**SECTION** **27 41 00**

**AUDIO-VIDEO SYSTEMS**

**BASED ON DFD MASTER SPECIFICATION DATED 09/03/24**

Notes to A/E:

This section has been written to cover Audio-Video Systems for new construction, remodeling of building or specific rooms and depending on the requirements of your specific project, you will need to add material, delete items, or modify what is currently written.

Section 27 08 00.41 – AV System Commissioning is complementary to this section and includes Test and Measurement requirements and Systems Verification Checklists.

It is recommended that you examine the Communications Structured Cabling System Standards & Design Guidelines document available on the DFD web site.

Edit all areas as applicable to meet the requirements of the project. Common options or features recognized by the DFD, or items where A/E input is needed are enclosed in [brackets] and/or <less-greater brackets>. Delete product types (Part 2) and related installation (Part 3) instructions that are not applicable to the project.

Editing instructions are included throughout the document (italic text; red if viewed/printed in color). Delete these instructions final printing.

The document is structured to automatically update the Table of Contents when printed or in response to an “Update Field” command (right mouse click on TOC opens menu) in MS-Word. Confirm that TOC has updated and is accurate of prior to printing. TOC entries are Hyperlinks and can be used to navigate the document.

Note: AV Design Team is also responsible for editing of specification Section 27 05 33.41 – Raceway and Boxes for Audio-Video Systems which includes content specific to Audio-Video scope.

Revision History:

In the on-line “DFD Document Library” Under “Master Specifications/Design Guidelines / Division 27 – Communications” see “Div. 27 Revision History”.

1. GENERAL

Scope

This section describes the products and execution requirements relating to furnishing and installation of Audio-Video Systems for the project.

Included are the following topics:

[PART 1 - GENERAL](#_Toc175894736)

[Scope](#_Toc175894737)

[Related Work](#_Toc175894738)

[Definitions](#_Toc175894739)

[References](#_Toc175894740)

[Scope of work](#_Toc175894741)

[AV System Design](#_Toc175894742)

[Project Management](#_Toc175894743)

[Typical Room/System Descriptions:](#_Toc175894744)

[Quality Assurance](#_Toc175894745)

[Submittals](#_Toc175894746)

[Work by State and/or Agency](#_Toc175894747)

[Warranty](#_Toc175894748)

[PART 2 - PRODUCTS](#_Toc175894749)

[Equipment Standards](#_Toc175894750)

[Equipment Changes and Substitutions](#_Toc175894751)

[Raceway and Boxes](#_Toc175894752)

[Cabling](#_Toc175894753)

[AV Equipment](#_Toc175894754)

[PART 3 - EXECUTION](#_Toc175894755)

[General](#_Toc175894756)

[Site Conditions](#_Toc175894757)

[Wiring and Terminations](#_Toc175894758)

[Labeling](#_Toc175894759)

[Equipment Racks and Cabinets](#_Toc175894760)

[Rigging](#_Toc175894761)

[Control System – Touch Screens](#_Toc175894762)

[Room Combining](#_Toc175894763)

[Video Preview](#_Toc175894764)

[Lighting And Window Shade Control](#_Toc175894765)

[Controlled Devices](#_Toc175894766)

[Video CODECs and Cameras](#_Toc175894767)

[Voice-over-IP (VoIP)](#_Toc175894768)

[Digital Signal Processor (DSP)](#_Toc175894769)

[Network](#_Toc175894770)

[Grounding](#_Toc175894771)

[AV Systems Clean Power](#_Toc175894772)

[Technical Requirements](#_Toc175894773)

[Commissioning](#_Toc175894774)

[Documentation](#_Toc175894775)

[Training](#_Toc175894776)

Provide bullet point list of sole source items as approved by the DFD Project Manager. Use generic terms such as “AV Control System”, “AV Projector”, etc. Identify manufacturer and model or product series for each item. Do not include technical details or specific part numbers. Delete Notice if not used.

CLASS 1 NOTICE:

Notice is hereby given in accordance with Section 16.855(10), Wisconsin Statutes, that the Division believes it is in the best interests of the State to contract the following work from only one source, without the usual statutory procedures:

* [Product type – Manufacturer; Product Series]

Related Work

Applicable provisions of Division 01 govern work under this Section.

Edit as applicable to match project requirements. Delete reference to sections that do not appear in the project documents. Add other sections that apply.

Section 01 91 01 or 01 91 02 – Commissioning Process

Section 26 05 00 – Common Work Results for Electrical

Section 26 05 04 – Cleaning, Inspection and Testing of Electrical Equipment

Section 26 05 26 – Grounding and Bonding for Electrical Systems

Section 26 05 29 – Hangers and Supports for Electrical Systems

Section 26 05 33 – Raceway and Boxes for Electrical Systems

Section 27 05 33.41 – Raceway and Boxes for Audio-Video Systems

Section 26 05 53 – Identification for Electrical Systems

Section 27 05 53 – Identification for Communications Systems

Section 27 08 00 – Commissioning of Communications

Section 27 08 00.41 – AV System Commissioning

Section 27 10 00 – Structured Cabling

Section 27 11 00 – Communications Equipment Room Fittings

Section 27 16 19 – Communications Patch Cords, Station Cords, and Cross-connect Wire.

Section 27 51 26 – Assistive Listening Systems

Coordinate with Division 26 on raceway/junction box locations for audio visual equipment and routing of audio, video, control, and power cables/raceway from equipment, terminal and pull boxes to system equipment racks.

Definitions

The following shall serve as general identifiers and govern the specified herein.

**Owner** – State of Wisconsin Department of Administration (DOA), Div. of Facilities Development (DFD).

**Agency –** User organization occupying or administering the project building(s) or site(e.g., UW-System, Department of Health Services, Department of Veterans Affairs, etc.)**.**

**Architect** – Project Architect sometimes referred to as the Lead Architect/Engineer (A/E).

**AE, Engineer or Consultant** – Company or individual responsible for Audio-Video System design.

**Contractor –** see AV System Installer.

**Division 26** – The Electrical Contractor’s business unit or sub-contractor responsible for Division 26 work.

**AV/IT –** Abbreviation for “Audio-Video /Information Technology”.

**AVIXA – “**Avixa” the trade association representing the professional Audio-Video and information communication industries worldwide. Previously known as InfoComm.

**AV Systems** – “Audio Visual Systems” include all equipment necessary to fulfil the intent of sharing, communicating, recording, audio/video sources to classrooms, conference rooms, large gathering rooms in person or virtually.

**AV Systems Room** – An enclosed area or room specifically designated for locating equipment racks for the AV system equipment that include routing, monitoring, termination, and/or cross connecting of Audio-Visual System cable (i.e., riser cable) to other Audio-Visual System cable, and/or equipment and racks.

**AV System Installer –** The Electrical Contractor’s business unit or sub-contractor responsible for work covered by this section and related drawings.

**AV Control System Programmer –** The programmer that develops the control code and touch panel user interface to operate the AV system.

**BYOD** – “Bring Your Own Device”. This refers to users bringing their own device as a source for AV systems.

**CEC –** Abbreviation for “Consumer Electronics Control”, an HDMI feature designed for the user to command and control CEC enabled devices – e.g., Displays, DVD, others – that are connected through HDMI connectors.

