UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2025
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USACE / NAVFAC / AFCEC **UFGS-27 41 00 (November 2021)**

Preparing Activity: NAVFAC

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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SECTION 27 41 00

AUDIO-VISUAL SYSTEMS
11/21

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Note: This guide specification covers the general requirements for most audio-visual system projects. This specification does not cover detailed, project specific, design requirements. The system designer will need to address these specific requirements in the SYSTEM DESCRIPTION and EQUIPMENT LIST AND SPECIFICATIONS paragraphs and on any related drawings or supplemental documents. An independent system designer may be required for this purpose. In this case, the design process should follow the requirements of ANSI/INFOCOMM 2M-2010 and ANSI/BICSI 001 2017, with the lead system designer having a CTS-D certification.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
****

PART 1 GENERAL

1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide

specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AUDIOVISUAL AND INTEGRATED EXPERIENCE ASSOCIATION (AVIXA)

ANSI/INFOCOMM 2M	(2010) Standard Guide for Audiovisual Design and Coordination Processes
ANSI/INFOCOMM 10	(2013) Audiovisual Systems Performance Verification
ANSI/INFOCOMM A102.01	(2017) Audio Coverage Uniformity in Listener Areas
AVIXA F502.01	(2018) Rack Building for Audiovisual Systems
AVIXA F502.02	(2020) Rack Design for Audiovisual Systems
INFOCOMM F501.01	(2015) Cable Labeling for Audiovisual Systems

BICSI International Standards Program (BICSI)

ANSI/BICSI 001	(2017) Information and Communication Technology Systems Design and Implementation Best Practices for Educational Institutions and Facilities
ANSI/BICSI N1	(2019) Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure
ANSI/BICSI N3	(2020) Planning and Installation Methods for the Bonding and Grounding of Telecommunication and ICT Systems and Infrastructure

ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)

ECIA EIA/ECA 310-E	(2005) Cabinets, Racks, Panels, and Associated Equipment

EXTRON ELECTRONICS (EE)

EE GUI Design Guide	(2020; 4th Edition) Graphical User Interface Design Guide

MIDDLE ATLANTIC PRODUCTS (MA)

MA Whitepaper	(2018) Controlling the Temperature Inside Equipment Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023; ERTA 1 2024; TIA 24-1) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-568.0	(2020e) Generic Telecommunications Cabling for Customer Premises
TIA-568.1	(2020e) Commercial Building Telecommunications Infrastructure Standard
TIA-568.2	(2024e) Balanced Twisted-Pair Telecommunications Cabling and Components Standards
TIA-568.3	(2022e) Optical Fiber Cabling Components Standard
TIA-568.4	(2022e) Broadband Coaxial Cabling and Components Standard
TIA-569	(2019e; Add 1 2022) Telecommunications Pathways and Spaces
TIA-606	(2021d) Administration Standard for Telecommunications Infrastructure
TIA-607	(2019d) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

U.S. Code (USC)

19 USC 13	Trade Agreements Act of 1979
41 USC 83	Buy American Act

U.S. DEPARTMENT OF DEFENSE (DOD)

DODI 8100.04	(2010) DOD Unified Capabilities (UC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

UL SOLUTIONS (UL)

UL 2043	(2023) Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
UL 62368-1	(2019) UL Standard for Audio/Video, Information, and Communication Technology Equipment - Part 1: Safety Requirements

1.2 RELATED DOCUMENTS

a. Drawings and general provisions of the Contract including General and Supplementary Conditions and UFGS Division 01 Specification Sections.

b. UFGS Division 26 Specification for Communications cabling, cabling pathways, termination and physical mounting of cable hangers and cable trays.

c. UFGS Division 26 Specification Sections for room lighting fixtures, dimmers, power receptacle outlets, and interconnecting wiring for these circuits.

d. UFGS Division 27 Specification Sections for all telecommunications requirements - including LAN connections, analog and digital telephone lines, digital data circuits, high speed internet access and building horizontal cabling.

e. Section 27 05 13.43 TELEVISION DISTRIBUTION SYSTEM for CATV Systems.

f. Section 25 05 11 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS.

g. UFGS Division 23 Specification Sections for Heating, Ventilation and Air Conditioning.

h. Audiovisual drawings and equipment lists.

i. If system design services are required, provide designs in accordance with ANSI/INFOCOMM 2M and ANSI/BICSI 001.

