

**SECTION 27 41 00****E.O.C. AUDIOVISUAL SYSTEMS**

## PART 1 - GENERAL

## 1.01 CORRELATED DOCUMENTS AND OTHER WORKS OF JURISDICTION

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.
- B. Audiovisual (AV) systems drawings and other attached appendices and tables.

## 1.02 DEFINITIONS OF TERMS

- A. Owner: shall refer to Shasta County, and all of its departments and agencies.
- B. Architect: shall refer to NMR Architects and Engineers.
- C. Audiovisual Consultant: shall refer to Z Consulting Group.
- D. Project/Construction Manager (CM): TBD.
- E. Bidder: shall refer to any party proposing to provide the services and material delineated in this Specification.
- F. Bid: shall refer to a Bidder's proposal to provide the services and material delineated in this Specification.
- G. Audiovisual Integrator (Audiovisual Contractor, Integrator, Contractor): shall refer to the awarded contractor for this scope of work.
- H. Audiovisual Specification (Specification): shall refer to the complete set of designs, performance and delivery requirements delineated within this document and all referenced documents.
- I. Audiovisual System (AV System): shall refer to the complete compliment of equipment, software and other material that upon completion of assembly, installation and configuration provides the full functionality and technical performance delineated in this Specification.
- J. Audiovisual Equipment (AV Equipment): shall refer to any and all individual equipment items and equipment items supplied by others installed as a part of the Audiovisual System.
- K. Work: Design and provision the Audiovisual Systems and associated equipment, software and services for the Project.
- L. Construction Documents: shall include all documentation associated with the design and general construction of the Project, including this Specification.
- M. Provide: Supply (furnish), deliver, install, test, configure, label, and commission.
- N. Manufacturer: shall refer to the original manufacturer of any equipment provided as part of the Work.
- O. Commissioning Date: shall refer to the date at which a system is formally accepted by the Owner.
- P. OFE: Owner Furnished Equipment.
- Q. OFCI: Owner Furnished, Contractor Installed.
- R. CFCl: Contractor Furnished, Contractor Installed.

## 1.03 SCOPE/DESCRIPTION OF WORK

- A. The work covered in this Specification consists of furnishing all labor, material and services to install a complete audiovisual system as indicated on the project documentation, including this specification and related drawings.
- B. The work described in this Specification shall include, but not be limited to, the following Basic Services:
  - 1. Engineering and Design:
    - a. Audiovisual Infrastructure

- 1) The Audiovisual System integrator shall provide design of pathway systems within building consisting of conduit, boxes, cable hangers, rated sleeves to support Audiovisual systems. This includes planning and coordination with Architects and other trades of inside plant pathway systems.
  - 2) Audiovisual System integrator shall coordinate with project electrical, mechanical engineers on required data outlets, power load including power receptacle's locations and type and cooling load from AV system components.
  - 3) Equipment Seismic Anchorage: Audiovisual System Integrator to include structural calculations for anchorage and seismic restraint of floor-mounted equipment (such as pedestal mounted Direct view LED display, racks, frames, cabinets), wall-mounted equipment (such as video display equipment, etc.), and overhead-mounted equipment (such as speakers, overhead cable support, etc.) in conformance with CBC, Chapter 16. Calculations shall be based on fully loaded equipment and support systems. Calculations shall demonstrate that the equipment and support systems will remain attached to the mounting surface during and after experiencing seismic forces in conformance with the CBC. A Structural Engineer registered in the State of California shall prepare Structural Calculations and shall wet stamp and sign them. Obtain approval from approving agency for the calculations.
- b. Audiovisual System: The Audiovisual Systems Integrator shall provide all system engineering and design necessary to develop the complete systems described herein. Engineering and Design shall include preparation of all necessary electronic schematics, hardware drawings, systems diagrams, schedules and lists.
2. Procurement and Assembly: The Audiovisual Systems Integrator shall procure and assemble all hardware and equipment and any additional materials as required to deliver completely functioning Audiovisual Systems.
  3. Software Programming: The Audiovisual Systems Integrator shall perform all required software setup, configuration, and programming required to develop a complete operating system in accordance with this Specification, including all control logic and push button component faceplate or interface programming.
  4. Installation: The Audiovisual Systems Integrator shall install all equipment, cable, wiring, connectors, plates and other material at the Project site per the Audiovisual Systems Integrator's approved designs. The Audiovisual Systems Integrator shall install any Owner Furnished Equipment identified in this document and calibrate it to work with the integrated systems.
  5. Testing and Adjustment: The Audiovisual Systems Integrator shall perform all tests and adjustments, furnish all test equipment necessary and perform all work required to properly configure the systems and to verify their performance in accordance with the information in this Specification and the Audiovisual Systems Integrator's approved engineered designs.
  6. Acceptance Testing: Prior to Owner acceptance and hand-over of the completed Audiovisual Systems, the Audiovisual Systems Integrator shall demonstrate the operation of the complete systems, including all individual devices and specified control functions. Both subjective and objective tests may be required by the Owner to determine compliance with the information in this Specification and the Audiovisual Systems Integrator's approved designs.
  7. Training: The Audiovisual Systems Integrator shall provide technical training of Owner's staff, instructing them on Audiovisual Systems operation, maintenance and troubleshooting.
  8. Warranty: The Audiovisual Systems Integrator shall warranty the Audiovisual Systems in accordance with the terms of this Specification.
  9. Specific Responsibilities:
    - a. Supply and install miscellaneous material, as necessary, to mount the audiovisual system equipment.
    - b. All primary conduit and wire-ways are included in the General Contractor's scope of work and are not to be provided in the Audiovisual Systems Contract. Supply and install all miscellaneous conduit and wireways to the extent not included in Division 26 in order to provide a complete and operable system.
  10. Coordinate with Owner's representative or Construction Manager to identify critical Project milestones and delivery expectations.
  11. Refer to "BID SUBMITTALS", Section 1.06 and "SUBMITTALS", Section 1.08 .A for additional information and requirements.

## 1.04 REGULATORY REQUIREMENTS

- A. The Audiovisual Systems Integrator must obtain any permits and shall pay all fees required by public agencies having jurisdiction over the Work.
- B. All products and materials provided shall be listed by Underwriters Laboratory (UL) and shall bear the UL label intended for the purpose specified and indicated. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels.
- C. All equipment and installations under this Specification shall conform to the latest editions of the following:
  - 1. NFPA 70 - National Electrical Code
  - 2. NFPA 72 - National Fire Alarm and Signaling Code
  - 3. IEEE C2 - National Electrical Safety Code
  - 4. ANSI/TIA-568, -569 and -607 Telecommunications Standards
  - 5. IEEE 142-2007 - Recommended Practice for Grounding of Industrial and Commercial Power Systems
- D. The Audiovisual Systems Integrator and its employees shall perform all work in compliance with current Occupational Safety and Health Administration (OSHA) guidelines and regulations and other safety and health requirements as may be mandated by the Owner, the General Contractor or other authorities.
- E. The Audiovisual Systems Integrator shall have a thorough knowledge of governing codes and standards in effect and having jurisdiction over the Project. Lack of awareness of any of the relevant codes and standards will not be accepted as a reason for non-compliance.
- F. The Audiovisual Systems Integrator shall be responsible for providing cable and materials that comply with applicable codes and requirements of regulating bodies. The cost for these materials shall be included in the Bid price, as the Owner shall not accept change orders for changes in materials.

## 1.05 COORDINATION OF RELATED WORK BY OTHERS

- A. Related Work Specified Elsewhere: The Audiovisual Systems Integrator shall coordinate with the General Contractor and other construction trades to ensure proper integration and operation of the Audiovisual Systems with the complete Project designs, building systems and all other elements of the Project. The Audiovisual Systems Integrator should request from the Owner, General Contractor, or Architect complete project Construction Documents to help facilitate effective coordination of the Audiovisual Systems Integrator's work with the work of others.
- B. Some components of the complete Audiovisual Systems will be provided by the GC, its sub-contractors or the owner. It shall be the responsibility of the Audiovisual Integrator to coordinate with all parties whose work impacts the Audiovisual Integrator's work to ensure the complete coordination and successful implementation of the Audiovisual Systems. Related work by GC shall include, but may not be limited to, the following:
  - 1. Electrical Work (Division 26):
    - a. Electrical (AC) Power Service and Connections:
      - 1) Technical Power Service: All electrical panels, power receptacles, lighting fixtures, dimmers, lighting controls, and interconnecting wiring shall be supplied by Electrical Contractor.
      - 2) The Audiovisual Integrator shall extend AC power circuits and insulated ground wires into each equipment rack. This work must be done by a qualified electrician, licensed in the jurisdiction of this project, and under direction from the Audiovisual Integrator.
    - b. Low Voltage Cable Containment
      - 1) Low voltage cable containment, including raceways, conduits and junction boxes, required to support Audiovisual System devices and interconnecting cabling shall be provided by general contractor.
      - 2) The Audiovisual Integrator shall provide blank cover plates or panels for all floor, wall and ceiling boxes that are dedicated to the Audiovisual Systems but do not have devices and/or connectors at the time of Audiovisual System commissioning. Colors and types shall be coordinated with the Architect. Devices and plates for other trades (AC power, voice/data, and security) within the AV floor boxes are by those respective contractors.
  - 2. Metals (Division 5)
  - 3. Rough Carpentry (061000)
  - 4. Millwork (062200) and Interior Architectural Woodwork (064023): All millwork and cabinetry modifications required to accommodate the installation of Audiovisual Systems, equipment and related cabling and

connections, except as may be individually identified in this Specification, shall be provided by General Contractor.

5. Joint Sealants (079200)
  6. Glazing (088115)
  7. Finishes (Division 9)
  8. Information Technology Systems: Unless otherwise specified, all data networking cabling shall be provided by the Owner. Patch cords to connect audiovisual equipment to a data network port shall be provided by the Audiovisual Systems Integrator. The Audiovisual Systems Integrator shall be responsible for coordinating with the Owner or the Owner's designated representative regarding connections between the Audiovisual Systems and the Owner's data network, including all client/server computing and peripherals, Internet, digital video storage and other data/media distribution systems.
  9. Paging and life safety: Interfacing the Audiovisual System(s) to the paging or life safety systems may be required. The Audiovisual Integrator shall be responsible for coordinating with the Contractor or the Owner's designated representative regarding connections between the Audiovisual Systems and the Paging or Life Safety system. All Audiovisual Systems with a control processor shall be connected to the fire/life safety systems by cabling extended by the F/LS contractor into the AV equipment rack and shall be configured upon fire alarm or testing contact closure trigger to mute the audio until the trigger is cleared and the system audio (program and voice) can be un-muted again.
  10. Other Systems: The Audiovisual Systems Integrator shall be responsible for identifying and integrating with any other technology systems and services required to deliver the completely operating Audiovisual Systems.
  11. Equipment Mounting and Support:
    - a. Structural support for audiovisual system equipment shall be provided by the Audiovisual Systems Integrator.
    - b. The Audiovisual Systems Integrator shall install all Audiovisual Equipment, including all loudspeaker and video monitor mounts, as indicated in this Specification and the Construction Documents. The Audiovisual Systems Integrator shall verify location and structural suitability before attaching equipment and mounts. Any variations from the drawings and specifications or any question of structural integrity shall be brought to the attention of the General Contractor, Architect, and Audiovisual Systems Consultant before installing the equipment.
- C. Work Furnished by Others ("F.B.O.") but installed by the AV Contractor:
1. Owner Furnished Equipment (OFE): Some equipment that will become a part of or connect to the Audiovisual Systems may be provided by the Owner and shall be designated as Owner Furnished Equipment (OFE). Owner Furnished Equipment shall be supplied by the Owner to the Audiovisual Systems Integrator for connection, installation and/or integration into the Audiovisual Systems as delineated in the construction documents and this Specification. This may include new or existing equipment. The Audiovisual Systems Integrator shall be responsible for coordinating with the Owner's representative or Construction Manager to ensure that all Owner Furnished Equipment is fully operational and compatible with other Audiovisual Equipment and that it is made available to the Audiovisual Systems Integrator in a timeframe that does not delay the Audiovisual Systems Integrator's work.

#### 1.06 BID SUBMITTALS

- A. Examinations: Carefully examine the contract documents and the construction site to obtain first-hand knowledge of existing conditions. Contractors are not compensated for conditions that can be determined by examining documents or site and will not be relieved of any obligations with respect to bid.
- B. Questions: Submit all questions about the contract documents in writing. Replies requiring changes to the contract documents will be issued to all bidders as addenda and will become part of the Contract. The Architect and Owner may give, but will not be responsible for, oral clarifications. Questions received less than 10 days before bid date cannot be answered in writing.
- C. Equipment Availability: Verify with manufacturers' availability and cost of all equipment proposed, including equipment specified herein. No cost increases will be allowed for manufacturers' cost increases, or for substitutions required because of unavailability of proposed equipment.

