

SECTION 11970

AUDIO SYSTEM

1.01	CONTRACT DOCUMENTS	2
1.02	GOVERNING CLAUSE	2
1.03	SCOPE OF WORK	2
1.04	PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION	3
1.05	RESPONSIBILITY AND RELATED WORK	4
1.06	REFERENCES	5
1.07	DEFINITIONS	7
1.08	SYSTEM DESCRIPTION OVERVIEW	9
1.09	DESIGN AND PERFORMANCE REQUIREMENTS	13
1.10	SUBMITTALS	13
1.11	QUALITY ASSURANCE	13
1.12	DELIVERY, HANDLING, STORAGE, AND CLEANUP	21
1.13	INSURANCE	21
1.14	PROJECT CONDITIONS	22
1.15	WARRANTY	23
1.16	EXTRA MATERIALS	23
2.01	ACCEPTABLE MANUFACTURERS	24
2.02	GENERAL	24
2.03	MISCELLANEOUS EQUIPMENT	25
2.04	AUDIO SYSTEM INPUT SOURCES	29
2.05	AUDIO SYSTEM DIGITAL SIGNAL PROCESSING UNIT AND ACCESSORIES	32
2.06	AUDIO SYSTEM LOUDSPEAKERS	32
2.07	PRESS FEED	33
2.08	NETWORK INFRASTRUCTURE COMPONENTS	33
2.09	MISCELLANEOUS AUDIO SYSTEM EQUIPMENT	34
2.10	COMMITTEE ROOM VIDEO PRESENTATION SYSTEM	35
2.11	VIDEO PRODUCTION SYSTEM	37
2.12	CONTROL SYSTEM	40
2.13	RACKS, INTERFACE PLATES AND CABLING	41
2.14	MISCELLANEOUS	44
3.01	GENERAL	44
3.02	MECHANICAL	45
3.03	WIRING	46
3.04	CONNECTIONS	51
3.05	LABELING	52
3.06	SYSTEM STARTUP	52
3.07	COMMISSIONING	57
3.08	CLEANING	59
3.09	INSTRUCTION	59

## **PART 1 GENERAL**

### **1.01 CONTRACT DOCUMENTS**

- A. The General and Special Conditions are hereby made a part of this Section. Where requirements of this Section are at odds with requirements stated in any Special or Supplementary Conditions, the more stringent requirements shall apply.
- B. The Contract Documents are complementary and are intended to include or imply all items required for the proper execution and completion of the work. Any item or work required by the Specification or other portion of the Contract Documents, but not shown on the drawings, or shown on the drawings but not described in the Specification, shall be provided and installed by the Contractor as if shown or mentioned in both.
- C. The Consultant may furnish additional instruction or clarification necessary for the proper execution of the work. Instructions or clarifications shall be consistent with the Contract Documents, or agreed upon modifications thereof, and inferable therefrom. In giving instruction or clarification, only the Contract Administration Officer and/or his technical representative shall have the authority to make minor changes in the work that will not entail an increase in the Contract price or time.
- D. Copies of drawings and specifications regardless of how furnished are the property of the Owner, and are not to be used on any other work or project. No contract documents may be released for publication or to any other party without the written consent of the Owner and Consultant. All references to "the Owner" in this document refer to the United States House of Representatives and the United States House of Representatives Committee on Agriculture.

### **1.02 GOVERNING CLAUSE**

- A. For the sake of brevity these specifications omit phrases such as "Contractor shall furnish and install," "unless otherwise noted or specified," etc.; nevertheless, the requirements of the specifications are mandatory, and these phrases shall be inferred. The mention of materials and operations implies the Contractor shall furnish and install such materials and perform such operations to the overall standards set by the Contract Documents. Exceptions are noted herein or shown on the drawings.
- B. In the event that a Consultant is not a participant in this project after award of contract, all references to "Consultant" in this document shall be replaced with "Owner".

### **1.03 SCOPE OF WORK**

- A. Work under this Contract includes all labor, materials, tools and equipment, transportation services, supervision, coordination, etc., necessary to complete the installation of high quality Audio Systems, in excellent working order, as described in

these specifications and the associated drawings and in accordance with good engineering practice, and to maintain the systems throughout the warranty period. The systems shall be called the "Audio Systems" or "AV Systems" and the Contractor the "Audio System Contractor" or "AV Systems Contractor". The systems include, but are not limited to, the following major items:

1. Audio mixers, equalizers, amplifiers, program sources, microphones and other signal processing equipment;
2. Network equipment;
3. Video equipment;
4. Loudspeakers and loudspeaker mounting, aiming, rigging, and support hardware;
5. Equipment racks, cabinetry, and furniture;
6. Control systems including all control panels, interfaces, control hardware, software, software programming and all required control accessories
7. System accessories;
8. Cable, connectors, plates, panels, transformers, and other interface devices.
9. Hearing room witness timers: the Contractor shall coordinate with the electricians and representatives of the Architect of the Capitol, to ensure that the required infrastructure including conduit and wiring for installation of new and Owner-furnished witness timers is in place at the time of system installation;
10. Accommodations for data and video wiring and facilities provided and installed by others, including mounting holes and rack space. Coordinate panel layouts and rack elevations, as required, with the Consultant and Owner.

B. The Contract also includes:

1. Verification of dimensions and conditions at the job site.
2. Preparation of submittal information.
3. Installation in accordance with the contract documents, manufacturer's recommendations, and all applicable code and legal requirements.
4. Initial tests and adjustments, written report, demonstration for approval, final adjustments, and documentation.
5. Instruction of operating personnel; provision of manuals.
6. Maintenance services; warranty.

#### **1.04 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION**

- A. Certain equipment may be identified after the bid is awarded as Owner Furnished Equipment (OFE). Owner Furnished Equipment is presently part of the Owner's system, or will be provided by the Owner, and will be delivered to Contractor's off-site construction facility, delivered to the Contractor's on-site secured storage area, or installed on site by others, as appropriate, for incorporation into the system.
- B. Inspect the OFE, and notify the Owner promptly in writing of damage or defect and the extent of repair and/or adjustment required to bring the OFE to original specification. Service OFE only as directed by the Owner, under the arrangements of a separate contract.

- C. Incorporate into the system as if provided new, excepting warranty coverage.

