

## SECTION 27 41 16

## INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes

1. This Section includes the furnishing of all necessary labor, supervision, materials, equipment, accessories, and services to completely execute the provision and installation of products as described in this specification, including but not limited to:
  - a. Audio visual presentation, conferencing, and/or recording systems and components.
  - b. Audio visual equipment supports and mounts.
  - c. Control system and audio DSP programming.
  - d. Audio visual related furniture (equipment racks, lecterns, teaching stations, credenzas).
  - e. Audio visual system accessories, cables, connectors, adapters, plates, and panels.
2. This Standard is for Architects, audiovisual Design Consultants, and Project Design Team members involved in the infrastructure design of audiovisual systems.
3. Design professionals shall use the Design and Construction Standards defined in this document when designing audiovisual systems and related project specifications. This document is not intended to act as a complete bid specification.
4. AV system design, procurement and integration is handled under Cornell's Preferred AV Supplier program: <https://www.dfa.cornell.edu/procurement/buyers/commodities/audiovisual>

## B. Scope of Work

1. The Contractor's scope of work includes, but is not limited to:
  - a. The finalized system design engineering, furnishing of equipment, programming services, and installation labor for fully functional AV systems. The systems shall be delivered free of engineering, manufacturing, installation, and operating defects. They shall be engineered and installed for ease of operation, maintenance, and testing.
  - b. The Contractor shall complete all work which is shown on the drawings, outlined in these specifications, dictated by manufacturer suggested design and installation specifications, or reasonably implied as necessary to complete the contract for this project, which includes but is not limited to:
    - (i) General requirements outlined in Division 0 and 1 (if applicable)
    - (ii) Coordination with specifications outlined in related architectural, electrical, structural, and mechanical specification divisions, sections, and drawings
    - (iii) Construction means and methods
    - (iv) Preparation of submittal materials
    - (v) Sequencing of work
    - (vi) Coordination of work with other sections, stakeholders, and trades
    - (vii) Coordination of installation of Owner furnished items
    - (viii) Change and substitution procedures and criteria
    - (ix) Attendance at construction meetings
    - (x) Verification of job site dimensions and conditions
    - (xi) Installation and AV system programming practices
    - (xii) Testing requirements and systems verification
    - (xiii) Owner training
    - (xiv) Preparation of record documentation
    - (xv) Warranty services

## C. Related Documents

1. Drawings, basis of design narrative description, basis of design equipment lists, and general provisions of the Contract apply to this Section, as applicable.

## D. Related Specification Sections If Included By Others

1. Division 0 (Procurement and Contracting Requirements)
2. Division 01 (General Requirements)
3. Division 11 (Equipment)
4. Division 12 (Furnishings)
5. Division 23 (Heating, Ventilating, and Air Conditioning HVAC)
6. Division 26 (Electrical)
7. Division 27 (Communications)
8. Division 28 (Electronic Safety and Security)

**1.02 REFERENCES & DEFINITIONS**

## A. References

1. The workmanship and products shall comply with the following safety, certification, and industry standards. The following documents, or the versions closest in time prior to the release of this specification, form a part of this specification to the extent specified herein. Where the requirements of these documents conflict with the instructions herein, the Contractor shall notify the Owner for written clarification.
  - a. Cornell University AV System Design Standards Documents: <https://it.cornell.edu/integrated-av/av-standards>
  - b. Refer to other sections of CU Design & Construction Standards as appropriate: <https://fcs.cornell.edu/projects/design-standards-details/design-standards-details>
  - c. National Fire Protection Agency (NFPA), "National Electrical Code".
  - d. US Department of Justice, "2010 ADA Standards for Accessible Design".
  - e. Telecommunications Industry Association (TIA), "TIA Wiring Standards" (Includes the most recent versions of ANSI/TIA-568-0, ANSI/TIA-568-1, ANSI/TIA-568-2, ANSI/TIA-568-3, ANSI/TIA-568-4, TIA-569, ANSI/TIA-570, TIA-598, ANSI/TIA-606, TIA-607, TIA-758, TIA-526-7 and TIA-526-14).
  - f. IEEE, "IEEE Standard 142 Recommended Practice for Grounding of Industrial and Commercial Power Systems".
  - g. AVIXA (formerly InfoComm International) Standards:
    - (i) ANSI/AVIXA 10:2013 Audiovisual Systems Performance Verification Standard
    - (ii) AVIXA A102.01:2017 Audio Coverage Uniformity in Enclosed Listener Areas Standard
    - (iii) ANSI/AVIXA 3M-2011 Projected Image System Contrast Ratio Standard
    - (iv) ANSI/AVIXA 4:2012 Audiovisual Systems Energy Management Standard
    - (v) AVIXA ANSI-J-STD-710 Audio, Video and Control Architectural Drawing Symbols Standard
    - (vi) AVIXA F501.01:2015 Cable Labeling for Audiovisual Systems
    - (vii) AVIXA F502.01:2018 Rack Building for Audiovisual Systems
    - (viii) AVIXA V202.01:2016 Display Image Size for 2D Content in Audiovisual Systems
    - (ix) ANSI/IES/AVIXA RP-38-17 Recommended Practice for Lighting Performance for Small to Medium Sized Videoconferencing Rooms
  - h. Building Industry Consulting Service International (BICSI), "Telecommunications Distribution Methods Manual".
  - i. ANSI/BICSI 007-2020, "Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises".

- j. National Institute of Building Sciences, “Unites States National CAD Standard”.

