SECTION 27 41 16

AUDIOVISUAL SYSTEMS

PART 1 – GENERAL

1.1 PURPOSE

A. This guideline is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. PSP is to apply the principles of this section such that the University of Texas at Arlington (UTA) may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be approved by UTA and may require justification through Life Cycle Cost (LCC) analysis and submitted to UTA for approval.

1.2 **LESSONS LEARNED AND DESIGN CONSIDERATIONS**

A. Contractor shall review and adhere to all of University of Texas at Arlington Educational Technology Support Services.

1.3 SUMMARY

A. This section includes the installation of audio-video (AV) systems.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.4 REFERENCES

A. Execute work in accordance with best AV system installation practices, National Electrical Code, and applicable state and local codes.

B. Comply with terms and conditions of Americans with Disabilities Act, especially regarding provisions for hearing impaired and wheelchair access in control areas.

1.5 SUBMITTALS

A. General
   1. Refer to Division 1.
   2. Submit in quantities, format and timetable as required by General Conditions.

B. Product Data Binders
   1. Minimum number of Sets: four (4) or one (1) electronic copy on CD.
   2. Timetable
      a. Submit within thirty (30) days after award of contract.
      b. Submit simultaneously with Shop Drawings.
      c. Allow minimum of ten (10) business days for review. All sets minus one (1) will be returned with review comments. If a resubmit is required, resubmit total quantity of complete sets. If second resubmit is required, Contractor shall reimburse Owner for expenses incurred during additional review process.
      d. Review and approval of Product Data is required before equipment purchase and installation.
      e. Bind product data sheets together either in GBC or 3-ring type binders.

C. Shop Drawings
   1. Minimum Number of Sets: four (4) or one (1) electronic copy on CD.
   2. Timetable
      a. Submit within thirty (30) days after award of contract.
      b. Submit simultaneously with Product Data Binders.
      c. Allow minimum of ten (10) business days for review. All sets minus one (1) will be returned with review comments. If a resubmit is required, resubmit total quantity of complete sets. If second resubmit is required, Contract shall reimburse Owner for expenses incurred during additional review process.
   3. Description:
      a. Shop Drawings shall be used for coordination between trades and updated as final record drawings.
      b. Bind all Shop Drawings together to form set. Loose drawings will not be accepted.

c. Each drawing shall include: Project, Building, Location, Contractor Name, Architect, AV Consultant, Date and Revision Number.
d. Number and title each drawing in logical manner as a set.
e. Include cover sheet with listing of all drawings included in bound set.
f. Ensure that labeling on Shop Drawings match labeling on equipment.
g. Minimum Scale:
h. Floor Plans: 1/8 inch = 1 foot.
i. Rack Elevations: 1-½ inch = 1 foot.
   1). Plate/Panel Details: 6 inches = 1 foot.
   2). Loudspeaker Details: 1 inch = 1 foot.
j. Include as a minimum:
   1). Floor plans indicating locations of all AV devices, vertical risers, pull boxes, and exposed wiring. Include Device ID (PRJ, SCREEN, FRK, FB, AVP, etc., as referenced in design contract documents), as appropriate for projectors, screens, racks, floor boxes, AV plates in walls, etc.
   2). Schematic diagram showing all primary and secondary devices, interconnectivity and signal flow.
   3). Plate details showing size, material, finish, connectors, engraving, etc.
   4). Mounting detail drawings of loudspeakers, racks, and overhead equipment. Hire services of professional structural engineer, licensed by the appropriate governing authority, to review shop drawings, building structural drawings, and any existing structures from which equipment is to be suspended. Include Structural Engineer's stamped report with shop drawing submittal. Report shall include:
      a). Itemization of items reviewed by the Structural Engineer.
      b). Confirmation that proposed methods of suspending equipment as shown on the shop drawings conform to required safety factors.
      c). Confirmation that building structure from which equipment is to be suspended will support equipment including required safety factors.
   5). Rack elevations.
   6). Complete schematic diagram. One-line diagram with detailed descriptions of product inputs and outputs is acceptable. Include terminal strip details and cable label information. If wiring diagram spans more than three (3) sheets, additionally provide simplified block diagram of entire system on one (1) sheet.
   7). Electrical power wiring diagram. Include circuit, switching, and control details.
   8). Wiring diagram of grounding and shielding scheme.
   9). Drawings for custom-fabricated items (i.e., plates, panels, cables, and assemblies).
   10). General construction drawings necessary for completion of work.

D. Operation and Maintenance Manuals
   1. Minimum number of Sets: four (4).
   2. Bind Operation and Maintenance Manuals using either GBC or 3-ring binders.
   3. Format and Minimum Information below:
      a. Section 1 - System Operation.
         1). Introduction/overview to system components and their functions and locations. Include a brief listing of basic system functions.
         2). Complete but simple system operating instructions to accomplish basic system functions, written for non-technical personnel.
         3). Certificate indicating names of Owner personnel trained by AV Contactor, date of training, name of AV Contractor representative that provided training, and name of project.
      b. Section 2 - System Documentation.
         1) Simplified system one-line schematic diagram showing changes made during construction.
         2) Complete inventory of system components including serial numbers. Identify location (equipment rack, over stage, stored in control room, etc.) of each component.
         3) Cable and terminal strip documentation including cable numbers, functions, originating locations, terminating locations, and signal levels.
         4) All Shop Drawings corrected to reflect as-built conditions.