- D. Performance Bond: With the RFP response, furnish a Performance Payment Bond and Labor and Material Bond, underwritten by a surety company approved by the Owner or Owner's representative, for fulfillment of all provisions of the contract.
- E. Basis of Bids: To be eligible for Bid consideration, submit bids in accordance with the following in Attachment F Pricing Response Workbook.xlsx:
1. Include a complete itemized list for each base-bid system indicating the manufacturer, model number, unit cost and total costs for all specified items. Itemization of miscellaneous equipment such as cable, switches, and receptacles is not required.
  2. Systems Include (Quantity 1 unless otherwise noted):
    - a. EOC Main Open Office
    - b. EOC Conference
    - c. EOC Conference 2
    - d. PIO Office-11
    - e. Office-23
    - f. Office-24
  3. Clearly indicate the total cost, including all expenses, for each individual system to allow the Owner to select any or all to be included in the contract. Itemization of miscellaneous equipment such as cable, switches, and receptacles is not required.
  4. Organize each list with the information presented, in the order that it appears in this specification, in Attachment F Pricing Response Workbook.xlsx:
    - a. Paragraph number as it appears in this specification.
    - b. Paragraph title as it appears in this specification.
    - c. Manufacturer and model number.
    - d. Quantity.
    - e. Unit Cost.
    - f. Discount.
    - g. Unit Cost after discount.
    - h. Extension (unit cost times quantity).
  5. At the end of each list indicate the cost of all other items such as for miscellaneous equipment, engineering, installation labor, overhead, taxes, etc.
  6. On a separate list indicate costs of any specified add- or deduct-alternates with the information presented in the same manner as for the base-bid system.
  7. Include a listing of any voluntary alternates proposed by the bidder as substitutions or additions to the specified systems.
  8. Include any notes or comments if necessary to qualify the bid.
- F. Identify any sub-contractors and indicate the work they are to do.
- G. Identify the proposed project management, engineering, and installation staff. Include resumes for each individual indicating relevant experience and certifications.
- H. Include certification of ownership and full familiarity with the operation of the following minimum test equipment. Provide a list of the manufacturer, model, and serial number for each item of test equipment required, and the date of last calibration traceable to NIST, as applicable.
1. GENERAL CONTRACTING
    - a. Multimeter.
    - b. Cable Tester (Kopul CBT-MF or similar).
  2. VIDEO/BROADCAST/TELECONFERENCE
    - a. Multi-frequency computer test pattern generator with DVI output.
    - b. Photometer with luminance and illuminance probes.
    - c. DVD format test disc: 3:4 (SMPTE 259M-C) and 16:9 (SMPTE 294M/296M) NTSC/ATSC/US region 1 material.
    - d. Fiber-optic testing and field servicing equipment.

- I. Include certification of ownership and full familiarity with the operation of the following minimum software and analysis tools:
  - 1. AutoCAD, version as required by the Owner (or .dwg compatible software, Stardraw not acceptable).

J. BIDS NOT FULLY ITEMIZED OR NOT SUBMITTED IN THIS FORMAT WILL BE REJECTED.

#### 1.07 QUALITY ASSURANCE

- A. Project Management: Maintain the same person in charge of work throughout installation. Engineering and construction supervisors shall be CTS-I certified.
- B. Contract Documents: Maintain a complete set of system drawings and specifications at the site at all times during installation.
- C. Fabrication and Installation: Fabricate all equipment racks and subassemblies. Make field connections of all audio, video and control wiring including microphone, line level, loudspeaker, video, and control system circuits to equipment, equipment racks and connection panels. Continuously supervise the installation and connections of cable and equipment.
- D. Subcontractors: The Contractor may arrange for sub-contract field and special shop work to be done by others.
- E. Prime Contractors: Any other installer who intends to bid on this work as the Prime Contractor and does not meet the "Contractor Qualifications" described above shall employ the services of a single "Audiovisual Systems Contractor" who does meet these requirements. The Audiovisual System Contractor shall Furnish and Install the equipment. The Prime Contractor shall clearly identify the Audiovisual Systems Contractor and submit complete qualification information for the Audiovisual Systems Contractor in the Bid. Failure to do so will be cause for rejection of the Bid.

#### 1.08 SUBSTITUTIONS

- A. General:
  - 1. The Audiovisual Systems Contractor has the burden of proving, at the Contractor's own cost and expense and to the satisfaction of the Architect, that the proposed product is similar and equal to the named product.
- B. Documentation:
  - 1. File a formal request for each substitution, documenting the conditions outlined below, including:
    - a. Complete data on the proposed substitution, substantiating compliance with the Audiovisual Systems Contract Documents, including:
      - 1) Specification Section and description of the equipment or service originally specified by the Audiovisual Systems Consultant
      - 2) Product manufacturer, model, and description of the proposed substitution
      - 3) Performance specification and test data verifying the proposed substitution's compliance with Audiovisual System and installation requirements.
      - 4) References and samples, where applicable
      - 5) An itemized comparison of the proposed substitution with the item originally selected in the Audiovisual Specification
      - 6) The impact of the proposed substitution on the Contract time schedule, system design, artistic effect (for changes in finish or dimension), and related contracts and trades
  - 2. Submit item comparisons, coordination schedules, and design impact via addenda appended to manufacturer documentation.
- C. Basis:
  - 1. Requests for acceptance of proposed equivalents made following the award of bid are considered only in the following cases:
    - a. The named products cannot be obtained by the Audiovisual Systems Contractor because of strikes, lockouts, bankruptcies or discontinuance of manufacturer and the Audiovisual Systems Contractor makes a written request for consideration of the proposed equivalent.
    - b. The proposed equivalent is approved as equal or superior to the named product and its use is to the advantage of the Owner.

## D. Consideration:

1. A request for substitution is a representation by the Audiovisual Systems Contractor that:
  - a. The Audiovisual Systems Contractor has personally investigated the proposed substitution and determined that it is equal or superior in all respects to that specified.
  - b. The same warranty is provided for the substitution as the original equipment specified.
  - c. The cost data presented is complete and includes all related costs under this Contract, but excludes costs under separate contracts and excludes Architect's re-design costs, and that the Audiovisual Systems Contractor waives all claims for additional costs related to the substitution which subsequently becomes apparent.
  - d. Any cost impact on work by other trades is indicated.
  - e. Installation of the accepted substitute will be coordinated by the Audiovisual Systems Contractor, making such changes as may be required for the Work to be complete in all respects.
2. An accepted substitution shall be documented by Change Order, effectively modifying the Audiovisual Systems Specification. The Contract Price will be changed only if the substitution results in cost savings to the Owner.

## 1.09 AV SYSTEM IMPLEMENTATION SUBMITTALS

## A. General

1. Provide all submittals in PDF format unless otherwise directed by the project manager.
2. Delivery Schedule:
  - a. Within 21 days of award provide:
    - 1) Bill of Materials
  - b. Audiovisual Infrastructure
    - 1) The Audiovisual System integrator shall provide design of pathway systems within building consisting of conduit, boxes, cable hangers, rated sleeves to support Audiovisual systems. This includes planning and coordination with Architects and other trades of inside plant pathway systems.
    - 2) Equipment Seismic Anchorage: Audiovisual System Integrator to include structural calculations for anchorage and seismic restraint of floor-mounted equipment (such as pedestal mounted Direct view LED display, racks, frames, cabinets), wall-mounted equipment (such as video display equipment, etc.), and overhead-mounted equipment (such as speakers, overhead cable support, etc.) in conformance with CBC, Chapter 16. Calculations shall be based on fully loaded equipment and support systems. Calculations shall demonstrate that the equipment and support systems will remain attached to the mounting surface during and after experiencing seismic forces in conformance with the CBC. A Structural Engineer registered in the State of California shall prepare Structural Calculations and shall wet stamp and sign them. Obtain approval from approving agency for the calculations.
    - 3) Manufacturer Catalog Data Sheets: Product Submittals shall be issued no sooner than six (6) months prior to scheduled installation onsite.
    - 4) Shop Drawings
    - 5) Custom finish material samples, if applicable.
  - c. One week before acceptance testing visits (system "check-out") provide:
    - 1) System test and certification reports
    - 2) Manufacturer's owner's manuals
    - 3) One (1) draft copy of user operational manuals
    - 4) One (1) draft copy of "as-built" system diagrams
  - d. Within 30 days after final acceptance testing visit provide:
    - 1) As-built system diagrams
    - 2) User operational manuals
3. Unless otherwise directed by contract, do not order equipment until the Bill of Materials, Catalog Data Sheets, and shop drawings have been reviewed and approved by the Owner, Owner's representative, or Audiovisual Systems Consultant. Any acquisition, assembly or installation of any systems or components without Audiovisual Systems Consultant's approval will be subject to removal at the Audiovisual Systems Integrator's expense.
4. Approval for isolated items will not be considered, except by prior authorization by the Audiovisual Systems Consultant.

5. All rejected items and items requiring correction must be resubmitted together in entirety, unless otherwise approved.
- B. Catalog Data Sheets:
1. Provide product data sheets in electronic .pdf format, or other approved file format. Data sheets shall be organized in a logical manner, such as per system, to allow efficient review against the design documents.
- C. Bill of Materials & Manufacturer Product Data Sheets:
1. Organize the Bill of Materials with the information presented in the order and format that it appears in this specification.
  2. After the Bill of Materials, include Catalog Data Sheets (“cut” sheets) for all specified products arranged in the order listed in the Bill of Materials.
  3. Clearly indicate all finishes, colors and, options for equipment.
- D. Shop Drawings:
1. Size: minimum 24” x 36” unless otherwise specified.
  2. Media: provide in electronic .pdf file format unless otherwise specified or directed by the Construction Manager.
  3. Prepare a drawing package on the approved Computer Aided Drafting (CAD) or Building Information Modeling (BIM) system, including:
    - a. Audiovisual Systems Integrator name, address, and phone number.
    - b. Block diagrams indicating proposed connections of all equipment and indicating equipment brand and model numbers.
    - c. DSP Settings: Schematic diagram of processing blocks and signal flow in CAD, printed block diagram with settings from manufacturer’s software, or saved software settings and manufacturer’s authorized DSP editing software on CD-ROM.
    - d. Equipment/ control room layout and equipment rack and cabinet details
    - e. Provide detailed drawings of custom-fabricated or stock mounts and hardware.
    - f. Video display arrangements.
    - g. Flown loudspeaker arrangements.
    - h. Shop drawings of any unit to be fabricated or modified under the scope of the Audiovisual Systems Integrator such as control panels, switch panels, loudspeaker enclosures or grilles.
    - i. Detailed control panel layouts and control logic notes, prepared by the control system programmer:
      - 1) Provide engraved button labeling details or page graphics (including text, button colors, images, and backgrounds) as well as page flips, sub-pages and overall command logic flow.
      - 2) Audiovisual Systems contractor may choose to submit control panel information under separate cover, bound into a commercial quality three-ring binder.
    - j. Other drawings and sketches as required by the Architect or Audiovisual Systems Consultant during the course of project installation.
  4. Control System Software Submittals
  5. Control System Software consists of the following two primary components:
    - a. Control System Graphical User Interface (GUI)
    - b. Control System Processor Software
  6. In order to develop Control System Software that is functional and understandable by the intended users, it will be necessary for the Audiovisual Systems Integrator to provide “working” copies of software for review and comment by the Owner and the Project team as it is being developed.
  7. The software programming process must be an iterative process that includes a minimum of three (3) iterative submittals prior to first beneficial use. The following table is provided to help facilitate the software development process:



Deliverable	Notes	Due
Initial Submittal	Listing of individual device control functions GUI logic flow diagram Static touch panel layouts Initial labeling of button panels	Due no later than one week after return of approved shop drawings
First Beta Review	Dynamic touch panel Layouts including page flips, pop-ups, feedback, etc to show operational relationships between pages	Due no later than two weeks after return of approved Initial Submittal
Second Beta Review	Interface updates and revisions Test of loaded working system (in shop or on site)	Due no later than three weeks after return of approved First Beta Review submittal
Implementation / On-site Testing	Loading of live code into working systems	Prior to Substantial Completion
Completion	Follow-up programming review and minor modifications based on user feedback	60 days after Final Acceptance

E. Project Plan

1. Provide a complete and detailed Schedule for the Audiovisual Systems Integrator’s work describing the major tasks, sequence of work, submittals and other critical milestones. At a minimum the tasks noted in the Schedule shall include all required submittals, rack assembly and shop testing, on-site cable installation, periodic shop and site visits, on-site equipment installation, testing and commissioning, Substantial Completion and Project Completion. Indicate the sequence of installation and completion by room and/or system. The Schedule shall also include anticipated dates of acquisition of major equipment and their installation milestones.
2. Provide a complete listing of the Audiovisual Systems Integrator’s project team, including the names and all contact information (email address, cell phone, etc.) for all personnel assigned to the Project. At a minimum this Project Team Directory shall include the Audiovisual Systems Integrator’s executive in charge of the Project as well as the Project Manager, Lead Engineer and Lead Installer. Include names and contact information for all sub-contractors.

F. Weekly Status Reports

1. The Audiovisual Systems Integrator shall provide weekly progress updates to the Architect and Audiovisual Systems Consultant. Weekly Status Reports shall be submitted as directed by the Construction Manager via faxed hard copy or electronic means (i.e., email). Issuance of Weekly Status Reports shall commence from the date of the first submittal delivery and shall continue until contract closeout.
2. The Weekly Status Report shall not be used as an official means of communicating Project issues. It does not replace any part of a required submittal, request for information, proposed change order, report of field conditions, schedule issues, etc. No official response will be given to the Weekly Status Report.
3. A representative of the Audiovisual Systems Integrator shall attend the weekly construction meeting at the job site. This representative shall be fully knowledgeable in all aspects of the Project and the Audiovisual Systems Integrator’s work and shall have the authority to make binding commitments on behalf of the Audiovisual Systems Integrator.

G. Substantial Completion Submittals

Substantial Completion of the Audiovisual System installation shall be the point at which all Audiovisual Equipment has been installed, programmed, configured and initially tested to confirm proper operation. The point of Substantial Completion shall be as mutually agreed between the Audiovisual Systems Integrator and the Audiovisual Systems Consultant following discussion and observation. At the point of agreed Substantial Completion, the Audiovisual Systems Integrator shall submit the following:

1. Test Reports:
  - a. Upon completion of SYSTEM PERFORMANCE TESTS AND ADJUSTMENTS specified in PART 3 - EXECUTION, submit for approval in writing test results including numerical values for all measurements.