**B. Abbreviations, Acronyms, and Definitions**

1. AFC: above finished ceiling.
2. AFF: above finished floor.
3. AV: audio visual.
4. AVC: audio visual contractor.
5. Contractor: the contractor bidding on this section to act as the audio visual vendor, programmer, and installer.
6. DSP: digital signal processor.
7. EC: electrical contractor.
8. EMT: electrical metallic tubing (conduit).
9. Furnish: to supply and deliver to the project site, ready to install.
10. GC: general contractor.
11. HVAC: heating, venting & air conditioning.
12. ID: inner diameter (conduit).
13. Install: to place in position for service or use.
14. IWE: included with equipment.
15. KO: knock out.
16. LV: low voltage.
17. LVC: low voltage controller.
18. NIC: not in contract.
19. NTS: not to scale.
20. OC: on center.
21. OD: outer diameter (conduit).
22. OFCI: owner furnished contractor installed.
23. OFE: owner furnished equipment.
24. Provide: designed, engineered, furnished, installed, and tested by a party.
25. Shall: describes a mandatory task or item.
26. Should: used to advise, but not deem a task or item to be mandatory.
27. TBD: to be determined.
28. TYP: typical.
29. VIF: verify in field.
30. Will: informative statement.

**1.03 ADMINISTRATIVE REQUIREMENTS**

**A. Coordination**

1. Cornell University Project Manager and/or appointed designees are the approving authorities. The Contractor is cautioned to obtain in writing, approvals for changes relating to the published contract specifications and drawings from the approving authorities before proceeding with the change.
2. Should the Contractor at any time discover a discrepancy between this Section and the related project documents, with respect to significant variance between location, violation of code requirements, or any other discrepancies, the Contractor shall notify the Owner for clarification and shall not proceed with the work affected until this clarification has been made.
3. The Contractor shall ensure that all management, sales, engineering and installation personnel have read and understood the requirements of this specification, drawings, and related project documents before the systems are designed, engineered, delivered, and installed. Failure to examine any and all construction documents will in no way relieve the Contractor from the requirement of furnishing all materials and equipment, or performing any tasks that may be required to complete the scope of work in accordance with the Construction Documents. Neglect of these specified requirements shall not be accepted as reason for delay in the work or additional compensation.

4. The Contractor shall promptly notify the Project Manager in writing of any difficulties that may prevent proper coordination or time of completion of this work. Failure to do so shall constitute acceptance of construction site and indicate that the site is suitable in all ways for this work, except for defects that may develop in work of others after commencement of system installation.
5. The Contractor shall be required to coordinate all construction activity to eliminate impact on traffic and normal operations of existing tenants.
6. The Contractor shall provide a working project superintendent to oversee the work of their employees and subcontractors at the job site.

**B. Pre-installation Meetings**

1. A representative of the Contractor shall attend construction meetings at the job site, or electronically, if required by the Project Manager. This representative shall have the authority to make commitments on behalf of the Contractor.

**C. Sequencing**

1. The Contractor shall coordinate with other trades and interface with other base building systems to ensure proper integration and operation of AV systems. The Contractor should request from the Owner, General Contractor, or Architect complete project design drawings, specifications, and related project documents to coordinate their work with the work of others.

**D. Scheduling**

1. The Contractor shall submit a "Project Plan Submittal" to the Project Manager, as described in the "Submittals" paragraph of this specifications section. Work shall not commence without the approval of this Project Plan Submittal by the Project Manager, General Contractor, and the Owner. Contractor shall revise and keep the schedule current and accurate throughout installation and shall publish updated schedules as required.
2. The Contractor shall notify the Consultant in writing ten days before anticipated completion of milestones "On-site verification", "Final systems verification", or any other shop/site visits by the Consultant. The Contractor shall acknowledge that all rooms and systems specified for shop pre-build, installation, or verification meet all specified installation and setup requirements.
3. The Contractor shall coordinate with the General Contractor and other trades to establish AV room ready dates, and verification of the condition of rooms prior to on-site AV equipment delivery, storage, and installation.
4. The Contractor shall coordinate their work schedule to meet the anticipated first use of the AV systems by the Owner, with adequate time allowed for setup, verification, punch list correction, and owner training.

## **1.04 SUBMITTALS**

**A. General**

1. If applicable, submit under provisions of Section 01 33 00 (Submittal Procedures) and as required by other sections of the Specifications.
2. Unless directed otherwise in writing by the Owner's Representative, the Contractor is not authorized to proceed with the purchase, acquisition, fabrication, assembly, installation, or any work related to any systems or components until the submittals specified in this section have been approved by the Owner's Representative. Any purchase, acquisition, assembly, or installation of any systems or components without the Owner Representative's approval shall be subject to return and/or removal at the Contractor's expense.
3. Partial submittals and combined submittals will not be accepted.

4. If submittal materials are rejected by the Owner's Representative, the Contractor shall resubmit corrected materials within five (5) working days.
5. Approval of submittal materials by the Owner's Representative indicates that the use of the proposed materials or methods generally conforms to the contract documents, but does not relieve the Contractor from ultimate responsibility for the accuracy and completeness of details, dimensions, quantities, instructions for installation, safety precautions, or the performance of products or systems.
6. Deviations from the contract documents can be made only by approved change order, and unless the Contractor specifically indicates deviations from the contract documents in the submittal itself, approval by the Owner's Representative shall not constitute approval of the deviation.