1.3 SCOPE OF WORK

****
NOTE: Delete items i., j., and k. below if not included in the Scope of Work.
****

This Specification Section outlines the minimum requirements and installation methods for the integrated audiovisual System, hardware, software, cables, accessories, and acceptance testing. System refers to the complete and functional assemblage of equipment required to achieve

the specified functionality, performance, and design intent. This includes but is not limited to:

a. Audio equipment: Speakers, mixers, amplifiers, microphones, signal processing equipment, and source equipment.

b. Video equipment: Displays, signal routing and processing equipment, and source equipment.

c. Video projection screens

d. Remote control equipment including touch panels, control processors, software, and programming.

e. Equipment racks and associated hardware such as rack screws, power distribution products, cooling products, and blank panels.

f. Cables, snakes, connectors, plates, and wiring.

g. Other similar parts that may be required for normal operation such as projector bulbs and lenses.

h. Mounts, rigging, and required hardware such as all-thread, unistrut, chains, and cables.

[i. Floor boxes

][j. Display wall boxes

][k. AV lecterns and credenzas

] l. System commissioning

m. Training

n. Documentation

o. Communication and coordination with all team members and trades to fulfill the requirements of this Specification.

1.4 EXCLUDED SCOPE OF WORK

****

NOTE: Delete items c., d., and e. below if included in the paragraph SCOPE OF WORK.

****

a. Cutting and patching

b. Painting, refinishing and finishes

[c. Floor boxes

][d. Display wall boxes

][e. AV lecterns and credenzas

] f. Work specified in other UFGS Specification Sections.

1.5 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G". Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy and Air Force projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualifications; G

Bid Pricing; G

SD-02 Shop Drawings

Shop Drawings; G

SD-09 Manufacturer's Field Reports

Status Reports and Meeting Minutes; G

SD-10 Operation and Maintenance Data

Record Drawings; G

Operation and Maintenance (O&M) Manuals, G

1.6 CYBERSECURITY

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NOTE: Coordinate any audio-video networking requirements with facility needs and cybersecurity requirements.

****

Coordinate any network security requirements related to this Specification in accordance with Section 25 05 11 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS.

1.7 QUALIFICATIONS

1.7.1 General

a. Comply with all UFGS Division 1 (General Requirements) standards to include Section 01 14 00 WORK RESTRICTIONS.

b. The Government reserves the right to accept or reject the System Contractor or Manufacturer based upon qualifications and ability to conform to specified technical or licensing requirements of this Section. System Contractors, Installers and Manufacturers that do not have the specified qualifications will not be acceptable and will not be allowed to perform the work of this Section.

c. The Government will determine the acceptability of any proposed System Contractor, Installer and Manufacturer based on submitted and verified documentation that substantiates that the proposed System Contractor, Installer and Manufacturer have the qualifications specified in this Section.

d. Submit documented verification of the specified qualifications as part of the Data Qualifications submittal. The Government maintains the right to request, inspect and verify references and resumes of all technical and managerial personnel assigned to the project.

1.7.2 System Contractor Qualifications

The System Contractor must:

a. Be licensed in the project jurisdiction as required to perform the work included in this Specification.

b. Be regularly engaged in the system application design, documentation, installation, testing, training, and maintenance of the type of system specified in this Section.

c. Have a minimum of five [_____] years of experience providing these services for systems having the same level of features and functions as the system being provided.

d. Submit [five] [_____] references with contact names and valid telephone numbers regarding similar projects successfully completed within the last [3] [_____] years.

e. Be capable of providing manufacturer-specified installation, programming, training, maintenance, and repair for all equipment provided.

f. Have an office within a [120] [_____] mile radius of the project site that can provide all specified service and support.

g. Be responsible for any required low voltage permits.

h. Use a Project Manager with a [CTS] [CTS-I] [CTS-D] [RCDD] [RTPM] [PMP] [_____] certification.

i. Use a Lead Installer with a [CTS] [CTS-I] [CTS-D] [RCDD] [_____] certification.

j. Use a Control System and Digital Signal Processor (DSP) Programmer certified by the manufacturer(s) of the product(s) used in the project.

k. Submit names and resumes of key personnel that will be assigned to the project. As a minimum, these personnel must include the Project Salesman, Project Manager, Lead Installer, Control System Programmer, and Digital Signal Processor Programmer. The same person may be utilized for multiple project responsibilities. Once approved, these personnel are expected to work on the project through the duration. Any replacement personnel must be approved by the Contracting Officer. The approved Lead Installer, Control System Programmer, and Digital Signal Processor Programmer must be present during system commissioning.

1.7.3 Manufacturer Qualifications

Each product manufacturer must:

a. Have a minimum of [5] [_____] years' experience in producing the products and type of system included in this Specification Section.

b. Guarantee the availability of the replacement parts for the designed system for a minimum of [3] [_____] years from the date of final acceptance of the system by the Contracting Officer.

1.8 BID PRICING

****
NOTE: Remove this paragraph if the project does not require bid pricing to be submitted.
****

Submit the following in conjunction with the System Contractor Qualifications information:

a. Complete and accurate listing of all equipment to be used in assembling the system(s).

b. Itemized pricing for all equipment. Include sales tax where applicable.

c. Itemized costs for all pertinent labor/installation categories.

d. Itemized costs for any optional items such as Add/Deduct Alternates and Extended Warranties.