#### **1.05 RESPONSIBILITY AND RELATED WORK**

- A. Coordinate work with the Committee Staff, other House of Representatives personnel involved in this project, Consultant, Representatives and employees of the Architect of the Capitol, including electricians and the scheduled work of other trades.
- B. Conduit; wireways; floor, wall, pull, and junction boxes; metal loudspeaker enclosures; and AC power circuits and ground wiring to the Audio System junction box(es), permanently installed in the building or in architectural millwork, are provided by the Architect of the Capitol. This does not relieve the Audio System Contractor from responsibility for a complete working system, and coordination with the electricians and representatives of the Architect of the Capitol in the course of his or her installation is required to achieve a correct conduit system. Failures in coordination shall not be reason for additional payment to correct omissions or errors in conduit or box installation.
- C. Distribute AC Power within the Audio System from the junction box(es). All cable for this distribution, and conduit, wireways, receptacles, and boxes in equipment racks or furniture provided by the Audio System Contractor, are the responsibility of the Audio System Contractor.
- D. Provide and install all Audio System cable and wiring. Unless otherwise noted, install all wiring in conduit, enclosed wireways, or cable trays.
- E. The Contractor shall be responsible for ensuring that any Owner-furnished Witness Timers are installed and in full working order upon delivery of the system. This shall include coordination with the electricians and representatives of the Architect of the Capitol to ensure that the required infrastructure including conduit and wiring is in place at the time of system installation.
- F. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Audio System Contractor to supply systems in full working order, and of the Architect of the Capitol and Audio System Contractors to meet all code requirements for the installation of conduit and cable, respectively.
- G. Notify the Contract Administration Officer of any discrepancies in part numbers, sizes, or quantities before bid. Failing to provide such notification, supply items, sizes, and quantities according to the intent of the design as described in the Specifications and Drawings, without claim for additional payment.
- H. Supply accessories and minor equipment items needed for a complete and properly functioning system, or where required to meet the specified performance, even if not specifically mentioned herein or on the drawings, without claim for additional payment.

- I. Cooperate with all trades present on the project, so lost time, work stoppages, interference, and work inefficiencies do not occur. Assure labor "harmony" among personnel and subcontractors, and with other trades associated with construction, delivery, installation, and testing of the facility.
- J. Coordinate and schedule all on-site activities with the Owner. Audio System Contractor shall work and complete all on-site tasks in accordance with the access to the site provided by the Owner.

## 1.06 REFERENCES

- A. National Fire Protection Association (N.F.P.A.)
- B. National Electrical Code (N.E.C.)
- C. National Electric Safety Code (N.E.S.C.).
- D. American National Standards Institute (ANSI)
- E. Electronics Industries Association (E.I.A.)
- F. Telecommunications Industries Association (T.I.A.).
- G. Society of Motion Picture and Television Engineers (S.M.P.T.E.)
- H. American Society for Testing Materials (A.S.T.M.).
- I. Building Seismic Safety Council (B.S.S.C.)
- J. International Standard ISO 31-0:1992(E), Quantities and units – Part 0: General principles.
- K. International Standard CEI/IEC 27-3:1989, Letter symbols to be used in electrical technology – Part 3: Logarithmic quantities and units.
- L. AES-2id-1996, AES information document for digital Audio engineering - Guidelines for the use of the AES3 interface. All the following AES Standards are available for download from the Audio Engineering Society web site (<http://www.aes.org/>).
- M. AES-3id-2001, AES information document for Digital Audio engineering - Transmission of AES3 formatted data by unbalanced coaxial cable.
- N. AES-R2-1998, AES project report for articles on professional Audio and for equipment specifications - Notations for expressing levels.
- O. AES3-1992, (r1997), AES Recommended Practice for Digital Audio Engineering - Serial transmission format for two-channel linearly represented digital Audio data

(Revision of AES3-1985, ANSI S4.40-1985).

- P. AES5-1998, AES recommended practice for professional digital Audio - Preferred sampling frequencies for applications employing pulse-code modulation.
- Q. AES11-1997, AES Recommended Practice for Digital Audio Engineering - Synchronization of digital Audio equipment in studio operations.
- R. AES14-1992 (r1998), AES standard for professional Audio equipment - Application of connectors, part 1, XLR-type polarity and gender.
- S. AES17-1998 (revision of AES17-1991), AES standard method for digital Audio engineering - Measurement of digital Audio equipment.
- T. AES18-1996 (r2001), AES Recommended practice for digital Audio engineering - Format for the user data channel of the AES digital Audio interface.
- U. AES26-2001 (revision of AES26-1995), AES recommended practice for professional Audio - Conservation of the polarity of Audio signals.
- V. Shields and Grounds: Safety, Power Mains, Studio, Cable and Equipment, (special excerpt) The June 1995 issue of the Journal of the Audio Engineering Society.
- W. A Clean Audio Installation Guide, by Al Burdick. Available for download from the Benchmark Media Systems web site (<http://www.benchmarkmedia.com/>).
- X. Grounding and Shielding Techniques in Instrumentation, by Ralph Morrison, published by John Wiley and Sons, Inc.
- Y. Audio System Design and Installation, by Phillip Giddings, published by Sams.
- Z. Sound Reinforcement Handbook, by Gary Davis and Ralph Jones, published by Hal Leonard Publishing Corporation.
- AA. Sound System Engineering, 2<sup>nd</sup> edition, by Don & Carolyn Davis, published by Sams.
- BB. Cable Television Technology, Kenneth T. Deschler, New York: McGraw-Hill, Inc., 1987
- CC. DOJ 28 CFR Part 36, Revised as of July 1, 1994, Appendix A to Part 36 - Standards for Accessible Design: Americans with Disabilities Act Accessibility Guidelines (ADAAG).
- DD. "Recommended Wiring Practices", Broadcast Audio Equipment For AM, FM, Television (5th Edition), Radio Corporation of America (RCA) Camden, N.J., 1962.