5) Other data and drawings required during construction.
6) Initial Tests and Adjustments data.
7) Final Tests and Adjustments data.
8) CD-ROM discs including all utilized manufacturer's software and saved copies of software configurations (configurations as established during Final Tests and Adjustments).

c. Section 3 - Manufacturer's Documentation.
1) For each equipment model at no additional costs to Owner, even if manufacturer does not include costs of such documentation with purchase of equipment item.
2) Manufacturer's Product Data.
3) Operating instructions.
4) Installation instructions.
5) Service information.
6) Schematic diagrams.
7) Replacement parts list.

d. Section 4 - Maintenance Information.
1) Preventive maintenance schedule letter clearly stating target dates of six month and end-of-warranty preventative maintenance inspections, and list of maintenance tasks performed.
2) Maintenance instructions including manufacturer's recommended maintenance, recommended maintenance schedule and information concerning proper inspection, testing, and replacement of components.
3) Troubleshooting information complete with instructions for procedures during equipment failure.

b. Section 5 – Warranty Information
1) System warranty letter.

4. Provide three (3) sets on CD-R disc that include all material in Operation and Maintenance Manuals in PDF format except for copyrighted material.
5. Submit one (1) set of Operation and Maintenance Manuals at least ten (10) days before Final Tests and Adjustments procedures (minus data from Final Tests and Adjustments). This set will be reviewed by Owner and returned to Contractor. Re-submit after Final Tests and Adjustments and include data. NOTE: Do not schedule Final Tests and Adjustments or perform training of Owner personnel before submitting Operation and Maintenance Manual.
6. Submit remaining number of complete manuals as required by General Conditions within ten (10) days after return of reviewed set(s). Include Final Tests and Adjustment data, warranty period letter, and any other data not included in first submission.

E. Samples.
1. Request for Samples - Upon request, furnish samples (at no additional cost) to Owner and/or General Contractor of submitted items proposed as substitutes for specified items. Products will be reviewed to determine if proposed substitute items meet required function and quality.
2. Product Tests
a. Products submitted as samples may require testing by independent laboratory. Testing at expense of Contractor.
b. Obtain written approval of tested products before incorporating into system.

1.6 QUALITY ASSURANCE

A. AV Contractor Qualifications.
3. Be established AV System Contractor, regularly engaged in furnishing and installing AV systems. NOTE: Electrical or general contracting firms responsible for completion of this work, but not meeting above requirement, shall employ services of approved AV Contractor as subcontractor to perform work described herein.
4. Be experienced in installations of similar size and scope within last five (5) years. Submit list of four (4) (minimum) installed jobs of similar magnitude, completed within last five years. For verification, submit complete information, including project name, project address, contact person, daytime telephone

number plus month and year of project completion. At Owner's request, accompany Owner or Owner's representative on visit to any or all example completed projects submitted.

5. Be Authorized Dealer for all major lines of equipment listed in Part 2 (Chief, Crestron, Da- Lite, JBL, Middle Atlantic, Panasonic, etc.) Must have at least one permanent staff member who is factory trained in the installation and maintenance of each major product line offered.
6. Employ personnel (at all levels of work) experienced in projects of similar size and scope. Provide list of key personnel to be responsible for each of the following aspects of work: Project Management, Technical Documentation, Control System programming, DSP programming and Leadership of Field Work (one who is present for all field work). For each identified employee, indicate number of years employed by contractor, number of years' experience in assigned responsibilities, and list of previously completed projects where similar responsibilities were required.
7. Project manager assigned to this project must have a minimum of five (5) years' experience in installing and integrating AV systems of similar scale. Project Manager shall also have either an INFOCOMM CTS-I or CTS-D certification.