[e. Any proposed Handing and Administration Rates (HAR) are not to exceed 5 percent. This fee will account for all administrative costs, overhead, bonding fees, administration of subcontracts, profit, and any other costs associated with and related to the coordination and processing of the procurement and installation of the equipment. The proposed HAR percentage will be incorporated into the contract award and will not be adjusted regardless of fluctuations from the estimate amount for the FF&E. The proposed HAR is a fixed rate.

]1.9 SHOP DRAWINGS

Submit the following prior to the purchase, assembly, or installation of any equipment:

a. Drawing Index and Title Page.

b. Symbols Legend showing all devices, cable types, labelling scheme and any other information required to decipher symbols in the submittal package.

c. Floor Plans, Reflected Ceiling Plans, and Sectional View drawings as required to completely document all devices, dimensional locations, and infrastructure requirements.

d. System wiring diagrams showing make and model of equipment, logical wire traces, cable types, and any other identifying labels for wiring or ancillary devices.

e. Rack Elevations showing rack identifiers, equipment location within each rack, per-outlet power distribution details, and any rack accessories.

f. Plate and Panel drawings showing connections, size, finish, color, engraving, and any other information required to document fit and finish of wall plates or floor boxes.

g. Riser drawings showing cable routing between wall plates, floor boxes, ceiling devices, racks, and any other devices as required.

h. Additional drawings as required -including but not limited to custom furniture and millwork, custom display details and equipment mounting.

i. Patch Panel and/or Network Switch Layouts that show port numbering schemes and IP information as required.

j. Product data sheets for equipment and cabling, organized logically by system type and indexed for reference. Any parts used but not approved may be rejected at any time.

k. Material samples as required.

l. Project schedule including key milestones including but not limited to submittal packages, material procurement, rack fabrication and shop testing, installation milestones as applicable, acceptance testing, and completion.

m. Images of proposed touch panel layouts, with functional descriptions of buttons and pages. The Contractor will make up to two iterative edits based on comments from the Contracting Officer at no additional cost.

1.10 STATUS REPORTS AND MEETING MINUTES

a. Provide [weekly] [daily] status reports outlining progress on the project to the Contracting Officer. These reports must include information on the work completed during the [week] [day], the work to be completed during the upcoming [week] [day] and any potential scheduling issues.

b. Provide minutes for any meetings directly related to this project. Minutes are to be completed within one [week] [day] of the meeting.

1.11 DELIVERY, STORAGE, AND HANDLING

a. All costs for shipping to the site, and of any unusual storage requirements, are to be a part of this Specification.

b. Make appropriate arrangements, and coordinate with authorized personnel at the site, for the proper acceptance, handling, protection, and storage of equipment so delivered.

c. Until site conditions are ready for installation of the AV equipment, some AV equipment must be received and stored offsite in suitable environmental conditions for sensitive electronic equipment. This equipment must be made available to the Government for inspection as required.

PART 2 PRODUCTS

2.1 GENERAL

a. All materials must be new, free from defects and not less than the quality specified. Materials must be designed to ensure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.

b. At the time of submittal, supply the latest model for each piece of equipment.

c. All products used must be manufactured no more than one year prior to installation.

d. All products must be provided with the latest version of all software/firmware.

e. All equipment must be UL 62368-1 or equivalent listed or industry standard and comply with the NEC NFPA 70.

f. Equipment installed in air handling spaces must be UL 2043 listed

g. Where indicated as relevant to this project, all equipment must be 19 USC 13 compliant, 41 USC 83 compliant, and approved prior to purchase.

h. Where indicated as relevant to this project, all equipment must be

DISA compliant and on the DODI 8100.04 DoDIN Approved Products List.

i. No Substitutions or Variances are allowed without the written consent of the Contracting Officer or their approved representative.

j. Substitute equipment must meet or exceed the performance specifications of the basis of design equipment and be at no additional cost.

k. Substitute equipment must not impact the existing architectural, mechanical or electrical designs.

l. Submit equipment pricing based on the specified equipment herein. Any substitute equipment or new proposed equipment necessary to fulfill the design intent, must be clearly categorized and priced individually on a separate page as an alternate to the specified equipment. Pricing for the original specified equipment must still be provided.