- b. Submit written certification that the installation conforms to specifications, is complete and operable, and is ready for FINAL ADJUSTMENTS AND ACCEPTANCE TESTS specified in PART 3 - EXECUTION.
          - c. The Owner or Owner's representative reserves the right to withhold the final site visit "check-out" and any final certification of project completion until receipt of test report documents, as outlined in this section (SECTION 1 – "Test Reports").
  2. Preliminary Project Record Documents Submittal
    - a. Upon Substantial Completion the Audiovisual Systems Integrator shall submit Preliminary Project Record Documents to the Audiovisual Systems Consultant. Preliminary Project Record documents shall be submitted prior to the Preliminary Checkout.
    - b. Preliminary Project Record Documents shall include:
      - 1) Corrected/updated shop drawings
      - 2) Updated Equipment List
      - 3) Half-size drawings modified to reflect the actual installation conditions
      - 4) CD-ROM with manufacturers' operation manuals arranged alphabetically and current drawings in .DWG format
    - c. Audiovisual Systems Consultant's Preliminary Checkout will be scheduled after the Preliminary Project Record Documents and Test Reports have been approved.
- H. Manufacturer's Owner's Manuals:
  1. Archive all Manufacturers' Owner's Manuals for specified equipment in the following manner:
    - a. Provide all Manufacturer's Owner's Manuals in electronic .pdf format on CD-ROM. Owner's Manuals shall be organized in a logical manner such as per system and/or alphabetical order, by manufacturer.
- I. User Operational Manual:
  1. Intent: Prepare in the form of a system operations manual for use by Owner's personnel.
  2. Cover: Identify each volume with typed or printed titles "SYSTEM OPERATING INSTRUCTIONS".
  3. Format: Submit the User Operational Manual in the following format:
    - a. Size: 8-1/2" x 11", 20 lb. minimum weight white paper for typed pages, either manufacturer's printed data, or neatly typewritten.
    - b. Drawings: Provide reinforced punched binder tab, bind in with text. Fold larger drawings to size of text pages.
    - c. In addition, provide Operational Manual in electronic .pdf format.
  4. Content of Manuals: Prepare the User Operational Manual with the following content:
    - a. Neatly typewritten table of contents for each volume, arranged in systematic order. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
    - b. Contractor name of responsible principal, address and telephone number
    - c. Certificate of Warranty
    - d. Service Contract: Include a preliminary schedule for the specified semi-annual site visits.
    - e. Complete as-built diagrams for systems.
    - f. Receptacle Location Plan
    - g. Shop drawings of all custom-fabricated items
    - h. Control Setting Schedule.
    - i. Documentation of all touch-panel screens both in the form of data files on CD-ROM and graphical printouts.
    - j. Audiovisual control system programming files on CD-ROMs for the control system, the touch screen display program, and all programming, graphics, communication, or other software required for re-programming the AV control system.
- J. System Diagrams:
  1. Provide sufficiently clear and complete information that a technician of average skill may efficiently troubleshoot and service the system, even if unfamiliar with the installation, based on diagrammatic representations of the installed system.
  2. Provide drawings showing all terminal blocks, connectors, relays, switches, equipment, components, and wires.

3. Provide layout drawings of panels and other custom assemblies containing switches, relays, terminal blocks, receptacles, etc., using reference numbers to identify physical locations of devices or label devices with reference numbers in a location visible while viewing cable terminations.
4. On wiring diagrams, label all conductors within cables for insulation color or other identifier.
5. Label connectors, barrier strips, switches, relay sockets, etc., for terminal number.
6. If device does not provide terminal designations, provide key diagram for reference.
7. Label all devices with manufacturer, model number, and reference number (e.g., "SW 15", "TB 6"); reference numbers shall be consistent across all drawings with no repetitions.
8. Provide labels for cables continued onto another drawing, indicating termination device, terminal numbers, and drawing sheet on which the termination is shown.
9. Illustrate all receptacles, patch panel jacks, and switches.
10. Mount one photographic, wash-off Mylar or rag paper photocopy prints of each system behind acrylic at locations to be determined.
11. Receptacle Location Plan: Plan drawing of area showing locations and designations of all receptacles.
12. Control Setting Schedule: Fully document the settings of all non-user-adjustable controls. This includes power amplifier gain controls, equalizer settings, etc.

K. Samples:

1. Advance Finish Samples for Approval/Coordination: Provide advance samples of finish for custom control panels and other custom items specified and provided by the Audiovisual Systems Contractor, as mandated within this document.
2. As-built Finish Samples for Archiving: For future repairs or modifications, include source information and samples for any custom finish or material including custom control panels and other custom items provided by the Audiovisual Systems Contractor.

L. Forward all submittals to:

1. The Project Manager, or as directed.

M. Sustainable Building Submittals

1. Sustainable Building Submittals are required to verify compliance with the "Sustainable Building Performance Criteria" defined in this section.
2. Refer to Division 1 Section "Sustainable Design and Construction," for detailed descriptions of the submittal documents listed below.
3. Green Building Materials Certification Form (GMF): Submit a completed GMF for the materials included in this section (blank copy is appended to Division 1 Section "Sustainable Design and Construction"). The following information shall be provided:
  - a. Itemized material costs for the Green Building Focus Material (GBFMs) identified under the "Sustainable Building Performance Criteria" heading of this section.
4. Supplementary Information: In addition to the GMF, the following Sustainable Building submittal information shall be provided per Section 01 81 13:
  - a. GMF Back-Up Documentation
  - b. Product Cut Sheets
  - c. Verification of lack of Prohibited Compounds in Adhesives, Sealants, and Sealant Primers.
  - d. Energy Star Label Certification (Note: only include where applicable).

## 1.10 JOB CONDITIONS

A. Sequencing and Scheduling:

1. Coordinate work with adjacent work of other trades to facilitate construction and prevent conflicts.
2. Afford other trades reasonable opportunity for installation of work and for the storage of materials.
3. Staff the job to keep pace with the other Trades; otherwise, the project manager will require an increase in force or overtime work without additional expenses to the Owner.
4. Abide by the decision of the project manager in case of conflict or interference by other trades.
5. Remove all refuse from the job site to the satisfaction of the Owner's representative.

B. Do not install equipment in dusty conditions or allow dust to accumulate in or on installed Audiovisual Equipment.

- C. Protect all work and equipment from damage by others.
- D. Protect all existing work-in-place by others from damage by the Audiovisual Systems Integrator, the Audiovisual Systems Integrator's agents and/or sub-contractors, or any employees or vendors. The Audiovisual Systems Integrator will be solely responsible for any/all damage to work-in-place by others.
- E. Keep areas around and inside of each piece of equipment and each rack free from dust, dirt and debris throughout the project. Equipment that is not properly maintained during installation shall be replaced at no cost to the Owner before final payment is made to the Audiovisual Systems Integrator.
- F. Storage and Staging:
  - 1. The Audiovisual Systems Contractor is ultimately responsible for acquiring secure storage at the job site. Coordinate with project management and/or Owner to determine the location and size of the storage area.
  - 2. All Audiovisual Systems Integrator equipment and materials and all owner furnished equipment turned over to the Audiovisual Systems Integrator stored at the Audiovisual Systems Integrator's facility(s) or stored and/or installed at the Project site will remain the property of the Audiovisual Systems Integrator unless ownership is legally transferred and accepted in writing by the Owner. The Audiovisual Systems Integrator shall be solely responsible for the protection of all equipment from damage, theft or vandalism regardless of cause, until the work described herein is accepted by the Owner at the time of Final Checkout.
- G. Refuse and Repair:
  - 1. Upon completion of work remove all associated debris, waste, refuse, and rubbish from premises. Leave all areas and equipment within the scope of this contract clean, free of blemishes, and operational.
  - 2. Repair any damage to the premises, at no cost to the Owner, caused by the Audiovisual Systems Contractor, its agents, and/or subcontractors.
- H. Adhere to the safety standards established by the General Contractor while performing work on site.
- I. All employees of the Audiovisual Systems Integrator shall wear identification clearly indicating the Audiovisual Integrator's company name while on site.
- J. All employees of the Audiovisual Systems Integrator shall comply with rules and policies established by the Owner and/or the General Contractor.
- K. All vehicles of the Audiovisual Systems Integrator or employees shall be parked in areas designated by the Owner and/or the General Contractor.
- L. Environmental Impact Considerations
  - 1. The Audiovisual Systems Integrator is expected to comply with project specific practices and environmental considerations to comply with any LEED objectives and local environmental regulations.
  - 2. The Audiovisual Systems Integrator is encouraged to utilize environmentally sustainable materials and work practices in the delivery of the Work. This may consist of (but not be limited to):
    - a. Energy Efficiency/Conservation
    - b. Waste Reduction/Recycling
    - c. Water Conservation
    - d. Pollution Prevention
    - e. Employee Education Programs
    - f. Transportation Planning
    - g. Utilization of Renewable Materials
    - h. Minimize Emission of Greenhouse Gases
  - 3. Upon request, the Audiovisual Systems Integrator shall supply documentation on in-house policies for recycling and environmental offset goals.
- M. Promotion/Publication:
  - 1. The contractor does not have the rights to use any information or images, relative to this contractor installation, for publication or in promotional materials without the express written permission of the Owner, Architect, and MDC consulting engineers. Upon approval, the contractor must disclose full credit to the Architect and Consultant for facilities and system design.
- N. Insurances on the work of this specialty trade shall be provided as specified in relevant project documentation.

- O. Inspection
  - 1. Notify the Architect of any defects in work by other trades affecting installation.
- P. Packaging: Material and equipment manufacturers shall demonstrate efforts to reduce packaging waste and/or to use environmentally-preferable packaging materials. Examples include, but are not limited to, the following:
  - 1. Reusable and/or returnable pallets or crates
  - 2. FSC-certified wood or salvaged wood pallets or crates
  - 3. High recycled-content cardboard, paper, steel, or plastic packaging
  - 4. Bio-based foam packing materials

#### 1.11 DESCRIPTION OF SYSTEMS:

- A. Project Description
  - 1. The project concerns the installation of new audiovisual systems in spaces at the E.O.C., as described below and shown on the drawings.
- B. Functional Requirements of Systems:
  - 1. EOC Main Open Office:
    - a. EOC Main serves as main hub of EOC operations with the following capabilities.
      - 1) Direct view LED and associated windowing processor will have flexibility to display up to 8 sources in multiple preset windows options (up to 6 options) from control panels.
    - b. Sources
      - 1) Video feed from Redding Electric Utility (REU), City of Redding, 911 Dispatch, Helicopter, Drones.
      - 2) Multiple (OFE) PCs in rack.
      - 3) (4) local AV wall inputs.
      - 4) Wireless AV Hub for presentation from office cubicles.
    - c. Mixing, Processing, Routing, & Distribution
      - 1) AV network switch, encoders and decoders to route sources to displays
      - 2) Audio DSP for:
        - a) Applying AEC to microphones pre-digital mixer
        - b) VoIP interface
        - c) Loudspeaker management
        - d) Room equalization
    - d. Display
      - 1) (1) 20' W x 11' H Direct View LED Display(1.25 MM Pixel Pitch)
      - 2) (3) 98" flat panel displays
    - e. Loudspeakers
      - 1) Ceiling loudspeaker assemblies for program audio
    - f. Control
      - 1) Desktop touch panel at operator counter and wall mounted touch panel. Minimum functions to include:
        - a) Digital mixer preset recall
        - b) Network video switcher routing control inside EOC and other areas of EOC
        - c) Volume control
          - (1) Program and far-end audio
          - (2) Program audio to other rooms
        - d) Video wall processor control
        - e) Window processor preset recall and configuration
        - f) Lighting system control. Coordinate preset and dimming requirements with Division 26 contractor
        - g) HDBaseT transmitter and receiver configuration
        - h) Control of flat Panel Displays in EOC and displays in all other rooms.
      - 2) Control processor for interface to touch panel and lighting control system
      - 3) Managed Ethernet Switch for IP control of devices
    - g. Equipment Racks and Miscellaneous Equipment

- 1) (2) Floor-standing equipment rack located in IT room on Mezzanine.
2. EOC Conference
    - a. EOC Conference serves as main video conference room with the following capabilities.
    - b. Sources
      - 1) (OFE) PC for video conferencing in rack
      - 2) (2) local AV wall inputs
      - 3) Wireless AV hub for presentation
      - 4) Video conferencing camera
    - c. Mixing, Processing, Routing, & Distribution
      - 1) AV network switch, encoders and decoders to route sources to displays
      - 2) Audio DSP for:
        - a) Applying AEC to microphones pre-digital mixer
        - b) VoIP interface
        - c) Loudspeaker management
        - d) Room equalization
        - e) Ceiling microphones
    - d. Display
      - 1) (1) 120" Direct View LED Display(1.38 MM Pixel Pitch)
      - 2) (1) 85" flat panel displays
    - e. Loudspeakers
      - 1) Ceiling loudspeaker assemblies for program audio
    - f. Control
      - 1) (4) licenses for software based control panel on an OFE(laptop or desktop computer, iPad, and Surface)
      - 2) Wall mounted and desktop touch panel. Minimum functions to include:
        - a) Digital mixer preset recall
        - b) Network video switcher routing control inside EOC conference
        - c) Volume control
          - (1) Program and far-end audio
          - (2) Program audio
        - d) Window processor preset recall and configuration
        - e) Lighting system control. Coordinate preset and dimming requirements with Division 26 contractor
        - f) HDBaseT transmitter and receiver configuration
        - g) Control of flat panel displays and direct view LED display
      - 3) Control processor for interface to touch panel and lighting control system
      - 4) Managed Ethernet Switch for IP control of devices
    - g. Equipment Racks and Miscellaneous Equipment
      - 1) Shared floor-standing equipment rack located in IT room on Mezzanine.
  3. EOC Conference 2
    - a. EOC Conference 2 serves as extension of EOC conference room with the following capabilities.
    - b. Sources
      - 1) (2) local AV wall inputs.
      - 2) Wireless AV hub for presentation
      - 3) Video conferencing camera
      - 4) (OFE) PC for video conferencing in rack
    - c. Mixing, Processing, Routing, & Distribution
      - 1) AV network switch, encoders and decoders to route sources to displays
      - 2) Audio DSP for:
        - a) Applying AEC to microphones pre-digital mixer
        - b) VoIP interface
        - c) Loudspeaker management

