Product:
    a. RCI Custom
    b. ProCo
    c. Whirlwind

F. Patch Panels for Audio/Video plate tie lines:

1. Flat all-metal Shielded modular patch panels
2. Mounts to standard cabinets and EIA 19” Racks
3. 16-ports per 1U panel
4. Strain relief bar includes cable tie slots for managing and supporting cables
5. Label area to correspond to unique ID number of AV, AVC, FB plates (Labels to be printed, not hand-written)
6. Utilizes Mini-Com Shielded snap-in modules
7. Acceptable Product to include:
    a. Panduit #CP16WSBLY
    b. Panduit TX6 10Gig Shielded Modules
    c. Mounting screws as needed

2.7 CABLES & WIRING

A. All electrical conductors installed under this contract, except where otherwise specified, will be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper, and meet appropriate ratings (e.g., CMR, CMP, etc.)

B. Cable will carry appropriate fire rating (e.g., CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.

C. Where cables are routed through cable tray, provide tray rated cable of equal specification.

D. Where speaker cables are run exposed through a return air plenum, provide plenum rated cable of equal specification.

E. Where cabling is run through in-grade pathways, provide direct burial cable, underground rated, or cable treated with water blocking. Adjust conduit sizes accordingly to accommodate larger diameter cable.

F. Shielded cables located in raceways will have aluminum foil shield with drain wire.

G. The Belden cables listed below are approved for use on this project and are listed to set the acceptable standard of performance. If field conditions or actual cable pathway requires tray or plenum cable, provide version of cable that meets required rating. Cables from Liberty, Commscope, Gepco, Clark, Windy City, and West Penn are also acceptable provided they meet the performance specifications of the approved listed cables.

H. Loudspeaker Cables:

1. Amplifier to Rack Room Terminals:
   a. Distance not to exceed 25 feet.
   b. 12 gauge twisted pair, jacketed.
   c. Acceptable Product:
      1) Belden 5000UP
2. Rack Room Terminals to Junction Box Terminals near loudspeaker, low impedance:
   a. 10 gauge twisted pair, jacketed.
   b. Acceptable Product:
      1) Non-Plenum: Belden 5T00UP
      2) Plenum: Belden 6T00UP
      3) In-grade: Belden 1313A
3. Rack Room Terminals to Junction Box Terminals near loudspeaker, 70V Zones:
   a. 12 gauge twisted pair, jacketed.
   b. Acceptable Product:
      1) Non-Plenum: Belden 5000UP
      2) Plenum: Belden 6000UE
      3) In-grade: Belden 1311A

I. Microphone and Line Level Cable:

1. Twisted pairs, shielded, jacketed, 110 Ohm cable.
2. Acceptable Product:
   a. Single Pair:
      1) Non-Plenum: Belden 1696A
      2) Plenum: Belden 1801B
      3) Riser: Belden 9451
      4) In-grade: Belden 9451WB
   b. Six Pair:
      1) Non-Plenum: Belden 1218B
      2) Plenum: Belden 1816P
      3) Riser: Belden 1816R
      4) In-grade: Belden 1816WB
   c. Twelve Pair:

1) Non-Plenum: Belden 1220B
2) Plenum: Belden 1818P
3) Riser: Belden 1818R
4) In-grade: Belden 1818WB

J. Category 6A Patch Cables:

1. Rack Patch Cables
2. Length as required
3. Acceptable Product:
   a. Belden 10GX UTP LSZH series

2.8 CONNECTORS

A. XLR Panel mount Connectors:

1. Provide panel mount XLR connectors with unified metal shell
2. RF-Protector connectors
3. Shell Color: Black
4. Contacts: Silver
5. Terminations: Solder
6. Acceptable Product:
   a. Male Connectors: Neutrik NC*MD-L-1-BAG Series
   b. Female Connectors: Neutrik NC*FD-L-1-BAG Series

B. XLR Cable Connectors:

1. Provide XLR cable connectors with die cast shell
2. No-screw type assembly
3. Chuck-type strain relief
4. Shell Color: Black
5. Contacts: Silver
6. Terminations: Solder
7. Acceptable Product:
   a. Male Connectors: Neutrik NC*MX-BAG Series
   b. Female Connectors: Neutrik NC*FX-BAG Series.