## 1.07 DEFINITIONS

- A. **dBu** Where "dBu" is used in this specification it denotes the RMS value of a voltage with respect to a reference level of 0.775 Volts into an unspecified impedance.
- B. **Levels:** Where power, voltage, or sound pressure levels are used in this specification, they shall refer to measurement with a properly calibrated RMS responding indicator which is flat,  $\pm 0.1$  dB between 20 and 20,000 Hz.
1. **Sound Pressure Level:** Reference level shall be 0.00002 Pascals.
  2. **Rated Input Level:** Defined as the input voltage below which all samples of an electronic product meet all provisions of this specification with respect to distortion.
  3. **Rated Output Level:** Defined as the output voltage below which all samples of an electronic product meet all provisions of this specification with respect to distortion while working into its rated load.
  4. **Rated Load Impedance:** Defined in terms of the equivalent circuit an electronic product can drive, while meeting all relevant provisions of this specification.
    - a. **Line Level Devices:** A product's rated load shall be defined in terms of a minimum resistive component of load impedance, in parallel with a maximum capacitive component. All samples of a product must meet all provisions of this specification with respect to frequency response and distortion at its rated output voltage when loaded by an impedance equal or greater than the rated load.
    - b. **Power Amplifiers:** A product's rated load shall be defined as the magnitude of the impedance above which all samples of a product meet all provisions of this specification with respect to frequency response and distortion at its rated output voltage.
  5. **Line Level: +4 dBu.** A line level device shall be defined as one which is capable of driving a load impedance of 600 ohms or greater to an RMS level of at least +20 dBu without distortion, but cannot drive a load of less than 150 ohms to a level greater than +30 dBu.
  6. **Mic Level:** Any signal level which requires 10 dB or more of amplification to reach line level.
  7. **Power Amplifier:** A device that is capable of providing at least four watts into any rated load impedance.
- C. **Hum and Noise:** Where hum and/or noise measurements are referred to in this specification, they shall be made with properly calibrated unweighted RMS responding instrument which is flat  $\pm 0.5$  dB between 20 and 20,000 Hz. Levels shall be referred to 0 dBu.
- D. **Signal to Noise (or hum and noise) ratios** shall be defined as the RMS value of a sine wave one dB below clip level for the circuit involved divided by the RMS value of the noise (or hum and noise) and expressed in dB.

- E. Signal to Noise in Multi-Way Systems: Where signal to noise ratios are expressed for multi-way loudspeaker systems, the signal level shall be defined as the RMS value of an acoustic sine wave one dB below clip for the amplifier(s) supplying power in the octave band centered at 1 kHz. It is understood that measurements to confirm this specification will be made well below this level.
- F. A Technical Facilities Panel (TFP) is defined as any panel containing electrical connections providing user access to or control of the Audio System. Technical Facilities Panels typically consist of Audio and video connectors and wiring mounted on a custom coverplate, which is then mounted to a standard electrical box, but conditions of this specification may dictate a different mounting.
- G. A Junction Box (JB) is defined as an enclosure for electrical wiring wherein connections between electrical circuits may be made. A Junction Box is also the point of interconnection of electrical conduit and raceway, and provides access to wiring and interconnections.
- H. The Contractor referred to in this specification is the Audio Systems Contractor selected by the Owner, through competitive bidding or negotiation, to provide the Audio systems described by this specification, and to whom a contract has been awarded to do so.
- I. Owner: The Owner is the United States House of Representatives and the Committee on Agriculture.
- J. A Bidder is a bona fide Audio/Sound Contractor who chooses to submit a bid or to negotiate a contract with the Owner in response to this specification.
- K. Consultant: The "Consultant" or "Sound System Consultant" or "Audio Consultant" or "Audio Consultant" referred to in these specifications is K2 Audio.
- L. Masculine Pronoun: In all cases where a masculine pronoun is used within these specifications, the pronoun is used in the interest of simplicity of syntax, and the reference shall be interpreted as genderless.
- M. Utility: The term "Utility" when referring to a system element is defined as an element which is provided or installed in such a manner that it is not limited to a specific function, system, or configuration, but may be used in more than one way, with more than one system, or in more than one configuration depending on a day to day need.
- N. Good Engineering Practice: The proper and balanced implementation of all applicable and relevant scientific principles and well disciplined working practices, taking into account all factors which could reasonably be expected to affect the safety, operation, reliability, usefulness, maintainability, and effectiveness of the systems and system elements involved, and in a manner such as to optimize the interaction of those systems and system elements with other systems.



## 1.08 SYSTEM DESCRIPTION OVERVIEW

- A. The AV systems will be for the use of the United States House of Representatives Committee on Agriculture in Room 1300 of the Longworth House Office Building. The system will be used during Congressional hearings, markups and widely attended events.
- B. Purpose: The purpose of this system is to allow the Committee Members, witnesses, audience, staff, and press to clearly and effortlessly hear and see all Committee proceedings, by amplifying speech, by displaying images from various video sources within the room, and via the playback of other pre-recorded and live source materials. In addition to sound reinforcement, the audio system shall provide output feeds to assistive listening systems for ADA compliance, the stenographer, teleconferencing, Internet streaming (cable, conduit and equipment provided by others), overflow room 1302, existing squawk boxes in room 1305, and in-room press distribution panels. The system will also include video display and a broadcast camera system, with video feeds for Internet streaming (cable, conduit and equipment provided by others), overflow 1302 and anteroom 1336A.
- C. Control of the System: Control of the Audio system will be accomplished through a graphical user interface to the digital signal processing (DSP) system. Access to this user interface is provided at the audio equipment rack location, and through a remote PC (O.F.E.) located at the producer's station. This interface will be password protected to prevent unauthorized tampering with the system. Once the mode of operation has been selected, the system is intended to operate without the need for user intervention. Control of the AV system sources and displays is possible from a portable touchscreen capable of operating in both wired and wireless mode, from a permanently-mounted touchscreen at the producer's station rack, or in the future, from the House Media Center.
- D. Equipment Location: Most video equipment will be housed in an equipment rack located at the producer's station adjacent to Room 1336B. All other equipment will be housed in equipment racks located in closet 112.
- E. Digital Equipment: The sound system shall be based on state of the art digital technology, with all mixing and signal processing accomplished by a digital signal processing unit.
- F. Audio Routing: With the exception of the analog microphone floorbox inputs, all analog inputs will be preamplified at the source location. The outputs of the preamplifiers will be connected to the digital signal processing system over an Ethernet network. Conversely, the output of the digital signal processing system will be carried over the network to feed the required output devices.