PART 2 - PRODUCTS

2.1 GUIDELINES

A. Infrastructure Products – All conduits, basket tray/cable tray, pull boxes and associated parts required for infrastructure shall be installed by the electrical contractor unless specifically excluded in these specifications or drawings.
B. Performance - Regardless of completeness of descriptive paragraphs herein, each device shall meet its manufacturer's published specifications. Verify performance.
C. Contract Documents - Drawings and specifications are to be used in conjunction with one another and to supplement one another. In general the specifications determine the nature and quality of the materials, and the drawings establish the quantities, details, and give characteristics of performance that should be adhered to in the installation of the AV system components. If there is an apparent conflict between the drawings and specifications, the items with the greater quantity or quality shall be provided and installed. Clarification with the owner about these items shall be made prior to the ordering and installation.
D. Quantities – All quantities are indicated on AV drawings or in Part 2 AV Products list. Confirm quantities on final Contract Documents. If Contract Documents do not include quantities necessary to deliver complete working system, provide notification of disparity, and install required quantity of devices for complete working system.
E. Small Parts - Systems are described in terms of major products. Even if not specifically mentioned, provide and install patch cables, connectors, hardware, converters, power supplies, labels, terminals, mounting accessories etc. necessary for complete and working system meeting design intent of specifications.
F. Keys - Provide five (5) sets of keys for any AV system product requiring keys.
G. Condition - Provide and install products listed in this section in factory new condition, conforming to applicable provisions of American National Standards Institute.
H. Designations - Each major product item is given unique designation (such as MIX1 for mixer number 1). The product designations are unique in this section only and may be repeated in other specification sections.
I. Security Screws - Use Bryce Security Penta-Plus button-head screws and bits to secure rack components, LCD mounts, Projector mounts and any other location deemed necessary by Owner. Use nylon washers (not provided by Bryce) to protect equipment surfaces. Account for appropriate tip wear when ordering quantity and do no use a bit beyond the manufacturer's recommendations. Provide ten (10) additional unused driver bits and deliver to the customer after completion.
J. AV Electrical Power - Coordinate with Electrical Contractor regarding proper placement of isolated-ground duplex outlets for any AV equipment. Electrical circuits should be connected (and outlets wired) by the Electrical Contractor to the AV system circuit breaker panel (N.I.C.). Ensure that "Star" ground configuration is properly implemented by the Electrical Contractor. Ensure that ground wires from each outlet are isolated from conduit, neutrals, and each other.
K. AV Screens – For any screen specified, size as indicated in drawings. Unless otherwise indicated in drawings or specifications, set limits so projected images are 48" above finished floor, and include additional black drop as appropriate considering screen size and mounting height.
L. AV Racks:
    1. Provide blank faceplate in any area marked BLANK in drawings.
    2. Provide shelf for mounting of any device for which rack mount kit is not available.

3. Provide one (1) Panelcrafters DATCO-XXXXX-RHIM-01 designer/integrator information plate or approved alternate per rack. Install information plate at the top of each rack unless 1RU space is not available. Contact Panelcrafters sales department to add AV Contractor graphic to the "integrator" section (approximately 8.5" x 1.75" of the right-hand side). All alternates must include AV Consultant graphic. Submit to AV designer for approval of final plate design prior to purchasing and installation.

M. AV Floor Boxes:
1. Clean floor boxes of all dust and debris prior to installation of any active or connectorized plate.
2. Any floor box with active or connectorized AV plates found to have any dust, debris or water in bottom of box are subject to replacement of all plates and components. A re-test of all associated components must be completed.

N. Wireless Microphones - Coordinate frequency selection with other radio-frequency sources in the area and with manufacturer's recommendations.

O. Control System Programming:
1. Program each panel to provide simple, intuitive control of all basic AV functions including:
   a. program and speech volume levels
   b. video source and destination routing
   c. screen control
   d. video projector lift control (where applicable)
   e. AV system power
   f. media player transport functions
   g. video conferencing CODEC controls including call initiation (where applicable)
   h. video conferencing PTZ camera control (where applicable)
   i. combine/uncombine settings for all combinations of controlled rooms
   j. local lighting and blackout shade controls (where applicable)
2. Utilize Infocomm International's "Dashboard for Controls" concept for touch panel layout unless directed otherwise by Owner.
3. AV management software shall be installed on Owner furnished computer(s) with adequate specifications per manufacturer's recommendations.
4. Provide layout of each and every touch panel and hard-button panel pages in the product data submittal for approval by Owner.
5. Provide web-control for each touch panel in AV system. Include page tracking, and track current button feedback between touch panel and web-control panel.
6. Staff member certified by control system manufacturer shall program control system.
7. After programming is approved, all control system code and programming, including touch panel code and graphics, will become property of Owner. AV Contractor shall provide Owner both raw and compiled code on CD-R disc.

P. Audio System Programming - Owner shall coordinate layout and logical branching of DSP audio system. Include screen layout and menu branching drawings in AV submittal. After AV system is approved, all audio control system code and programming will become property of Owner. AV Contractor shall provide Owner both raw and compiled code on CD-R disc.

Q. AV Design Bid & Substitutions:
1. System design is around products listed in Part 2. Intent of product specification is to provide standard of quality and function for installed materials. Certain performance specifications are given to clarify job requirements.
2. Bid AV system with products specified in Base Bid section below unless noted otherwise from Owner.
3. No substitutions will be allowed without prior approval from Owner specific to proposed manufacturer and model numbers.
4. Equipment listed in Part 2 is based on performance criteria to meet Owner design requirements.
5. All requested substitutions need to meet or exceed performance of devices listed in Part 2. For each request provide manufacturer's published specifications to verify performance and explain functional and cost impact.
6. Evaluation and approval of substitution requests will be performed by Owner.