**B. Submittal Packages**

1. Submittal packages to be provided by the Contractor:
  - a. "Project Plan Submittal":
    - (i) Create a proposed project timeline that includes all milestones listed in the "Scheduling" paragraph of this specifications section, as well as other significant milestones, activities, or deadlines (including those by other trades) that may impact the project schedule. Include scheduling details for shop rack/system assembly and testing, on-site cable installation and equipment delivery, on-site equipment installation, and all Consultant verifications. Indicate the sequence and anticipated dates of acquisition of major equipment and installation milestones.
    - (ii) Include a project team list that contains names and all contact information for the Contractor's Project Manager, Lead Engineer, Lead Programmer, Lead Installer, Site Supervisor, sub-contractors, and any other pertinent team members.
  - b. "Long Lead Time Equipment Submittal" includes a list of items that require longer lead time and shall be ordered before full project submittals are due and approved. Failure to include an item that may require long lead time shall not relieve the Contractor of the responsibility of furnishing said item to meet the project schedule. No equipment, materials, or furniture shall be purchased prior to approval of this submittal.
  - c. "AV Furniture Submittal" includes cut sheets, shop drawings, finish schedule describing all products that have a selection of multiple available finishes, and any requested finish samples for all AV furniture furnished by the Contractor. No furniture shall be purchased prior to approval of this submittal.
  - d. "Design Submittal" includes an equipment list and shop drawings for the proposed finalized systems design. Samples and product cut (specification) sheets need only be included for recommended substitutions. No equipment or materials shall be purchased prior to approval of this submittal. Shop drawings for the Design Submittal package shall include:
    - (i) Floor plan, reflected ceiling plan, section, and elevation drawings depicting audio visual device and related infrastructure locations, dimensioning, mounting heights, throw distances, and clearances.
    - (ii) Audio, video, control, and network data signal flow diagrams, including interconnections between AV systems and systems provided by others.
    - (iii) Conduit and raceway riser diagrams.
    - (iv) Elevation drawings for equipment racks, lecterns, credenzas, cabinets, consoles, tables, and carts.
    - (v) If required by the project, stamped structural engineering drawings showing detailed ceiling attachment and mounting method for flown speakers and subwoofers.
    - (vi) Details of panels, plates, cable labeling scheme, and designation strips, including details relating to engraving, terminology, finish and color. Floor box and table box internal layouts shall be included.
    - (vii) Equipment structural mounting details, including but not limited to ceiling/wall/floor mounting of all AV devices. Provide detail on installation method and all proposed attachment and other fastening hardware. Verify load ratings of all hanging components, including attachment hardware.

- (viii) Finish schedule describing all AV devices and products that have a selection of multiple available finishes.
- (ix) Furniture and millwork mounting and modification details and AV device mounting/layout.
- (x) Scaled, detailed and dimensioned drawings of all custom assemblies and fabricated items.
- (xi) Non-factory equipment modifications.
- e. "Programming Submittal" includes control system/DSP functional description (theory of operation), and user interface screen shots. Approval of this submittal may require the Contractor to host a meeting coordinating AV system programming with the Owner.
- f. "Network Provisioning Submittal" includes a chart listing AV equipment make, model, location, MAC address, serial number, and PoE requirements.
- g. "Closeout Submittal" shall include:
  - (i) Equipment list: The Contractor shall provide an equipment list for each room containing the following information for each piece of equipment/AV furniture:
    1. Make
    2. Model
    3. Location
    4. Serial number
    5. IP address
    6. MAC address
    7. Firmware version
    8. Manufacturer warranty end date
    9. Usernames & passwords
  - (ii) Software licenses
  - (iii) Warranty statements:
    1. The Contractor shall provide a statement describing the one year system warranty, as indicated in the "Warranty" paragraph of this specification section.
    2. Indicate warranty start and end dates, scope of warranty, and conditional limitations. Indicate excluded items.
    3. Indicate procedure for obtaining telephone support and onsite service. Include a list indicating Contractor's name, address, e-mail address and service department telephone number.
  - (iv) Maintenance and service contracts
  - (v) As-built record drawings:
    1. The Contractor shall provide as-built record drawings, which shall be based on updated/corrected shop drawings.
    2. The drawings shall document actual as-built condition of all inputs and outputs of all equipment correctly identified according to the markers installed on the interconnecting cables, equipment & room/area locations, and finalized equipment settings & adjustments.
    3. The Contractor shall electronically provide to the Owner Adobe PDF files of the as-built record drawings.
  - (vi) Programming software files (compiled and uncompiled code, custom modules, licenses):
    1. The Contractor shall provide the Owner with editable, electronic copies of the compiled and un-compiled programming code, custom/stock modules, graphics, licenses, and associated support files for control systems, audio DSPs, video switching/processing, and any other AV equipment that requires programming or software configuration.
    2. Creation and ownership of these items shall be regarded as work for hire and shall be the sole property of the Owner.
  - (vii) Keys for AV furniture and equipment, with a list describing their purpose
  - (viii) Spare parts, extra stock materials, and tools that were included with products furnished and installed for this project

**C. Product Data**

1. Product cut (specification) sheets shall not be submitted for products listed in Part 2 of this Section or attached equipment/product list.
2. Product cut sheets shall accompany all requests for product substitutions for any reason, and shall be submitted electronically in Adobe PDF format.

**D. Shop/As-Built Drawings**

1. The Contractor's shop drawings shall conform to the following:
  - a. Shop drawings shall be submitted electronically in Adobe PDF format.
  - b. Shop drawings shall be created with ARCH D (24"x36") sheet sizes.
  - c. Fonts shall be legible (suggested minimum 3/32" height on 24"x36" prints).
  - d. AV plans for indicating AV equipment layouts shall be scaled to be not less 1/8" = 1'0". Details for particular equipment mounting shall be scaled to be not less than 1/4" = 1'0".
  - e. Printed shop drawings (if requested by the Owner) shall be provided on ARCH D (24"x36") paper.

**E. Samples**

1. If requested by the project, the Contractor shall provide a sample of the finish on all AV furniture and for each item or type of material which is available in more than one color, finish, or style.
2. Consultant or Architect shall notify Contractor if any additional sample products are required for fit or finish coordination. Samples shall be provided by the Contractor at no additional cost to the project.