- G. **Audio Input Sources:** Input sources will include dais-mounted gooseneck style microphones, desk-unit mounted witness table microphones and up to 16 auxiliary microphones. Audio inputs for a wireless microphone, cassette deck, DVD player, VCR and teleconferencing will also be provided.
- H. **Desk Units:** At each Member position will be a desk unit.
1. **Desk Unit Electronics:** Each Desk Unit contains A/D and D/A converters, a network interface card, an amplifier and microphone pre-amplifier, and supports a remote microphone, loudspeaker and button control panel(s). It mounts under the dais and is powered over Ethernet. A Desk Unit connects to the Ethernet network via UTP CAT 5e or better cable. The following remote devices are connected to the Desk Unit.
    - a. **Loudspeakers:** The remote loudspeaker is powered by an amplifier located within the desk unit. Signals to the desk units will be arranged into zones to help eliminate the possibility of feedback, with each loudspeaker at the dais being an independent zone.
    - b. **Controls:**
      - 1) Mounted to the dais will be a control panel containing a button that will turn on and off each microphone. A lighted switch will indicate the status of the microphone. The function and indication of these switches can be remotely controlled, allowing a system operator to easily reset all microphones.
      - 2) **Chairman's Controls:** In addition to the on/off button, the Chairman's control panel will contain two additional switches. One will put the system into "Private Mode" ensuring that no signals leave the room. The second "Override" button will mute all other microphones and engage the Chairman's microphone. "Cough" switches will be mounted to the front edge of the Chairman's dais and at the Ranking Member's position. Pushing this switch will momentarily mute the Chairman's (or Ranking Member's) microphone to avoid picking up side conversations.
    - c. **Microphones:** A gooseneck style microphone will be located at each Member position on the dais for speech amplification.
    - d. **Witness Timer:** A connection for a portable witness timer display is mounted on a panel at each Member position on the top dais.
  2. **Member Panel:** On the lower and portable dais units. The above devices are all mounted to a Member Panel.
  3. **VGA:** A connection for a portable LCD display (O.F.E.) is mounted on a panel at each Member position.
- I. **Witness Table Desk Unit:** The Witness Table Desk Unit contains all of the components of the Desk Unit described above, but integrates the loudspeaker, microphone jack, button control panel and witness timer display in a single, portable, wooden enclosure.

- J. Audio Network: Each of the Members' Desk Units connects to the Hearing room audio network using two CAT5 UTP cables. Each cable then connects to two different Ethernet switches via 100Mbps Fast Ethernet links. Should one of the ports or Ethernet switches fail, the Desk Unit will detect the failure and automatically utilize the CAT5 connection to the remaining operable port.
1. Portable Dais Connections:
    - a. Each Portable Dais will connect to a floorbox using a multi-pair cable bundle. At the floorbox end of this cable, is an RJ-21 multipin connector.
    - b. At the desk unit end of the cable, the cable is broken out to six RJ-45 connectors. Each cable should be numbered to match its correct mating receptacle/terminal strip connections.
    - c. A single witness timer connection in each portable dais floorbox will be daisy-chained between the witness timer displays mounted on each Member panel of the portable dais unit.
    - d. Two VGA connections are provided in each portable dais floorbox for connection to the VGA panels at each Member position on the portable dais.
- K. Audience Sound Reinforcement Zones: Sound reinforcement for the audience will be provided by two, self-powered column loudspeakers, one mounted on each of the side walls.
- L. Additional Audio Feeds: Additional loudspeaker feeds will be sent to the ante room, 1336. A wall-mounted loudspeaker with front panel volume control will be provided. These signals are subject to "secure mode" disconnect (see below). A line-level feed is sent to overflow room 1302 for connection to the existing audio system. A line-level feed is also sent to room 1305 for connection to the existing squawk boxes.
- M. Auxiliary Microphone Inputs & the Digital Snake: The auxiliary mic input system is housed in small, portable cases containing an XLR microphone connector panel and network electronics. Two portable cases are provided, and each case provides 8 microphone inputs. Inputs for the cases are provided at the Witness Table floorbox, Portable Dais floorboxes and on three panels located at both side walls and the rear wall of the room. Connecting a CAT5 cable between any of these connectors and the portable cases will allow the use of up to sixteen microphones on portable tables for press conferences or for special functions above and beyond a "normal" Committee hearing. Sixteen microphones are provided with this design.
- N. Broadcast Feed Auxiliary Mix: An auxiliary mix from the digital signal processing system will be routed to audio distribution amplifiers, which will in turn feed the press output panels located at the dais.
- O. Assistive Listening Systems: An audio feed to assistive listening devices shall be provided. This will be comprised of an in-room infrared (IR) system that can be used in the hearing room even during a closed hearing.

- P. The operator will perform all top-level control functions from the digital signal processor user interface located in the equipment rack, or from a remote user interface at the producer's station. Preset modes in the DSP configuration allow the operator to rapidly change the routing based on the Hearing room mode of operation required. Changes in level for selective subsystems and the ability to change microphone on/off state are also available for operator control through the user interface.
- Q. Analog Back-up System: This system contains an interface plate that will allow a crash cart-style back-up system (crash cart equipment not included) to be used in place of the installed system in the event of a failure. Connections for the back-up cart are provided at the audio in Room 112 and on panel ASX-2 in the hearing room.
- R. Video Input Sources: Video input sources include a VCR/DVD machine located at the producer's station, inputs for computers at the Witness Table and the producer's station, a feed from the House CATV system, and 5 cameras. In the future, signals from each of these video sources (excluding the CATV feed) may also be transmitted to the House Media Center in SDI format over fiber optic cable (OFE).
- S. Video Displays:
1. The following displays will be capable of displaying video from any of the above-mentioned video sources:
    - a. Audience displays consist of 2 large format flat screen monitors mounted to the side walls.
    - b. Three LCD screens will be located at the Witness table to provide video display for the Witnesses.
    - c. An LCD screen will be located at the Clerk's position.
    - d. An LCD screen will be located at the Stenographer's position.
    - e. An LCD will be provided at the Chairman's position.
    - f. An LCD screen capable of displaying multiple images simultaneously will be provided at the Producer's Station.
  2. Connections for video displays at each Member position are provided as previously described. No screens other than those listed above are provided as part of this contract.
- T. AV Routing: Routing of signals to the in-room displays and of the broadcast feed will be controlled through the touchscreen located at the Producer's Station.
- U. Security Requirements: There will be a "secure" mode of operation that does not allow any signals to leave the Hearing room. All feeds to anywhere outside of the secure perimeter of the Hearing room (designated as Room 1300 including the producer's station room near Alcove 1336B and the audio equipment rack in room 112) must be physically broken at a central disconnect panel. In the secure mode, all audio and video feeds to areas outside the secure perimeter are disabled, in order to comply with HISPUB 009.0. The Contractor should become familiar with HISPUB 009.0 – *The United States House of Representatives Information Security Publication – Committee*

*and Event Room Security Standards* document and should assure that all work is in compliance with this document. This document is available from the Contract Administration Officer. Additionally, the control software will have a “private” mode that will mute all audio outputs that leave the hearing room, with the exception of audio teleconferencing, thus allowing less formal “closed hearings” to use remote conferencing.

## **1.09 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. Environmental Requirements
  - 1. The system is designed to operate correctly given the acoustic environment in the U. S. House of Representatives Committee on Agriculture Hearing Room, Longworth Office Building Room 1300, extant at the time of design in February 2006.
  - 2. All locations where any portion of the equipment specified in this Section is installed must be temperature and humidity controlled, clean, and dust free. Conditions suitable for office work and equipment will be acceptable.
  - 3. Specific items will dissipate heat, and must be provided with additional airflow and cooling. Make sure adequate HVAC is supplied to equipment spaces to remove the heat generated on a year round basis.
  - 4. Electrical power must be clean and provided with a technical ground system.