**CIS -** Abbreviation for “Common Intelligibility Scale” used to provide a scale for a room intelligibility response.

**CTS** – “Certified Technology Specialist” the AV basic level of tested certification offered by Avixa.

**CTS-I** – “Certified Technology Specialist - Installer” the AV installation level of tested certification offered by Avixa.

**CTS-D** – “Certified Technology Specialist - Designer” the AV designer level of tested certification offered by Avixa.

**DSP – “**Digital Signal Processor”, a microprocessor-based system to take input signals like microphones, audio video sources, phone lines, and process them with built-in audio tools. Route them to outputs for use in multiple destinations in the AV system architecture.

**HDMI –** Abbreviation for “High-Definition Multimedia Interface”, a proprietary audio-video interface for transmitting uncompressed video data and compressed signals from an HDMI compliant source to an HDMI compliant display including projectors. HDMI implements the EIA/CEA-861 standards.

**HVAC –** “Heating Ventilation and Air Conditioning”. Division 23 Contractor responsibility.

**NIC** – The terms “NIC” and “Not in Contract” are equivalent to “Provided by Others”. The Contractor is responsible for providing cabling, plates, installation materials, and other infrastructure as indicated on drawings and herein to provide ready installation of NIC equipment.

**OFCI** - The term “OFCI” is defined as “Owner Furnished Contractor Installed” shall refer to equipment that will be furnished by the Owner or Agency for installation by the Contractor.

**OFOI –** The term “OFOI” is defined as “Owner furnished Owner installed” to indicate the AV, computer equipment that will be furnished and installed by owner or agency.

**STI –** Abbreviation for “Speech Transmission Index” to measure speech intelligibility in a room or theater.

**Telecom/Data Installer –** The Electrical Contractor’s business unit or sub-contractor responsible for Division 27 work that does NOT include the AV systems as described in specification 27 41 00.

References

All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the Wisconsin Electrical Code and present manufacturing standards.

Add reference to Intertek / ETL listing as applicable.

All materials shall be listed by UL and shall bear the UL label. 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. Where UL has an applicable system listing and label, the entire system shall be so labeled.

Other applicable standards (plus applicable update bulletins and errata) are as follows:

General

ANSI/IEEE C2 - National Electrical Safety Code

SPS Chapter 316 – Wisconsin Dept. of Safety and Professional Services Electrical Code

AV-Specific

Avixa AV/IT Infrastructure Guidelines for Higher Education-No Document Number Published

Avixa Display Image Size for 2D content in Audio/Visual Systems - V202.01:2016.

Avixa Audio Coverage Uniformity in Listener Areas - A102.01:2017

Avixa Cable Separation Guidelines - F502.01:2018

Include the following where the digital video systems need to pass higher data rate for video production and broadcast.

[SMPTE 259M, 292M, 424M, 2081-1]

Structured Cabling and Infrastructure

Refer to specification Section 27 10 00.

Scope of work

General

Provide all materials, labor, drawings, in the design for a complete and fully operational AV system as described herein and on related drawings. See Articles AV SYSTEM DESIGN and TYPICAL ROOM/SYSTEM DESCRIPTIONS.

Provide all connectors, hardware, transformers, power supplies, rack panels, interfaces, fasteners, wire harnessing materials, bushings and any other incidentals required for complete and proper functioning of this system whether specifically listed or not.

Confirm that drawing content includes this direction. Otherwise edit drawings and/or specs to avoid contradictions.

Coordination

Coordinate with the DFD, AE, Agency, Architect, Electrical Divisions 26, 27 and 28 and other trades to comply with all requirements as defined by the Plans and Specifications.

Coordinate with Division 26 as applicable to include AV-specific power and grounding and bonding.

Coordinate with Division 27 Telecom/Data installer as applicable to include AV-specific Telecom/Data devices.

Coordinate with the Architect and Agency on final color selection and/or the painting of any exposed loudspeakers and any/all exposed system components to match the room’s aesthetics and finishes.

Coordinate Conference Room table-mounted AV input Assembly as applicable. Include automatic cable recoiling. Identify proposed location with-in tabletop(s) to coordinate aesthetics for final table ordering (by agency) and hole cutting by table supplier.

Installation

Installation work shall not begin on the project installation without approved Shop Drawings.

Follow manufacturer’s recommendations as specified for cabling and equipment system installation.

Furnish and install cable management hardware as required including areas internal to rack cabinets, areas between pieces of equipment not housed in rack cabinets, and areas that extend cabling from rack cabinets and equipment to the greater facility cabling infrastructure.

Furnish and manage all lifts, ladders, scaffolding or other resources as needed for safe installation. Coordinating with other trades as needed.

Ensure that all equipment, except for portable equipment, are firmly fastened or attached in place.

A safety factor of at least five shall be utilized for all brackets, fasteners, and attachments.

Furnish and install all video projector mounts, including support assemblies back to structural members. The AV System Installer shall pay close attention to obstructions which vary from room to room. Provide safety retention cables for overhead equipment such as loudspeakers, projectors, etc.

Field verify all projector locations.

Resolve any obstruction conflicts for optimal performance with the AE consultant and Architect. Confirm projector lens selection prior to construction.

Mount and align the projectors so that digital keystone correction is not required. Optical lens shift may be used if necessary to align the image with the screen image area. If possible, mount projectors perpendicular to the screen surface. The image quality shall provide a focus on the content by reducing any image distortion from poor geometry due to projector mounting.

Ensure that all equipment mounting styles and locations comply with the 2010 ADA Standards for Accessible Design.

Furnish AV-specific boxes as noted on the AV drawings for installation by Division 26.

Work by Others

Edit to match project requirements. Coordinate with applicable drawings sheets and specifications.

* Conduit, power receptacles, junction boxes, cable raceways, electrical back-boxes, and floor boxes by Division 26. (See above re: AV-specific boxes.)
* Grounding Infrastructure – not including rack, cabinet, equipment, etc. – by Division 26.
* Lighting fixtures, lighting dimming systems, and lighting controllers by Division 26.
* Blocking as required to support wall-mounted AV components by General Prime Contractor.
* Millwork – except where otherwise specified – by General Prime Contractor.
* Window shades, drapes, or controllers by General Prime Contractor.

AV System Design

General

See Article TYPICAL ROOM/SYSTEM DESCRIPTIONS for project-specific requirements.

The design shall provide for a minimum 4K resolution as the design required for displays, and projectors.

Performance requirements for some systems may exceed this. See PART 2.

Digital audio systems as the design requires for mixing analog audio signals and digital audio signals. Coordinate any RF based audio systems with Agency for operating frequencies already in use on campus.

Provide a control system design that will operate as the design requires include feedback from the Agency on operational concerns.

Coordination with Agency’s IP Network

Coordinate network requirements with agency where agency LAN is to be used or linked to for AV connectivity. Consider for each AV device on the Agency’s network (not limited to) the following:

IP address (DHCP or Static)

Subnet information

VLAN setup, authorization including AV over IP specific equipment and Dante audio equipment.

Provide the AV equipment list to include equipment MAC addresses at the time of requesting IP network information.

AV System Programming

Provide an operational AV System Control program designed and programmed with the submittals as specified including screen layouts of touch panels for Owner approval.

Provide Develop, install, and debug all custom control programming code as required and/or as specified.