2.2 SAMPLE ROOM DESCRIPTIONS

A. Classrooms
1. Ceiling mounted projector.
2. Fixed wall mounted projection screen.

3. Control system with wired touch panel at teaching station/lectern.
4. Sound system with wall mounted digitally steerable powered column array loudspeakers for program audio and speech re-enforcement.
5. Wired microphone at teaching station/lectern and wireless microphone system.
6. Audio, video and computer input connectors in floor poke-thru to accommodate teaching station/lectern.
7. Full height free-standing AV equipment rack located in AV Closet within room.
8. PTZ camera for lecture capture and IMAG.
9. Permanent IR based assistive listening system.

B. Conference Rooms
1. 65” wall mounted flat panel display.
2. Control system with wired touch panel at table top.
3. Audio, video and computer input connectors in floor poke-thru that present at table top.
4. Sound system with ceiling mounted loudspeakers for program audio.
5. Wall connectivity to accommodate portable assistive listening system.

C. Medium Conference Rooms (Type 1)
1. 95” wall mounted flat panel display.
2. Control system with wired touch panel at table top.
3. Audio, video and computer input connectors in floor poke-thru that present at table top.
4. Sound system with ceiling mounted loudspeakers for program audio.
5. Wall connectivity to accommodate portable assistive listening system.

D. Medium Conference Rooms (Type 2)
1. 95” wall mounted flat panel display.
2. Control system with wired touch panel at table top.
3. Audio, video and computer input connectors in floor poke-thru that present at table top.
4. Sound system with ceiling mounted loudspeakers for program audio.
5. Wall connectivity to accommodate portable assistive listening system.
6. Video conferencing capabilities via standards based hardware CODEC and bridge to OFE computer to enable software based CODEC.
7. Ceiling mounted microphones.

E. Large Conference Rooms
1. Ceiling mounted projector.
2. Ceiling recessed electric drop-down projection screen.
3. Control system with wired touch panel at table top.
4. Audio, video and computer input connectors in multiple floor poke-thru that present at table top.
5. Audio, video and computer input connectors in floor poke-thru to accommodate lectern.
6. Wireless presentation capabilities.
7. Sound system with ceiling mounted loudspeakers for program audio.
8. Wall connectivity to accommodate portable assistive listening system.

F. Collaboration Rooms (Type 1)
1. 48” wall mounted flat panel display.
2. Audio, video and computer input connectors at wall plate beneath display.
3. Flat panel display loudspeakers will serve program audio.

G. Collaboration Rooms (Type 2)
1. Infrastructure to support future wall mounted flat panel display.
2. Infrastructure to support audio, video and computer input connectors at wall plate beneath display.
3. Infrastructure to support future wall mounted control pad or button control.

2.3 AV PRODUCTS – ACTIVE EQUIPMENT

A. The following are major active products for this project. All products will be OFOI.
1. ADA (Audio Distribution Amplifier) RDL ST-MX2 audio mixer
2. AMP (Power Amplifier)
   a. Type 1: Extron XPA 2001
   b. Type 2: Extron MPA 401
      1). Provide MLA VC10 (VOL) volume control interface.
3. AVB (Audio Visual Bridge) Extron MediaPort 200
4. AVP (AV Plate) Extron AAP 102 mounting frame.
   a. Provide Extron AAP adapter plates as indicated on drawings.

b. Coordinate finish type with architect.

5. CAM (Camera)
   a. Type 1: Vaddio AutoTrak 2.0 with HD-20 camera
      1). Provide Vaddio camara mount shelf or similar
      2). Provide AutoTrak 2.0 CPU
      3). Provide Quick-Connect DVI/HDMI SR Interface
   b. Type 2: HD-BX7-5 HD-SDI camera with 5-50mm lens
6. CS (Control System)
   a. Type 1: Crestron AV3
   b. Type 2: Crestron CP3N
7. CDC (Video Conferencing CODEC) Cisco SX20
   a. Provide Precision HD 12X camera with control cable
   b. Provide Chief FCA811 above display camera shelf
8. CM (Confidence Monitor) Delvcam DELV-HD7 7” HDMI monitor
9. DOC (Document Camera) Wolfvision VZ-8 Light-4
10. DESK (Teaching Station)
    a. Euro Design Systems AVDESK2465-RR-36 (Qty. Four)
    b. Base color S73 Graphite Spectrum
    c. Counter Top color S54 African Mahogany
11. DSP (Digital Signal Processor)
    a. Type 1: Biamp Tesira Forte AI
    b. Type 2: Crestron DSP-1281
12. FRK (Equipment Rack) Middle Atlantic WRK-44-27
    a. Provide Pair of BSPN-45-267 side panels
    b. Provide BGR-552FT-FC fan top
    c. Provide PDT-2020TL-NS vertical power strip with PB-5A mounting brackets
    d. Provide rack isolation kit ISO-1 and proper seismic anchor kit for each rack. Rack base, supports, and any conduit connected at rack to be isolated from rack.
    e. Provide one (1) Middle Atlantic TEMP-DC digital thermometer with 3-foot probe per rack. Mount thermometer display at front of rack and place probe at center of rack near amplifiers.
    f. Power strip for appropriate power distribution
13. FPD (Flat Panel Display)
    a. Type 1: Samsung DM48E 48” LED TV or approved current model.
       1). Provide Chief MTM1U wall mount.
    b. Type 2: Samsung DM65E 65” LED TV or approved current model.
       1). Provide Chief LSM1U wall mount.
    c. Type 3: Samsung DM82D 82” LED TV or approved current model.
       1). Provide Chief XSM1U wall mount.
    d. Type 4: Samsung ME95C 95” LED TV or approved current model.
       1). Provide Chief XSM1U wall mount.
    e. Provide 3 year commercial warranty on all displays.
14. Assisted Listening System (LAS)
    a. Listen Technologies LS-85-SIR-GY-01
       1). (1) LT-82 with LA-326 Universal Mounting Kit
       2). (1) LA-140 Stationary IR Radiator
       3). (3) LR-42 IR Stethoscope 4-Channel Receiver
       4). (1) LR-44 IR Lanyard 4-Channel Receiver
       5). (1) LA-166 Neck Loop
       6). (1) LA-165 Stereo Headphones
       7). (4) LA-363 High Capacity AAA Alkaline Batteries (2)
       8). LA-304 Assistive Listening Notification Signage Kit
15. Lecture Capture (LC) Echo 360 PRO
16. M (Ceiling Microphone) Shure MXA 910
    a. Provide Cisco 300 series PoE switch
17. MIC (Wired Microphone) Audio Technica ES915SC24
    a. Provide AT8646QM shock mount.
18. MRK (Millwork Rack) Middle Atlantic SRSR-2-12