## **1.10 SUBMITTALS**

- A. Submit A/V System product information, shop drawings, and samples to the Consultant for review. Begin submittals not later than ten (10) days after the date of Contract execution; failure to comply with this requirement shall be cause for cancellation of the contract, on the basis the selected Contractor does not have the ability or intention to comply with the specifications or schedule. Submit product data binders and submittal drawing information in not more than three submittals. If any submittal drawings are rejected, correct and resubmit within five (5) working days.
- B. Obtain approval prior to ordering material or fabrication. Ordering, receipt, or assembly of any equipment before approval is done entirely at the risk of the Contractor, and any rework required is not a valid cause for delay to the project or additional cost to the Owner.
- C. As an alternate to the “hard copy” submittals required below, the contractor may furnish all required information on a navigable CD-ROM that follows the same hard copy format described below. The title sheet should behave as active “links” that redirect the user to the appropriate content on the CD. If utilizing this method for submittals, at least one (1) 24x36 hard copy of the drawing set must also be provided.

- D. Product Data Submittal. Submit three (3) copies.
1. Utilize three ring binders not exceeding 3" spine size, with clear vinyl pockets on cover and spine.
  2. Provide title sheets for cover and spine identifying the project and the system, room, or area covered by the submittal.
  3. Print title sheets in ink (pen plotter, inkjet or laser printer) on heavy paper sized to fill the entire pocket.
  4. In Section One, provide a complete list in specification order, of all products and materials to be provided under each paragraph of the specification. "Minor" equipment items are specifically included.
  5. In Section Two, provide the manufacturer's product literature for all products, organized in alphabetical order separated by alphabet letter tabular dividers. Full line catalogs, short form catalogs, product pictures with little or no technical data, and unreadable photocopies are not acceptable.
  6. In Section Three provide any copies of Contractor-provided software, configuration files, or software data when applicable.
  7. In Section Four provide a list showing coordination of selected frequencies for all wireless transmitters.
  8. In Section Five provide a schedule of finishes indicating proposed materials and color selections for all exposed items subject to Owner's selection.
- E. Shop Drawings
1. Execute drawings at an appropriate scale, but not smaller than 1/8" = 1'-0", utilizing architectural scale factors exclusively.
  2. Title, number, and note the scale on each drawing.
  3. Minimum drawing sheet size: 24" x 36".
  4. Submit three (3) paper sets of drawings.
  5. Submittal drawings shall contain sufficient information to describe the work to be performed, or the item to be manufactured, and to thoroughly and completely guide installers, technicians, and manufacturers in the assembly of the system element.
  6. Drawings shall include but not necessarily be limited to the following:
    - a. Cover Sheet - Provide a cover sheet clearly showing and dimensioning cable preparation details for each cable and connector utilized in the system, and generally used symbology or detail.
    - b. Wiring diagrams - Furnish complete, detailed wiring diagrams for all systems, based on the contract drawings, but with the addition of:
      - 1) Cable types, and identification and color codes
      - 2) Details of connections, both at equipment and between equipment racks and furniture and wiring in the building
      - 3) Application of connector models and types
      - 4) Comply with AES, ANSI, IEC, and ISO recommendations and standards.
      - 5) Wire numbers for any and all existing wiring

- c. Conduit riser diagrams showing connection of all devices, required conduit sizes along with types and quantities of cables to be used and cable identification tags.
  - d. Patch Panels and Custom Plates and Panels - As plates and panels are to be fabricated exactly as shown on the submittal drawings, shop drawings shall consist of actual machine shop drawings. If discrepancies are discovered by the Contractor due to errors or modification of a manufactured product, these must be called to the attention of the Consultant and propose their resolution on the Submittal Drawings.
  - e. Engraving details and requirements for patch panel and rack labels.
  - f. Consoles, enclosures, tables, and supports. Requirements shall be similar to subparagraph c above. Include detailed construction drawings of cabinetwork and metalwork, including materials, finishes, adhesives, and fasteners.
  - g. Equipment - Show the location of all equipment in racks, consoles, and millwork, with dimensions; wire routing, cabling, and support details; AC power outlet and ground buss locations; location of transformers, relays, accessories, etc.
  - h. Include detailed drawings of loudspeaker installation, showing the location, orientation, and support and aiming system for each case. Verify load ratings of all hanging components including attachment hardware.
  - i. Provide samples required in various specification paragraphs, or by the Consultant or Owner throughout the course of the project; prepay shipping. Samples of minor items such as hardware, connectors, etc. will not be returned.
  - j. Schematic drawings of any custom circuitry or equipment modifications, including connector pinouts and component part lists.
7. References may be made in specification paragraphs to a requirement for submittal drawings for that particular item. Such references do not define the only items requiring submittal drawings.
  8. Do not consider the Consultant's review of submittals to be exhaustive or complete in every detail. Approval of shop drawings and submittals indicates only the acceptance of the manufacturer, model, materials, general design or method of construction, and quality.
  9. Requirements, arrangements, quantities, and installation must comply with the contract documents unless specifically approved to the contrary. Submittal approval does not relieve the Contractor of responsibility for errors in dimensions, details, sizes, fit, etc., or for coordinating items with actual building conditions and dimensions.
  10. Submittals which, in the Consultant's opinion, are incomplete, deviate significantly from the requirements of the Contract Documents, or contain numerous errors, will be returned without review for rework and resubmittal.

#### F. Substitute Equipment

1. Materials and equipment specified herein provide the overall physical appearance sound or visual quality, component part and construction quality, and background

of proven desired by the Owner and, therefore, establish the standard of quality required for this project. Substitute equipment will generally not be considered unless the specified item is discontinued.

2. If equipment or material other than that specified is proposed, furnish the Consultant a written request including a detailed specification sheet and any samples or information required for evaluation. Samples of specified equipment may be required as well as the proposed substitute to facilitate comparison.
3. If required as a condition of accepting the proposed substitute, the Contractor shall warranty the quality of the substitute item. Contractor shall recognize function, performance, appearance, size, utility of service, and accessory requirements are based upon the model or product cited in the specifications, and that:
  - a. If a substitute product varies in any respect and is approved, any additional cost incurred by such approval shall be borne by the Contractor;
  - b. Approval of a substitute, if and when given, does not relieve the Contractor, material/product supplier, or manufacturer of any responsibility whatsoever; but rather, they jointly assume the responsibility the material/product installed will meet the functions, intent, and performance required by the contract drawings and specifications;
  - c. Delay in delivery of any substitute product or material shall not be cause for change to the construction schedule or completion date.
4. The drawings and specifications are based on specific equipment, processes, and arrangements. At no additional cost to the Owner, furnish accessories, parts, and equipment, and perform all work necessary, for the proper functioning and fit of any approved substitute item to the purpose, arrangement, and intent originally indicated.