**1.05 QUALITY ASSURANCE****A. Electrical Components, Devices, and Accessories**

1. Shall have the listing of the Underwriters' Laboratories, Inc. and shall bear the labels attesting to UL listing, and types approved by the Municipal Departments having jurisdiction.
2. Listed and labeled as defined in NFPA 70 National Electric Code, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

**B. Qualifications**

1. The Contractor shall provide organization information with the bid, including:
  - a. Staff size (indicate full-time, part-time, or freelance staff for the office servicing this project, and exclude sub-contractors)
  - b. Staff certifications and training
  - c. Total number of offices
  - d. Identify the firm's primary business (audio visual sales/installation, security, etc.)
  - e. Number of years the firm has been involved in the programming, fabrication, assembly and installation of audio visual presentation, conferencing, and control systems of comparable size and quality.
  - f. Resumes for proposed project team members (project manager, project engineer, lead installer, and lead programmer) that include years of experience, project experience, certifications/training, and full-time/part-time/freelance/sub-contractor status.
2. The Contractor shall provide no less than three (3) references for projects within the past two years of similar size and scope. Reference information shall include:
  - a. Project name, address, and description indicative of similarities to this project
  - b. Name of primary contact, telephone number and email address
  - c. Design consultant (if applicable)

- d. Completion date
- e. Contract and change order amount
- f. Names of project manager, project engineer, lead installer, and lead programmer
- 3. The Contractor shall have at least five (5) years of experience in the programming, fabrication, assembly and installation of audio visual presentation, conferencing, and control systems of comparable size, magnitude and quality in regards to coordinating, engineering, testing, certifying, supervising, training, and documentation as specified for the subject job.
- 4. The Contractor shall be an authorized sales and service center for all listed components, or approved product offerings in the specification.
- 5. Upon request, the Contractor shall show written proof of contractual relationship or technical certification by the respective equipment manufacturers and shall be authorized by that equipment manufacturer to pass through the manufacturer's certification and equipment warranty to the Owner.

C. Certifications

- 1. The Contractor's personnel assigned to the systems shall carry valid and current industry certifications regarding the engineering, installation, operation and testing of audio visual technologies. Upon request, each Contractor shall provide formal written evidence of current industry certifications for their personnel as a part of their submittal.
- 2. At least one each AVIXA CTS-D and CTS-I shall be assigned to oversee the complete design, engineering, and installation of the system.
- 3. The Contractor's personnel assigned to this project shall be fully trained, qualified, and certified by the respective original equipment manufacturers on the engineering, installation, operation and testing of the systems. Upon request, each Contractor shall provide formal written evidence of current original equipment manufacturer's certifications for their personnel as a part of their submittal.
- 4. The individual(s) responsible for programming the control systems shall be a Crestron Certified Programmer with current certification credentials.
- 5. The individual(s) responsible for programming the audio DSPs shall be trained and certified by the DSP manufacturer, with current certification credentials.

D. Regulatory Requirements

- 1. Contractor and their sub-contractors shall be licensed as required by local regulations.
- 2. Contractor shall adhere to all local, state, and federal codes and laws.
- 3. If applicable, Contractor shall be solely responsible to possess or obtain all permits and certificates required to complete this project. Payment of all necessary fees and charges for inspections, permits, and other services required for the work are the responsibility of the Contractor.
- 4. Contractor and employees shall perform all work in compliance with current Occupational Safety and Health Administration (OSHA) guidelines and regulations.
- 5. Contractor shall adhere to the standards described in the "References" paragraph of this specification section.

## 1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements

- 1. The Contractor is responsible for assessing the conditions of the job site and facilities for delivery of materials and products. The Contractor shall confirm before delivery that hallways, stairways, passageways, doorways, rooms, entries, elevators, and foyers are of sufficient size to accommodate the passage and installation of the products and systems. Failure to do so may result in additional labor or the rental of specialized equipment to deliver equipment to installation locations at the cost of the Contractor.



2. The Contractor shall coordinate dates and times of deliveries with the Owner. Deliveries attempted outside of Owner approved days and times may be rejected by the Owner.
3. Projection screens shall not be delivered until the building is enclosed, other construction within spaces where screens shall be installed is substantially complete, and installation of screens is ready to begin.

**B. Storage and Handling Requirements**

1. The Contractor is responsible for assessing the conditions of the job site, and facilities for storage and handling of materials and products.
2. Transportation, parking, delivery and on-site storage of the products shall be the responsibility of the Contractor. The Contractor is also responsible for all transportation of personnel to and from the site.
3. On-site storage of the products and necessary tools shall be the responsibility of the Contractor.
4. Store projection screens in a dry, ventilated area, protected from exposure to harmful weather conditions, at temperatures greater than 40 degrees F and less than 80 degrees F.
5. Projection screens shall always be transported, handled, and stored in a horizontal position, never vertically. Screens shall always be stored and handled with the correct top up orientation, and never on their side or upside down. Handle projection screen materials with care in order to prevent damage.

**C. Packaging Waste Management**

1. The Contractor is responsible for the removal and disposal methods and cost of all packaging waste materials from any of the products.

**1.07 SITE CONDITIONS**

**A. General**

1. Refer to Division 1 (if available) of the construction documents for this project for coordination with other trades on this project.
2. The Contractor is responsible for assessing the conditions of the job site and facilities for installation of materials and products.
3. Coordinate all access to the site at all times with the General Contractor and the Owner.
4. Adhere to the safety standards and safety training requirements established by the General Contractor and the Owner before and while performing work on site.
5. Store products in a manner that will not interfere with others. Coordinate secured storage at the site with the General Contractor and the Owner.
6. Protect all work and products installed under this contract from damage by others.
7. Protect all existing work in place by others from damage by the Contractor, the Contractor's agents/sub-contractors, or any employees, agents or sub-contractors of the Contractor's vendors. The Contractor shall be solely responsible for the cost of repairing any/all damage to work in place by others.
8. The Contractor shall be responsible for replacing or repairing to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.
9. Keep areas around and inside of each piece of equipment free from dust, dirt, and debris throughout the project. Products that are not properly protected and maintained during installation shall be replaced at no cost to the Owner before final payment is made to the Contractor.

10. All products and materials stored at the Contractor's facility(s) or stored and/or installed at the project site shall remain the property of the Contractor unless ownership is specifically transferred in writing to the Owner. The Contractor shall be solely responsible for the protection of all products from damage, theft, or vandalism regardless of cause, until ownership is specifically transferred in writing to the Owner or the work described here-in is accepted by the Owner at the time of official turnover.
11. Failure to assess the site conditions shall in no way relieve the Contractor from the requirement of furnishing all materials and products, or performing any work that may be required to complete the work in accordance with the construction documents.
12. If this proposed work is to be accomplished in an existing occupied building, the Contractor shall make every effort to keep installation noise levels to a minimum. Contractor shall coordinate approved work times with the Owner, especially in cases where extreme or disruptive noise levels are expected, or electrical system shutdown is required. The Contractor should anticipate after hours work required if excessive noise levels are required.
13. Perform projection screen work when temperatures are greater than 40 degrees F.