- d) Room equalization
      - e) Ceiling microphones
    - d. Display
      - 1) (2) 85" flat panel displays
    - e. Loudspeakers
      - 1) Ceiling loudspeaker assemblies for program audio
    - f. Control
      - 1) Wall mounted touch panel. Minimum functions to include:
        - a) Digital mixer preset recall
        - b) Network video switcher routing control inside EOC conference overflow displays
        - c) Volume control
          - (1) Program and far-end audio
          - (2) Program audio
        - d) EOC CONFERENCE Lighting system control. Coordinate preset and dimming requirements with Division 26 contractor
        - e) HDBaseT transmitter and receiver configuration
        - f) Control of flat panel displays inside EOC conference overflow.
      - 2) Control processor for interface to touch panel and lighting control system
      - 3) Managed Ethernet Switch for IP control of devices
    - g. Equipment Racks and Miscellaneous Equipment
      - 1) Shared floor-standing equipment rack located in IT room on Mezzanine.
4. PIO Office-11
  - a. PIO Office-11 serves as break out conference room with the following capabilities.
  - b. Sources
    - 1) (1) local AV wall input.
    - 2) Wireless AV hub for presentation
    - 3) Video conferencing camera and microphone integrated to sound bar.
  - c. Mixing, Processing, Routing, & Distribution
    - 1) AV network switch, encoders and decoders to route sources to displays
    - 2) Audio DSP for:
      - a) Loudspeaker management
      - b) Room equalization
  - d. Display
    - 1) (1) 65" flat panel display
  - e. Loudspeakers
    - 1) Integrated to sound bar.
  - f. Control
    - 1) Wall mounted touch panel. Minimum functions to include:
      - a) Digital mixer preset recall
      - b) Network video switcher routing control inside PIO Office
      - c) Volume control
        - (1) Program audio
      - d) Lighting system control. Coordinate preset and dimming requirements with Division 26 contractor
      - e) HDBaseT transmitter and receiver configuration
      - f) Control of flat panel displays inside PIO Office
    - 2) Control processor for interface to touch panel and lighting control system
    - 3) Managed Ethernet Switch for IP control of devices
  - g. Equipment Racks and Miscellaneous Equipment
    - 1) Shared floor-standing equipment rack located in IT room on Mezzanine.
5. Office-23 and Office 24

- a. Office -23 and Office 24 serves local presentation(wired and wireless) with the following capabilities.
- b. Sources
  - 1) (1) local AV wall input.
  - 2) Wireless AV hub for presentation
- c. Mixing, Processing, Routing, & Distribution
  - 1) AV network switch, encoders and decoders to route sources to displays
  - 2) Audio DSP for:
    - a) Loudspeaker management
    - b) Room equalization
- d. Display
  - 1) (1) 65" flat panel display
- e. Loudspeakers
  - 1) Integrated to display speakers
- f. Control
  - 1) Software based control panel for OFE tablet or windows devices. Minimum functions to include:
    - a) Network video switcher routing control inside PIO Office
    - b) Volume control
    - (1) Program audio
    - c) HDBaseT transmitter and receiver configuration
    - d) Control of flat panel displays inside PIO Office
  - 2) Managed Ethernet Switch for IP control of devices
- g. Equipment Racks and Miscellaneous Equipment
  - 1) Shared floor-standing equipment rack located in IT room on Mezzanine.

## PART 2 - PRODUCTS

### 2.01 ENGINEERING AND DESIGN

- A. Engineering and other pre-site services included in this Specification are considered furnished goods delivered to the site in a similar manner to physical materials. PART 2 of the AV specifications is for review by the AV contractor's engineering department. The contractor is responsible for reviewing the specification and drawings and providing an ENGINEERED fixed-price quotation covering the cost of all equipment and labor to install, program, warranty and service the systems described.
- B. The contractor is responsible for attending all pre-bid meetings and reviewing and understanding the systems design, functionality and intent.
- C. The owner assumes that all contractors providing bid responses have included all of the necessary equipment, parts, cabling, labor, engineering, programming, project management, testing and training costs, and will not approve any additional fees or costs, unless shown and approved to be beyond the scope of the specification and drawings.
- D. The equipment identified below provides examples of the level of quality and functionality required. These are predominantly major or unusual items and do not represent a complete list of equipment. The contractor is responsible for providing all equipment necessary for fully functioning turnkey systems.

### 2.02 GENERAL EQUIPMENT AND MISCELLANEOUS

- A. Cabling, and Misc.
  - 1. Unless otherwise called for in these specifications and drawings, the following cables are approved for the associated application or signal type. Ensure the chosen cable is appropriate for the signal type, available pathway capacity, and run length.



Application	Non-Plenum Product, or equal	Plenum Product, or equal
HDBaseT	Belden 2183R West Penn 4246F Extron XTP DTP 24 Superior Essex 6H-246-xA Windy City Wire CAT6S	Belden 2183P West Penn 254246F Extron XTP DTP 24P Superior Essex 6H-246-xB Windy City Wire CAT6SP
Control cable (AMX AXLink, Crestron Cresnet)	Belden 1502R West Penn 77350, C4215 Liberty LLINX-U Windy City Wire CRESCOM	Belden 1502P West Penn D25350 Liberty LLINX-U-P Windy City Wire CRESCOMP
Microphone and line-level audio cable	Belden 9451 West Penn 454 Liberty 20-2C-SH-GRY Windy City Wire 22-1PREZ-BLK	Belden 9451P West Penn 25291B Liberty 20-2C-PSH-GRY Windy City Wire 22-1PREZP-BLK
Program loudspeaker cable	Belden 5000UE West Penn 227 Liberty 12-2C-GRY Windy City Wire 12-02-GRY	Belden 6000UE West Penn 25227B Liberty 12-2C-P-BLK Windy City Wire 12-02P-BLK
Distributed loudspeaker speaker cable	Belden 5300UE West Penn 224 Liberty 18-2C-GRY Windy City Wire 18-02-BLK	Belden 6300UE West Penn 25224B Liberty 18-2C-P-BLK Windy City Wire 18-02P-BLK
ALS emitter	See Antenna cable (wireless microphone) – 50-ohm, below	
Antenna cable (wireless microphone) – 50-Ohm	West Penn 813 Liberty RG8-CMR-BLK RG8-BLK Or equal by Belden	West Penn 2598G8 Liberty RG8-CMP-BLK RG8P-BLK Or equal by Belden
Antenna cable (wireless microphone) – 75-Ohm	See CATV trunk and drop cables, below	
Analog video coaxial cable, RG59-type	Extron 815 Liberty RG59-CCTV-CM-BLK Windy City Wire RG59-BLK	West Penn 25815 Liberty RG59-CCTV-PL-BLK Windy City Wire RG59P-BLK
Serial digital coaxial cable	West Penn 819 Liberty 20-CMR-VIDEO-BLK Windy City Wire RG59HD-BLK	West Penn 25825 Liberty 20-CMP-VID-COAX-BLK Windy City Wire RG59HDP-BLK
CATV trunk cable	West Penn 811 Liberty RG11-CATV-BLK Windy City Wire RG11-BLK	West Penn 25821 Liberty RG11-CCTV-PL-WHT Windy City Wire RG11P-BLK
CATV drop cable	West Penn 806 Liberty 18-CMR-SD-BLK Windy City Wire RG6-BLK	West Penn 25841 Liberty 18-CMP-VID-COAX-BLK Windy City Wire RG6P-BLK

2. Cable Markers:
  - a. High-grade PVC clip-on or permanent-type cable markers with permanent markings, or printed vinyl tape protected by clear shrink tubing or adhesive wrap.
  - b. Acceptable Products:
    - 1) Electrovert Type C or Z.
    - 2) Brady B-702 with Alpha FIT-221 series clear tubing.
    - 3) Thomas & Betts EZCODER.
3. Microphone and Line-Level Line Terminal Blocks:
  - a. Insulation displacement "punch" block.
  - b. Contact Construction: Insulation displacement phosphor bronze contact, with plastic insulator, for AWG #22, #24, and #26 solid or stranded wire, allowing 100 insertions/ withdrawals, and accepting four wires total for each connection point.
  - c. Acceptable Products:

- 1) ADC Products UP3 with UP-W or UP-R mounts as required with one Q-814-804 wire insertion tool.
  - 2) Siemens Multiflex block with one 714 insertion tool with cutting blade.
- B. Connectors:
1. Microphone and Line Connectors (Panel Mount):
    - a. Balanced Input Receptacles
      - 1) Female gender "XLR"-type receptacles.
      - 2) Acceptable Products:
        - a) Switchcraft C3F or D3F.
        - b) Equivalent.
    - b. Balanced Output Receptacles
      - 1) Male gender "XLR"-type receptacles.
      - 2) Acceptable Products:
        - a) Switchcraft C3M or D3M.
        - b) Equivalent.
    - c. Dual Format Line Input Receptacles
      - 1) Balanced input receptacle accepting both male gender "XLR"-type connectors and 1/4" TRS phone plugs.
      - 2) Acceptable Products:
        - a) Neutrik NCJ6FK-V.
        - b) Equivalent.
    - d. Unbalanced Input and Output Receptacles
      - 1) Two-conductor 1/4" phone jacks with type J-4 single-closed circuit schematic, molded plastic enclosure, and insulating molded nylon bushing.
      - 2) Acceptable Products:
        - a) Switchcraft N112A or NL112A as required.
        - b) Equivalent.
    - e. Locking 1/4" Receptacles
      - 1) Two- or three-conductor 1/4" phone jacks with locking tab to prevent accidental removal of plug.
      - 2) Acceptable Products:
        - a) Switchcraft E111L (2-cond.) or E112BL (3-cond.) as required.
        - b) Neutrik NJ3FP6C.
        - c) Equivalent.
    - f. Unbalanced Input and Output Receptacles
      - 1) Female gender phono jacks (RCA jack) with closed circuit switching and non-grounding mount.
      - 2) Acceptable Products:
        - a) Switchcraft 3512.
        - b) Equivalent.
    - g. 3.5mm (1/8" Mini) Stereo Phone Jack
      - 1) Female gender, 3-conductor, open-circuit, enclosed, panel-mount, 3.5mm (1/8" mini) phone jack.
      - 2) Acceptable Products:
        - a) Switchcraft 35HD-series.
        - b) Equivalent.
    - h. Multipin Receptacles
      - 1) Multipin connectors compatible with microphone snakes supplied. Gender and channel capacity as shown on drawings and/or equipment schedule.
  2. Microphone and Line Connectors (Cable Mount):
    - a. Balanced Input Connectors
      - 1) Female gender "XLR"-type connectors.
      - 2) Acceptable Products:
        - a) Switchcraft A3F.
        - b) Neutrik NC3FX.
    - b. Balanced Output Connectors
      - 1) Male gender "XLR" type connectors.

- 2) Acceptable Products:
  - a) Switchcraft A3M.
  - b) Neutrik NC3MX.
- c. 1/4" Phone Plug
  - 1) Two- or three-conductor 1/4" phone jacks.
  - 2) Acceptable Products:
    - a) Switchcraft 184 (2-cond.) or 190 (3-cond.) as required.
    - b) Neutrik NP-2C (2-cond.) or NP-3C (3-cond) as required.
- d. Unbalanced Line
  - 1) Two-conductor RCA plug or jack connector with steel shell and internal cable clamp. Provide with minimum 2" of rubberized shrink-wrap strain relief at each connector.
  - 2) Acceptable Products:
    - a) Switchcraft 3502 or 3503 as required.
    - b) Equivalent.
- 3. Loudspeaker Connectors and Receptacles (4 conductor):
  - a. General: Connector system specifically designed for high power loudspeaker signal distribution, with twist type locking device. Contacts nickel-gold alloy, 250 VAC, 30 amps continuous per contact.
  - b. Cable Connectors: Four contacts, wired separately per manufacturer's recommendation for bi-amplified applications, or with pins 1+ and 1- (pins 2+ and 2- not used) for single channel applications. Cable strain-relieved with chuck type retainer for cable diameters 5-15mm (.2-.6 inch). Cable conductors attached with screws (not soldered) to facilitate field repair. Cable conductor size AWG #10 maximum. Each pair for extension cables supplied complete with one in-line coupler to permit cable linking.
  - c. Acceptable Product: Neutrik "SPEAKON" Model NL4FC with NL4MM coupler.
- 4. Wall or Panel Receptacles: Airtight connector compatible with above cable connectors, size 26mm W x 3mm H. Contacts wired with Faston connectors (not soldered).
  - a. Acceptable Product: Neutrik "SPEAKON" Model NL4MP with Faston connectors.
- 5. Video Receptacles:
  - a. Insulated, feed-through BNC panel jack with beryllium copper outer conductor spring for use with Series 59-type cables.
  - b. Cable termination: BNC.
  - c. Acceptable Products:
    - 1) Trompeter UBJ28.
    - 2) Kings KC-99-54.
    - 3) ITT Pomona 3846.
    - 4) Canare BCJ-JR with IU-7/16 panel isolation bushing.
- 6. Recessed Video Receptacles:
  - a. Insulated, feed-through BNC panel jack in recessed housing to resist damage to connector.
  - b. Impedance: 75 ohms.
  - c. Cable Termination: BNC
  - d. Acceptable Products:
    - 1) Canare BCJ-JRU.
    - 2) Equivalent.
- 7. BNC Video Cable Connectors:
  - a. BNC type for terminating video cable in conduit or video extension cables. Crimp connector with beryllium copper outer conductor spring and captive center pin, exceeding MIL-C-39012,A.
  - b. For Belden 8281 type cable.
    - 1) Acceptable Products:
      - a) Kings KC-59-299 (use KTH-1000 crimp tool, KTH-2012 die, and KTJ-43 and KTD-30 trim jigs).
      - b) Belden BNC0081 (use 9CRT012 crimp die).
      - c) Trompeter UPL-220-016.
  - c. For Belden 8281A type cable.
    - 1) Acceptable Products:
      - a) Kings 755-48-9 (use KTH-1000 tool, KTH-2178 die, and KTJ-43 and KTD-406 trim jigs).