#### G. Samples

1. Submit electronic copies of any custom programming including source code. Include printed copies of all control screens, wiring pages, etc.
2. Provide product samples as specified in Part 2.

#### H. Labeling

1. Describe complete labeling techniques, including proposed lettering/numbering scheme and data format that cable log will be supplied in.
2. Include representative equipment labeling sizes, styles, and numbering.

#### I. Questions

1. Submit questions about the Drawings and Specification to the Consultant *in writing*.

#### J. Shop Testing

1. The entire A/V system and all its component parts are to be burned in, and tested in the Contractor's shop, prior to shipping to the job site.



2. Verify the depth of each rack prior to assembly to ensure that mounted equipment will fit completely inside with the rear door closed. Install all rack-mounted equipment and test the systems before delivery of equipment racks to the project site.
3. After assembly of rack systems in the shop, measure, and record the DC resistance between the racks ground bus bar and the chassis of all rack-mounted components. Also measure and record the DC resistance between the rack ground bus bar and the signal common for all components.
4. Use a sine wave signal generator, dual trace oscilloscope and dBu meter to measure and document the input and output levels that produce clipping at each component analog input and output in the system.
5. Using a +4 dBu sine wave input for line level inputs and a -36 dBu sine wave input for microphone level inputs, set controls of each component to produce a +4 dBu sine wave output on line level outputs. Under these operating conditions, note the presence of any waveform distortion, interference, or oscillations. Take corrective action to eliminate the anomalies and document the corrective measures.
6. All microphones are to be listened to using live speech as a source.
7. All loudspeakers are to be listened to using recorded speech as a source.
8. In the shop, photograph the interconnect wiring within racks including patch panels and grounding to show the quality of workmanship and compliance with the specified grounding procedures.
9. All test results are to be documented, and submitted to the Consultant for approval before system is shipped to the job site.

#### K. Field Samples

1. Before delivery of equipment to the job site, submit test reports for all measurements specified under Shop Testing above.
2. Before delivery to the job site, submit photographs depicting the quality of wiring and grounding within equipment racks.
3. Immediately after installation, submit photographs showing cable entries and terminations within equipment racks, enclosures and pedestals at the job site.

#### L. Record Documentation

1. Keep a complete set of documents - contract and approved submittal - on the job, note any changes made during installation, and provide one corrected set of reproducible drawings showing the work as installed, with input and output levels noted, for review.
2. Prepare System Reference Manuals as outlined below. Directly submit one copy of each manual to the Consultant for review at least ten days prior to acceptance testing. After review, make corrections and additions required by the Consultant, return the corrected copy to the Consultant, and deliver two additional corrected copies of the System Reference Manual to the Owner. The total requirement is for three copies of the System Reference Manual.

- a. System Reference Manual. Assume the intended reader of the manual to be technically inexperienced and unfamiliar with the facility. Utilize three ring binders not exceeding 3" spine size, with full-size clear vinyl pockets on front cover and spine. Provide title sheets for both cover and spine identifying the project and the system, room, or area covered by that manual; title sheets shall be printed in ink on heavy paper and fill the entire cover or spine pocket. Divide the manual into two or more binders, Part I containing elements 1) through 8) described below, and Part II containing elements 9) through 14). The first section of each binder shall be a Table of Contents. Provide tabular dividers on heavy paper with permanent laser printed legends for the following sections:
- 1) Typed description of each system including key features and operational concepts (e.g. remote control features, switching or routing functions, patch points, mixing and linking capabilities).
  - 2) System Operation and Instructions. Start with "quick set-up" instructions oriented at inexperienced users under time pressure. Next provide typical procedures for the operation of the equipment. Finally provide complete procedures for the operation of the equipment as a system, organized by subsystem or activity.
  - 3) Equipment Settings. Provide a list of the settings of all semi-fixed controls, as finalized after Acceptance Testing. When these settings are in a software format, include software files with settings saved on them. Indicate the name of the product that the file is associated with and all file names on a label physically attached to all software provided.
  - 4) As-Built Drawings. Include original or xerographically reproduced wiring diagrams of each major subsystem, including plans showing locations and circuit numbers for all system outlets and receptacles, mounting and other pertinent details of the system installation, based on the contract drawings, at a reduced scale easy to handle but fully legible. Normal maximum drawing size: 17" x 22". Blueline (or similar diazo process) prints are not acceptable. Provide one additional full size bound set separately, as well as one electronic set in AutoCAD format, one set each for Owner and Consultant. Place an additional set of reduced-size drawings in a pocket folder attached to the equipment rack for convenient future reference.
  - 5) Manufacturers' Operation Manuals. Furnish manufacturer's instruction manuals for all items of equipment, incorporating manufacturer's warranty statements. Provide printed original manuals, not photocopies, unless more copies of a manual are required than the number of units in the total system. For custom circuits or modifications, provide a thorough description of the purpose, function, specifications, and operation.
  - 6) A properly licensed working copy of the latest version of any and all contractor-provided software required to operate or configure the

systems specified herein shall be a part of the system supplied. This includes, but is not limited to, all software, firmware and hardware required for configuration, adjustment, diagnosis and repair. Software shall be fully documented, and that documentation included.

- 7) Software shall be included in its “installable” state on industry standard CD-ROM. Back-up of the working software may be provided as an additional inclusion. Disk images are unacceptable.
  - 8) Other Data. Furnish any other pertinent data generated during the project or required for future service.
  - 9) Maintenance Instructions. Include a clear statement of the terms and period of the Contractor's warranty; Contractor's service department phone and facsimile number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes; and instructions for the proper use of maintenance products.
  - 10) Equipment List. Provide a comprehensive list of all equipment by subsystem, tabulating the manufacturer, model, serial number, physical location, and wiring diagram drawing number and code.
  - 11) Product manufacturers' warranties.
  - 12) Manufacturers' service manuals for all major equipment items. For custom circuits or modifications, provide a thorough description of the purpose, function, specifications, and operation.
  - 13) Performance Test Reports. Include a copy of the shop testing test report generated meeting the requirements of Article 1.10 I of this Specification. Also include a copy of the system startup test report generated meeting the requirements of Article 3.06 of this Specification, and test results generated during Commissioning of the system.
  - 14) Provide a recommended preventative maintenance schedule with reference to the applicable pages in the manufacturer’s maintenance manuals. Where inadequate information is provided by the manufacturer, provide the information necessary for proper maintenance.
3. Correct and update the System Reference Manuals, if necessary, according to the Consultant's instructions after acceptance testing.
  4. Provide VHS or CD-ROM (unless otherwise requested by the Owner) copies of the training sessions for later review by the operators and maintenance staff.