Provide to the Owner uncompiled programming control code as specified and audio DSP operating code.

Provide low voltage control system interfaces (serial, IP, relay dry contact) to facilitate operation of lighting and/or shades where specified.

Testing

Refer to specification Section 27 08 00.41 – AV SYSTEMS COMMISSIONING for project-specific testing and acceptance criteria.

Test and adjust AV systems and components for optimal performance.

Provide test data measurements that are included with test equipment used in testing system performance.

Provide initial date of test and measurement verification reports to the AE Consultant as specified.

Verify that all individual AV system components operate within the complete AV system as intended by the approved AV system design documents and specifications.

Project Management

Oversee and coordinate all activities for the successful completion of the Project.

Provide to the Owner, as a part of the prefabrication submittal, the name of the Project Manager that will manage all duties and responsibilities as specified herein, during the term of the project including the name of a backup Project Manager.

Make decisions on behalf of the AV System Installer on a day-to-day basis and shall retain the authority of accepting notices of deduction, inspection reports, payment schedules and any other project related correspondence on behalf of the owner.

Manage schedule and attend project management meetings, during which time all system related issues are discussed, scheduled, confirmed, and/or resolved.

Upon notification by the Owner, of any project related installation issue, or issue that may contradict the specifications as stated herein, the Project Manager shall respond to such issue, verbally and/or in writing within an eight (8) hour period.

Responses to such issues as stated above shall include a clear understanding of the issue, along with a tentative plan of action, reflecting milestones and/or deadlines to resolve the issue.

Where appropriate, based on the overall importance of the project issue, the Project Manager shall follow-up their initial response with a written response to the issue within 24 hours of identification of the issue.

Submit prior to installation a schedule reflecting key milestone of the Project, including but not limited to the following:

* Kick-off meeting
* Master Plan submittal
* Prefabrication submittal
* Ordering, delivery, and installation of head-end System equipment
* Field equipment delivery
* Installation schedule including start and end dates and major milestones
* Final System test
* Acceptance of System
* Delivery of Documentation
* Training

Provide updates to the schedule on a weekly basis to reflect the status of each key milestone as the Project progresses.

Provide updates to the above-mentioned items at the request of the Owner, and shall address each item, as it relates to the active status of the Project.

Typical Room/System Descriptions:

Edit the list and room descriptions as applicable. Room descriptions are suggestions. Identify major equipment and functional requirements for each room type. Delete room types that do not apply. Do not include performance-level detail. Use generic product descriptions. Note that this content is referenced in specification Section 27 08 00.41 – AV SYSTEMS COMMISSIONING as a basis for system functional testing. Include content that will inform such testing.

Active Learning Classroom

A group seated academic space to maximize student interaction.

Auditorium (large Venue)

Academic space with a capacity that exceeds 200 Students.

Combinable Classrooms

Two Medium Classrooms adjacent to each other to combine into one.

Combinable Conference Rooms

Two small conference rooms adjacent to each other to combine into one.

Conference Room (Large)

A room with seating capacity of 12-16 People.

Conference Room (Small)

A room with seating capacity of 6-10 People.

Digital Signage Locations

Public Spaces and Hallways.

Distance Learning Classroom

A remote hybrid learning environment with dual stream capture video conferencing technology and cloud-based technology innovations.

General Classroom (Movable furniture)

A classroom with seating for 24-90 Students.

General Classrooms (Fixed furniture)

A classroom with seating for 24-90 Students.

General Classrooms Medium

A classroom with seating of less than 24 Students.

Huddle/Study Rooms

A small conference area for collaboration that may include one video display.

Lecture Hall

Academic space tiered or sloped with a capacity of 30-200 Students.

Public Waiting Areas

Seating for 4-6 people that may include BYOD inputs to video display of digital signage.

Security Control Room

Room large enough to have two operators working 24/7 and including video displays of the various computers monitoring the building emergency alarm systems, camera security systems, and building automation systems.

Simulation Labs and Review Classrooms

Simulation Labs for training including rooms for review of recorded simulation sessions.

Sporting Venue

Facility – either indoor or outdoor – requiring Scoreboard, Timing, Video and/or other event-related systems.

Quality Assurance

Manufactured Items

The manufacturer(s) of cabling and connectivity components shall be a company specializing in and having a minimum of five years documented experience in producing products like those specified in this and related sections.

AV System Installer Qualifications

General

AV System Installer shall:

* Have been in the professional AV business for a minimum of five (5) years.
* Have expertise in designing and building an AV system of the size and scope described herein and in related drawings.
* Have successfully completed one or more projects of scope 50% or more of the magnitude specified by these documents.
* Have the necessary certifications to install products and provide for Guarantees as specified herein.
* Be a dealer for the past five years for the active equipment provided.
* Be capable of providing all quality control (QC) and safety inspections as needed throughout installation.
* Have access-to and experience-with Test Equipment necessary to perform commissioning tasks as detailed in specification Section 27 08 00.41.

Certifications

AV System Installer staff credentials shall include:

* AVIXA Certified Technology Specialist certification with an installation endorsement (CTS‐I) in good standing.
* AVIXA Certified Technology Specialist certification with a designer endorsement (CTS-D) in good standing for design review.

Where project scope includes EXTRON, CRESTRON, QSC or other products requiring a manufacturer-certified installer, edit the list to match project scope. Otherwise, Delete the additional bullets.

* [Enter manufacturer] Certified Designer/Programmer.

Installation Personnel shall have a AVIXA CTS certification; no more than four (4) CTS certified installers for each CTS‐I certified installer on-site.

Certifications shall be current and in place at time of Bidding and remain so throughout project.

AV Control System Programmer Certifications and Qualifications:

Individuals performing the AV/DSP control programming and setup shall have manufacturer’s control system programming training and certification for the specified AV control system designed in the contract documents.

Shall be the dealer of record for the control system specified.

Provide an uncompiled final approved copy of the AV/DSP source code to Agency via agreed method.

Sub‐Contractors shall conform to the same certification standards listed above. All AV/DSP control source code shall become the property of the Agency upon completion of the project.

Submittals

General:

The AV System Installer shall be responsible for verifying the accuracy of the system designs documented in the Scope of Work and related acceptance of responsibility provide in the shop drawings.

Submit general catalog sheets and system design drawings with model numbers highlighted to indicate specific items proposed and proper identification of equipment by name and/or number, as indicated in the design documents.

AE consultant shall provide comments for the Contractor’s correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.

Provide Submittal documents as required to support the construction schedule to be identified at the Pre-Construction Meeting.

Group Submittals to include complete submittals of related systems, products, and accessories in a single submittal.

Submittal documents that are re-submitted for review shall include revision dates that indicate when changes from previous reviews were performed. All revisions made to re-submittal documents must be clouded and all clouds must be identified by the corresponding line-item number on the review roster. A

list of changes to re-submittal documents must also be included.

Mark dimensions and values in units to match those specified.

Submit interim drawing in searchable electronic (Acrobat PDF) format.

Reproductions of AE Consultant's drawings shall not be acceptable.

Submit record drawing in searchable electronic (Acrobat PDF) format and in the original AutoCAD (.dwg) format.

Shop drawings

Wiring diagrams shall show AV systems wiring and schematic designations and equipment locations on drawings submitted in 30" x 42" format.