19. MSW (Matrix Switcher)
    a. Type 1: Crestron DMPS3-4K-150-C
    b. Type 2: Crestron DM-MD8x8
    c. Provide DMC-C-DSP input cards. Quantity as indicated on drawings.
    d. Provide DMCO 8G+ output cards. Quantity as indicated on drawings.
    e. Connect all control processors to building network, and coordinate with Owner to acquire and configure network properties for each processor.
20. PWR (Power Conditioner)
    a. Type 1: Furman Sound F1000-UPS rack mount Uninterruptible Power Supply
    b. Type 2: Furman Sound PL-8 C rack mount power strip
    c. Type 3: Furman Sound AC-215A compact power conditioner
21. PRJ (Video Projector)
    a. Type 1: Panasonic PT-RZ670 1920x1200, 6,500 lumen, DLP projector
        1). Provide ET-DLE085 Zoom lens
    b. Type 2: Panasonic PT-RZ970K 1920x1200, 10,000 lumen, DLP projector
        1). Provide ET-DLE030 Fixed-focus lens
    c. Type 3: Panasonic PT-RZ970K 1920x1200, 10,000 lumen, DLP projector
        1). Provide ET-DLE085 Zoom lens
22. S (Ceiling Recessed Loudspeakers) JBL Control 26CT
23. S (Wall Mounted Loud Speaker) Digitally Steerable Column Array Loudspeaker
    a. Type 1 – Tannoy Q24
    b. Type 2 – Tannoy Q8
24. TP (Touch Panel)
    a. Type 1: Crestron TSW-1052
        1). Provide TSW-1050-TTK-B-S table top kit.
    b. Type 2: Crestron MPC-M5
        1). Provide TTK-MP/MPC/IPAC table top kit
25. TPRX (Digital Media Receiver) Crestron DM-RMC-SCALER-C.
26. TPTX (Digital Media Transmitter)
    a. Type 1: Crestron DM-TX-200C-2G
    b. Type 2: Crestron DM-TX-4K-302-C
27. USBT/USBR (USB Extender Pair) Extron USB Extender Plus T and Plus R
28. WCP (Control Touch Panel) Crestron MPC-M5
29. WPD (Wireless Presentation Device) Barco ClickShare CSE-200
30. WM (Wireless Microphone) Shure ULXD4D dual channel receiver wireless microphone system
    a. Provide ULXD1 14/85 lavaliere microphone transmitter
    b. Provide ULXD2/SM58 handheld microphone transmitter

2.4 AV PRODUCTS – PORTABLE EQUIPMENT

A. The following are major portable active products for this project.
    1. Assistive Listening System
        a. Provide Listen Technologies LS-ADA-072
        b. Da-Lite AV1-UL-M-32 cart or similar
        c. Tecnec 25’ XLR Canare Star Quad cable with Neutrik XLR connectors

2.5 CABLES

A. Interconnect Wiring – Provide and install following cable as required for connections in all areas. Meet provisions of N.E.C. Provide plenum rated cable only where required.
    1. Analog Audio Plenum Rated cable - West Penn 25452, West Penn 25291, or similar.
    2. Digital Audio Plenum Rated Cable: Belden 1505B/1506A or Plenum rated AES/EBU compliant equivalent.
    3. Analog Composite Video Plenum Rated Cable: West Penn 25806 or Belden 88281.
    4. RGBHV Plenum Rated Cable: Belden 258195, West Penn 258195 or Liberty RGB5C- SD-PLN.
    5. Control Plenum Rated Cable: West Penn D25350.
    6. Loudspeaker Plenum Rated Cable: West Penn 25226B & 25227B.
    7. HDMI cables: Extron HDMI Pro and HDMI Ultra series
    8. Digital Media Transport Cable: Crestron DM-CBL-8G-P