- b) Belden BNC0082 (use 9CRT078 crimp die).
  - d. For Belden 8279 type cable.
    - 1) Acceptable Products:
      - a) Kings KC-59-397 (use KTH-6000 crimp tool, KTH-6029 die, and KTJ-134 and KTD-26 trim jigs).
      - b) Belden BNC0079 (use 9CRT026 crimp die).
      - c) Trompeter UPL-220-019.
  - e. For Series 59-type cable.
    - 1) Acceptable Products:
      - a) Kings KC-59-294.
      - b) Belden BNC0041 (use 9CRT0022 crimp die).
      - c) Trompeter UPL-220-013.
      - d) Canare BCP-C4 with one TC-0 crimp tool and TC-D-4C die.
  - f. For Belden 1505A type cable.
    - 1) Acceptable Products:
      - a) Kings 2025-51-9.
      - b) Trompeter UPL-220-014.
  - g. For Belden 1506A type cable.
    - 1) Acceptable Products:
      - a) Kings 2025-53-9.
      - b) Trompeter UPL-220-023.
- 8. RCA type connector for Series 59-Type Video Cables:
  - a. 75 Ohm true impedance matched RCA type connector.
  - b. Crimps to any Series 59-type cable.
  - c. VSWR 1.1 or less to 200 MHz.
  - d. Fully captive gold plated center pin.
  - e. Nickel plated brass body with Beryllium copper outer contacts.
  - f. Acceptable Products:
    - 1) Canare RP-C4 series with TC-1 Crimp tool and TCD-series crimp die.
    - 2) Equivalent.
- 9. Normalled Video Receptacle:
  - a. BNC panel jack with built-in switch activated by insertion of BNC connector.
  - b. Impedance: 75 ohms.
  - c. Acceptable Products:
    - 1) TE SVJ-2T.
    - 2) Equivalent.
- 10. "F" connector for Series 59-Type Video Cables:
  - a. 75 Ohm true impedance matched "F" connector compatible with the specified cable.
  - b. Acceptable Products:
    - 1) Gilbert
    - 2) Trompeter
    - 3) T&B
- 11. S-Video to Y/C Adapter:
  - a. Adapts din-type S-Video output cable to separate Y/C coaxial video cables.
  - b. Acceptable Products:
    - 1) Extron SVHSx-BNCy.
    - 2) Equivalent.
- 12. IP Control/Data/Audio and Video Transport Connectors:
  - a. RJ-45 Receptacle:
    - 1) Refer to Tel/Data specification for requirements.
    - 2) Acceptable Products:
      - a) Refer to Tel/Data specification for acceptable products.
  - b. RJ-45 Modular Plug:
    - 1) Refer to Tel/Data specification for requirements.

- 2) Acceptable Products:
  - a) Refer to Tel/Data specification for acceptable products.
13. Hybrid Fiber Optic Connectors:
  - a. SMPTE 304 Receptacle
    - 1) Lemo EBW.3K.93C.TLC with fiber optic contacts
    - 2) Canare FCFR
    - 3) Approved equal.
  - b. SMPTE 304 Plug
    - 1) Lemo FGW.3K.93C.CLMTxxZ with bend relief and fiber optic contacts
    - 2) Canare FCM
    - 3) Approved equal.
14. Singlemode Optical Fiber Connectors - LC:
  - a. Refer to Tel/Data specification for requirements. If none exist, use the following:
    - 1) Small form factor, fitting in the same size opening as an RJ-45 connector.
    - 2) Duplex, handling one pair (two elements) per connector.
    - 3) Blue in color.
    - 4) Compatible with both 900 micron buffered strands and 250 micron loose tube strands.
    - 5) Maximum insertion loss, of mated pair, less than 0.5 dB at acceptance.
    - 6) Minimum return loss of greater than or equal to 50 dB.
    - 7) Durability better than 500 matings, with a maximum increase in insertion loss of not more than 0.2 dB.
    - 8) Meets ANSI/TIA/EIA 568-C.3 and ISO 11801 standards.
  - b. Acceptable Products:
    - 1) Refer to Tel/Data specification for requirements. If none exist, use the following:
    - 2) Commscope
    - 3) Corning
    - 4) BerkTek
    - 5) Approved equal.
15. Singlemode Optical Fiber Connectors - ST:
  - a. Refer to Tel/Data specification for requirements. If none exist, use the following:
    - 1) Boot color: Blue in color.
    - 2) Nominal fiber outer diameter: 125 micron.
    - 3) Maximum insertion loss, of mated pair, less than 0.5 dB at acceptance.
    - 4) Minimum return loss of greater than or equal to 50 dB.
    - 5) Durability better than 500 matings, with a maximum increase in insertion loss of not more than 0.2 dB.
    - 6) Meets ANSI/TIA/EIA 568-C.3 and ISO 11801 standards.
  - b. Acceptable Products:
    - 1) Refer to Tel/Data specification for requirements. If none exist, use the following:
    - 2) Commscope
    - 3) Corning
    - 4) BerkTek
    - 5) Approved equal.
16. HDBaseT Copper Connectors:
  - a. Shielded RJ-45 compatible with Category 6A cable.
  - b. Acceptable Products:
    - 1) As recommended by the HDBaseT electronics manufacturer.
    - 2) Approved equal.
17. HDBaseT Fiber Connectors:
  - a. LC or as required by HDBaseT electronics.
  - b. Acceptable Products:
    - 1) As recommended by the HDBaseT electronics manufacturer or approved equal.

## EXECUTION

## 2.03 GENERAL

- A. All types of equipment installed by competent workers at locations shown on the drawings in strict accordance with approved shop drawings and manufacturer's instructions.
- B. All delivered equipment, except portable equipment, firmly fastened or held in place. "Delivered equipment" includes loudspeakers, enclosures, amplifiers, cables, etc. Apply a minimum safety factor of four (4) times the load for all equipment fastenings and supports.
- C. Take necessary precautions to prevent and guard against electro-magnetic and electro-static hum and to install the equipment to provide safety for the operator.
- D. Protect all equipment, including patch panels, connectors, receptacles, racks, consoles, and video projectors, from construction dust and debris until final acceptance of the system.

## 2.04 INTEGRATION/INSTALLATION

- A. Conformance to Existing Facility Standards
  - 1. Wherever possible provide equipment, finishes, and interfaces similar in nature to systems already in use by the Owner. Provide uniform functionality and operation to enhance ease of use and minimize instruction. Provide uniform finish and equipment to enhance the aesthetic unity of systems facility wide, and to improve end-user familiarity with equipment.
  - 2. Equipment Integration:
    - a. New Equipment: Unless otherwise specified, supply only new equipment, parts and materials, and protect all equipment from construction dust and debris until final acceptance.
    - b. Equipment Handling and Wear: Operate specified equipment only as required for testing, as part of the installation procedure.
    - c. Single Source: The provision of all manufactured components, installation, wiring, and testing is the responsibility of a single audiovisual systems contractor.
    - d. All equipment and installations under this Specification shall conform to the following:
      - 1) ANSI/NFPA 70 - National Electrical Code.
      - 2) ANSI/IEEE C2 - National Electrical Safety Code
      - 3) ANSI/TIA Standards 568-C, 569 and 607
      - 4) IEEE/ANSI 142-2007 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
  - 3. Equipment Quantities:
    - a. Determine and provide the quantities of installed equipment based on the Bid Documents including the plans, functional diagrams, riser diagrams, and specification.
    - b. Quantities of portable equipment are indicated in schedules contained in the drawings or specifications.
  - 4. Engineering and Documentation:
    - a. The system drawings indicate the general layout of the various items of equipment and their functional relationships. Layout of equipment, accessories, and conduit systems are diagrammatic unless specifically detailed and do not necessarily indicate every item or parameter required for a complete installation.
    - b. The AV Contractor shall provide any incidental equipment needed in order to result in a complete and operable system even if not specified or shown on drawings without claim for additional payment.

## B. Labels

1. Dry transfer, "Dymo", or other types of adhesive labels not acceptable
2. Except where otherwise specified label as shown on drawings, and as specified, each item of rack-mounted equipment and all switches, controls, and receptacles
3. Switch and Control Panels: Constructed of engraved and filled anodized aluminum plates. Minimum 1/8" plate thickness - Dry transfer or other types of adhesive labels not acceptable
4. Rack-Mounted Equipment: Labels constructed of engraved and filled plastic laminate engraving stock. Designate function and input and output line(s) or loudspeaker(s) served by labeled equipment. Key all designations to system functional and patch panel diagrams. Where possible, mount labels on blank panel directly above corresponding component. For modular equipment, provide label on inside of mainframe door identifying type of module for each slot (unless there is only one type) and gain setting as established at final checkout.
5. Identification Panel: See drawings for layout and nomenclature. AV Contractor is responsible for completing all bracketed items with the appropriate project-specific information.
6. Branding and Recognition: Identification of the contractor, or use of contractor logos or similar "trademarks" or "signatures" (including but not limited to touch panel graphics and color schemes, silk-screened or engraved corporate logos, copyrighted fonts, and/or custom emblazoned panels) is strictly forbidden except where explicitly indicated within the bid documents. Any unauthorized use of these marks will be rejected.
7. Receptacles: Engrave and fill receptacle label directly on mounting plate as indicated on drawings.
8. Patch Panels: Labels for jacks constructed of engraved and filled plastic laminate engraving stock or printable composition material with clear plastic cover. Labels for jack rows constructed of engraved and filled plastic laminate engraving stock. Paper strips may be used as temporary labels only.
  - a. Label jacks with functional description of jack ("Main Cluster EQ Out", "Console Mic Input 4", etc.)
  - b. Color-code jack labels with different colors for microphone level jacks, input and output jacks for recording/playback equipment, miscellaneous devices such as pads or multiples, and other line-level jacks.
9. Identify all wires and cables at every termination and connection point in accordance with INFOCOMM F501.01:2015 Cable Labeling for Audiovisual Systems using the specified cable markers, unless otherwise instructed by the Owner. Use a numbering scheme that identifies all cables terminating at patch panel jacks with the patch bay row and jack designation; use A, B, and C suffixes to distinguish multiple cables terminating at the same jack. Submit proposed numbering scheme for approval prior to installation.
10. Identify switches, relays, terminal blocks, etc., with reference numbers keyed to the as-built wiring diagrams.
11. Room numbers appear on the contract documents for reference only. All labels shall reflect the Owner's final room designations.
12. All labels and legends shall be as approved on shop drawings.

## C. Racks, Cables, Connectors, and Miscellaneous Equipment

1. Wiring and Interconnections:
  - a. General:
    - 1) Exercise care in wiring to avoid damage to cables and equipment.
    - 2) Make all joints and connections with rosin-core solder or approved mechanical connectors, except mechanical connectors are NOT acceptable on microphone lines. Connections to transformer leads for distributed loudspeakers may be made using properly-sized wire nuts or nylon-insulated pigtail crimp connectors such as Waldom CE series. Wire nuts are not acceptable except at individual loudspeakers.
    - 3) All connections to screw-type terminals shall be made using spade lugs. Bare or tinned wire is not acceptable.
    - 4) All connections to lugless compression-type screw terminals shall be made using bare wire only. Do not tin wire.
    - 5) All wiring executed in strict adherence to standard broadcast practices. This includes:
      - a) Dress cables in conveniently sized bundles, combed into parallel runs, either laced or banded with sufficient plastic ties.
      - b) For equipment mounted on glides, or otherwise requiring servicing from the front of the rack incorporate a cable "service loop" of sufficient length to permit the equipment to be pulled forward from the rack for servicing.

- c) Support cables and bundles with sufficient plastic ties and support bars to ensure that no strain is placed on any connections or connectors.
- d) Organize cables and cable bundles behind patch bays to permit easy access to the patch panels to add or remove cables.
- e) Place cable markers 3"-5" back from video connectors to permit easy viewing. Do not bind markers into cable bundles.
- 6) All audio signal lines carried by twisted-pair cable and switched with two poles per line unless noted otherwise. Do not tie one side of audio line to other audio lines.
- b. Grounding:
  - 1) Ground equipment, racks, and audio line shields to independent audio system ground ONLY as shown on drawings. If not shown on drawings, ground case of power striplines in equipment racks to the racks and directly to isolated ground buss in the power panel or to power system ground at the building AC service entry only.
  - 2) Ground all conduits ONLY to power system ground. Insulate all conduits and electrical boxes from sound system, including equipment racks and audio system ground.
  - 3) Insulate all conductors in conduit, including shields, from the conduit, back boxes, and from each other for the entire conduit length.
- c. Equipment Racks:
  - 1) Install equipment in racks to permit access to all equipment for service. Transformers, relays, terminal blocks, etc., mounted in rear of racks behind other equipment shall not prevent access to equipment connections or shall be mounted on hinged panels to permit access.
  - 2) Wire all racks completely in the shop. No internal rack wiring to be done on the job site.
  - 3) Install equipment in racks with ventilating panels as required to provide adequate ventilation and according to equipment manufacturer's recommendations.
  - 4) Connect all microphone, DC control, and line level cables to equipment racks via specified audio terminal blocks. External lines to patch bay terminated directly on patch bay terminal blocks.
  - 5) Connect loudspeaker lines with equipment racks via specified terminal blocks. Use spade lugs if barrier strips are used. Do not buss commons together. Do not ground.
  - 6) No signal or control lines shall leave a rack without connecting via terminal blocks.
  - 7) Provide unused panel space with blank or ventilating panels as shown on drawings.
  - 8) Locate free-standing racks as indicated and to provide access to rear.
- d. Conduit:
  - 1) Run all lines in metallic conduit or wireways unless otherwise indicated. Run microphone level, line level, loudspeaker level, and DC control wiring each in separate conduit.
  - 2) Do not locate AC power lines in conduit containing audio or video lines.
  - 3) Do not splice lines in conduit.
- e. Exposed Cables:
  - 1) Line level or mic level lines exposed above countertops (such as those lines serving mixing consoles, program source equipment, etc.) shall be rubber-jacketed, AWG #20 two conductor with braided shield such as Belden 8412 or equivalent. Plastic or vinyl jacketed cables are not acceptable.
- f. Receptacles:
  - 1) Provide finish sample for approval by Architect.
  - 2) Wall-mounted receptacles in metal boxes at building standard receptacle height unless otherwise indicated.
  - 3) Floor-mounted receptacles in flush floor boxes with flush lids.
- g. Video Receptacles:
  - 1) Install feed-through receptacles to mounting plates with insulating washer and sleeve to electrically isolate the receptacle from the electrical box and conduit.
  - 2) Punch receptacles with "D" hole to prevent receptacle rotation within hole.
- D. Microphone Equipment
  - 1. General:
    - a. Excluding wireless microphones, each portable microphone provided with case, stand adapter and min. 15-ft. cable with attached XLR-type connector.