## 1.08 WARRANTY

### A. Manufacturer warranty

1. The Contractor shall have a contractual relationship or technical certification by the respective products manufacturers and shall be authorized by that product manufacturer to pass through the manufacturer's certification and products warranty to the Owner.
2. The Contractor shall provide original product manufacturer's warranty documents to the Owner that certifies each item of equipment installed conforms to each original equipment manufacturer's published specifications.
3. Manufacturer's product warranties supplied with the products and which extend beyond the specified one year system installation warranty period shall be serviced by the Contractor.
4. Registration for all manufacturer's warranties supplied with the products shall be in the name of the Owner.

### B. Special warranty

1. The Contractor shall provide a "System Warranty" that includes warranty repair or replacement for one (1) year on all products and custom software programming provided by the Contractor (including products having a manufacturer's warranty of less than one year) and all Contractor workmanship at no additional cost to the Owner.
2. This System Warranty is not to cover vandalism, mischief, Owner or user misuse, or subsequent activities out of the control of the installing contractor. Consumable items such as lamps, batteries, recordable media, etc. are not covered.
3. The System Warranty Period shall commence upon the completion and Owner acceptance of final system verification, following execution and acceptance of all punch list items.
4. Warranties relating to the custom software programming shall apply only to the original, unmodified software, as provided by the Contractor in the Closeout Submittal, or programming modifications made by the Contractor during the warranty period.
5. The Owner shall have the ability to contact the Contractor and original equipment manufacturers for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. The Contractor and original equipment manufacturers shall provide this contact capability at no additional cost to the Owner.
6. All Contractor maintenance and supervisor personnel shall be fully qualified by the original equipment manufacturers and shall provide copies of current and qualified original equipment manufacturer training certificates and certification upon request.
7. During the System Warranty period the Contractor shall:
  - a. Provide telephone or email acknowledgment within 4 hours of the Owner reported issue.

- b. Provide on-site support within 48 hours of a call requesting service that was not corrected by telephone support.
- c. Repair or replace faulty items within 72 hours of on-site service or within manufacturer's specific repair program, whichever is quicker.
- 8. The Contractor shall not involve the Owner with the responsibility or costs of removing, re-installing equipment, shipping, or receiving equipment being repaired under warranty, nor shall the Owner be responsible for any shipping or freight charges associated with any item under warranty.

## PART 2 - PRODUCTS

### 2.01 GENERAL

- A. Acceptable products constituting the Basis of Design are listed in this Section, on the drawings, and in the attached equipment/product lists as an appendix to this specification Section.
- B. Specifications of products as set forth in this Section, on the drawings, and in the attached equipment list are salient and minimum requirements constituting the Basis of Design, unless otherwise stated, and shall not be construed as limiting the overall quality, quantity, or performance characteristics of items furnished in the system.
- C. As an appendix to this Section is the Consultant's good faith effort to provide equipment/product lists based on the drawings and specifications. However, Contractors are cautioned that the list may not be complete, may have discrepancies against the drawings, and may not indicate all pertinent information required to prepare an accurate bid.
- D. Product substitution deviating from the Basis of Design is allowed only by written consent of the Owner's Representative and only during the RFI period before the bid is received, even with "Approved equal" specified. When the Contractor recommends a product or an approved equal substitute for which there is a specification contained herein, that product shall meet or exceed the specification for that product.
- E. Where substitutions are warranted, the Contractor has the responsibility to select products that meet the requirements of this specification. The Contractor is advised, however, that other areas of the design may be affected by the Contractor's product selection. The Contractor is responsible for verifying that all products chosen by it, including substitutions, are compatible with each other as a holistic system, and with the products specified in the contract documents.
- F. Unless a specified product has been discontinued by the manufacturer, there shall be no product substitution after the issuance of the Contract Award, Notice to Proceed, or Purchase Order.
- G. Where a specified product has been discontinued by the manufacturer and/or replaced by a new model, the Owner's Representative may require submission of a demo unit of the new model for evaluation prior to acceptance as a substitute, at the expense of the Contractor.
- H. The Contractor is solely responsible for the completeness and accuracy of take-offs and bids. Determination of final quantities to meet the function of the design shall be the sole responsibility of the Contractor.
- I. The Contractor shall provide all options, accessories, power supplies, miscellaneous components, interconnections, terminations, fasteners, hardware, anchors, brackets, hardware, and other components necessary to meet the function of the design for proper installation and operation of all systems even if they are not specifically listed in the specifications.

- J. Each product to be supplied under this specification shall be new, under warranty, and the current model of a standard product of an original product manufacturer of record. B-stock, previously installed, refurbished, or used products shall not be provided on this project.
- K. The Contractor shall confirm with the Consultant the selected color and finish of all products with multiple choices.
- L. Applicable to projects awarded 8 months prior to installation date, prior to procurement of equipment and at 5 months before on-site installation of AV systems, the Contractor shall be responsible for reviewing approved equipment models and notifying the Owner of updated models from the time of the original bid. Products shall not be changed or procured without the written approval of the Owner.

## **2.02 OWNER FURNISHED PRODUCTS**

- A. Products installed by this Section and furnished by the Owner shall be identified by the design team.
- B. The Contractor shall coordinate with the Owner for the delivery, installation, setup, configuration, and testing of all Owner furnished items.

## **2.03 COMPONENTS**

- A. The Contractor shall refer to the appendix of this specification Section for Basis of Design equipment lists describing the make and model of all acceptable equipment, as well as refer to the TA series AV design drawings.