PART 3 – EXECUTION

3.1 INSTALLATION

A. General Guidelines
1. Quality of Work - Perform labor to accepted industry standards and state and local codes to accomplish complete and working system.
2. Material and Labor - Provide specified products and other incidental materials, appliances, tools, and transportation required for complete and functioning systems. Provide personnel to perform labor who are skilled in techniques and can demonstrate technical knowledge AV infrastructure system installations.
3. Documents at Job Site - Keep following documents at job site during entire construction period:
   a. Complete Specifications and Drawings.
   b. Approved Shop Drawings.
   c. Approved Product Data.
   d. Progress Set of Project Record Documents.
4. Mounting - Mount equipment and enclosures plumb and square. Ensure that permanently installed equipment is firmly and safely held in place. Design equipment supports to support loads imposed with project safety factor of five (5) or greater. For devices hung overhead, obtain review by Structural Engineer licensed by the appropriate governing authority prior to installation.
5. Dimension Verification - Verify dimensions and space requirements to assure that proper mounting, clearance, and maintenance access space is available for system components.
6. Clean-Up - Leave project clean each day. Place debris where designated by General Contractor. Debris includes but not limited to: solder splatter, cable ends, stripped insulation, spent crimp connectors, gypsum board and ceiling tile dust, and product wrappings and cartons. After completion of installation, thoroughly clean areas worked, including non-visible areas such as equipment rack interiors, rack top panels, and inside lockable floor and wall boxes.
7. Coordinate installation of AV infrastructure and equipment with other trades in order to follow project schedule.
8. Maintain any licensing required by the appropriate governing authority to install and terminate low voltage systems.

B. Labeling
1. Equipment Labels - AV Contractor shall provide engraved lamicoid labels on front and rear of rack-mounted equipment. Mount labels plumb and square. Include schematic reference design, item name, and system or area controlled by labeled component. On program preamps and mixers, provide label for each input indicating which source is controlled by labeled channel. Unless otherwise indicated, provide permanently-mounted black labels engraved with 1/8-inch white block characters. Handwritten, self-laminating, or embossed plastic (Dymo) labels are not acceptable. Provide labels for major equipment with two (2) lines (minimum) of engraving, coded as follows:
   a. Line 1: Generic name of device, such as MIXER AMPLIFIER.
   b. Line 2: Schematic designation of device, such as AV-MSW-1.
2. Control Labels – AV Contractor shall provide engraved label over each user-operated control that describes the function or purpose of control. Provide label of proper size to fit available space.
3. Terminal Strip Labels - AV Contractor shall label each terminal strip with unique identification code in addition to numerical label (Cinch MS series) for each terminal. Show terminal strip codes on system schematic drawings included with Project Record Documents.
4. Rear Equipment Labels - AV Contractor shall provide adhesive label on rear of equipment where cables attach, to indicate designation of cable connected at each point.
5. Cable and Wire Labels - Label cables and wiring logically, legibly and permanently for easy identification. Labels on cables shall be adhesive strip type, covered with clear heat shrink tubing. Factory stamped heat shrink tubing may be used. Hand-written or self- laminating type labels are not acceptable.
6. Cable Label Codes and Locations - Label each cable with unique alpha-numeric code. Locate cable designation at start and end of each cable run, within three (3) inches of termination point. For cable runs that have intermediate splice points, label cable with same designation throughout, with additional suffix to indicate each segment of run. Provide cable designation codes to schematic drawings included with

Project Record Documents and Operation and Maintenance Manuals.

C. Power and Grounding
   1. Power Coordination – Coordinate final connection of power and ground wiring to rack. Electrical contractor will provide power to AV systems. Before installation, verify load requirements for systems as accepted.
   2. Bus Bars - Install 1-inch by ¼-inch copper ground bus bar, top to bottom in floor mounted AV racks. Ground and bond equipment chassis of each rack-mounted component without three-pin grounding plug to bus bars with #12 AWG insulated green wire using 6- 32 or larger nuts, bolts, lock-washers, and appropriate NEMA connectors. Electrical Contractor (Division 16) shall provide and connect #4 AWG green insulated wire from Bus Bars to ground point in AV technical electrical panel.

D. Equipment Racks
   1. Ventilation - Provide ventilation adequate to keep temperature in rack below 85 degrees Fahrenheit. Use "whisper" type ventilation fans in racks, adjusted to come on when temperature in rack rises above 85 degrees Fahrenheit, only if adequate cooling cannot be provided by Owner.