2. Cardioid Dynamic Hanging Microphone:
    - a. Locate in plan as shown on the drawings.
    - b. Locate to provide typical 6' working distance between microphone and talker; nominally  $\leq 10'$  AFF.
  3. Wireless Microphone Systems:
    - a. Use frequency band, as required by local and national standards.
    - b. Coordinate specific transmission frequencies such that transmitters do not interfere with other wireless microphone systems within the building.
- E. Amplifiers and Signal Processors
1. Gain Control Security:
    - a. Power Amplifiers: Provide each power amplifier with calibrated, stepped controls, which are provided with tamper-resistant covers or are located on the back or inside of the chassis (contact manufacturers for gain control security options). Shaft locks or caps are NOT ACCEPTABLE. Verify acceptability of gain control security provisions with Audiovisual Systems Consultant BEFORE ordering the amplifiers.
    - b. Signal Processing equipment: Signal processing equipment with front panel controls which are to be permanently adjusted (not normally adjusted by the operator), such as equalizers, limiters, and audio delays, shall be furnished with security panels or sub panel mounted behind blank panels. Provide plastic vision panels for viewing of indicators such as meters or clipping indicators.
  2. Compressor/Limiters:
    - a. Adjust to protect loudspeaker components from overdrive damage, and to prevent amplifiers from clipping.
  3. Levelers/AGC
    - a. Adjust so that all speech inputs are normalized to the same nominal signal level. Do not apply AGC to inputs used in music performances.
    - b. Do not apply AGC to recorded content so that dynamics are preserved.
  4. Loudspeaker Management
    - a. Configure all filters, crossovers, delays, and gain controls using the loudspeaker manufacturer's supplied parameters.
- F. Loudspeaker Equipment
1. Program Playback Loudspeakers:
    - a. Provide detailed shop drawings for the opening dimensions and installation of loudspeakers and for the coordination of finish trades.
    - b. Mount in locations shown on drawings.
    - c. Coordinate with General Contract personnel to achieve aesthetic results as directed by the Owner or Architect.
    - d. Refer all questions and/or decisions regarding installation and finish methods to the Architect and Consultant.
  2. Ceiling Loudspeaker Assemblies
    - a. Loosely fill all enclosures with nominal 1-1/2 lb. per cu. ft. density fiberglass.
    - b. Ceiling Enclosures: Enclosures supported directly from ceiling structure in an approved manner. Support directly by acoustical ceiling tile is NOT ACCEPTABLE. Assemblies for 12" loudspeakers or larger to be supported directly from building superstructure.
    - c. Flush and Surface-Mounted Ceiling Enclosures: Provide enclosures as required, located as indicated on drawings.
    - d. Finish grilles and any exposed components per Architect's instructions.
  3. Flown Loudspeakers
    - a. Provide detailed shop drawings for the installation of loudspeakers. Drawings must be stamped by a professional engineer registered in the project's jurisdiction and approved by the project structural engineer prior to installation.
    - b. Mount in locations shown on drawings.
    - c. Provide all clamps, aircraft cable, and miscellaneous hardware necessary to attach loudspeaker assemblies to building superstructure.
    - d. Coordinate with General Contract personnel to achieve aesthetic results as directed by the Owner or Architect.

- e. Refer all questions and/or decisions regarding installation and finish methods to the Architect and Consultant.
- G. Video Monitors
  - 1. Verify that sufficient blocking has been provided by the General Contractor.
  - 2. Mount in locations shown on drawings using universal wall and ceiling mounts as specified.
  - 3. Coordinate power and wall box locations with Electrical Contractor so they are hidden from view.
  - 4. Neatly dress all cables to be hidden from view.
- H. Cameras
  - 1. Set for Auto-Iris.
  - 2. Set ABL (auto black level) off.
  - 3. Set color temperature filter to setting 1.
  - 4. Set Gain to 0 dB.
  - 5. Determine a white-balancing procedure for normal use. Determine if an appropriate white area is available in each room or can be made available prior to each room use. If providing white surface for each day's use is difficult, evaluate the effect of using the preset 3200°K color temperature setting. Consult with Owner to confirm procedure suitability. Note that following camera shutdown, white balance, iris, and pedestal adjustments are stored in memory for a maximum of 12 hours. In the test results submission, report on findings.
  - 6. Set lens Macro to "OFF".
  - 7. Set horizontal and subcarrier phase for all cameras. Determine that all video signal parameters can be adjusted to within normal limits, with settings as described above.
  - 8. Coordinate pan/tilt/zoom preset requirements with Owner, and program as required.
- I. Videoconferencing Codecs
  - 1. Securely mount hard codecs in equipment racks, as shown on the drawings.
  - 2. Assist Owner's IT staff in the installation and configuration of soft codecs, as required.
  - 3. Coordinate videoconferencing management server or software requirements with Owner's IT staff.
  - 4. Coordinate codec network requirements, including IP addresses and firewall configuration, with Owner's IT staff.
- J. Assistive Listening System
  - 1. General:
    - a. Verify RF antennae, emitters, and induction loops will provide coverage throughout the intended areas. Notify the Audiovisual Systems Consultant immediately of any concerns.
    - b. Provide all receivers and accessories (ear speaker, neck loop, batteries, etc.), as specified. Coordinate turnover of all portable equipment with Owner.
  - 2. RF Systems:
    - a. Locate RF transmitters as shown on the drawings.
    - b. Use frequency band, as required by local and national standards.
    - c. Coordinate specific transmission frequencies such that RF transmitters do not interfere with other wireless systems within the building.
  - 3. IR Systems:
    - a. Locate IR emitters and modulators as shown on the drawings.
    - b. Provide detailed shop drawings for the installation of IR emitters/modulators.
    - c. Verify specified emitter transmission frequency will not be adversely affected by local natural and manmade light.
  - 4. Induction Loop Systems:
    - a. Provide detailed shop drawings for installation of the induction loop.
    - b. Coordinate removal/installation of floor finishes with General Contractor.

## 2.05 SOFTWARE

- A. Control System Software
  - 1. Graphical User Interface

- a. The Control System Graphical User Interface is the visual portion of the human interface of a touch control panel. This is the layout that the Owner and their users will operate the system by and use for navigating the various system features. Preview monitoring may also be contained in versions of the GUI.
  - b. Graphical User Interface (GUI) designs for all Audiovisual System control touch panels developed in accordance with the guidelines of the InfoComm International® “Dashboard for Controls Design Reference” and “Integrators Guide” for layout and flow principals.
  - c. Graphical User Interface designs shall conform to Owner’s graphic standards and guidelines for use of logos or other graphical treatments.
  - d. Coordinate and integrate requirements for lighting control presets with control panel scene recall where appropriate.
  - e. Coordinate and integrate requirements for motorized window covering and screen controls.
  - f. Set up of all video windowing software in multi-image processors whether in stand-alone units or within video projectors.
  - g. Set up of Codecs in coordination with the Owner’s videoconference and/or network support staff including any specific networking or line provisioning.
  - h. Coordinate with Owner’s data network administrator for all required IP address range and info for AV networked devices and supply any specific requirements for network parameters (MDO for switches, multicast for streaming, bandwidth and port settings for videoconferencing, etc.). Configure and record all final IP address information and supply final listing of devices and their information to Owner’s data network administrator.
  - i. Configure of all networked AV devices with appropriate settings and instruct Owner-designated personnel on how to access remotely for support of management. Tie all control system and networked AV peripherals into main Owner or specific management software package (either included in this scope or existing system) for remote control, management and support.
2. Processor Configuration Code
    - a. The Control System Processor Configuration Code is the programming code that provides control communication between the Control System and all of the Audiovisual Equipment components.
    - b. The Processor Configuration Code shall be developed by the Audiovisual Systems Integrator to enable Control System operation of all controllable device functions, whether or not those functions are made available through the GUI.
  3. Control System Software Programming
    - a. In order to develop Control System Software that is functional and understandable by the intended users it will be necessary for the Audiovisual Systems Integrator to provide “working” copies of software as it is being developed for review and comment by the Owner.
    - b. The Control System software programming process must be an iterative process that includes a minimum of three (3) iterative submittals prior to first beneficial use.
  4. Programming Rights:
    - a. Provide all Control System Programming to the end users upon completion and approval of system installation and integration.
    - b. Freely share programming graphics and blocks with the owner to ensure consistent facility-wide standards and system support. Project specific programming and graphics are not the exclusive property of the AV system contractor or programmer.
    - c. The Owner shall be granted a license in perpetuity for use.
    - d. All source code becomes the exclusive property of the Owner.
    - e. All source code changes must be fully documented. Updated programming (compiled and uncompiled hard and soft copy versions of code) must be updated and located at all equipment rack locations and for all equipment manuals.
    - f. Source code changes and/or additional programming will be warranted by the vendor for a period of 1 year with the Audiovisual Systems Integrator responsible for any required diagnosis and repair.
    - g. All manufacturers’ software operating system updates, bug fixes, patches, etc., shall be installed as part of the periodic system maintenance during the Warranty period.

- B. Archival System User Interface / Media Management
  - 1. Archival System User Interfacing shall be required for management of locally and/or remotely stored recorded media content. This may include, but not limited to:
    - a. Configuring of FTP transfer of locally stored materials to the designated server.
    - b. Configuring the Video on Demand (VOD) server to display all managed media content by user.
    - c. Configuring the database and front-end control page(s) for content preparation and recording.
    - d. Configuring system encoders and decoders
- C. Web-Based Hardware Interfaces
  - 1. Where applicable, Web-Based Hardware Interfaces may be required for remote management or configuration of Audiovisual System components. This may include digital audio mixing consoles, Web-Based camera controls, Web-Based GUI extensions. Integrator will provide technician level hardware interfaces customized for this project.

## 2.06 REFERENCES

- A. The following documents provide information regarding audiovisual industry “best practices,” including commonly accepted standards for design, installation, and performance of integrated audiovisual systems. The technical quality of the Audiovisual Systems Integrator’s work and the resulting performance of the Audiovisual Systems installed in the Project will generally be measured against the standards and practices delineated in these References.
  - 1. Audiovisual Best Practices: The Design and Integration Process for the AV and Construction Industry, Timothy Cape and Jim Smith; Fairfax, VA; International Communications Industries Association, 2005
  - 2. ANSI/INFOCOMM 4:2012, Audiovisual Systems Energy Management <http://www.infocomm.org>
  - 3. ANSI/INFOCOMM 3M-2011, Projected Image System Contrast Ratio <http://www.infocomm.org>
  - 4. ANSI/INFOCOMM 10:2013, AV Systems Performance Verification <http://www.infocomm.org>
  - 5. INFOCOMM 5M-201X, Display Image Size for 2D Content <http://www.infocomm.org>
  - 6. INFOCOMM A102.01:2015 Audio Coverage Uniformity <http://www.infocomm.org>
  - 7. INFOCOMM V201.02:2015 Direct View Display Image System Contrast Ratio <http://www.infocomm.org>
  - 8. INFOCOMM F501.01:2015 Cable Labeling for Audiovisual Systems <http://www.infocomm.org>
  - 9. INFOCOMM F502.01:2016 Rack Building for Audiovisual Systems <http://www.infocomm.org>

## 2.07 SYSTEM PERFORMANCE TESTS AND ADJUSTMENTS

- A. Test all equipment to verify conformance with manufacturer's performance specifications and with this specification.
- B. At a minimum, the following items shall be verified:
- C. Audio System Performance Reference Verification Item Numbers and Descriptions
  - 1. AP-100 – Emergency Muting
    - a. Verify that any required muting or operational change of the installed sound system(s) has been made in accordance with local regulations in the event of a life safety or similar emergency.
  - 2. AP-101 – Loudspeaker Zoning
    - a. Verify that loudspeaker zones are wired as defined in the project documentation.
  - 3. AP-102 – Alignment of Multiple Audio Source Levels
    - a. Verify calibration of permanent audio system inputs such that the difference between any input signal level after the first common gain adjustment meets the requirements of the project documentation.
  - 4. AP-103 – Audio Buzz and Rattles
    - a. Verify that no audible noise caused by improper installation of any equipment provided in completed system(s) is present.
  - 5. AP-104 – Audio Routes
    - a. Verify that all audio routes are tested from endpoint to endpoint via the appropriate midpoint(s) for operation and routing as defined in the project documentation.
  - 6. AP-106 – DSP Programming
    - a. Verify that all DSP-based products have been programmed as defined in the project documentation.
  - 7. AP-107 – Loudspeaker Physical Alignment