# **PART 3 - EXECUTION**

## **3.01 EXAMINATION**

- A. Verification of Conditions
  - 1. The Contractor shall assess the readiness and cleanliness of the site prior to product installation. This may include but not limited to installation by Others of blocking, structural supports, in-wall boxes, electrical service, conduit, raceway, electrical boxes, and data/telecom services.
  - 2. The Contractor shall provide written notification to the Owner's Representative of any problems impacting the Contractor's work. Failure of the Contractor to notify the Owner's Representative in a timely manner of incomplete, inadequate, unfinished, or otherwise unacceptable prerequisite work by other trades in the base building infrastructure shall not relieve the Contractor of the responsibility to complete the work under this contract.

## **3.02 PREPARATION**

- A. Protection of In-Place Conditions
  - 1. The Contractor shall not damage any adjacent areas that are not affected by this work or are not scheduled for change.
- B. Surface Preparation
  - 1. Existing finishes shall be protected with drop cloths, plastic covering, or other methods to protect them from damage, dirt, debris, and dust during installation.
- C. Demolition/Removal

1. Carefully remove all existing products not being reused.
2. Coordinate with the Owner for salvage of all existing equipment and materials. All equipment and materials removed for demolition and not slated for salvage shall be removed from the site and deposited legally at a local fill accepting those types of materials, at the expense of the Contractor.
3. Noise levels during demolition shall be kept to a minimum or after hours work shall be coordinated with the Project Manager.

### 3.03 INSTALLATION

#### A. General

1. The Contractor shall install all systems to comply with NFPA 70 National Electric Code, and local/state codes, ordinances, regulations, recommendations, guidelines and directives, in a manner which complies with accepted industry standards of good practice, the requirements of this specification, and in a manner which does not constitute a life or physical safety hazard.
2. Comply with manufacturer's written data and specifications, including product technical bulletins, installation instructions, and technical data sheets.
3. Install all products at locations, heights, and specifications indicated on Drawings.
4. Coordinate product placement with placement of other ceiling and wall mounted components, including but not limited to lighting fixtures, HVAC duct & equipment, fire alarm/suppression systems, conduit, pipes, and chalk/white boards. Notify the Owner's Representative of conflicts prior to product installation.
5. The Contractor shall be solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.
6. The installation of AV equipment shall adhere to the standards dictated within the "2010 ADA Standards for Accessible Design".
7. Products shall be installed plumb and square unless specifically detailed otherwise.
8. Permanently installed products shall have proper alignment, sufficient ventilation and cooling, and adequate access for maintenance.
9. Products shall be fully adjusted, optimally aligned, functionally tested, and performance tested from end-to-end under all programmed conditions.
10. All products, except that designated as movable, portable or loose products, shall be secured and permanently attached to racks or structure in a manner which will require the use of a tool or key for removal.
11. Equipment shall not be attached or secured with only the use of Velcro tape or other adhesive products that may peel off over time.
12. All supports shall meet or exceed the load requirements of the intended application with a minimum safety factor of five. Support hardware shall have a minimum of SAE Grade 8 load rating.
13. All products installed on walls or ceilings shall be secured to structural or hard deck ceiling with safety tethers, and able to support the gross weight of the equipment plus a safety factor of five, in the event of mounting failure.
14. Where penetrations of fire-rated assemblies are involved, the Contractor shall seal penetrations with appropriate firestopping systems per Section 07 84 13 (Penetration Firestopping) and/or coordinated with the Project Manager.
15. The Contractor shall coordinate with stakeholders to investigate the presence of post-tension rods before drilling into concrete floors/ceilings.
16. The Contractor shall provide all tools, ladders, lifts, scaffolding, test equipment, required for installation.

#### B. Interface with Other Work

1. The coordination with other trades regarding AV related infrastructure requirements shall be the AV Contractor's responsibility. The AV Contractor shall review the electrical, architectural, structural, mechanical, data network, and other construction drawings and specifications to determine necessary coordination with other trades, and bring any discrepancies or additional needed scope to the attention of the Owner's Representative.
2. The AV Contractor shall coordinate AV related conduit, raceway, and cable tray sizing and routing with the Electrical Contractor.
3. The AV Contractor is responsible for interfacing the AV systems with each required building sub-system, and coordinating this work with the related trades. This may include (but not limited to) lighting systems, data network, mechanical window coverings, movable partitions, fire alarm systems, etc. The AV Contractor shall continually employ interfacing methods that are approved by the original equipment manufacturers and industry best practices.

C. Mounting, Rigging and Seismic Restraint

1. All overhead mounting or rigging installations shall comply with their manufacturer specifications. If custom mounting is required, approval of a Professional Structural Engineer at the submittal stage is required prior to installation.
2. Rigid and fixed mounting systems (brackets, tube and clamp, frames etc.) used for any piece of suspended equipment must have a safety cable attached between the suspended device and the superstructure used to support the mounting system. The size and construction of the safety cable, and attachment points must be suitable to support the weight of the equipment being restrained plus a safety factor of five.

D. Power

1. Power extension cords, power Y-cables, power splitters, triple taps, etc. may not be used for permanent installation of equipment.
2. Power strips may be used, but must contain a resettable circuit breaker. Power cables from power strips must be run directly to the outlet, not daisy chained to another power strip.
3. Equipment may not be plugged directly into power outlets. The Contractor is responsible for providing surge suppressing power strips containing a resettable circuit breaker for all equipment.
4. The Contractor shall provide power strips with right angle plugs for flat panel displays or other equipment with limited open space between the device and the power outlet.

E. Firmware and Passwords

1. Default passwords for all devices shall be changed by the Contractor to unique passwords and documented for the Closeout Submittal.

F. Labeling

1. Contractor's name and contact information may be displayed on a 1RU rack panel if space allows, and shall not replace a vent panel specified in project documentation.
2. Cable labels shall adhere to the "AVIXA F501.01:2015 Cable Labeling for Audiovisual Systems" standard.
3. Label type, text, and graphics shall be approved by the Consultant before fabrication of labeling, plates or other labeled items.
4. All labels shall be legible. Handwritten labels are not acceptable.
5. Provide permanent label on plug end of power cords of all rack mounted equipment identifying the associated equipment.
6. Provide labels for front panel input and output buttons of AV routers, switches, mixers, etc.
7. Provide text/graphics engraved directly on receptacle plates, panels, and rack panels.
  - a. Letters shall have contrasting fill color.