C. ¼” Panel mount Connectors:

1. Provide panel mount ¼” connectors with unified metal shell
2. Shell Color: Black
3. Contacts: Silver
4. Terminations: Solder
5. Acceptable Product:
   a. Female Connectors: Neutrik NJ3FP6C-BAG Series

D. ¼” Cable Connectors:

1. Provide ¼” cable connectors with die cast shell
2. No-screw type assembly
3. Chuck-type strain relief
4. Shell Color: Black
5. Contacts: Nickel
6. Terminations: Solder
7. Acceptable Product:
   a. Male Connectors: Neutrik NP3C-BAG Series

E. BNC Cable Connectors:

1. Provide cable mount BNC connectors
2. Contacts: Brass or copper
3. Terminations: Crimp
4. Acceptable Product:
   a. Kings
   b. Amp
   c. Amphenol
   d. Canare
   e. Liberty

F. RCA Male Cable Connectors:

1. Provide RCA cable connectors with die cast shell
2. Shell Color: Silver
3. Contacts: Silver
4. Terminations: Solder
5. Acceptable Product:
   a. Switchcraft 3502 Series
   b. Liberty

G. F Connector:

1. Provide commercial style gold plated connector with integral sleeve for F6 Series, F11 Series, and F59 Headend cable
2. Provide seal ring in all moisture intensive environments
3. Install with manufacturer recommended compression tool
4. Provide weatherized boots and seal covers for all antenna connections
5. Verify connector cable type, size and construction with manufacturer
6. Acceptable Product:
   a. Gilbert Engineering GF-US-6Q series, GF-US-11Q, and GF-US-59Q series respectively
   b. Gilbert Engineering Seal ring: G-SR-1/2

H. RJ45 Connectors:

1. UTP Category 6, 8-pin wiring inserts T568A/B jacks
2. Acceptable Products:
   a. Belden PN#AX101320 (color to match plate)

PART 3 - EXECUTION

3.1 GENERAL

A. Coordination of the Work specified herein with other project work so as to facilitate a cohesive final Product.

B. The installation recommendations contained within ASDI and Telecommunications Distribution Methods Manual are mandatory minimum standards and requirements.

C. Mount equipment and enclosures plumb and level.

D. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five. Seismic bracing will be installed on appropriate equipment where local codes require such installation.

E. Verify all locations of equipment in all rooms with Owner's Representative, Owner, and Consultant.

3.2 INSTALLATION

A. Installation of cable and wiring

1. Cabling and Wiring:
   a. Install cable in a manner to adhere to manufacturer's specifications for maximum cable pulling tension, minimum bend radius, and any other restrictions.
   b. Provide appropriate support at all horizontal-to-vertical transitions in order to keep the weight of the cable from degrading at the point of transition.
   c. If a J-hook or trapeze system is used to support cable bundles, all horizontal cables will be supported at a maximum of 48-inch (1.2 meter) intervals. At no point will the cables rest on light fixtures, acoustic ceiling grids, panels, conduits, sprinkler pipe, water pipe and/or HVAC system ducting.
   d. Horizontal distribution cables will be bundled in groups of no more than 50 cables when being supported by J-Hook or trapeze systems. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance. An exception to this rule is when cable is installed in cable tray systems.
   e. Cable will be installed above fire-sprinkler systems and will not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware will be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
   f. Cables will not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.
   g. Any cable damaged or exceeding recommended installation parameters during installation will be replaced prior to final acceptance at no cost to the Owner.
   h. Cables will be identified by a self-adhesive machine label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label will be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
   i. Unshielded twisted pair cable will be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
   j. Provide splice free wiring and cabling from origination to destination. Cables will be installed in continuous lengths from origin to destination (no splices). Properly designed transition points, or consolidation points are not considered 'splice' points.
   k. Make joints and connections with rosin-core 60/40 solder or with mechanical connectors specifically intended for the type and class of cable being used. Where spade lugs are used, crimp properly with ratchet type tool.
   l. Take precaution to prevent and guard against electromagnetic and electrostatic hum. For line-level audio signal, float cable shield at one end. Shield(s) that are not connected are to be folded back over the cable jacket and covered with heat-shrink tubing. Do not cut off unused shield.
   m. Isolate cables and wires of different signals or different levels are to be separated, organized, and routed in order to restrict channel crosstalk, or create feedback