M. Keys. Submit in triplicate all keys required for access to and operation of the systems.

## **1.11 QUALITY ASSURANCE**

- A. Qualifications. The Audio system described in the Specification is a complex system requiring the services of a trained and experienced specialty contractor with the resources to carry out the project in a timely and professional manner.

B. Regulatory Requirements.

1. Obtain all permits necessary for the execution of any work pertaining to the installation or operation of any system equipment by the Owner. Comply with applicable federal, state, and local labor and union regulations.
2. Execute all work in accordance with the National Electrical Code, the National Electrical Safety Code, the Life Safety Code, and all applicable federal, state, and local codes, laws, ordinances, regulations, and requirements including, but not limited to, those of OSHA, EEOC, ATBCB, ADA, ANSI, UL, and the FCC. If a conflict exists between the contract documents and any code or regulation, and is reported to the Consultant sufficiently before bid opening, the Consultant will prepare the clarification required. Where a conflict is reported after the contract is awarded, propose a resolution of the conflict and, upon approval of the change, install the work.

C. Construction Observation. The failure of the Consultant or other representative of The Architect of the Capitol or Owner to condemn any defective work or material shall not release the Contractor from the obligation to at once tear out, remove, and replace the same at any time prior to final acceptance upon discovery of said defective work or material.

D. Pre-installation meetings.

1. Meet with the Owner on the site and reach a written understanding regarding project conditions outside the Audio Systems Contractor's scope of work which will impact the timely completion of this contract. Items that must be coordinated include a schedule of access to the Hearing room, Equipment Room(s), and all other areas where access will be required; security of the equipment room; secure storage for equipment and tools on site; cleanliness of the equipment room including both trash and dust; HVAC for the equipment room; technical power in the equipment room and other required locations; conduit and junction box completion; any wire pulling needed for this contract but not provided by the Audio Systems Contractor; any and all job site conditions that may impact the timely completion of this contract or its conclusion in excellent condition; and any and all other work that must be provided by others that is required for the timely completion of this contract or its conclusion in excellent condition. Develop an agreed time line for all the above items, showing the last acceptable completion date for each item, and signed by the Owner and the representative of the Audio Systems Contractor.
2. The Electrical Contractor for this project will be the in-house electricians of the Architect of the Capitol. Meet with the Architect's designated electrician and present him with a copy of the signed and approved time line. Discuss the electrical issues on the timeline and make sure the time requirements are understood by the AOC. Coordinate the electrical and conduit requirements of this contract, and verify that all power and conduit required for this contract is in the AOC's scope of work. If there is a discrepancy between this contract and the

AOC's scope of work, notify the Owner and the Consultant, and request a clarification or modification of the Contracts to achieve coordination. It is the Contractor's responsibility to verify that all conduits, junction boxes, raceways, and backboxes will be of the proper size and type to meet the Contractor's requirements.

3. Meet with any other contractor whose work will impact the performance of this contract, and coordinate as in subparagraph 2 above.

E. Continuity of Supervision

1. The Contractor shall maintain the same individual in charge of work for the full duration of the project unless illness, loss of personnel, or other circumstances beyond the control of the Contractor intervene.

### **1.12 DELIVERY, HANDLING, STORAGE, AND CLEANUP**

- A. All equipment shall be assembled in the Contractor's shop into equipment racks, furniture, or other assemblies, and fully wired and tested before delivery to the site. All loudspeakers and loudspeaker assemblies shall be tested by the Contractor in the Contractor's shop before delivery to the site. Do not ship, or cause to be shipped to the site, any material without first ensuring secure dust free storage facilities are available and HVAC system is operating.
- B. Coordinate with Owner's Representative for any equipment and materials to be delivered or stored on site.
- C. Store and protect products and material in accordance with common sense and the manufacturer's recommendations, regardless of location.
- D. Make all equipment including loudspeakers available for testing by the Consultant on the site before installation.
- E. Keep work area neat and orderly and free from accumulation of waste materials. Remove debris caused by installation from the building or site to a common trash point or receptacle on the job site, as determined by the Owner or Building Superintendent.

### **1.13 INSURANCE**

- A. Insure materials against theft, vandalism, damage due to the elements, fire, etc., to their full value. Materials and the flawless condition of materials shall remain the responsibility of the Audio System Contractor until acceptance of the system by the Owner.
- B. Provide policies of insurance from reputable companies, in amounts sufficient to protect the Owner from any and all claims, actions, demands, losses, costs, judgments, or damages, for the following:

1. Workman's Compensation and Liability for all personnel as required by law.
  2. Motor Vehicle Liability, including coverage for owned, non-owned, and hired vehicles, with combined single limits of \$1,000,000 per occurrence.
  3. Commercial General Liability, including coverage for premises/operations and personal injury, with limits of \$1,000,000 per occurrence.
- C. Furnish certificate evidence of the insurance, and copies of policies, to the Owner prior to execution of a Contract.
- D. Keep insurance in full force until all work is completed and accepted by the Owner. Insurance shall be modified or canceled only on written notice to the Owner, given thirty (30) days in advance, with replacement policies going immediately into effect.

#### **1.14 PROJECT CONDITIONS**

- A. Do not install equipment unless the location is clean, dust free, and dry, and you have reason to believe it will continue to stay that way.
- B. Do not power up equipment unless you have a source of clean technical power, and the HVAC system is operating correctly.
- C. Verify all conditions on the job site applicable to this work. Notify Owner and Consultant in writing of conflicts, discrepancies, or omissions promptly upon discovery.
- D. The drawings diagrammatically show conduit, wiring, and arrangements of equipment fitting the space available without interference. If conditions exist at the job site which make it impossible or disadvantageous to install the work as shown, recommend solutions and/or submit drawings for approval showing how the work may be installed.
- E. Seismic Safety
1. Observe mechanical and electrical support means of all installed equipment as required for the seismic hazard zone for this installation. Refer to Federal Emergency Management Agency (FEMA) Document 303: Recommended Provisions for Seismic Regulations for New Buildings and Other Structures. Also refer to any applicable local building codes.
  2. All equipment racks are to be anchored with suitable anchors to meet safety standards.
  3. Appropriate safety attachments as required for overhead mounting of devices.
  4. Shock and/or vibration isolation of equipment or fixtures as required.
- F. Fiber Optic Cable Safety
1. The following warnings shall be posted on the job site: **WARNING:  
PERMANENT EYE DAMAGE CAN RESULT FROM LOOKING DIRECTLY  
INTO A LIGHT BEAM GENERATED BY AN LED OR LASER SOURCE OR**

INTO THE END OF A CABLE FIBER CONNECTED TO ONE OR THESE SOURCES. CAUTION: LIGHT GENERATED BY THESE SOURCES MAY NOT BE VISIBLE, YET REMAIN HAZARDOUS TO THE EYE. LOOK FOR WARNING LABELS ON SOURCE DEVICES.