[2.2 SPARE PARTS

****
NOTE: Remove this paragraph if not applicable to the project. If applicable, the system designer must update this paragraph based on the actual project requirements.
****

Provide spare parts/attic stock as identified below:

a. XLRM to XLRF microphone cable, 7.6 meter 25-foot, black. QTY. 2

b. Cat6 patch cable, 0.9 meter 3-foot, white. QTY.6

c. Rechargeable battery for wireless microphone. QTY. 2

]2.3 SYSTEM DESCRIPTION

****
NOTE: The system designer must update this paragraph based on the actual project requirements. This sample paragraph is based on the design used in the Technical Paper.
****

2.3.1 Large Conference Room

a. A wall-mounted flat panel display is required for local presentations and video conferencing. The display will be sized to allow appropriate viewing from the furthest point at the conference table based on mixed media (video and graphics) content and basic decision-making calculations. The display will include a tilting wall mount. An in-wall storage box will be located behind the display to recess a surge protection AC power outlet and any accessory devices.

b. Sources to the display will include an in-house CATV feed (provided and installed by others), a Government provided room computer located in the credenza, a wired laptop input at the credenza (with both HDMI and VGA connections), and a wireless presentation device.

c. The Government provided computer will include a wireless keyboard and mouse and will be configured with software as required to allow web conferencing.

d. The wireless presentation device will allow connectivity from Windows, Android, OSX and iOS devices. It will also be used for basic digital signage and emergency notifications.

e. A high definition (1080P) USB web camera with pan/tilt/zoom capability will be provided to allow capture of room participants seated at the conference table. The camera will allow all seated participants to be viewed at once or allow along with the ability to zoom in on individual participants or smaller groups of participants. The output of the camera will be extended to the room computer.

f. Pendant ceiling microphones will be located above the conference table to capture participant voices from a seated position at the conference table. The microphones will include tracking technology to allow them to focus on participants speaking. These microphones will feed the room PC (via a USB interface) for web conferencing. Local voice reinforcement is not required.

g. Ceiling speakers will be provided for program audio playback.

h. The room will also include integrated VoIP audio conferencing using the built-in room microphones and speakers. VoIP service will be provided by others.

i. A wireless touch screen, with a docking station at the credenza, will be provided for room control. Refer to paragraph REMOTE CONTROL SYSTEM PROGRAMMING for control system functionality. The system will interface with the room lights and shades if programmable lighting and shading systems are provided.

j. A room scheduling panel will be located outside of the room. This panel will be PoE powered and connect to the Government LAN. It will interface with Office 365 to allow scheduling of the room through a standard Outlook Calendar invitation. Coordinate the configuration of this touch panel with the Contracting Officer. The panel will include indicator lights that turn from green to red when the room becomes unavailable.

k. Rack mounted equipment will be installed in a small cabinet in the room credenza. The rack and credenza will be designed to allow adequate ventilation.

2.4 EQUIPMENT LIST AND SPECIFICATIONS

****

NOTE: The system designer must update this paragraph based on the actual project requirements. This list should include all required types, and quantities of equipment by room, along with their pertinent specifications. For ease of formatting and overall management of the large number of products that may be specified, it is recommended that this equipment list be prepared as a separate spreadsheet and inserted into this Specification as an Attachment or included on the design drawings.

See example based on the Conference Room document in the Technical Paper.

****

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with the details of the work and working conditions, verify dimensions and equipment locations in the field, and advise the Contracting Officer of any discrepancies before performing the work.

3.2 GENERAL INSTALLATION STANDARDS

a. Coordinate the installation of all equipment, wiring, and associated hardware to be compatible with the work of other trades and with the overall construction completion schedule. Coordinate all access and work with the Government in advance.

b. Protect all finishes, furniture, and equipment, and maintain a clean work environment while working and when finished each day.

c. Perform installation in strict accordance with AVIXA standards and best practices, general industry standards and best practices, the National Electrical Code, and any other governing codes.

d. Keep a complete and accurate set of installation drawings at the job site. Note any changes made during installation on the drawings. Include a final set of as-built drawings with the Operation and Maintenance manuals.

e. Install all equipment following the manufacturers' recommendations and broadcast standards. Adjust and test to assure that all components are functioning properly by themselves and in conjunction with their associated components.

f. Install all equipment in appropriate cabinets or consoles at the locations designated in this document or on the associated contract drawings.

g. Apply no advertising to racks, equipment, and accessories. Where possible, [and requested by the Contracting Officer,] remove all visible manufacturer name badges from equipment mounted in public areas.

h. Cleanup and dispose of all waste materials daily. Wherever possible, materials must be properly recycled.

3.3 MOUNTING, RIGGING AND SEISMIC RESTRAINT

a. Design and build equipment racks in accordance with AVIXA F502.01, AVIXA F502.02, and ECIA EIA/ECA 310-E.

b. Mount equipment in accordance with 36 CFR 1191.

c. Securely fasten all equipment in place unless requirements of portability dictate otherwise. Fastenings and supports must be adequate to support their loads with a safety factor of at least five.

d. Provide seismic protection, including supports and hangers, as required by applicable code.

e. Install all boxes and equipment plumb and square per the manufacturer's recommended mounting practice.

f. Securely fasten and support all equipment without hindering equipment operation.

g. Provide shaft locks or security covers on all non-user-operated equipment having front panel controls.

h. Provide structural/rigging calculations for mounting equipment more than [227 Kilograms] [500 pounds] [_____]. Mounting details may require review and approval by the project's Structural Engineer.

i. Equipment racks will be designed to ensure proper thermal management. Maximum constant operating temperature of equipment should not exceed 85 degrees Fahrenheit. Where cooling fans are provided in racks located in sensitive areas, select fans to minimize the noise impact in the area. Refer to MA Whitepaper.