oscillation in any amplifier section. Keep wiring separated into groups for microphone level circuits, line level circuits, loudspeaker circuits, and power circuits.

n. Connect cable to active components through XLR connections whenever multiple formats are available. Make connections to speaker transformers with properly sized closed-end connectors crimped with factory approved ratchet type tool. Wire nut or "Scotchlock" connectors are not acceptable. Do not wrap audio cable splices or connections with adhesive backed tape.

o. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.

p. Execute wiring in strict adherence to:

1) Phillip Giddings. Audio System Design and Installation. Indianapolis: Howard W. Sams & Co., 1990.

2) Don Davis and Carolyn Davis. Appendix II, Recommended Wiring Practices. Sound System Engineering, 2nd Edition. Indianapolis: Howard W. Sams & Co., 1989.

3) AV Installation Handbook Second Edition: The Best Practices for Quality Audiovisual Systems, Infocomm, 2009

2. Equipment Housing Cabling and Wiring:

a. Lace, tie, or harness wire or cable as required herein, and in accordance with accepted professional practice. Dress, lace, or harness all wire or cable to prevent mechanical stress on electrical connections; no wire or cable will be supported by a connection point. Install cable and wire neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars if cable bundles sag.

b. Provide adequate service loops so that equipment mounted on rack slides may be pulled fully out to their locked position without straining cable.

c. Neatly bundle excess AC power cable from housing mounted equipment with plastic cable ties.

d. Provide plastic cable ties or Velcro straps to bundle cabling and wiring. Electrical tape and adhesive backed cable tie anchors are not acceptable.

e. Install with connections completely visible and labeled.

f. Provide termination resistors, if required, of 5 percent tolerance. Mount the termination resistors fully visible.

B. Installation of connectors, plates & panels:

1. Install panel mounted connectors rigidly attached to panels, plumb and level.
2. Custom rack panels will be flanged standard EIA sizes, brushed black anodized finish unless otherwise noted.
3. Custom connector plates (loudspeaker, microphone, etc. lamicoid) are typically stainless steel, unless otherwise noted or specified. However, verify plate finish with the Owner.
4. Install XLR type connectors in accordance with IEC-268 standard, with a wiring scheme of pin 2 hot (high), pin 3 (low), and pin 1 screen (shield).
5. Other Plates and Panels may be required to satisfy the requirements of the Work.

C. Installation power and grounding:

1. Coordinate final connection of power and ground wiring to housings.
2. Hardwire power wiring directly to internal AC receptacles to ensure uninterrupted operation.
3. Provide 3-conductor, isolated ground, 120 VAC outlets as required within each housing. Provide a minimum of two spare outlets in each rack.
4. Provide a copper ground buss top to bottom in each housing, insulated from the housing. Ground equipment chassis not having a three wire power cord to these busses using

6/32 nuts, bolts and lock-washers with No. 12 wire. Connect green ground wire from each AC outlet in housing to this buss bar.

5. Replace manufacturers supplied 18 gauge IEC power cords with UL listed 18 gauge pre-molded 6”, 12”, 18”, or 24”. Use minimum length required. No looped or cable tied IEC power cords will be permitted within the equipment rack.
6. Replace manufacturers supplied 14 gauge IEC power cords with UL listed 14 gauge pre-molded 18” or 36” folamr all equipment IEC capable. Use minimum length required and minimize looped or cable tied IEC power cords present in the equipment rack.