E. Wiring
   1. Wiring Standards - Execute wiring in strict adherence to best AV engineering practices.
   2. Field Connection Devices - Connect cable to active components through screw terminal connections and spade lugs when appropriate. For BNC connections use three-piece, dual crimp BNC properly sized for cable with insulating bushings. Wire nut or "Skotchlock" connectors are not acceptable. Do not wrap audio cable splices or connections with adhesive backed tape. Punch connectors or telephone-style punch blocks are not acceptable anywhere in the installation unless specifically authorized by Owner.
   3. Run cable in ceiling plenums neatly parallel to building walls, supported every three feet to structure with plenum rated ties.
   4. Raceways - Run vertical wiring inside rack in Panduit (or equivalent) plastic raceways with snap-on covers, sized to allow at least 50% future wiring. Mount raceways on full length ¾-inch flat black plywood backboards, attached to rack sides. If between-rack wiring chases are provided, Panduit raceways are not required. Horizontal wiring in rack shall be neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack, but still allow for service and testing. Provide horizontal support bars if cable bundles sag. Individually bundle excess AC power cable away from rack mounted equipment with plastic cable ties. Electrical tape and adhesive backed cable tie anchors are not acceptable.
   5. Accessibility - Ensure that wiring and connections are completely visible and labeled in rack. Mount termination resistors, if required, on terminal strips, fully visible and not concealed within equipment or connectors.
   6. Loudspeaker Polarity - Connect loudspeakers electrically in phase, using same wire color for loudspeaker wiring throughout project.
   7. Physical Damage Prevention - Take necessary precautions to prevent physical damage to cables and equipment. Damaged cables or equipment will not be accepted. Separate, organize, and route cables to restrict channel crosstalk and feedback oscillation.
   8. Racks - Looking into the rack from the rear, locate AC power, control, data and speaker wiring on the left; line level audio, control, video, and RF wiring on the right. Keep several inches of space between power cables and other signals.
   9. Other Connections - Make connections using rosin core solder or approved mechanical connectors. Where spade lugs are used, crimp properly with ratchet type crimping tool. Solder spade lugs mounted on #22 AWG or smaller cable after crimping.

3.2 STORAGE AND HANDLING

A. Power up any electronic equipment to ensure its proper functioning before its arrival onsite.
B. Ensure that materials (especially electronic and electro-acoustic devices) are protected against physical, environmental, and electronic damage until final acceptance by Owner.
C. Schedule delivery to minimize delays in the project.
D. Provide storage protection against temperature and humidity extremes, theft, vandalism, physical damage, and environmental damage.

3.3 WARRANTY

A. Refer to Division 1.
B. Warranty - Submit letter providing warranty covering labor and materials supplied under this contract. Bind

in Operation and Maintenance Manuals. Terms as described in General Conditions. Minimum terms as follows:

1. System - Systems shall be free of manufacturing or installation defects for a minimum period of one (1) year from the date of final acceptance. Clearly designate begin and end dates of system warranty period.
2. Parts and Labor - Provide parts and labor to repair defects in materials and workmanship during system warranty period.
3. Response Time - Within system warranty period, provide initial on-site service response within one (1) business day of service call. Provide resolution to any system defects within 72 hours or within 48 hours of receipt of repaired or replaced product from manufacturer.
4. Replacement Products - If any item must be removed for repair during system warranty period, provide replacement item of similar quality at no charge.
5. Repair Limit - Do not repair any piece of equipment found defective during installation or system warranty period more than two (2) times. After second repair, replace defective item with similar approved item at no additional cost to Owner.
6. Extended Manufacturer's Warranties – Identify products with manufacturer's warranties extending beyond one (1) year. Provide terms and conditions of such warranties.
7. Service Personnel Information - Provide name(s) and telephone number(s) of service personnel to be contacted regarding repair and maintenance.

C. Extended Warranty - Provide cost to extend complete AV system warranty from one (1) year to three (3) years. Included a list of all provided services including maintenance schedules.

3.4 INITIAL TESTS

A. Purpose – These tests are to ensure that the AV system is installed and functioning as specified, and to ensure the system is ready for Final Tests and Adjustments (described later).
B. Testing Standards – Perform testing in accordance with ANSI standards.
C. Inspection - Verify prior to beginning actual tests and adjustments on systems:
   1. Proper grounding of all electronic components (through third prong of power connector or separate connection between component chassis and ground bus bar).
   2. Cables dressed, routed, and labeled, connected with proper polarity.
   3. Insulation and shrink tubing in place.
   4. Dust, debris, solder splatter, etc. removed.
   5. Proper frequency settings (or modules) at crossovers and controllers.
   6. All equalizer bands and tone controls set for flat frequency response.
   7. Survey temperatures of each piece of equipment after four (4) hours use (minimum). Note and report any hot equipment.
D. Electrical Power Quality - While all sound and AV system components are unplugged from electrical power outlets, AV Contractor shall turn on power to outlets, and confirm proper voltages at each outlet across the following pairs of terminals: hot and neutral, hot and ground, and neutral and ground (zero volts across neutral and ground). AV Contractor to document measurements.
E. General Function Tests - Test each piece of equipment to ensure that it performs its intended function. Include all portable equipment in tests. Intent of initial tests is to verify complete, functioning system before Final Tests and Adjustments. Correct problems found during initial testing before beginning Final Tests and Adjustments. Document whether all pieces performed intended functions; note any unresolved malfunctions.
F. Initial Tests and Adjustments Data - Submit written report of Initial Tests and Adjustments data upon completion to Owner. Include printed name(s) of technician(s) performing tests, date(s) and time(s) of tests, model and serial numbers of test equipment, results of each initial test, descriptions of problems encountered and their solutions, and statement that system is ready for Final Tests and Adjustments. Initial Tests and Adjustments Data to include signatures of technician(s) performing tests.