Provide a full list in Excel spreadsheet form of cable runs including termination locations, numbers/identification, equipment schedule and electrical grounding to AV equipment rack locations and AV headend locations.

Floor plan drawings shall be required for raceway, floor boxes, poke throughs and cabling. Drawings shall indicate pull-box locations required in addition to boxes already indicated on the plans.

Include in wiring diagram drawings electrically powered equipment that shall remain on (not under system control) and the electrically powered equipment that shall be on/off under system control.

Provide conduit riser drawings for AV conduits required for installation of back boxes and ceiling enclosures including the proper grounding inclusion on the schematic drawings.

Provide detailed drawings of instructor workstations indicating the locations of AV equipment to be mounted in the workstations (if applicable).

Provide detailed elevation drawings of equipment racks providing locations of AV equipment being mounted in these racks and future space openings.

Drawings shall include cable layouts, locations for terminal blocks, transformers, relays, and power supplies.

Provide Display- and Projection System-specific drawings and calculations.

Include screen sizes, projector locations, projector throw ranges and field verified measurements to confirm lens selection and viewing angles (plan drawings).

Provide remote control touch screen layouts and flowcharts. Provide full size drawing sheet (PDF Format) showing touch panel screen shots organized as a flow chart.

Develop and submit As-Built Drawings detailing the installed systems as specified for approval including the room numbers on drawings that reflect Agency room numbers and not Architect room numbers.

During Construction

Provide updates to the AV system design that may affect the design drawings as approved. The updates shall include change orders, equipment model updates that are due to model changes by the specified manufacturer.

Mockups

Provide on request, mockups of:

* Floor boxes
* Poke-through Assemblies
* AV Backboxes
* Wall Mounted Touch Panels
* AV-specific Boxes and Wall Plates
* Conference Room table-mounted AV input Assembly

Provide samples of the AV System furniture finishes to provide selection before ordering to be reviewed and approved by Owner, and Architect.

Work by State and/or Agency

If there is work to be included, describe in detail. Agency-provided AV equipment (in the form of a video projectors, audio amplifiers, fiber optic receiver, for example) is not un-common. Where the AV system utilized agency Network Infrastructure (e.g., “Campus” or “enterprise” LAN, indicate as such. Otherwise indicate “None”.

None.

Warranty

Provide guarantees per Conditions of the Contract.

Warranty Period:

* Equipment and Materials – two (2) years
* Labor – one (1) year

Manufacturer warranties shall be activated in the Agency’s name.

The warranty start date period shall be the date of “Substantial Completion” of the system as defined by the conditions of the DFD Construction Contract.

Items not covered include Agency-caused failure, defect or damage including controls re-adjustment, system re-tuning or injury to the system beyond normal wear.

During the warranty period – within 48 hours of original notification – provide emergency service to restore operation of the system, replacing defective materials, repairing faulty workmanship, making temporary repairs, and providing loaner equipment as necessary, all at no charge.

Provide to the Agency before any service call whether such call is or is not covered under warranty. The Agency may be invoiced for non-warranty calls.

After hours or weekend service shall be available at a rate not to exceed 1.5 times normal hourly rate.

Provide technical support via telephone at no charge during the warranty period.

Maintain engineering and service departments capable of rendering phone support and advice regarding system operations regarding installation and operational adjustment of the systems. This support may result in scheduling a service call to the site to further determine any equipment issues that could not be handled via the phone support.

Where equipment provided by the owner (agency) and installed by the contractor (OFCI), contractor warrant shall cover the labor related to that equipment.

Prior to the end of the warranty period provide (2) scheduled follow-up service and maintenance visits by technically qualified personnel to make AV system updates and adjustments at no additional charge.

Make all tests, adjustments, or replacements in the presence of an Agency Technician, or other person designated by the Agency Representative. Upon completion of each call provide a report to clearly indicate any replacements or adjustments and any evidence of tampering.

All service calls pertaining to the Control System (e.g., alteration of buttons, non-responsive commands, etc.) shall fall under the purview of the Control System Programmer.

1. PRODUCTS

Equipment Standards

The products used in the design and installation shall include the latest equipment available to provide an operational and expandable AV system as designed.

Where product is to be sole source procured (and identified in the Class 1 Notice), include only the manufacturer, model & and any required options. Technical specs are not needed for such items.

Components that comprise the various systems shall be UL listed where a UL listing exists for that component.

Displays and projectors shall have at minimum 4K video resolution.

Video extenders shall have at minimum 4K video resolution. Extenders shall operate with CAT6 or fiber optic cable.

Video sources shall have at minimum 4K video resolution. When the video sources do not meet the minimum video resolution requirement the design shall include video scaling to match the display or projector resolution.

Control system shall provide operational control of devices either through RS-232 or IP based interface.

The control system shall also provide contact control for devices that use this type of control interface. The control system shall also provide IR based connection for devices that use an IR handheld remote for control.

Verify the completeness of the drawings, specifications, and schedules and the suitability of devices including AV equipment firmware to meet the design intent of the specifications.

Provide additional equipment, accessories, or incidentals required, whether specifically mentioned herein, without claim for additional payment, it being understood that a complete operational system is required.

Equivalent manufacturers and products shall be in strict accordance with this specification.

Equipment Changes and Substitutions

Prior to construction, confirm scope and intent of the original design to confirm that no changes are needed to accommodate changes in standards or agency preference, new technology, manufacturer product updates, etc.

Provide the latest model of AV equipment types specified.

If, during construction, the specified AV equipment is found to have been discontinued, the proposed replacement for that item shall be compatible with all other components of the specified system and meet or exceed the technical attributes for that of the originally specified item.

Request for approval of a substitution shall identify:

* The original item including Make and Model Number.
* The reason for requesting the substitution.
* The suggested replacement, including Make and Model Number and relevant product data.

Request to substitute loudspeaker arrays designed for arenas, theaters, auditoriums shall include a complete room model of the space in EASE 4.2 or higher demonstrating equivalent coverage to the AE Consultant’s satisfaction, the suitability of the proposed loudspeaker arrays in addition to documentation described above.

Refer to contract terms & conditions.

Raceway and Boxes

Coordinate with Division 26.

See specification Sections 26 05 33 - Raceway and Boxes for Electrical Systems and 27 05 33.41 - Raceway and Boxes for Audio-Video Systems and drawings.

Cabling

Edit to consider AV device manufacturers requirements. Delete cable types that do not apply. Add other cable types as applicable.

General

Provide AV-specific cable requirements for cable routing to match project requirements. Coordinate with drawing content.

See specification Section 27 10 00 for general cable installation requirements.

Twisted Pair Cable

Edit to consider AV device manufacturers requirements. Specify Twisted Pair solutions when HDMI, DVI-D, or Display Port pre-made cables will not support those cable lengths. Specify HDBaseT compliance requirements as applicable. Unless a design requirement and identified as a “sole source”, do not use manufacturer specific cable designations such as “Digital Twisted Pair (DTP)”, an Extron trademark).

[Enter content here]

Digital Video Cabling

Cabling for certain systems may require a higher video resolution depending on the devices interfaced to the digital video systems displays. The video cabling design shall match the resolution and other requirements as applicable for the display system required and consider future requirements.