3.4 GROUNDING AND SHIELDING

a. Install grounding in accordance with NFPA 70, TIA-607, ANSI/BICSI N3 and all Division 26 Specification Sections.

b. As a minimum, provide individual equipment racks with a rack grounding stud or bus bar and a #12 stranded (minimum) bonding jumper connected to the grounding and bonding stud on the primary power distribution unit that is plugged into the power receptacle serving the rack. Isolate the rack from the floor with plastic or rubber wheels/leveling feet.

c. Verify the integrity of grounding systems prior to connection of equipment.

3.5 GENERAL WIRING STANDARDS

a. Provide, install, terminate, and test all cabling in accordance with TIA-568.0, TIA-568.1, TIA-568.2, TIA-568.3, TIA-568.4, TIA-569, ANSI/BICSI N1, AVIXA F502.01, AVIXA F502.02 and other industry best practices.

b. All wiring runs must be unspliced where possible. Splices are not permitted in conduit, outside of listed splice boxes.

c. Cable routed in conduits or equipment racks to have non-plenum (PVC) rated jacket. All other cables to have a plenum rated jacket.

d. Cables routed above ceilings must be suspended above the ceiling tiles in J-hooks or cable tray.

e. Provide outdoor-rated, direct burial, or other similar specialty rated cable types where required based on installation conditions and applicable codes.

f. The following denotes the most common cabling types and the minimum

performance requirements. The Contractor is required to verify all cabling specifications based on the actual equipment provided.

(1) Microphone and Line Audio Cable:

(a) 22 AWG (7x30) stranded twisted shielded pair with overall shield

(b) Nominal Capacitance (Conductor to Conductor): less than or equal to 35 pF/ft

(c) Nominal Capacitance (Conductor to Conductor and Shield): less than or equal to 67 pF/ft

(2) Low Impedance Loudspeaker Cable:

(a) 14 AWG (19x27) stranded twisted pair

(b) Nominal Capacitance (Conductor to Conductor): less than or equal to 36 pF/ft

(3) Low Impedance Loudspeaker Cable:

(a) 12 AWG (19x25) stranded twisted pair

(b) Nominal Capacitance (Conductor to Conductor): less than or equal to 36 pF/ft

(4) Low or High Impedance Loudspeaker Cable

(a) 16 AWG (19x29) stranded pair

(b) Nominal Capacitance (Conductor to Conductor): less than or equal to 36.5 pF/ft

(5) High Impedance Loudspeaker Cable (70V / 100V)

(a) 18 AWG (7x26) stranded pair

(b) Nominal Capacitance (Conductor to Conductor): less than or equal to 34 pF/ft

(6) Antenna Cables - RG58 - Wireless Microphone and Assisted Listening

(a) 50 ohm RG-58 19 AWG solid center conductor

(b) Nominal Capacitance (Conductor to Shield): less than or equal to 27 pF/ft

(c) Nominal Attenuation at 900MHz: less than or equal to 12.5 dB/100 ft

(7) Antenna Cables - RG213 - Wireless Microphone and Assisted Listening

(a) 50 ohm RG-213 13 AWG solid center conductor

(b) Nominal Capacitance (Conductor to Shield): less than or equal to 31 pF/ft

(c) Nominal Attenuation at 900MHz: less than or equal to 6.5 dB/100 ft

(8) Antenna Cables - RG8/U - Wireless Microphone and Assisted Listening

(a) 50 ohm RG-8/U 10 AWG solid center conductor

(b) Nominal Capacitance (Conductor to Shield): less than or equal to 25 pF/ft

(c) Nominal Attenuation at 900MHz: less than or equal to 4 dB/100 ft

(9) Video Tie Line Cable:

(a) RG59/U coaxial cable 20 AWG solid bare copper

(b) Nominal Capacitance (Conductor to Shield): less than or equal to 16.5 pF/ft

(c) Nominal Attenuation at 3000MHz: less than or equal to 22 dB/100 ft

(10) Video Tie Line Cable:

(a) RG6/U coaxial cable 18 AWG solid bare copper

(b) Nominal Capacitance (Conductor to Shield): less than or equal to 16.5 pF/ft

(c) Nominal Attenuation at 3000MHz: less than or equal to 18 dB/100 ft

(11) Video Tie Line Cable:

(a) RG11/U coaxial cable 14 AWG solid bare copper

(b) Nominal Capacitance (Conductor to Shield): less than or equal to 16.5 pF/ft

(c) Nominal Attenuation at 3000MHz: less than or equal to 10.5 dB/100 ft

(12) Video Tie Line Cable Five (5) Conductor - Mini High-Res:

(a) 5 x 26 AWG coaxial cable with overall jacket

(b) Nominal Capacitance (Conductor to Shield): less than or equal to 17 pF/ft

(c) Nominal Attenuation at 1000MHz: less than or equal to 21.5 dB/100 ft

(13) Video Tie Line Cable Five (5) Conductor - RG59:

(a) 5 x 24 AWG coaxial cable with overall jacket

(b) Nominal Capacitance (Conductor to Shield): less than or equal to 17.5 pF/ft

(c) Nominal Attenuation at 1000MHz: less than or equal to 13.5 dB/100 ft

(14) Digital Video SUTP Tie Line Cable

(a) 4 x 26 AWG solid bare copper, shielded twisted pair

(b) Nominal Capacitance (Conductor to Shield): less than or equal to 25 pF/ft

(c) Nominal Attenuation at 500MHz: less than or equal to 20.5 dB/100 ft

(15) Data Tie Line Cable:

(a) Refer to telecommunications specifications for project-standard data cabling information.

(16) RS-232 Control Cable

(a) 22 AWG (7X30) Two pair twisted, individually shielded with drain wire

(b) Nominal Capacitance (Conductor to Conductor): less than or equal to 17 pF/ft

(17) Specialty Control Cable - AXLINK, CRESNET:

(a) 22 AWG (7X30) shielded twisted pair with drain wire and 18 AWG unshielded pair in single jacket

(b) Nominal Capacitance (Conductor to Conductor): less than or equal to 14 pF/ft

(18) Multimode Optical Fiber:

(a) 50/125 micron as required per transmission equipment manufacturer recommendation. If transmission equipment does not support 50/125 micron, 62.5/125 micron shall be permitted.

(b) Strand count per functional drawings; minimum of two strands for each run outside the main equipment cabinet.

(c) Shall support 10Gbps transmission speed for length of run

(d) Each optical fiber strand shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of this specification and all TIA-568.3 performance parameters.

(19) Single-Mode Optical Fiber:

(a) 8.3/125 micron

(b) Each optical fiber strand shall be sufficiently free of

surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of this specification and all TIA-568.3 performance parameters.

(20) Unshielded Ethernet:

(a) 4Px24 AWG UTP

(b) Cat6 with a minimum TIA-568.2 standard rating

(21) Shielded Ethernet:

(a) 4Px24 AWG STP

(b) Cat6 with a minimum TIA-568.2 standard rating

g. Use digital video cable as specified by the product manufacturer to obtain a signal at the maximum capable system resolution (minimum 1080P, 60Hz) that is free from all artifacts at each display from each source location. Use shielded cabling and connectors as required. Where multiple cabling options are provided by a manufacturer, use the option resulting in the greatest performance.

h. All Category cabling and connectors are to be rated at CAT6 or greater with a minimum TIA-568.2 standard rating.

i. All Category cabling and connectors to be terminated to the T568A standard unless otherwise required.

j. Use color-coded ruggedized and lockable (Neutrik EtherCON or similar) shielded panel connectors and shielded inline connectors for all Contractor provided signal distribution equipment that requires RJ-45 style connectors at wall panel or floor box panel connections, except for those connecting a piece of AV equipment to the LAN. Maintain all cable shielding as required.

k. Each digital AV over RJ-45 receptacle, permanently installed cable, equipment cord, and patch panel will be of a color or have markings that are non-standard with the voice/data system, and be plainly and permanently labeled "AV Only".

l. Arrange, route, and isolate wiring according to signal level to minimize crosstalk, hum, or spurious signals. Wiring categories must consist of: microphone level (minus 80 dBm to minus 20 dBm), line level (minus 20 dBm to plus 30 dBm), loudspeaker level (plus 30 dBm and above), AC power, and DC control or emergency power.

m. Select cable color according to signal type. Submit color scheme to Contracting Officer for approval as a part of the Shop Drawing submission package.

n. Install all cabling in an orderly and professional manner. Provide service loops to allow access to the rear of equipment.

3.6 LABELING

a. Label all cables and equipment in accordance with TIA-606 and INFOCOMM F501.01.

b. Use white labeling with black text unless requested otherwise by the Contracting Officer.

c. Provide the wire run list as an Excel spreadsheet and include as a part of the Operation and Maintenance Manuals.

d. Clearly and logically label external devices such as audio mixers, wireless microphones, belt packs, and assistive listening receivers.

e. Label relevant inputs and outputs on switchers, matrices, and mixers. This includes digital/virtual labelling of audio channels and video inputs and outputs.

f. Label telephone numbers, ISDN numbers and IP addresses of pertinent devices.

g. Label cabling wherever it is exposed in junction or pull boxes.