- b. Label all plate mounted connectors and receptacles as shown on approved shop drawings.
- 8. All cables shall be labeled with permanent labels at the terminals of the AV equipment and at each junction point.
- 9. The lettering on the cables shall correspond with the lettering on the as-built record drawings.
- 10. Provide wire labels on both ends of cable.

#### G. Cables and Wires

- 1. Cables and wires shall be provided in the same manner and use like construction practices that are identified and outlined in the NFPA 70 National Electric Code.
- 2. All structured cabling used on this project shall be rated for plenum use unless specified otherwise.
- 3. The Contractor shall select the cable type for correct operation of equipment. The Contractor is responsible for verifying that the cables used are recommended and approved by the original equipment manufacturers.
- 4. Wiring and cabling shall be properly supported, protected, labeled, and dressed.
- 5. Cables shall be contained or supported in conduit, raceway, cable trays, J-hooks, hangers, etc.
- 6. Include spare conductors as appropriate and as specified on drawings.
- 7. Do not make any in-line cable splices.
- 8. Use only cable pulling lubricants approved by the cable manufacturer.
- 9. Pull tension shall not be more than specified by the cable manufacturer.
- 10. A nylon pull string shall be installed with all cables installed in conduit.
- 11. Cables installed within conduit shall not exceed 40% fill. Contractor shall seek clarification from the Owner's Representative before exceeding 40% conduit fill.
- 12. Provide grommets or chase nipples at cable entry where conduit is not installed.
- 13. The Contractor shall take precautions to ensure that cabling is not kinked, compressed, or otherwise damaged such that performance is compromised.
- 14. Bend radius shall not be less than specified by the cable manufacturer.
- 15. Provide cable anchors for any cable or cable bundle larger than one inch diameter, permanently installed and not in conduit. Do not use sticky back cable anchors.
- 16. Cables and wires used in equipment racks or other AV furniture shall be formed into harnesses that are bundled and tied. Harnessed cables and wires shall be combed straight, formed, and dressed in either a vertical or horizontal relationship to equipment, controls, components or terminations. Harnesses with intertwined members are not acceptable.
- 17. Cables and wires shall be grouped according to service and industry best practices (i.e.: AC, grounds, signal, DC, control, etc.). Cables and wires shall be neatly formed and shall not change position in the group throughout the conduit run. Concealed splices are not allowed.
- 18. Separate, organize, bundle, and route wires or cables to restrict channel cross-talk or interference inside any enclosure.
- 19. This installation shall be accomplished with the use of zip ties and/or Velcro strips that will not damage or distort the cables or wires. No plastic zip ties shall be used on Category cable, only Velcro strips.
- 20. Provide a service loop for each cable that connects to equipment in racks or AV furniture. Service loop length shall be sufficient to allow one re-termination without removing cable ties.
- 21. All cables connecting to a movable lectern, cart, or desk shall be highly flexible cable, specifically designed by the manufacturer to be flexed repeatedly. Permanent installation type cable is not acceptable for this application.
- 22. All cables connecting to a movable lectern, cart, or desk shall be enclosed in a flexible braided mesh sleeve.
- 23. Cables labeled "future" on the drawings shall be installed as drawn, and the ends shall be labeled "For future AV use".

#### H. Connectors and Terminations

- 1. Use crimping and compression tools recommended by the termination manufacturer.

2. Provide insulated spade lugs for screw terminals, two lugs per terminal maximum. Use properly sized spade lugs for cable gauge and screw size.
3. Conductors in phoenix type connectors shall not be tinned, and ferrules shall not be used.
4. Terminate conductors with proper mating connectors.
5. Twist-on wire nuts are not acceptable.
6. Audio shield/drain wires shall not be connected to the connector body at any time.
7. Only one cable or set of wires shall be installed into any single connector; do not loop cable in and out of a connector. Provide a terminal block to parallel any audio signal wiring.
8. If multiple connection types are available on a given piece of equipment, the screw terminal type (including phoenix type) shall be used as first choice, with locking connections used as second choice, and other connectors as last choice.
9. Maintain proper polarity when wiring components and loudspeakers.
10. Provide vertically mounted 1/2 inch, painted plywood or 1/8 inch thick blank panels for mounting terminal strips. Do not mount terminal strips on the bottom of metal racks.
11. Bi-directional serial terminations shall always be assumed to be at minimum 5-wire in the absence of approved information which indicates otherwise.

I. Video and Projection

1. EDID shall be set and managed by the Contractor on all devices allowing EDID settings.
2. HDCP shall pass through the video system from all sources to all destinations, unless specified otherwise.
3. Projector mount tilt and lens shift should be adjusted to square the projected image before applying electronic keystone or corner adjustments.
4. Projected images shall be properly focused and sized to completely fill the screen.
5. Cables shall be pulled through projector mounting pipes, unless the power cable needs to run on the outside of the pipe for connection to a ceiling mounted outlet. In this case, the power cable shall be cleanly zip tied to the back of the projector's mounting pipe, and the cable color shall match the pipe color.
6. The Contractor is responsible for providing and installing escutcheon rings where finished ceilings are cut for projector mounting pipes.
7. Interactive (touch) displays and projectors shall be calibrated by the Contractor.

J. Audio DSP

1. Audio DSPs shall be programmed by the Contractor.
2. The Contractor shall be responsible for full commissioning of the DSPs prior to any systems verification testing by the Consultant. This may include signal routing, gain structure, phantom power, equalization, dynamics (gating, compression, limiting, ducking, AGC, feedback suppression, delay), acoustic echo cancellation, networked audio configuration, and any control of or by the DSP.

K. Speakers

1. The Contractor shall set all speaker taps at the time of installation.
2. The Contractor shall physically align all speakers per the project documentation or best practices.
3. The Contractor shall set all speaker delay times in audio processor.
4. The Contractor shall verify that proper speaker coverage exists throughout the listening area. No less than 3 dB difference across listening area measured at multiple locations.