Where the digital video systems need to pass higher data rate for video production and broadcast, include the following sentence. Otherwise delete.

All digital video cabling shall be designed to pass at minimum [4K] [8K] video resolution or higher.

[Cables shall be compliant with the referenced SMPTE standards.]

Edit to indicate applicable cable type(s).

Digital cable types shall be as follows:

* [HDMI 2.0] [HDMI 2.0b] [HDMI 2.1]
* [DVI-D (Single Link)] [DVI-D (Dual Link)]
* [Display Port 1.1] [Display Port 1.2] [Display Port 1.3/1.4] [Display Port 2.0]
* [SDI] [HD-SDI] [UHD-SDI]

AV Equipment

Edit the list below and add product-specific content to reflect equipment applicable to the project. Delete non-applicable product types.

Use the same terminology in specification as used on drawings.

Where a sole-source procurement is allowed, each item must be listed in the Class 1 Notice in the specification section which includes the item. Coordinate with the lead A/E to also list the sole source item(s) in the Class 1 Notice which must appear in Division 1. Here in PART 2, identify Manufacturer/Model by part number and all required options. Performance and construction specifications are not needed for such items.

Where a “Basis-of-Design” product is indicated (equals must be allowed), include all pertinent performance and features for the product. Such content will be the basis on which equals are determined. Features of a “basis-of-design” product not included in the technical language might not be considered.

General

The following systems descriptions are a summary of system types throughout project.

Where a "Basis of Design" product is identified, this is done to identify a known-compliant product and to aid in contractor understanding of intent. Equals are allowed where Basis-of-Design products are identified.

Equipment identified as “Owner (Agency) Furnished Owner Installed (OFOI)” included is for reference only.

Use the same terminology herein and on drawings to identify each product. Where abbreviations are used on drawings (e.g. on an Equipment Schedule), consider using them herein as well.

Audio Digital Signal Processors

Specify the digital signal processor that meets the design requirements for audio inputs and audio outputs.

Wireless Microphone Systems

Specify system RF band(s). Coordinate with other wireless systems that may interfere (including project design and local TV stations).

Associated Audio Sources

Specify sources to be included in design including DVD player, Computer audio output, Video Codec output, IP based decoder, wireless sharing device, and others.

Audio Mixers

AV system may require the use an external audio mixing console to operate in addition to the designed DSP processor.

Audio Amplifiers

Specify amplifier output wattage for each room based on speaker power requirements. Select [70v] [100v] [8ohm] output. Include control to the power amplifier on last during power up, and the first device to turn off during power down.

Loudspeakers

Specify ceiling mounted speakers as indicated on the reflected ceiling drawings. Tap to the design wattage for each speaker.

Sound Bars

Specify sound bars for displays that require sound support in spaces that require low profile and short throw of sound coverage.

Assistive Listening System

See specification Section 27 51 26.

Sound Masking System

Design and install the sound masking system in rooms that may require sound masking.

Video Sources & Recorders

Design and install cameras, DVD/Blu-ray players, video Codec, Streaming recording system, video decoders, computers, screen sharing technology, and digital signage player.

Video Switching & Extension

Design for AV switching as specified in the AV system drawings. Provide AV extension systems where applicable.

IPTV System

Provide in the AV system design Internet Protocol TV as maybe required by the Owner.

Video Displays

Provide and install video displays in locations as included in the AV drawings. Include the supporting drawings to show the viewing lines for each display.

Video Display Mounts

Provide and install including coordination with GPC for mount blocking for each display based on size and weight.

Video Projector

Provide and install video projectors in locations as included in the AV drawings. Include the supporting drawings to show the viewing lines for each projector.

Video Projector Lifts

Install and coordinate with other trades per room requirements for installation and secured mounting.

Video Projection Screens

Provide and install video projection screens in locations as included in the AV drawings. Include the supporting drawings to show the viewing lines for each projection screen.

If screens are to be GPC responsibility, coordinate with Lead A/E to ensure that the appropriate content is included in Division 11.

AV Control Systems and Control Interfaces

Coordinate with Owner and control system programmer on operation and GUI layout for touch panels.

AV Network Switches

Coordinate with Owner as AV systems require connectivity to the Owners network.

Table Boxes & Retractors

Coordinate with Owner and Architect on installation as AV systems require connectivity to the Owners conference table and podiums.

Equipment Racks

Provide and install equipment racks in locations as included in the AV drawings. Include the supporting drawings to show the floor plan and elevation for each rack.

AV Power Distribution

Coordinate with Division 26 contractor for all AV systems power distribution requirements.

1. EXECUTION

General

Verify all dimensions and conditions at the project site. Submit any conflicts for resolution and coordinate their efforts with the Construction Manager and AE Consultant for coordination of the conflicts, completion of work, avoid conflicts over scheduling, access, and locations of their work.

The Project Manager shall be responsible for ensuring all floor boxes and back boxes noted as Standard, if applicable, are supplied to the Division 26 contractor for the project.

The Division 26 Contractor shall ensure all power connections are installed as noted on the drawings. AV System Installer is responsible for providing a coordinated schedule of completion of each system or space to the Division 26 Contractor to ensure timely completion of AV installation.

Provide and furnish all mounting brackets, raceways, sleeves, rack rails, termination plugs, jacks, faceplate mounting hardware, back boxes, and other unique components as necessary to securely mount equipment and panels.

Coordinate with other divisions of work the interface of room systems including lighting control systems, motorized shades, motorized projection lifts, motorized projection screens, HVAC system, e.g., where noted on drawings.

Furnish painting and finishing as may be required to match components, cabinetry, and room décor. Coordinate the color and finish of any visible element of the system with Project Manager approval.

Determine the location for mounting projector/lift, camera, display device to ensure these mountings to be free from vibration or shake. If these mounting locations are not free of vibration or shake. Provide isolation mounting devices to ensure the projected video images are stable.

This requirement may add significant cost and effort. Confirm requirement and add reference to drawings as applicable

Provide power control for selected equipment racks and AV devices including but not limited to what is shown on the bid documents. All devices should be capable of being shut down except for the control system, audio digital signal processor, and AV network switches. If a power sequencer is included in design, provide the power on and off sequence of equipment included on the AV record drawings

Site Conditions

Coordination:

Coordinate all work with other on-site trades.

Schedule and manage equipment delivery and make appropriate arrangements to coordinate with job site personnel for the proper receiving, handling, and secure storage of equipment delivered.

Site Clean-up:

Keep the project site free of all debris generated by the AV System Installer’s work, to the satisfaction of the Owner or Construction Manager. Remove waste and debris related to the specified work from the site daily and shall leave the relevant areas and equipment clean and in an operational state. Repair any damage caused to the premises by the AV System Installer’s installation activities, at no cost to the Owner.

At the completion of work, remove all remaining waste materials, tools/job box belonging to the AV System Installer, construction equipment, machinery, and surplus materials.

Confine operations at the site to the areas permitted in the Contract Documents and do not unreasonably encumber the site with materials or equipment.

Wiring and Terminations

Do not exceed manufacturer’s recommendations for cable pulling tension Where cable-pulling lubricant is used, the lubricant must not damage the conduit and cable sleeve materials and must not harden over time to prevent future pulls.

Confirm Division 26 installation of a pull string in every conduit. If additional cables are pulled in after the initial cable pull, pull a nylon pull string with the added cable.