D. Installation of electronic equipment:

1. Take appropriate precautions against electrostatic discharge (ESD). Establish a personal ground before handling electronic equipment through the use of a grounded wrist wrap and/or an anti-static floor pad.
2. Take appropriate precautions to protect the equipment from damage during installation. Equipment to be installed free of damages, scratches, dents, etc.
3. Mount trim potentiometers, custom circuit cards, relays, and transformers (except large 70V units) in shielded enclosures, and mark their function and connections with engraved lamicoid labels.
4. Mount equipment plumb and level, firmly and safely held in place.

E. Installation of equipment housing:

1. Mount equipment in racks or other project specific equipment housing apparatus. Fully wire and test before delivery to job site. If field conditions prevent prior assembly of racks, notify Owner in writing that racks will be fabricated on site and the reasons for the change.
2. Secure rack mounted devices utilizing all available fastener mounting positions on device.
3. Provide rear support for housing mounted equipment greater than 15 inches deep.
4. Provide blank panels to fill unused panel space within the equipment housing.
5. If Key door locks are required, key each housing type alike.
6. Looking at the rack from the rear, locate AC power and speaker wiring on the left; line level audio, video, and RF wiring on the right.
7. Provide shaft locks or security covers on non-user operated equipment having front panel controls. These panels are to be installed at the conclusion of testing.
8. If forced-air active thermal management is used, provide ventilation blocking material on the front, sides, and rear of the equipment rack as needed. Reference Middle Atlantic Products “Controlling the Temperature Inside Equipment Racks”. Air temperature inside of the rack is not to exceed 90 degrees Fahrenheit.
9. Panels, or equipment mounted on the rear rack rails, will not block access to any front mounted components.
10. If equipment rack is not equipped with casters, provide two inch high wood base to isolate equipment rack from floor. Wood base should be capable of supporting the load.

F. Installation of flat panel monitors:

1. Confirm location before mounting.
2. Monitors will be mounted plumb and level at the operating position in a safe, secure, and permanent manner.
3. All hardware required to locate the mount and monitor at the required position will be provided.
4. Locate monitor on the center line of the room unless noted otherwise.

G. Outdoor mounting of equipment

1. Objects mounted outdoors and within the building bowl structure will be properly treated for exposure to moisture and temperature extremes.
2. Mounting hardware will be non-corrosive or be coated with a corrosion inhibiting layer.
3. Structural supports for loudspeakers, or other equipment, will have inherent corrosion resistance, or be covered with a corrosion inhibiting layer.
4. Speaker components mounted in exterior environments will be rigidly connected to the structure to prevent movement caused by wind gusts.
5. Speaker and microphone enclosures to include grille capable of breaking up direct water sprays or rain.
6. Seal all exposed electrical connections on speaker enclosure with waterproof silicone sealant.
7. Treat paper cones of outdoor speakers with silicone based moisture repellent if not factory treated.
8. Provide screened cover over all openings in horn type speakers to keep out birds, insects, or small animals. Screened covering to be stretched with no visible wrinkles.

3.3 FIRESTOP

A. A fire-stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Fire-stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

B. All penetrations through fire-rated building structures (walls and floors) will be sealed with an appropriate fire-stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. will be properly fire-stopped.

C. Fire-stop systems will be reviewed by a Professional Engineer (PE) licensed to practice in the State in which the project is located. Stamped drawings showing the fire stop systems will be included as a submittal item. Once the systems are installed, the engineer of record for the firestop system will physically inspect the methods and means used to verify compliance with the original design.

D. A drawing showing the proposed fire-stop system, stamped/embossed by the PE will be provided to the Owner’s Technical Representative prior to installing the fire-stop system(s).

E. All fire-stop systems will be installed in accordance with the manufacturer’s recommendations and will be completely installed and available for observation by the local authorities prior to cable system acceptance.

3.4 CONTROL SYSTEM PROGRAMMING

A. Transport Control

1. Provide standard Stop, Play, Pause, Fast Forward, and Rewind for each playback device and menu control for DVD players. Buttons should be arranged in a conventional fashion that will be familiar to the normal user.