8. a. Verify that loudspeakers are placed and aimed as defined in the project documentation.  
AP-108 – Loudspeaker Polarity
9. a. Verify that all loudspeakers have correct polarity as defined in the project documentation.  
AP-109 – Loudspeaker Time Alignment
10. a. Verify that loudspeaker time alignment performs as defined in the project documentation.  
AP-110 – Phantom Power
11. a. Verify that phantom power is provided at the correct voltage and correct locations as defined in the project documentation.  
AP-111 – Loudspeaker Transformer Tap Setting
12. a. Verify the loudspeaker transformer tap setting in constant voltage systems is as defined in the project documentation.  
AP-113 – Assistive Listening Devices
13. a. Verify that all devices that are part of the assistive listening system have been tested as a complete end-to-end personal listening system. Verify that the assistive listening system complies with regulatory requirements and adheres to project documentation.  
AP-114 – Audio Coverage in Listener Areas
14. a. Verify that coverage of the audio systems in listener areas meets the performance requirements as defined in the project documentation. INFOCOMM A102.01:2015, *Audio Coverage Uniformity* should be used. Perform separate tests for all independent systems within the project, including but not limited to program sound, speech reinforcement, and show relay.  
AP-115 – Audio Dynamics
15. a. Verify use of audio dynamics, including but not limited to noise compensation, automatic gain control, gating, feedback suppression, compression, limiting, delays, and levelers meets the requirements defined in the project documentation.  
AP-116 – Audio Level Exceeds Background Noise Level
16. a. Verify that the audio level provided by the installed audio system exceeds the background noise level as defined in the project documentation.  
AP-117 – System Electronic Frequency Response
17. a. Verify that the electronic frequency response of the audio system is as defined in the project documentation.  
AP-118 – Audio System Equalization for Spectral Balance
18. a. Verify that the audio system equalization is in accordance with the acoustic response curves as defined in the project documentation.  
AP-119 – Audio System Latency
19. a. Verify that audio system latency meets requirements defined in the project documentation.  
AP-120 – Audio System Speech Reproduction at Listener Positions
20. a. Verify that the audio system provides speech reproduction (intelligibility) as defined in the project documentation.  
AP-121 – Audio System Total Harmonic Distortion
21. a. Verify that the total harmonic distortion of the installed audio system is as defined in the project documentation.  
AP-122 – Conferencing Audio Levels
22. a. Verify that in a conferencing audio application, the incoming and outgoing audio levels are checked and adjusted in the system as defined in the project documentation.  
AP-123 – Conferencing Echo Suppression Performance
23. a. Verify that a system with conferencing capability performs at nominal operating levels in a full duplex mode with echo and latency performance as defined in the project documentation.  
AP-124 – Loudspeaker Impedance
24. a. Verify that all loudspeaker circuits have the correct impedance as defined in the project documentation.  
AP-125 – Microphone Physical Alignment and Placement
25. a. Verify proper alignment and placement of microphones in the system as defined in the project documentation.  
AP-126 – Microphone Gain Before Feedback

- a. Verify that the speech reinforcement system is operating without feedback and at audio levels as defined in the project documentation.
- 26. AP-127 – Microphone Level Alignment
  - a. Verify calibration of microphone inputs so that the difference between any input signal level after the first common gain adjustment meets the requirements of the project documentation.
- 27. AP-128 – Multi-channel Loudspeaker System Output
  - a. Verify that the audio outputs of a multi-channel loudspeaker system are assigned correctly to designated outputs as defined in the project documentation.
- 28. AP-130 – Audio Reinforcement System Headroom
  - a. Verify that the audio system is capable of performing above nominal operating levels without distortion as defined in the project documentation.
- 29. AP-131 – Audio System Signal-to-Noise Ratio
  - a. Verify audio system electrical signal-to-noise ratio meets the minimum levels defined in the project documentation.

D. Video System Performance Verification Item Numbers and Descriptions

- 1. VP-100 – EDID Management Plan
  - a. Verify that the EDID (Extended Display Identification Data) management plan has been implemented as defined in the project documentation.
- 2. VP-101 – HDCP Management Plan
  - a. Verify that the HDCP (High-bandwidth Digital Content Protection) management plan has been implemented as defined in the project documentation.
- 3. VP-102 – Projected Display Physical Alignment
  - a. Verify that the combined installation of projector and screen provides a displayed image that is correctly aligned to the active projection screen surface without misalignment unless an alternative condition is specified in the project documentation.
- 4. VP-103 – Video System Pixel Failure Tolerance
  - a. Verify that all displayed images do not have pixel failures (bright or dead pixels) that exceed the requirements of the project documentation or the manufacturer's specifications.
- 5. VP-104 – Image Geometry
  - a. Verify that all displayed images are correctly focused, have the correct image geometry and are free from distortion (e.g., stretching, keystone, barrel/pincushion). Any requirements for projection mapping or image shaping to unusual surfaces should be validated in accordance with the requirements of the project documentation.
- 6. VP-105 – Displayed Image Performance
  - a. Verify that the components of the displayed image system(s) (projection or direct-view) perform(s) as required with relation to image size, viewing angles, sight lines, viewer locations and/or any other requirements as defined in the project documentation.
- 7. VP-106 – Colorimetry
  - a. Verify calibration of all video displays to ensure they display colors uniformly to a common reference standard as defined in the project documentation.
- 8. VP-107 – Multiple Resolution Performance of Video Displays
  - a. Verify that the system(s) accurately displays all resolutions required by project documentation on all displays within the system (i.e., no pixel shift, no geometric distortion, no artifacts from scaling, letterboxing, pillarboxing, or windowboxing).
- 9. VP-108 – Projected Display Brightness Uniformity
  - a. Verify that the combined installation of projector and screen provides a display to the viewer that meets the requirements of the project documentation.
- 10. VP-109 – Projected Image Contrast Ratio
  - a. Verify that the system conforms to the appropriate viewing category as defined in the project documentation. The testing methodology in ANSI/INFOCOMM 3M-2011 shall be used. The projected image contrast ratio shall be measured for all projected images within the system.
- 11. VP-110 – Test Video Routes

- a. Verify that all video routes are tested from endpoint to endpoint via the appropriate midpoint(s) for operation and routing required by the project documentation.
12. VP-111 – Video Camera Image and Operation
    - a. Verify that cameras, lenses, and pan/tilt systems operate as defined in the project documentation. Inspect the camera image through the full lens operation.
- E. Audio/Video System Performance Reference Verification Item Numbers and Descriptions
1. AVP-103 – Audio/Video Sync
    - a. Verify that audio/video synchronization is maintained to ensure the proper time alignment of signals during playback at the point of user experience or transmission as defined in the project documentation.
  2. AVP-104 – Radio Frequency Television Distribution
    - a. Verify that the radio frequency and satellite intermediate frequency distribution systems provide all services to all endpoints as defined in the project documentation.
  3. AVP-105 – Source Testing
    - a. Verify that the signal produced by a source typical of what will be used in normal operation of the system is routed through the system to applicable endpoints and produces the performance as defined in the project documentation. A test generator shall not be used for this verification item.
- F. Cable Management, Termination, and Labeling Verification Item Numbers and Descriptions
1. CABL-100 – Cable Bend Radius
    - a. Verify that cables are not bent beyond their minimum bend radius as specified in cable data sheet in order to maintain signal integrity as defined in the project documentation.
  2. CABL-101 – AV Connector Plate Input and Output Labeling
    - a. Verify that all AV connector plate inputs and outputs are labeled as defined in the project documentation.
  3. CABL-102 – AV Connector Seating
    - a. Verify that all AV connectors are correctly keyed, seated, and latched to respective connection points as defined in the project documentation. Conditions where physical parameters exceed the connector's ability to maintain full seating should be resolved as defined in the project documentation.
  4. CABL-103 – AV Connector Verification
    - a. Verify that all AV cable terminations are made securely and meet the recommendations of the connector and cable manufacturer(s), published standards, and requirements defined in the project documentation.
  5. CABL-104 – AV Equipment Power Cable Management
    - a. Verify that all AV equipment power cables are managed as defined in the project documentation. Verify that cables are managed in a uniform and acceptable manner so as not to compromise safety/OEM warranty, AV signal quality, and/or future field service.
  6. CABL-105 – AV System Cable Labeling
    - a. Verify that all AV system cables are identified by a unique ID as defined in the project documentation. Verify that this unique ID is displayed permanently at both ends of the cable, is legible, and is positioned where it can be seen without undue disturbance.
  7. CABL-106 – Cable Separation
    - a. Verify that both site and rack cables have appropriate separation according to signal type and level as defined in the project documentation.
  8. CABL-107 – Cable Supports
    - a. Verify that all cables are supported throughout their lengths as defined in the project documentation.
  9. CABL-108 – Cable Ties
    - a. Verify that, where appropriate, cable ties are used to secure the cables, are correctly tensioned, and that the correct type of cable tie(s) is used as defined in the project documentation.
  10. CABL-109 – Cables Bundled by Type
    - a. Verify that cables are only bundled together when their construction, signal type, and signal level are compatible and will not cause measurable crosstalk or interference between cables.
  11. CABL-110 – Cables Dressed

- a. Verify that cables are dressed to ensure that all rack and site cables are installed to provide serviceability, safety, and aesthetics as defined in the project documentation.
  12. CABL-113 – Termination Stress
    - a. Verify that all cable terminations have been completed and adequately supported to minimize stress on the termination point and/or connector.
  13. CABL-114 – AV Connector Plate Consistent Labeling
    - a. Verify that AV connector plates have consistent labeling throughout the project as defined in the project documentation.
  14. CABL-115 – AV System Cabling Verification
    - a. Verify that all cabling is the correct type and routed correctly from point to point as defined in the project documentation.
  15. CABL-116 – Cable Length Required for Serviceability
    - a. Verify that sufficient cabling is available so the device can be placed in a serviceable location as defined in the project documentation.
- G. Control Performance Reference Verification Item Numbers and Descriptions
1. CON-100 – Control System Communications
    - a. Verify that all control communications are tested from endpoint to endpoint via the appropriate midpoint(s) for operation and functionality as defined in the project documentation.
  2. CON-101 – Interfacing and Control of External Devices and Systems
    - a. Verify that AV control system interfaces to and from control systems provided by others conform to requirements as defined in the project documentation.
  3. CON-103 – System Response to Emergency Condition(s)
    - a. Verify that any required response of the installed audiovisual system(s) in the event of a life safety or similar emergency operates in accordance with local regulations and as defined in the project documentation. This item specifically excludes sound system response to an emergency condition, which is covered under item AP-100, Emergency Muting.
  4. CON-104 – Control System Automated Functions
    - a. Verify that all time-dependent or automated functions executed by the control system conform to requirements as defined in project documentation.
  5. CON-105 – Control System User Interface Performance
    - a. Verify that the control system is implemented in a manner consistent with the requirements as defined in the project documentation.
  6. CON-106 – Control System Response Time
    - a. Verify that the control system provides the user response time and maximum latency defined in the project documentation.
- H. System and Record Documentation Reference Verification Item Numbers and Descriptions
1. DOC-100 – Final Inventory of AV Equipment
    - a. Verify that all equipment has been delivered as defined in the project documentation.
  2. DOC-101 – Approval of Samples
    - a. Verify that samples of all equipment to be used as defined in the project documentation have been submitted for approval.
  3. DOC-102 – Delivered Product Against Samples
    - a. Where samples of products have been required for approval, verify that the products that are delivered are the same and of the same quality.
  4. DOC-103 – Wireless Frequency Licensing
    - a. Verify that the correct and valid wireless frequency licensing permits have been obtained for legal operation of the system.
  5. DOC-104 – Consultant's Testing
    - a. Verify that any consultant's testing requirements defined in the project documentation have been performed and approved.



6. DOC-105 – General Contractor’s Testing
  - a. Verify that any general contractor’s testing requirements defined in the project documentation have been performed and approved.
7. DOC-106 – Integrator’s Testing
  - a. Verify that any integrator’s testing requirements have been performed and approved as defined in the project documentation.
8. DOC-107 – Manufacturer’s Testing
  - a. Verify that any manufacturer’s testing requirements defined in the p r o j e c t documentation have been performed and approved.
9. DOC-108 – Owner’s Testing
  - a. Verify that any owner’s testing requirements defined in the project documentation have been performed and approved.
10. DOC-109 – Third-Party Testing
  - a. Verify that any third-party testing requirements h a v e b e e n p e r f o r m e d a n d approved as defined in the project documentation.
11. DOC-110 – Substantial/Practical Completion
  - a. Verify that a conditional acceptance of the project has been issued by the owner or owner’s representative, acknowledging that the project or a designated portion is substantially/practically complete and ready for use by the owner, however some requirements and/or deliverables defined in the project documentation may not be complete.
12. DOC-111 – As-Built Drawings Complete
  - a. Verify that a complete set of accurate as-built drawings indicating all AV devices, AV device locations, mounting details, system wiring and cabling interconnects, and all other details has been provided as defined in the project documentation.
13. DOC-112 – Audio System Test Reporting
  - a. Verify that the audio system test report has been completed and issued as defined in the project documentation.
14. DOC-113 – Control System Test Reporting
  - a. Verify that the control system test report has been completed and issued as defined in the project documentation.
15. DOC-114 – Final Commissioning Report and System Turnover
  - a. Verify that the final commissioning report has been completed, issued to the proper entity, and accepted as defined in the project documentation.
16. DOC-115 – Required Closeout Documentation
  - a. Verify that a complete set of as-built system documentation has been provided as defined in the project documentation.
17. DOC-116 – Software Licensing
  - a. Verify that the usage and ownership rights have been assigned as defined in the project documentation.
18. DOC-117 – User Manuals
  - a. Verify that manufacturer’s user manuals are delivered to the owner in a format defined in the project documentation (e.g., binders, PDFs), or dispose of the manuals in a responsible manner (recycling) if the owner specifies that they do not wish to receive the manuals.
  - b. Integrator- or programmer-created manuals and documentation shall be delivered to the owner in a format defined in the project documentation.
19. DOC-118 – Video System Test Reporting
  - a. Verify that the video system test report has been completed and issued as defined in the project documentation.
20. DOC-119 – Warranties
  - a. Verify that all warranties are activated and that all warranty details have been passed to the owner as defined in the project documentation.
21. DOC-120 – Final Acceptance
  - a. Verify that a final acceptance of the project has been issued by the owner or owner’s representative, acknowledging that the project is 100% complete, that all required deliverables, services,

project-specific verification lists, testing, verification and signoffs have been received, and that all requirements defined in the project documentation have been satisfied and completed.