Color-code all systems wiring with labeling and coding as submitted and approved by shop drawing. Cabling shall be continuous and shall not be spliced between equipment. Maintain color coding and tagging throughout the system at all accessible locations to the cabling.

Communication cables passing through any plenum space and not encased in steel conduits, must be plenum rated for their entire length.

The fire stop system shall comply with the latest editions of NEC and with NFPA 101-Life Safety Code and shall be made available for inspection by the local Authority Having Jurisdiction. The fire stop systems and products shall be UL tested and material shall be UL classified as materials for use in through-penetration fire stops.

Verify the fire rating of all walls and floors affected by their work.

Labeling

Equipment Racks & Rack-mounted Equipment

See specification Section 27 05 53 – Identification for Communications Systems for label material, text and general installation requirements.

Provide labeling for rack-mounted equipment with engraved and filled plastic laminate. Other methods of labeling rack-mounted equipment may be accepted upon prior approval by the AE Consultant and/or Owner.

Provide labels of contrasting color for rack-mounted equipment and racks on both the front and the rear.

Clearly label all racks, rack-mounted equipment, switches, controls, and panels unless noted otherwise.

Panels and plates shall be a minimum of 1/8” thick anodized aluminum etched, and epoxy filled unless noted otherwise.

Permanently mark each wire with a number at each end. Labels must be printed. Do not use adhesive wire labels from wire from books.

Coordinate with Division 26 to ensure that power receptacles within each rack and at remote equipment locations are labeled and match to the appropriate panel and circuit breaker.

Equipment Racks and Cabinets

Assemble equipment racks using best industry practices and tested off-site before on-site delivery and installation. No rack assembly shall be allowed on site depending on size and time frame of project without being completely wired except for terminations of field wiring to the rack.

Bond all equipment racks to the ground. Refer to specification Section 26 05 26.

Ensure that all equipment is installed with cooling and ventilation.

Coordinate with Division 26 contractor and construction manager the delivery of assembled racks to the construction site. Protect racks from dust, construction debris and other job site hazards during the entire duration of the installation. Depending on project timeline and size of the project.

Thoroughly clean all racks and equipment contained therein upon completion of the project and just prior to turn over.

Security covers designed to limit tampering of preset levels shall conceal all rack-mounted equipment not requiring frequent adjustment. Install blank and or vented panels as needed to fill unused spaces in racks.

Rigging

Install and mount equipment specified herein.

Provide drawings detailing mounting methods as well as attachment points and load ratings to building structure. If required by the AE Consultant, a structural engineer should sign/stamp the drawings.

Coordinate with all applicable trades. The rigging installer shall have experience in load calculations and the needed installation practices for safe rigging as the project equipment may require.

Provide safety wire of sufficient strength to anything suspended over audience areas excepting those that have three or more suspension points.

Minimum safety factor for all mounting and rigging: 5:1.

AV devices shall not share or utilize supporting structures intended for other systems.

Control System – Touch Screens

General

Provide a description of the control system programming to serve as a basis for the control system programming. Touch screen layouts and function shall not be limited to the operations outlined in this description.

Coordinate and schedule a meeting with AE Consultant and Owner to discuss touch screen operation prior to developing page layouts. Submit the touch screen page layouts and page relationship diagram, with a written button-by-button description of the function of each button, for review by the AE Consultant and Owner or Owner's Representative.

Pressing button "system on" shall power up devices in sequence. Pressing button "system off" shall be followed by a confirmation page to confirm system to turn off in sequence.

Provide light control presets as required in design. Include level control of lights (if integrated into control system), program volume, individual audio source volumes, etc. Microphone volumes shall be independently controlled on a subpage.

The control panels shall be intuitive and allow control of any source device available with a minimum of button presses. Provide visible feedback of the current operation of sources controlled on the touch panel. The panel should indicate audio levels for program and voice and indicate current lighting levels or preset.

The AV control system shall be capable of reporting status from all devices and locations in a central monitoring software system provided by the manufacturer of the control system. This feature is unusual for DFD projects it will need to be confirmed with Owner/Agency to determine the projects need to be included in the design.

AE NOTE: Some AV manufacturers allow this central control monitoring software to be installed/programmed by the AV System Installer and some do not.

Provide an information/help button on introduction page (splash page) of touch screen for project information/ help contact phone number. When pressed, display popup page that contains the following information.

PROJECT

Agency Name & Address

Room Name/Number

Original Installation Date

Current Version of Control Program

HELP DESK: Phone Number

SYSTEM DESIGNER: Name

Address

Telephone

AV SYSTEM INSTALLER: Company Name

Address

Telephone

[Technical Support Telephone if other that # above]

[GPC][STC]: Name

Address

Telephone

PROJECT ARCHITECT: Company Name

Address

Telephone

Coordinate and receive approval from Owner on graphics and final layout of project information page, welcome page (splash page).

Coordinate with the Owner and AE Consultant any control pages and/or functions that require passwords.

Room Combining

Provide where specified and components permit, a room combining page that shall be provided to visually show the floor layout and allows the user to insert and remove divider walls that mimic the spaces various combinations.

Provide and install components specified for automatic room combinations and divisions (for example: contact closures to detect air walls stored or utilized) the room combining page shall provide visual feedback.

The AV control system user shall be able to change room combining even if the configuration was automated.

If so, requested by the Owner, the room-combining page shall require a pass code to access.

Video Preview

Provide where specified and components permit, a video preview function shall be provided on the touch screen or in a podium display.

Preview function shall be accessible during live event operation without interrupting main displays and audio reinforcement system.

The video preview function shall be capable of using IP video streams.

Touching the video preview window on the touch screen shall toggle the video display between a predetermined sized video window and full screen display on the touch screen.

Lighting And Window Shade Control

Provide an interface for controlling the room lighting system and window shades if included in each room functionality.

Coordinate with Owner on presets for lighting and window shades.

Controlled Devices

Provide in the control coding and GUI touch screens positive real-time feedback of individual component control-state conditions. The feedback shall have minimum delay in response.

Provide an interface to environmental controls that are triggered with a specific device (e.g., dry contact relay), the trigger for the environmental control should provide feedback from the device rather than a simple button push.

Include a control system interface to mechanical or electronic devices such as screens, window shades, or room lighting. Where interfacing with systems installed by other trades, coordinate exact interface location with the appropriate contractor.

Provide remote power relays, wherever possible, shall be used to switch AV power to those devices whose power on/off function is otherwise not controllable. Using a device’s “stand-by” mode is an acceptable form of power down.

Include, when using infrared control, an external current sensor as part of the infrared control system; the sensor shall provide positive feedback to the control system to indicate whether the device is in a power on or power off state.

If so, requested by the Owner, all or select control system processors shall be programmed with an Auto Shutdown feature. Power off schedule shall be consulted with Owner prior to programming.

Owner furnished computers shall be connected to constant power source and shall not be included in the power down process.

Wherever devices that require keypad-style dialing, such as audio or video conferencing, mimic a telephone keypad display to allow dialing from the touch screen. Provide a display window above the keypad to display the number being dialed. The AV System Installer shall provide a backspace key to modify dialed numbers.