2. The selected control function should be displayed by showing the appropriate button “pressed”. It should remain this way until another function is selected.
3. For devices that will go into a standby mode after a period of time, the control system will sense this mode and restore normal operating mode once a transport function has been selected. This may require the use of current sensors to determine the state of the unit. No direct user action should be required at the playback device to restore the normal operating mode.

B. Screen/Shade Control

1. In addition to up-down functions, provide a Stop function to allow the movement to be halted. Once movement has been stopped, the up or down buttons should resume travel in the selected direction.
2. Control system will not prevent screen/shade wall controls from being used as well.
3. Touch panel controls should be readily accessible to the user to permit direct control of shades or screen with having to navigate through multiple control pages.

C. Room Combining

1. Combining of adjacent areas will be done through a graphical representation of the physical areas to be combined. Use of a floor plan metaphor is recommended with the graphic oriented correctly with respect to control panel location.
2. Use buttons or other appropriate objects placed along the common wall to enable the combining function.
3. When spaces are combined, the graphic appearance of those areas will change to reflect this configuration. Once an area is separated from a combination, the color of its area should revert to the normal room color.
4. Common control functions between combined rooms will be linked, allowing control of the combined area from any one of the touch panels. Examples of common functions include:
    a. Background music selection
    b. Background music volume
    c. Background music muting
    d. Lighting preset recall
    e. Master volume (not individual channel volume)
5. When combining adjacent rooms, the control system will force the common functions to a predetermined default configuration so all rooms have the same configuration.
6. To avoid unintentional changes, a control panel will not be able to operate a function in a remote location without also operating that same function in the room where the panel is located.

D. Level Control

1. Objects requiring level adjustment such as volume or tone controls will be through Up/Down buttons with a graphical representation of the actual level.
2. Increment of level change to be adjusted for reasonable range without the need to push the Up or Down buttons needlessly.

E. Volume Mute

1. Where the ability to mute the sound is needed, the button will use the label “Vol On” and “VOL OFF” instead of Mute and Unmute. When in a “VOL OFF” mode, pushing the “VOL UP” button will restore the sound and bring the system out of the muted mode.
2. VOL ON/OFF buttons will change color to indicate the status of the button.

F. Standard Colors

1. Control functions will be color coded to add clarity and show relationships between different groups of controls.
2. The color Red will be reserved to indicate a fault or abnormal condition.
3. Green may be used to indicate normal operation, but may be used for standard control colors as well.
4. Similar controls should maintain the same color scheme across all control pages.
5. When a function is selected, the graphical depiction of that button should appear to be pressed and its color change to a darker shade of the regular button color.
6. Color schemes used for background and foreground objects should be selected to be complimentary and provide a consistent theme throughout the control pages.

G. Minimum Button Size and Placement

1. Minimum visual size of a button is 3/8” wide by 1/4” high.
2. Spacing between buttons should be no less than 1/16”.
3. Where buttons are immediately adjacent, the active selection area of the button should be reduced to 80% of the visual area of the button.

H. Button Actions

1. When a function on a control page is selected, that button or visual object associated with that function should change to reflect what has been chosen.
2. For functions that are momentary selections (i.e., VOL UP), the change of state is visible for as long as the button is being pressed.
3. For function that are maintained selections (i.e., PLAY), the change of state remains visible until another function is selected and resets the previous function.
4. The state change of a button or visible object should depict real-world objects as much as possible including the appearance of the button be pressed inward, change in shade of the original color, but not a change in hue.

I. Labels

1. Use of simple words or titles are preferred to indicate functionality, navigation and system status.
2. Use of stylish symbols should be avoided unless their identity is commonly recognized by the general public. Standard symbols for transport functions are acceptable.
3. Labels should be presented in a clear, sans serif type face that will remain legible on lower resolution touch panels.
4. Where physical buttons are present along the side of a touch panel, these buttons should be engraved and filled with a contrasting color.

J. Power On/Off

1. For panels requiring an ON/OFF control, these functions should be linked through current sensors or other methods for the control system to detect the power on condition of the component being controlled.
2. Powering off a system should not interfere with the ability of a projector to complete its cool down cycle.