3.7 REMOTE CONTROL SYSTEM PROGRAMMING

a. Design graphical user interfaces in accordance with industry standards such as noted in EE GUI Design Guide.

b. As a minimum, the remote-control systems (where provided) will be programmed for the following general functionality as appropriate for each room:

(1) Power sequencer: Rack power on/off.

(2) Projection screen: Up/down. Screen must automatically lower when the projector is turned on and automatically raise when the projector is turned off.

(3) Projector lift: Up/down. Provide the following lift preset positions: projector off (fully up), show position (projector in normal operating position), and service position (fully down).

(4) Displays: Power on/off, input source select, video mute, lamp life monitoring. Automatic power on when a source is selected for display.

(5) Video matrices: Source routing.

(6) Video cameras: Pan/tilt/zoom, preset store and select.

(7) CATV/Satellite TV tuner: Manual channel select, preset channel store and recall.

(8) Media player: Standard transport and menu controls.

(9) Recorder: Standard transport and menu controls, record source select.

(10) Audio matrix: Dialing, privacy, local and remote volume up/down/mute, pick up/hang up.

(11) Video codec: Dialing, privacy, volume up/down/mute, pick up/hang up, camera controls, menu navigation, source send select.

c. Where all room video sources are portable, use video sync sensing to automatically power on the room display system upon connection of a video source and automatically power off the display upon disconnection of a video source.

d. Provide separate Program and Microphone audio level controls with mute function. Include a technician's page with access to individual microphone level controls. Include a preset button to recall default levels.

****
NOTE: If the Audiovisual system is not monitored, item e. can be deleted.
****

[e. UPS: System monitoring. Provide a technician page for the monitoring of the UPS. Feedback will be provided to monitor the following conditions as available by the UPS: Utility Voltage, Output Voltage, Current Load, Load Percentage, Wattage Load, Battery Capacity, Battery Voltage, Remaining Battery Time, Remaining Charging Time, and Cabinet Temperature. Provide alerts for the detection of any system faults, warnings, or abnormal conditions as available.

] f. Lighting system: Preset 1-4 recall, all lights on, all lights off, individual lighting zone raise/lower, all lights raise/lower.

g. Shades: Open, close, stop. Provide individual controls for each shade zone and type (such as sun control and blackout).

[h. Room combining: In room combined mode, all video sources must be made available to all video destinations and all microphone sources must be made available to all audio destinations. The audio from the last routed video source is to become the local program audio source. One control system touch panel is to become the master (or multiple touch panels can track together). In rooms with operable partition sensors, use the sensors to automatically recall the room combination presets.

][i. In the absence of pre-defined touch panel templates, propose draft touch panel pages for review and approval by the Government prior to programming. A minimum of one meeting must be provided to present these pages. Provide modifications as necessary based on comments resulting from the meeting.
]

****
NOTE: Powering off an Audiovisual system may not be recommended in certain applications. If not desired, item j. can be removed.
****

[j. Program the control system to automatically power down the AV systems each day at a time specified by the Contracting Officer. Fully power off (or place in stand-by mode) all non-critical equipment.

] k. Where applicable, provide web browser-based control of each room in addition to the room touch panels.

l. Coordinate all required control system LAN settings with the Contracting Officer.

m. Include [eight] [_____] hours of additional programming time as a part of this Specification for any requested control system modifications after initial system acceptance but prior to the expiration of the warranty period.

3.8 SYSTEM TESTING AND ADJUSTMENT

a. Perform in accordance with ANSI/INFOCOMM 10.

b. Demonstrate that all audio system coverage is in accordance with ANSI/INFOCOMM A102.01.

c. Demonstrate that the entire scope of work defined is complete and fully functional per the scope of this specification and drawings, as well as any additional approved modifications and revisions.

d. Prior to conducting Commissioning with the Government, complete an internal quality review including a minimum of the following:

(1) Verify that all equipment has been delivered and installed per specifications. Provide a detailed equipment list sorted by room number and rack complete with make, model and serial number.

(2) Verify that all other trades have completed the work associated with the functioning of the audiovisual systems and that any installed third-party devices such as screens, shades, and lights work properly with the AV systems.

(3) Power on all equipment and verify the intended functions.

(4) Verify signal paths and cable continuity/integrity for all field terminated wiring.

(5) Adjust and align all displays for color, contrast, and geometry.

(6) Verify all communications services such as POTS, ISDN, and Ethernet.

(7) Configure and test the functionality of all audio and video conferencing systems.