I. Electrical Reference Verification Item Numbers and Descriptions

1. ELEC-100 – AV Equipment Connected to Proper Circuit
  - a. Verify that all AV equipment is powered from the designated power circuit and outlet as defined in the project documentation. No additional (non-AV) equipment should be connected unless permitted in the project documentation.
2. ELEC-101 – Grounding/Earthing
  - a. Verify that all elements of the AV system are correctly bonded to an electrical ground/earth in accordance with the requirements of the regulatory authority and as defined in the project documentation.
3. ELEC-102 – Mains Voltage Sub-Distribution Integrity
  - a. Verify that all electrical sub-distribution systems provided by the AV contractor in equipment racks, furniture, and similar structures meet local regulatory requirements for electrical integrity.
4. ELEC-103 – Power Sources
  - a. Verify that the sources of mains voltage AC power to be used for the supply of AV equipment are correct as defined in the project documentation and have been tested to the outlet in accordance with local electrical standards.
5. ELEC-104 – Power Sequencing
  - a. Verify that the power sequencing of devices is correct as defined in the project documentation.
6. ELEC-105 – UPS Operation
  - a. Verify that the uninterruptible power supply (UPS) is performing to the specifications as defined in the project documentation.
7. ELEC-106 – DC Power Distribution
  - a. Verify that all DC powered devices are receiving the proper voltage and current for normal operation.
8. ELEC-107 – Power Loss Recovery
  - a. Verify that the AV systems resume normal operation on the restoration of power following a hard electrical power outage. Power loss recovery shall include verification of the resumption state on power recovery. Resumption state shall be the control system start-up condition/start page (where applicable) and resetting all devices to a known state as defined in the project documentation.

J. Information Technology Verification Item Numbers and Descriptions

1. IT-100 – Content Delivery Network
  - a. Verify that the content delivery network (e.g., digital signage) is in place and provides the required connectivity for the required audio, video, and control systems.
  - b. Verify that all required content licensing has been acquired.
2. IT-101 – IEEE 802 Wireless Security
  - a. Verify that the wireless network is protected in accordance with the client/owner's information security policies from unauthorized access and provides the required connectivity for the audio, video, and control systems.
3. IT-102 – Network Bandwidth
  - a. Verify that the required network bandwidth is available for control, audio, video, and data as part of either a shared or a dedicated audiovisual network.
4. IT-103 – Network QoS (Quality of Service)
  - a. Verify that the required Quality of Service (QoS) is in place for audio, video, and data as part of either a shared network or a dedicated audiovisual network.
5. IT-104 – Network Security
  - a. Verify that the shared or dedicated network is secure as defined in the project documentation and accessible to suit the required audio, video, and control systems.
6. IT-105 – Telephony
  - a. Verify that any required telephony connections to the AV system are in place and connectivity is verified.
7. IT-106 – Unified Communications

- a. Verify that any connections to IT-based unified communication applications that will interface with the AV system have been planned for and integrated.
- 8. IT-107 – AV IP Address Scheme
  - a. Verify and document that all network-connected equipment has the correct IP address, subnet mask, hostname, and gateway configuration as defined in the project documentation.
- 9. IT-108 – IEEE 802 Wireless Networks
  - a. Verify that the wireless network configuration is correct and valid (e.g., channel no., SSID, TX power) in defined areas of use as defined in the project documentation.
  - b. Verify that there is adequate channel separation between any client wireless networks that are required to co-exist in the same area.
- 10. IT-109 – PoE (Power over Ethernet)
  - a. Verify that PoE (Power over Ethernet) devices are supplied with correct power required for normal device operation.
  - b. Verify under normal operations that the switch providing PoE has the capacity to power all of the devices that are connected to it.
- 11. IT-110 – Network Topology
  - a. Verify that the network for audio, video, and control is of a suitable topology to support the services to be delivered as defined in the project documentation.
- 12. IT-111 – Application Integration
  - a. Verify that the audiovisual and control systems have been integrated and have been fully configured with headend software, including monitoring and asset management; databases; web-based front ends; digital signage software and systems; content generation and distribution platforms; and appliances as defined in the project documentation.
- 13. IT-112 – Enterprise Management Tools
  - a. Verify that enterprise management tools such as central monitoring client/server or web-based applications have been installed and connected to all systems they are required to monitor or control as specified in the project documentation.
- 14. IT-113 – Identity Management
  - a. Verify that all systems-authentication credentials are configured correctly. Any temporary credential used during system installation and commissioning should be removed.
  - b. User and group authentication and authorization are verified based on the requirements from the project documentation. Connectivity with the central directory, database, or other identity authority should be verified.
- 15. IT-114 – Network Performance Under Full Functional Load
  - a. Verify that the network can provide the required operational performance to carry control, audio, video, and data under production load and at times of peak production load (refer to IT-102 Network Bandwidth).
- 16. IT-115 – Remote Access
  - a. Verify that remote access to AV and IT systems are configured as defined in the project documentation.
- 17. IT-116 – Remote Management
  - a. Verify that remote management tools such as virtual touch panels, internal web applications, or manufacturer’s applications are configured and functional as required by the project documentation and/or manufacturer’s specification.
- K. Operations and Support Reference Verification Item Numbers and Descriptions
  - 1. OP-100 – Software
    - a. Verify that all control programming code, DSP configuration files, and any other associated software have been provided as defined in the project documentation.
  - 2. OP-101 – Battery Management Plan
    - a. Verify that a battery management plan has been completed and supplied to the owner in the project documentation package.
  - 3. OP-102 – Content Management Plan
    - a. Verify there is a plan for managing the content to be delivered by the audiovisual systems, including the means to create content and update content when new information needs to be conveyed.

4. OP-103 – System Content Provided
  - a. Verify that any owner, vendor, or third-party-produced system content that is required for operations as defined in the project documentation has been supplied, loaded, and tested in the completed AV system.
- L. Physical Environment Verification Item Numbers and Descriptions
  1. PHYSE-113 – Protection of Installed Equipment
    - a. Verify that all elements of the AV system are free of damage.
  2. PHYSE-114 – Accessibility
    - a. Verify that all systems are accessible in accordance with regulatory requirements.
- M. Physical Installation Reference Verification Item Numbers and Descriptions
  1. PHYSI-101 – AV Rack Air Flow and Temperature Performance
    - a. Verify that the AV rack(s) provides the air flow as required in the project documentation.
    - b. Verify that the temperature in the AV rack has been measured and is within tolerances defined by manufacturers' guidelines and the project documentation.
  2. PHYSI-102 – Equipment Security
    - a. Verify that equipment is secured as defined in the project documentation.
    - b. Verify that all security systems, devices, and manufacturer security accessories are installed and verified to be operating as defined in project documentation.
    - c. Verify that keyed devices have been keyed as defined in the project documentation and devices requiring configuration have been configured as defined in the project documentation and are verified to be operating within specification.
  3. PHYSI-103 – AV Equipment Labeling
    - a. Verify that all AV equipment has been labeled in accordance with the requirements of the project documentation. All labeling must be consistent, durable, accurate, and visible without dismantling of sub-assemblies.
  4. PHYSI-104 – Plumb and Level/Square
    - a. Verify that all AV equipment has been installed, aligned, or angled correctly as defined in the project documentation. Level and plumb are the default requirement unless particular angles or other alignments are defined in the project documentation.
  5. PHYSI-105 – Site Security
    - a. Verify that all elements of the AV system are free from loss, damage, or tampering.
  6. PHYSI-106 – AV Equipment Location
    - a. Verify that AV equipment is installed at the location and/or in the rack or enclosure as defined in the project documentation. Equipment is installed per the elevation or other specification provided by the project documentation or the manufacturer's specification.
  7. PHYSI-107 – AV Rack Cleanliness
    - a. Verify that all components installed in AV equipment racks are free from dirt, dust, water, or any other element that would compromise the performance and/or longevity of the AV system.
  8. PHYSI-108 – Non-End-User Controls Protection
    - a. Verify that installed items with user-facing controls that are not intended for end- user access have been covered, disabled, or otherwise secured to prevent end- user operation.
  9. PHYSI-109 – Optical Components Cleanliness
    - a. Verify that all optical components, such as lenses and mirrors, are free from dirt, dust, damage, or markings that would compromise the optical performance of those system components.
  10. PHYSI-110 – Handling of Accessories Otherwise Undefined
    - a. Verify that all items that are pre-packaged with primary system equipment but have no documented/planned use in the AV system(s) are managed in accordance with the project documentation.
  11. PHYSI-111 – Turnover of Accessory System Elements
    - a. Verify that any equipment that may be considered portable and/or otherwise not specifically incorporated into the installed AV system(s) has been set up, configured, and tested.



## 2.08 FINAL ADJUSTMENTS AND ACCEPTANCE TESTS

- A. Upon approval of the contractor's test report, and at a time set by the Owner or Owner's authorized representative, perform final system adjustments and acceptance tests.
- B. The contractor's representatives performing these tests shall be thoroughly familiar with all details of the system, and shall include the field supervisor in overall charge during the course of the installation work.
- C. Budget eight (8) working hours for the performance of these tests and adjustments. If final acceptance is delayed beyond this period because of installation not in accordance with these specifications, pay for all additional time and expenses of Owner-designated observers during any resultant extension of the acceptance testing period.
- D. Measurement of frequency response, distortion, noise, or other characteristics may be performed on any item or group of items deemed necessary to determine conformity with specifications.
- E. Adjustments: Adjust the system as instructed by the Audiovisual Systems Consultant.

## 2.09 TRAINING

- A. The Owner may assign personnel to participate with the contractor during installation. Without delaying the work, familiarize the Owner's personnel with the installation, equipment, and maintenance.
- B. During tests and adjustments, permit the Owner's personnel to observe. When feasible explain the significance of each test.
- C. After the completion of FINAL ADJUSTMENTS AND ACCEPTANCE TESTS, provide (3) sessions of on-site training to the end-user to instruct them on the proper use of each system, including:
  - 1. Conduct a separate training session for each discreet system type installed.
  - 2. Explain operation of control systems and overall function of installed systems to staff selected by the Owner as "requiring general instruction".
  - 3. Explain operation of control systems, set-up and operation of individual pieces of equipment (including booth equipment), functions of overall systems, and rudimentary service guidelines to staff selected by the Owner as "requiring technician level instruction".
  - 4. If requested by the Owner, record these training sessions and provide them to the Owner for future reference by the Owner's personnel.
  - 5. After successful training, a repair sequence (schedule of responsibility, response tree, etc.) should be established with any "technician level" staff, designated by the Owner as responsible for audiovisual systems operation and maintenance, to expedite service calls.

## 2.10 WARRANTY

- A. Provide for the warranty of each delivered system under the following terms and exclusions:
- B. Basic Warranty
  - 1. Basic Warranty provided by the Audiovisual Systems Integrator shall include repair or replacement for one year from date of Final Acceptance on all Audiovisual Systems Equipment provided (including products having a manufacturer's warranty of less than one year) and all Audiovisual Systems Integrator workmanship. Basic Warranty shall be provided at no additional cost, except in case of obvious abuse. Consumable items such as lamps, batteries, tapes, etc. are not covered by Basic Warranty.
  - 2. During the Basic Warranty period the Audiovisual Systems Integrator shall:
    - a. Provide telephone support within 4 hours of a call requesting service.
    - b. Provide emergency service: Within 24 hours of a call requesting service not corrected by telephone support, restore the system to operation, replacing defective materials and repairing faulty workmanship. Make temporary repairs and provide loaner equipment at no charge if defective materials cannot be permanently replaced or repaired within this 24-hour time period. Repair or replace faulty items within 72 hours of on-site service or within manufacturers' specific repair program whichever is quicker.
  - 3. Audiovisual Systems Integrator shall not involve the Owner with removing, re-installing equipment, shipping or receiving equipment being repaired under Basic Warranty, nor shall the Owner be responsible for any shipping or freight charges associated with any item under warranty.

4. The Owner shall be copied with all paperwork related to any and all warranty work during the Basic Warranty period.
  5. The Basic Warranty period will commence no sooner than the date of first beneficial use by the Owner and no later than the date of contract closeout.
  6. Paint and exterior finishes, fuses, lamps, projection lamps, and video picture tubes excluded from above warranties except when damage or failure results from defective materials or workmanship covered by warranty.
  7. The terms of individual equipment manufacturers' warranties are not diminished by the minimum warranty provisions specified above.
- C. Preventative Maintenance
1. Within the term of the one-year Basic Warranty period the Audiovisual Systems Integrator shall provide, at no additional cost, periodic Preventative Maintenance on the installed Audiovisual System to ensure proper ongoing maintenance and operation.
  2. A minimum of four (4) Preventive Maintenance visits shall be provided.
  3. Preventative Maintenance shall include, but not be limited to, the following:
    - a. Adjustments to video displays
    - b. Reviewing control system functionality
    - c. Any other maintenance and adjustments necessary to ensure that the Audiovisual System is in proper working order
  4. Any problems or issues noted by the users or other Owner representatives shall be documented and completely resolved at each of the scheduled visits.
  5. Preventative Maintenance Schedule
    - a. 90 days ( $\pm 15$  days) after the commencement of the Warranty Period.
    - b. 180 days ( $\pm 15$  days) after the commencement of the Warranty Period.
    - c. 270 days ( $\pm 15$  days) after the commencement of the Warranty Period.
    - d. 20 days ( $\pm 10$  days) before the end of the Warranty Period.
- D. Extended Warranty
1. The Audiovisual Systems Integrator may elect to propose to the Owner the offer of Extended Warranty coverage for the Audiovisual Systems. Extended Warranty shall be any optional warranty services offered by the Audiovisual Systems Integrator that expand on and complement the Basic Warranty coverage required by this Specification. Any provisions of Extended Warranty coverage shall not release the Audiovisual Systems Integrator from responsibility for performance of all requirements under the Basic Warranty coverage.
- E. Software Support
1. The Bidder shall also offer an annual Software Maintenance contract. This shall cover all software provided as part of this system and/or written for this system, and shall include routine upgrades to applications and operating systems. The Software Maintenance contract shall commence immediately after expiration of the warranty period and continue for three years. Maintenance visits will be four times per year and shall be scheduled to coincide with the periodic system maintenance of the system.

**END OF SECTION**