K. Look & Feel

1. Control pages should utilize a clean, elegant but stylish appearance.
2. Use a common graphical template across all control pages for a consistent look.
3. The touch screen layout should utilize graphical elements such as drop shadows, gradient fills and transparency to provide a pleasing overall appearance.
4. Utilize graphical representations of floor plans to convey location information.

5. Include company logos, icons or watermarks to portray the corporate identity.
6. Provide clear navigation tools for moving between control pages.
7. Each sub-page should have a “BACK” button to return to the previous page. This button should appear in the same location on each page.
8. Provide a “HELP” button or icon on each user page to provide clear, non-technical instructions on how to use the functions available to regular users.

L. Security

1. Provide password access to control pages not intended to be accessed by the general public.
2. Unless otherwise noted, provide a minimum of three levels of access
   a. General User
   b. Non-Technical Employee
   c. AV Technician
3. Segregate the control functions to only allow authorized individuals access to more sophisticated control pages.
4. Provide a timeout feature to automatically return the control panel back to the default opening screen after 30 seconds of inactivity. After this reset, passwords must be reentered to return to a previous control page.

M. Presets

1. For systems that have different operating modes or configurations, provide the ability to store and recall preset combinations of system settings.
2. Provide a “Preset” page that permits a minimum of five presets to be recalled. Each button to include a label describing the function or configuration associated with that button.
3. Provide the ability for new presets to be stored over previous settings. New preset to be able to change the label to reflect the new or revised configuration.
4. When a preset has been recalled, the control page should indicate the active configuration.

3.5 LABELING OF EQUIPMENT

A. Provide each terminal strip with a unique descriptor and a numerical designator for each terminal. Show terminal strip descriptor and designator on system schematic drawing.

B. Provide logical and legible cable and wiring label permanently affixed for easy identification.

1. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style.
2. Wiring designator to be an alpha-numeric code unique for each cable. Actual cable designation assignments to be determined by Contractor. Add cable designation codes to system schematic drawings.
3. Locate the cable designator at the origination and destination of each circuit within 3 inches of the point of termination or connection. Provide cable designator on circuits with intermediate splice points with an additional suffix to indicate each segment.

3.6 ENGRAVING

A. Text font: 1/8-inch block sans serif characters unless noted otherwise.

B. On dark materials, provide white characters; on stainless steel or brushed natural aluminum plates, or light-colored materials, provide black characters.

C. Provide at least two lines of text with first line listing the general device name, e.g., amplifier. Second line to include schematic reference of the device, e.g., AMP-1.

D. Equipment label: black with white characters except where indicated.

3.7 COMMISSIONING

A. Prior to energizing or testing the system, ensure the following:

1. All products are installed in proper and safe manner according to manufacturer's instructions.
2. Insulation and heat shrink tubing are present where required.
3. Dust, debris, wire trimmings, etc. is removed.
4. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
5. Labeling has been provided.
6. Temporary facilities and utilities have been properly disconnected and removed.
7. Products are neat, clean, and unmarred. Parts securely attached.
8. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired.

B. Prior to energizing the System, verify and perform the following tests and adjustments in compliance with applicable EIA standards.

1. Electronic devices are properly grounded.
2. Test each AC power receptacle with a circuit checker for proper hot, neutral, and ground connections.
3. Verify each individual component is operating properly.
4. Verify each individual component's performance meets the manufacturer's published performance for this unit.
5. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.

C. Loudspeaker Circuit Verification Test

1. Measure the impedance of each loudspeaker line leaving the equipment racks.
2. For constant voltage systems measure the impedance at 100 (or 250) Hz, 1 KHz and 8 (or 10) KHz of each line leaving the equipment rack with the line disconnected from the driving source. For band limited devices, use a frequency appropriate for the operating range of the transducer.
3. When documenting the results of these tests, include the calculated impedance based on number of units on a line and the size and distance of the run. Correct any field readings that differ more than 20% from the calculated impedance.
4. Include the results of the tests in the Project Record Manual.