L. Microphones

1. The Contractor shall calibrate proper gain structure has been set for all microphones, including wireless transmitters & receivers.



2. Verify audio levels are uniform across all microphones: no more than 1 dB difference between microphones.
3. The Contractor shall coordinate, document and verify all wireless microphone frequencies with the Consultant and Owner before procuring and installing equipment.
4. Wireless microphone transmitters shall be labeled with the room name and mic number.

M. Assistive Listening Systems

1. The Contractor shall verify all assistive listening system wireless frequencies with the Consultant and Owner before procuring and installing equipment.
2. Audio feed to the ALS is a fixed volume level (not variable level tied into in-room speaker volume adjustments) and is of nominal level into ALS.

N. Control System Programming

1. Control system touch panels, button panels, and processors shall be programmed by the Contractor.
2. The Contractor shall coordinate, obtain, verify, and follow established campus or organization standards per Owner.
3. The Contractor shall coordinate and verify the IP address assignments with the Owner.
4. All requirements herein are minimum requirements. Full and specific control system/GUI design, functionality, and user interface appearance shall be the responsibility of the Contractor, coordinating with the Consultant and Owner, and shall be verified and approved by the Consultant and Owner prior to finalization and loading of programming.
5. The Contractor shall demonstrate full systems programming functionality to the Consultant and Owner during final systems verification. The Contractor shall provide changes to the user interface and/or control programming beyond that described by the approved GUI, based on direction provided during verification.

O. Plates (wall, floor, ceiling) and Rack Mounted Panels

1. All wall plates shall be sized to cover the mounting or junction box as well as the rough opening. Flush mounted boxes shall be equipped with covers which overlap box sides by 3/4". Surface mounted boxes shall be equipped with covers of the same size as box.
2. All text and graphics on plates and rack panels shall be engraved.
3. Wall plate finish to be approved by Owner's Representative.
4. Provide blank plates with approved finish for all AV system wall, floor, and ceiling boxes that do not have receptacles.

P. Equipment Racks and Rack Accessories

1. Not necessarily specified on the drawings or equipment list, the Contractor is responsible for providing the following accessories for each equipment rack:
  - a. Side panels for each individual rack or for end racks of each group of racks.
  - b. Full height rear mounting rails.
  - c. Horizontal lacing bars.
  - d. Blank panels as necessary to close front of rack.
  - e. Vents, blowers, fans and fan packs as necessary to properly dissipate heat.
  - f. Security covers over devices needing protection from general users.
  - g. Security bit rack screws. Contractor shall coordinate requirements with Owner.
  - h. Shelves and drawers.
  - i. Rack rail recessors for network switches with front facing connectors/cabling to allow security covers to be placed.
  - j. Surge suppressing power distribution.
  - k. Caster base as shown in the equipment list, or as dictated by field conditions.

2. All accessories shall be from the same manufacturer as the rack enclosure unless otherwise specified.
3. If applicable, racks to be secured to the floor per manufacturer instructions and approval of the Owner's Representative.

**Q. Table Boxes**

1. Table box accessories (connector plates, blanks, cable stops, power outlets, etc.) shall be installed in the box with no openings or gaps.
2. Table box to be securely attached to the table and completely covering the cutout.
3. The Contractor shall verify in field furniture conditions (above and below the table surface) before cutting furniture for box installation.
4. Length of all cables within the table box shall be verified with Consultant to be of proper length to reach the necessary radius around the box.

**R. Flat Panel Display/Projector Ceiling Mounting Plate**

1. Mounting supports shall not be attached to any building structure or products that can cause vibration or movement of the mounting plate. The Contractor shall coordinate with the Consultant and Architect if structural vibration is affecting AV equipment.

### **3.04 FIELD QUALITY CONTROL**

**A. Site Tests and Inspections**

1. The Consultant shall visit the site during systems installation to verify progress and quality. The Contractor shall implement changes (that are within the specifications of the Contract Documents) to the installation as directed by the Consultant during these visits.

**B. Final Systems Verification**

1. The Contractor shall notify the Owner's Representative and Consultant that all installed products are ready for final verification. All products that are a part of this project shall be completely installed, functional, configured, and fully tested prior to final verification.
2. The Contractor's Project Manager or a senior technician who is familiar with the system shall demonstrate the complete functionality of each AV system to the Consultant.
3. The Consultant will create a punch list of deficiencies that shall be corrected by the Contractor prior to completion of the final systems verification. Items added to the punch list during this verification will not be re-verified or removed from the punch list during this same site visit.
4. It is the responsibility of the Contractor to verify that all work by others relating to the AV system operation (HVAC systems balanced, lighting system configured and programmed, shade system configured, data network/phone services active, etc.) is installed and functioning prior to AV systems verification.
5. All Owner furnished equipment shall be installed and working properly in all rooms. All software that is required for integration with AV system shall be installed by the Owner (or by the Contractor under the coordination/supervision of the Owner), and functioning properly.
6. During final system verification, the Contractor shall implement changes (that are within the Contract Documents) to the installation and setup as directed by the Consultant.

**C. Manufacturer Services**

1. Any required manufacturer testing, installation, configuration, and commissioning services required to execute the work described within this Section shall be the responsibility of the Contractor to coordinate and assume financial responsibility.

**3.05 CLEANING**

- A. The Contractor is responsible for the cleaning, removal, and disposal of all debris related to the AV systems installation.

**3.06 CLOSEOUT ACTIVITIES**

- A. Training
  - 1. The Contractor shall train the Owner in the proper operation of the system only after completion of the Final Systems Verification and all punch list remedy.
  - 2. The Contractor's project manager or lead engineer/technician who is familiar with the system shall conduct training session(s).

**END OF SECTION**

**APPENDIX A – AV BASIS OF DESIGN NARRATIVE DESCRIPTION**

[Provided by project Consultant/design team]

**APPENDIX B – BASIS OF DESIGN EQUIPMENT LISTS**

[Provided by project Consultant/design team]