Video CODECs and Cameras

Provide in the control programming dialing control, a touch screen layout similar in look to the manufacturer handheld remote shall be provided. Minimum features shall include local camera control, far end camera control, phone-add, and privacy function. The AV privacy function shall mute the near end audio or video (selectable audio, video, or both) and the control system shall provide a large icon to indicate that selected privacy is enabled.

Determine camera presets in consultation with the Owner.

Voice-over-IP (VoIP)

Coordinate with Agency on users need to operate the VOIP system via the touch panels.

Integrated rooms with video Codec and audio conference calling will need the AV control system to operate the VOIP/SIP interface. In those rooms where this is required the following will serve as guidance for operation via the touch panels:

The control system shall be able to initiate calls via VOIP, SIP, or analog telephone. Provide a touch screen layout similar in look to standard touch tone phone. The audio privacy function shall mute near end audio and the control system shall provide a large icon to indicate that privacy is enabled.

Touch screens specified with SIP/RAVE functionality with built-in speaker and microphone, shall initiate calls via VOIP, SIP, or standard telephone. Determine a separate touch screen layout in consultation with Owner as the page may be used as a phone, intercom, or help desk.

Digital Signal Processor (DSP)

Provide input and output signal routing with DSP audio system processing adjustments.

Provide programming provisions included and discussed with Owner about system reboots or system resets as it may affect the control interface of the audio DSP system.

Include Acoustic Echo Cancellation (AEC)

Network

If network switches are specified in PART 2, Edit this article to consider that.

General

Agency may require managed switches even though unmanaged switches allow portions of the AV systems to function.

Agency may also have campus standards of a selected manufacturer that will be the responsibility of the AV system installer to confirm the AV system design will operate with the campus selected equipment.

Review with Agency’s network administrator AV streaming protocols that are included in the systems design. Switch selection shall meet manufacturer's specifications for specified or substituted equipment (e.g., AVB or CobraNet).

Provide the AV equipment MAC addresses and serial numbers for coordination with agency’s IT staff.

Provide firmware updates as needed for AV devices prior to final system testing.

Switches for Digital Video Systems and Control Systems

Provide managed switches with gigabit (1Gbps) Base-T Ethernet ports and non-blocking layer-2 functionality. Ports shall provide a maximum of 34.2 Watts PoE.

Where specified, switches requiring PoE shall support Type 1 PoE, Class 0-3 power sourcing on Ethernet ports and Type 2 PoE+, Class 4 power sourcing on Ethernet ports. Reference to the schematics for the number of ports that require PoE and shall verify switch will be capable of power sourcing the number of ports simultaneously.

Provide a brush grommet panel above or below switch if Ethernet ports connected on the front face of network switch when mounted in an equipment rack.

Dante Network Switch

Dante Network Switches, where specified, shall have Ethernet Ports with gigabit (1Gbps) and 1.488Mpps packet forwarding rate at minimum. Dante Switches shall be non-blocking layer-2 managed switches supporting DiffServe (DSCP) Quality of Service (QoS) with strict priority and four (4) queues per port.

Confirm that all ports are capable of simultaneous gigabit transfer and capable of switching off Energy Efficient Ethernet (EEE) and other power-saving features.

Configure DiffServe (DSCP) QoS to give top priority to the Dante clock synchronization and audio data the next highest priority.

VLAN's shall be used to separate virtual networks for audio and non-Dante data over same network. Multicast transmissions may be required for audio sent to multiple Dante devices. To minimize unnecessary duplication of audio streams in multicast, Internet Group Management Protocol (IGMP) shall be enabled in the Dante Controller software.

Where specified, for switches located over long distances, a switch shall be capable of supporting optical modules.

Refer to Audinate support documents for full setup details.

Q-Lan Network Switch

Configure per manufacturer’s recommendations. Refer to QSC support documents for full setup details.

Grounding

Do not connect metallic raceway of any type to equipment racks. This includes but is not limited to AC power and AV conduits. Ground equipment racks using stranded copper wire conductors connected only to isolated technical ground buss and bonded to equipment rack ground buss.

Isolate AV equipment racks that have metal wheels or metal based leveling feet from floor by use plywood sheeting. Paint all six surfaces of the plywood with fire retardant paint. Isolate equipment rack AC receptacles from equipment rack by use of isolated ground receptacles.

*Exception*: Plywood sheeting is not required if equipment rack has isolating plastic or rubber wheels or isolating plastic cap leveling feet.

Connect receptacle-isolated grounds only to isolated technical ground buss.

Refer to specification Section 26 05 26 articles “CONDUCTORS” and “COMMUNICATIONS SYSTEM GROUNDING”.

AV Systems Clean Power

“Clean power” typically involves isolated grounding infrastructure and power conditioning. Both are expensive. Confer with DFD Electrical Section before specifying such systems. Coordinate with Division 26 specification sections. Delete if not applicable.

Refer to Division 26 specifications and related drawings for isolated ground / clean power system requirements as applicable.

Follow installation methods and practices that do not compromise the isolated ground / clean power scheme.

Technical Requirements

Speaker and Amplifiers

Install manufacturer-provided security covers over all amplifier gain knobs.

Label each amplifier with which speaker zones each amp channel is driving.

Set gain levels for appropriate gain structure and maximum range of system volume.

Sequence power so amplifier is last device to turn on and first device to turn off.

Assistive Listening System

This system may be specified in another Section. Confer with other Div. 27 designers and/or Lead A/E to confirm requirements. Coordinate with specification Section 27 51 26 where applicable.

Provide equipment and hardware for required percentage of seating per ADA 2010.

For purposes of bidding, assume the following quantities:

* Receivers e/w Headset & Rechargeable Batteries – Qty. <enter quantity>
* Neck Loops – Qty. <enter quantity>
* Charging Case – Qty. <enter quantity>

Backstage Paging System

Show status (visual feedback) of page on control touch panels (adjacent to the page mic position) so operator initiating the page knows that the page is going through.

Have the page status wake up the touch screen if it is asleep.

Blu-ray Player

Provide remote IR Control or IP based control as determined by the Blu-Ray player interface.

Plugged into constant power.

Provide rack/shelf mount.

Speakers (Ceiling, Pendant, Wall-Mounted and Suspended Type)

Include custom painting in bid.

Coordinate color with Architect and Owner prior to installation of speaker grills.

Coordinate color with Architect and Owner prior to purchase and installation of suspended speakers, wall mounted speakers, and pendant speakers.

Provide all required rigging hardware.

Provide all required mounting hardware including safety cabling.

Provide free air cable support.

Schedule and coordinate speaker placement with other trades.

Digital Video System

Provide Video Media Test reports for each system.

Adjust Video Media transmitters and receivers for proper EDID tables and resolutions confirmed with project and OFCI devices.

Video Media Receivers shall be set to maintain aspect ratio as determined by display orientation.

Transmitters shall be set to auto switch between Digital and Analog inputs.

Provide Owner with complete list of all IP address.

Adhere to streaming specifications for each AV product manufacturer as they have different requirements for each product.

Coordinate V-LAN’S and IP schemes with owner.

Equipment Racks

Coordinate with Division 26 Contractor to maintain isolated ground.

Provide mounting hardware as required.

Provide power distribution for all equipment located within rack.

Provide rack screws as required.

Coordinate equipment to be mounted in equipment racks including OFCI provided equipment.