D. Loudspeaker Polarity Verification Test

1. Use an electronic polarity checker, SysTune, SMAART, or other two-channel FFT measurement system to test each loudspeaker. All loudspeakers should have the same relative polarity.
2. Follow manufacturer's recommendations in conducting the tests.

3. Include the results of the tests in the Project Record Manual.

E. Audio Signal Paths

1. Verify operation from each source device through all switching, amplification, and distribution devices.

F. System Gain Adjustment

1. Adjust each active device to have proper gain structure from the mixer output to the input of the amplifier.
2. With all amplifiers turned off, connect a sine wave or pink noise generator to the input of the mixer. Using an RMS AC voltmeter with a dB scale, adjust the mixer to an output between -10 and 0 dBu. Note the dBfs level should be -18dB for digital outputs. Once the level has been established, it should remain unchanged throughout the test. All equalizers should be set flat for this test.
3. Follow the signal flow from the mixer to each subsequent component. Measure the input level and output level of each device at the point of connection to the device. The input level reading should differ no more than 0.25 dB from the level recorded for the preceding device. Diagnose and correct the wiring or equipment when any readings exceed this range.
4. Adjust the output of each component to achieve the proper output level.
5. Record the output levels of each device in the Project Record Manual.

G. System Equalization

1. Using SysTune, SMAART, or other two-channel FFT measurement system, equalize all loudspeaker systems to provide a suitable frequency response as follows:
   a. Speech Reinforcement Systems: flat response from 125 Hz to 2.5 KHz, with 2 dB roll off above. Adjust initial settings as necessary for best intelligibility
   b. Program Reproduction Systems: flat response from 65 Hz to 8 KHz, with 2 dB per octave roll off above. Adjust subwoofer level to +6dB above man speakers from 35Hz to Hz. Adjust initial settings to optimize audio quality.
2. Verify system gain and amplifier levels.
3. Provide program levels of at least 95 dB and speech reinforcement levels of at least 70 dB in the seating area without objectionable distortion, buzzes, or rattles.
4. Provide hard copy printouts of the spectral response with the test data.

H. RFI and Parasitic Oscillation

1. With systems operating, check to ensure that all systems are free from spurious oscillation and radio frequency interference in the absence of audio signal.

I. Buzzes, Rattles, and other Distortions

1. Adjust the system for normal operating level in the space. Apply a slow sine wave sweep from 60 Hz to 3 KHz and listen carefully for buzzes, rattles, and other objectionable distortions.
2. Correct the cause of the defect. If the cause is not from the system, bring the cause to the attention of the Owner, indicating cause and suggestive corrective actions.

J. Video Systems Test

1. Projected images and screen must be plumb with respect to ceiling line.

K. Video System Tests. Verify performance of all video equipment, components, and systems, as specified herein.

1. Video (signal):
    a. S/N (peak to RMS), unweighted DC to 4.2 MHz: 55 dB minimum.
    b. Crosstalk, unweighted DC to 4.2 MHz: 45 dB minimum.
    c. Frequency Response: Within plus to minus 0.5 dB to 4.2 MHz.
    d. Line and Field Tilt: 2% maximum.
    e. Differential Gain: 2% maximum.
    f. Differential Phase: 2 degrees maximum.
    g. Frequency Response: DC to 4.2 MHz within plus or minus 0.5 dB.

L. Video Signal Paths

1. Verify operation from each source device through all switching, amplification, and distribution devices.

M. Video Test Report will include the following:

1. Test Failures and Notices
    a. Sink Device EDID Test – Open items or failures will not be accepted.
    b. Cable Length Test – Open items or failures will not be accepted.
    c. HDCP KSV Limitations – Limitations will not be accepted.
    d. Cable Limitations - Limitations will not be accepted.
    e. EDID Limitations - Limitations will not be accepted.
    f. Cable Length Limits exceeded – Failing cables will not be accepted.
2. Device Model Number, Serial Number, and Firmware Version for main chassis and each input and output card.
3. Device Model Number, Serial Number, and Firmware Version for connected transmitter and receiver devices.
4. EDID – Input Resolution and 3D support status for each input.
5. EDID – Supported Output Resolution and 3D support status for devices connected to each output.
6. EDID – Supported Audio formats for each input.
7. EDID – Supported Audio formats for devices connected to each output.