(8) Load and test all DSP and control system software and provide button by button testing of all control system touch panels.

e. Provide documentation to the Contracting Officer that the systems are substantially complete at least [one week] [_____] in advance of Commissioning with the Government.

3.9 TEST EQUIPMENT

Provide all test equipment and test materials relative to the scope of the project to include legal copies of all source media in all appropriate formats and blank recordable media in all appropriate formats.

3.10 COMMISSIONING

a. Perform in accordance with ANSI/INFOCOMM 10.

b. After preliminary system installation and adjustment, conduct a

Commissioning Test with representatives from the Government present.

c. Schedule testing to ensure the availability of all required personnel and rooms.

d. During the commissioning, demonstrate the operation of each individual piece of equipment in the system, and the system as a whole. Also demonstrate that equipment functions according to manufacturer's specifications, industry standards, and as stated in this Specification.

e. This demonstration must include a minimum of the following:

(1) A physical inventory of all equipment

(2) An evaluation of general workmanship and construction quality

(3) A mechanical check of all system components

(4) The physical operation of all system equipment (audio, video, control, and network) including button-by-button control system testing

(5) The placement of audio and video test calls

3.11 SYSTEM TRAINING AND OPERATION ASSISTANCE

a. Conduct a training program for a nominal [_____] staff members as designated by the Contracting Officer to instruct on overall system and individual equipment operation, basic preventative maintenance, and basic system troubleshooting. Provide a nominal [____] hours of training which may be scheduled at the Government's request at any time up to one year following system acceptance.

b. The training program will include a minimum of two [video recorded] sessions. The first session must occur immediately after the acceptance of the systems and cover the basic operation of each system. Provide the second training session within [_____] weeks from the first session. The operation and maintenance manuals for the equipment must be completed and presented at this time. This training session will be used to train additional people and/or to answer questions/resolve issues developed within the first weeks of system use.

c. Notify the Contracting Officer at least [14] [_____] days prior to the start of each course.

3.12 RECORD DRAWINGS

a. Submit as-built documentation upon completion, including but not limited to, the following:

(1) All information contained in the Shop Drawings submittal package as detailed above and edited to reflect final conditions.

(2) Documentation of equipment serial numbers and network/phone/ISDN addressing scheme.

(3) Software files for touch panel interfaces, source code, DSP, and

equipment settings, both compiled and un-compiled code for future system modification.

(4) Manufacturer product guides and instruction manuals

(5) Warranty information and product registration as applicable.

3.13 OPERATION AND MAINTENANCE (O&M) MANUALS

a. As-built documentation must also contain a custom-generated system operation guide that details the proper setup and usage of each system in all its normal functions and common usage scenarios as defined by the Contracting Officer. This "Step-by-Step" operation guide must contain information such as a general description of the overall system(s), instructions for general system operation such as turning the system on and off, selecting various video sources for display, routing various audio sources to the speaker systems, setting up audio bridge calls, room combining, making VTC calls, using camera presets, etc. The intent is for this manual to provide simple "how-to" instructions on operating the system. This manual must also be a supplement to the system training specified above.

b. The operations guide must include screen captures of each touch panel page (where applicable) with descriptions of the functionality of each button.

c. Submit revisions of manuals that include changes based on feedback from prior training sessions, other government comments, errors in documentation, or any altered control interface programming prior to the second training session.

d. Complete the operation guide prior to the second training session system and use it for the training.

e. Post one copy of system specific equipment interconnection drawings (laminated or in a plastic bag to prevent damage) inside the front or rear door of the main equipment for each individual audiovisual system.

f. All control system software will become the property of the Government and the Government will have the right to make any desired modifications after the expiration of the system warranty.

g. At the end of the warranty period, provide an updated copy of the above to account for any modifications that may have occurred during the warranty period.

3.14 WARRANTY AND MAINTENANCE

a. Guarantee the system for a period of [one] [_____] year[s] from the date of final system acceptance against defective materials, design, workmanship, and improper adjustment. Repair or replace any defective material at no expense to the Government. During the warranty period, respond to any service calls within [24] [_____] hours [excluding Saturdays, Sundays, and holidays]. Where possible, provide substitute equipment to maintain system operation during repair.

b. Provide [two] [_____] service calls after the acceptance of the system at months [six] [_____] and [12] [_____] to perform routine system maintenance and adjustment.

c. The above warranty must not void warranties issued by individual equipment manufacturers. Individual warranties valid for greater than one year must remain in full effect.

d. The above warranty must not void any rights guaranteed by law to the Government.

e. The above warranty does not pertain to Government provided equipment.

[3.15 LIVE SUPPORT

Provide [one] [_____] service technician for [eight] [_____] man-hours starting on the first scheduled use date. For a period of [one] [_____] week(s) after this period, provide necessary support to ensure a [two] [_____]-hour response time for issues that arise.

] -- End of Section --