Provide appropriate equipment ventilation for equipment to operate at or below 80 degrees Fahrenheit.

Provide blank panels for all unused rack spaces.

Equipment Racks in Casework

Coordinate installation in architectural millwork or case work section.

Provide proper ventilation for maintaining equipment temperature below 80 degrees F.

Fire Alarm Coordination

Confirm if AV-system is to be connected to fire alarm system. Edit content as applicable.

All AV System audio shall be muted when fire alarm is activated.

Coordinate with Division 28.

Provide low voltage cable to fire alarm actuator.

Provide fire alarm actuator connection to relay input on AV system control master.

Flat-Panel Video Displays

Confirm display size and orientation with Owner prior to Owner ordering Display.

Confirm final mounting height and mounting locations with Owner prior to installing displays.

Flat-Panel Display installation shall meet ADA guidelines.

Supply appropriate wall mount bracket and specified backbox.

Coordinate with GPC the installation of wall blocking for wall mounting brackets.

Coordinate with Division 26 on providing and installing power outlets for AV back boxes.

Install, terminate, and test the each Display.

Provide and install AV over IP Network Connections and Digital Video connections.

Provide individual control of each Display as it may apply to that display’s use in the design. Control shall include:

Volume

On/Off

Input selects

Cable TV

Channel up/down

Keypad channels enter

Channel presets

Floor Boxes and Poke-Thru Assemblies and Outdoor Boxes

Coordinate with Division 26 and Telecom/Data Installer to ensure all required power and connectivity are provided for in the Box and/or Poke-Thru Assembly design.

See PART 1 direction re: mock-ups.

Front Fill Loudspeakers

Drive front fill speakers with a separate output from the DSP or mixing console.

Coordinate color with architect prior to installation.

Input/Output Panels

Mount at standard outlet height unless otherwise indicated in plans.

Coordinate finish with Architect prior to purchase or installation.

Confirm nomenclature of engraved labels with AE Consultant and Owner prior to ordering by submitting panel layouts with submittal package. See PART 1 Article SUBMITTALS.

Confirm number sequence of inputs and outputs with AE Consultant and Owner prior to ordering.

Interconnect Cables

Provide analog and digital interconnect cables/wiring for AV system inputs/outputs.

Loudspeakers and Emitters

Verify cabling routes, distances, paths between speakers, and mounting hardware manufacturer.

Provide all required mounting hardware including safety cabling.

Coordinate speaker placement with other trades (HVAC, lighting, fire protection, etc.).

Coordinate Color with Owner / Architect.

Provide additional speaker cable support as required. Where mounting in ceiling tile, provide support in the form of a Tile Bridge or other means. Do not support speaker solely by ceiling tile.

Paging Mics

Include in audio programming for the program audio system to "duck" program audio level when page mic is used.

At the end of a page, ramp program audio back up to previous level.

Projectors

Coordinate with AE Consultant and Owner on projector mounting positions with site conditions, image sizes, aspect ratios, and projector throw ratios prior to purchasing projectors.

Provide vibration isolation and additional support as required to stabilize projected image.

Provide the appropriate lens for all projectors. Field coordinate projector locations with other ceiling elements.

Projector mounting height shall be placed for optical alignment with projection screen so that keystone shall not be engaged.

Projection Screens

Self-perform or coordinate with Division 11 installer, if applicable, to ensure proper configuration and installation of projection screens.

Confirm mounting locations of screens.

All electric projection screens assumed to have 2" black drop unless otherwise noted.

Verify Black Drop in-field prior to procurement.

Provide adjustments to final trim of screens.

Tab-tensioned screens shall have no more than 4 inches of screen fabric on screen roller when screen is at presentation trim.

Screen Controls

Provide low voltage screen control three button wall plate as indicated on drawings.

Provide low voltage control interface from AV controller to screen controller.

Include if applicable and edit to match project requirements. Otherwise delete.

Sound Masking

Coordinate speaker placement with Sound Masking System.

Teaching Stations

Provide complete integrated solution with built in power and provisions for cooling and cabling.

Provide a finishing kit with approval of color / finish from owner / architect.

Provide touch screen mounts with tabletop kits on swivel mounts to meet ADA side reach accessibility guidelines.

Coordinate with Owner for instructor's station to be delivered to their shop for loading, wiring, and testing and then delivered to the job site for installation.

Touch screens and Button Panel Controllers

Must meet ADA guidelines.

Coordinate color with Owner / Architect approval.

Locate to avoid and conflicts with podium display.

Touch Screen Control

Provide “Welcome” page.

Provide owner representative approved graphics for welcome page.

All touch screen pages, and popup pages must be approved by Owner representative and AE Consultant.

Provide Help button on touch screen that displays help pages and Owner contact information for help calls.

Develop help pages that provide a button-by-button graphic representation of panel functionality.

Provide PDF printout of all help file pages.

Touch screen at equipment rack shall control system power.

Touch screen at equipment rack shall function as mater panel and shall control all system functions.

Touch screen layout and graphics shall be user friendly, intuitive, and consist of high-quality graphics and buttons that reflect a high-end technology system.

Upon completion, turn over to the Owner all accessories included with the manufacturer’s equipment but not used for the physical installation of the device. This includes but is not limited to remote controls, batteries, tools, installation hardware, cases, covers, software, etc.

Assistive Listening System

Where applicable, coordinate AV System installation with Assistive Listening System (ref. specification Section 27 51 26.

Commissioning

See section 27 08 00.41 – AV System Commissioning. Includes Testing and Acceptance requirements and Commissioning Checklists.

Documentation

General

Upon DFD and AE acceptance of the installed system, provide documentation as detailed below.

Submit all documentation in electronic form.

Provide:

* As-built Drawings
* Maintenance and Operations Manuals
* Test and Measurement Report (per 27 08 00.41)
* Construction Verification Checklists (per 27 08 00.41)

As-built Drawings

Provide updated Shop Drawings documenting as-built conditions for each system and room, including:

* Floor and Ceiling Plans showing device locations
* Schematics with wire-numbers
* Rack Elevations
* Power and Grounding. Include sequencing schedule where applicable.

Provide in Adobe PDF format. PDF shall be searchable and with each section bookmarked. Where original document is AutoCAD or REVIT generated, provided AutoCAD dwg file(s) also. Confirm AutoCAD file format version with DFD.

Identify as a Record Document (RD) and date on sheet or in the Title Block.

Maintenance and Operations Manuals

Refer to DIVISION 1 - GENERAL REQUIREMENTS Article 33 "Operating and Maintenance Manuals and Instructions".

Provide copies of approved submittals per specification Section 27 41 00. Documents should include products used on the project.

Provide User Manuals for all equipment provided.

Provide Equipment List that includes make/model and serial numbers of all installed equipment.

Training

General

Coordinate and schedule training with Agency selected team members and AV system installer design team.

Training shall be conducted at the project site using the project equipment for each unique system.

Training must cover, at minimum, the following items:

User Manual:

The manual outlined in Part 1, Maintenance and Operating Manuals, detailing the system functions.

Control Systems Programmer operations for each AV system.

Technical User:

Operations training on equipment and software use.

Maintenance User:

Updates and physical maintenance (cleaning of displays, bulb changes, filter cleaning, filter changing, etc.).

END OF SECTION