3.5 FINAL TESTS AND ADJUSTMENTS

A. Purpose – These tests are to be witnessed by AV Consultant to determine if system is complete and functioning as designed and specified. Also, AV Consultant will perform listening and viewing tests and witness adjustments of all images for optimum clarity.
B. Timetable - Coordinate with Owner, General Contractor, and AV Consultant to schedule Final Tests and Adjustments after submittal of Initial Tests and Adjustments data.
C. System and Site Conditions – AV Consultant will witness Final Tests and Adjustments. Have systems fully functional and ready for observation and testing upon AV Consultant's arrival. Coordinate with all trades for

quiet conditions throughout the listening areas and for the duration of the test schedule. If upon AV Consultant's arrival, systems do not meet criteria, site is not sufficiently quiet, or if Owner or AV Consultant is required to make additional trips to job site to witness additional testing or perform additional reviews of installed equipment, Contractor shall reimburse Owner for labor and expenses incurred by having incurred costs deducted from payments to contractor.

D. Test Labor - Provide technician familiar with this project's AV systems and operation of test equipment to perform testing. Provide additional technician to assist in the tests and to perform troubleshooting, repairs, and adjustments. Include labor for these technicians to be present for one (1), eight (8)-hour day during Final Tests and Adjustments.
E. Tools - Provide standard hand tools including screwdrivers, pliers, wire strippers, nut drivers, soldering iron, and other tools appropriate for troubleshooting system problems.
F. Ladders and Scaffolds - Provide ladders and scaffolds to inspect/adjust loudspeakers and rigging points.
G. Verification of Initial Tests and Adjustments - Verify that Initial Tests and Adjustments have been performed and meet criteria. During Final Tests and Adjustments, AV Consultant may require portions of the Initial Tests and Adjustments to be repeated. Repeat measurements as requested without claim for additional payment.

3.6 FINAL ACCEPTANCE BY OWNER

A. Certificate – Submit Certificate of Final Acceptance form signed by Owner verifying complete installation and proper operation of systems upon fulfillment of all requirements and upon recommendation by Owner.
B. General Adjustments – Adjust, balance, and align equipment for optimum quality, meeting manufacturers published specifications.
C. Input/Output Jack Demonstration – Demonstrate proper performance and phase of each system input and output jack (all audio input and output jacks) as received at AV and network systems.
D. Inventory – Inventory all installed and portable equipment for correct quantities.
E. Functional Demonstration – Demonstrate operation of each function of each major piece of equipment.
F. Other Tests - Perform any other tests on any part of the AV system as requested by Owner.
G. Final Equipment Settings – Record final settings of all equalizer bands, tone controls, filters, delays, limiters, etc., including those established through computer software settings. Include descriptions of settings (including software settings) in Operation and Maintenance Manual. Include software copy of configuration file(s) in Operation and Maintenance Manual.
H. Security Inspection – Inspect equipment for security from tampering (covers, shaft-locks, etc.).
I. Review of Labels – Review installed labels on cables, equipment, controls, and terminal strips.

3.7 OWNER TRAINING

A. Provide Owner training as described in General Conditions. As a minimum, provide eight (8) hours instruction (within two (2) trips to site) regarding AV Systems operation to Owner- designated personnel. Schedule instruction time(s) with Owner to occur after completion of Final Tests and Adjustments. Coordinate with Owner in advance to schedule instruction time. Document date, time, and attendees of the training session and include documentation in Operation and Maintenance Manuals to serve as record of trained personnel.

3.8 SUPPORT DURING OWNER'S FIRST USE OF COMPLETED SYSTEM

A. Provide personnel familiar with design, installation, and operation of each system to be present at Owner's first use of each completed system (up to eight (8) hours total over two sessions). During first use of each system, respond to Owner requests for troubleshooting, adjustments, and additional training. If no one contractor employee or representative can provide expertise in all aspects of the system, provide multiple personnel for the eight (8) hours per session as required. Schedule presence of personnel in advance with Owner. Should significant elements of the new system be operational prior to final completion, Owner may elect to schedule contractor presence for Owner function prior to final completion of system. Should Owner exercise this option, contractor presence will not be required at first use following final completion.

END OF SECTION