N. Control Systems

1. Verify operational functions of the control system and all interfaced devices.
2. Verify operational functionality of any wireless user devices.

3.8 FINAL OBSERVATION & TESTING

A. Upon completion of installation, initial adjustments, tests, and measurements specified in Part 3, and submission and review of the results, a final observation and test will be performed by the Owner or Owner’s representative no earlier than two weeks after receipt of the written results.

B. Provide a minimum of one (1) person for observation and testing familiar with aspects of the System to assist the Owner.

C. The process of testing the System may necessitate moving and adjusting certain components.

D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.

E. The following procedures will be performed on each System:

1. Observation of the methods and means employed to incorporate the System within the facility.
2. Verification of proper operation, from controlling devices to controlled devices.
3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each level control, and appropriately record these settings within the Record Documents.
4. Other tests on equipment or systems deemed appropriate.

F. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue their work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications and any extension of the observation and testing period is required, the Contractor will pay for additional time and expenses of the Owner at the standard rate in effect at that time.

3.9 TEST EQUIPMENT

A. Thirty days prior to start of testing, provide a list to the Owner of test equipment make, model numbers, and calibration dates that will be used.

B. The following equipment will be available on site for the entire test period through final system testing.

1. Sound Level Meter: ANSI S1.4-1971 Type S1A with digital or analog display. Meter to provide ranges of 40 to 120 dBA.
2. Pink Noise Source - Equal energy per octave bandwidth 20 Hz to 20,000 Hz, ±1 dB (long-term average) at 0 dBm output. Stability: ±2 dB per day.
3. Impedance Meter - Capable of testing audio lines at three frequencies, minimum, between 250 Hz and 5k Hz. Measurement Range: 1 ohm to 100 kohms.
4. Audio Oscillator: bandwidth 20 Hz to 20k Hz ±.5 dB at 0 dBm output. Output to be balanced. Oscillator to include adjustable output level over the range from –30 dBu to +10 dBu.
5. Multimeter - Measurement range, DC to 20k Hz, 100 mV to 300 V, 10 ma to 10 A, dB.
6. NTSC Test generator
7. Sound system measurement and alignment system
   a. SysTune, SMAART, or other two-channel FFT measurement system, with industry standard measurement microphones. Provide adequate microphone cabling for the venue size, or a wireless microphone system qualified for use with a test measurement system. Provide one microphone stand with each microphone.
8. Video (analog) test generator capable of generating signal up to 1920 x 1200 with audio.
9. Video (digital) test generator capable of generating signal up to 1920 x 1200 with audio.
10. Two-way radios to connect personnel in the equipment room(s) with personnel in other areas of the site for coordinated systems test and setup.
11. Ladders and scaffolding necessary to inspect elevated equipment, junction boxes, etc.

3.10 INSTRUCTION OF OWNER PERSONNEL

A. Provide 8 hours instruction to Owner designated personnel focusing on the use, operation, and maintenance of the systems, scheduled as a minimum of two separate sessions, by an instructor fully knowledgeable and qualified in system operation. The System Reference

Manuals should be complete and on site at the time of this instruction. Coordinate schedule of demonstration with Owner's Representative.

B. Video record all training sessions and compile a training video to be provided to the Owner electronically.

C. Provide sign in sheet to document the attendee's presence.

D. If Contractor is not properly equipped to conduct Owner training on particular equipment, arrange for factory representatives of the equipment to be present to provide training at no additional cost to the Owner.

E. Provide on-site event support for 4 events, chosen at the discretion of the Owner, by a technician fully knowledgeable and qualified in sound system operation, programming, and troubleshooting.

3.11 CLEANUP AND REPAIR

A. Upon completion of the work, remove refuse and rubbish from and about the premises. Leave areas and equipment clean and in an operational state. Repair any damage caused to the premises by the installation of systems at no cost to the Owner.

END OF SECTION 27 41 16