2. Observe all warning signs on equipment and all written safety precautions in the instruction manual or equipment technical manual.
3. Always handle cable carefully to avoid personal injury. Care should be taken with individual fibers to prevent injury to the eyes or penetration of the fibers into the skin.

G. Asbestos Prohibition

1. No Asbestos containing materials shall be used under this section. The contractor shall ensure that all materials incorporated in the project are Asbestos free unless specifically authorized in writing by the Owner.

### **1.15 WARRANTY**

- A. Labor and materials provided under this contract shall be warranted for one (1) year following the date of final acceptance to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Certain individual pieces of equipment may be covered for a longer period as provided in a specific manufacturer's warranty. Rectify defects occurring in labor or materials within the Warranty period by replacement or repair without charge. Projection lamps are excluded from this Warranty unless damage or failure is the result of defective material or workmanship covered by Warranty, or work performed under warranty.
- B. Within the warranty period, respond to service calls within twenty-four hours, and correct the problem within forty-eight hours if at all possible.
- C. Register warranty in the Owner's name for any product with a manufacturer's warranty stipulated in the Contract Documents.

### **1.16 EXTRA MATERIALS**

- A. Certain items in this specification will list extra quantities over and above those needed for the installation. Such extra quantities are intended as Owner's on-site spares and are to be turned over to the owner during the training session. Spares will include fuses, lamps, power supplies, hard drives (pre-loaded with all software), microphones, and loudspeakers.

## **PART 2 PRODUCTS**

## **2.01 ACCEPTABLE MANUFACTURERS**

- A. Model Numbers: Due to the short installation time frame required of this project, pre-bid equipment substitutions are not allowed.
- B. After award of contract equipment substitutions may be considered if and only if an economic benefit to the House of Representatives may be realized.
- C. In the event that a specified product has been discontinued by the manufacturer, Contractor should notify Consultant immediately.
- D. It is the responsibility of the Contractor to ensure that any and all substitutions made will work with the same functionality as the originally specified product.

## **2.02 GENERAL**

- A. New Equipment: All equipment and materials shall be new, and shall conform to applicable UL, CSA, or ANSI provisions. Take care during installation to prevent scratches, dents, chips, etc. Equipment with significant or disfiguring cosmetic flaws will be rejected.
- B. Device Specifications: Regardless of the length or completeness of the descriptive paragraph herein, each device shall meet all of its published manufacturer's specifications. Verify performance as required. Where two or more acceptable products are listed, the Contractor may use either at his or her option.
- C. Rack Mounted Equipment Installation: Install all rack mounted equipment with black 10-32 button head machine screws with Allen drive or stainless steel 10-32, button head machine screws with Allen drive. Use black insulating nylon shoulder washers on all rack mounting screws.
- D. Equipment Security: Provide shaft locks or security covers on all non-user-operated equipment having front panel controls. Rack slides shall be provided for all equipment requiring access to side or top panels for routine adjustment or cleaning; all Video Cassette and Open Reel Video Tape Recorders; all Picture Monitors over 20 pounds. Install this equipment at the conclusion of Acceptance Testing as described in Part 3.
- E. Provide rack slides and mounts equal to those of the original manufacturer for the OFE requiring rack mounting. Where no same manufacturer mount is available, contractor shall supply custom mounts as manufactured by Middle Atlantic Audio Products.



- F. Equipment Labels: Provide engraved lamicoïd labels at the front and rear of all signal processing equipment mounted in racks. Mount labels on the equipment and attach in a neat, plumb, and permanent manner. Embossed or printed labels will not be accepted. Provide engraved labels at the rear only for equipment mounted in furniture consoles.
- G. Engraving: All engraving shall be 1/8-inch block sans serif characters unless noted otherwise. On dark panels or push buttons, letters shall be white; on stainless steel or brushed natural aluminum plates, or light-colored push buttons, letters shall be black.
- H. Custom Parts: Custom rack panels shall be 1/8-inch thick aluminum, standard EIA sizes, and brushed black anodized finish unless otherwise noted. (Brush in direction of aluminum grain only.) Custom connector plates (loudspeaker, microphone, etc.) are typically stainless steel; however, it is the Contractor's responsibility to verify plate finish with the Owner. Plastic plates will not be accepted.
- I. Mount trim potentiometers, custom circuit cards, relays, and transformers (except large 70V units) in shielded enclosures, and mark their function and connections with engraved lamicoïd labels.
- J. In accordance with the IEC-268 Standard, all XLR connectors shall be wired pin 2 hot (high), pin 3 low, and pin 1 screen (shield).
- K. Patch Panels and Jack Positions: All patch panels shall be wired so that signal "sources" (outputs from devices) appear on the upper row of a row pair; all "loads" (inputs to devices) appear on the lower row of a row pair. All patch panel designation strips shall utilize alphanumeric and descriptive labels. The jack positions in each horizontal row shall be numbered sequentially from left to right. The horizontal jack rows shall be lettered sequentially from top to bottom. The alphanumeric identification of each jack shall be included on the functional block drawings.

### **2.03 MISCELLANEOUS EQUIPMENT**

- A. Cable. High purity copper cable; insulation dielectric appropriate to signal and code requirements. Install in metallic conduit, wire-way, or flex, unless otherwise noted or instructed. No splices or intermediate connection points are permitted unless specifically called for in the specification or drawings. No substitutions are allowable without specific written approval. All cable for a given wiring category shall be consistent; (i.e., if Belden 1800B is chosen for fixed line level wiring, all fixed line level wiring shall be done with this cable). Cables with wire shields, braid or wound, must use all the wire conductors for shield termination, and not just a drain wire or some of the shield strands. Connections not following this requirement will be rejected. Foil shielded cables only provided with a drain wire must use the drain wire for shield termination. Not all acceptable cables listed below may be employed in the system. Molded cable/connectors are not acceptable for audio, video, or control

circuits, except computer signal interconnection or AC power cords. All equipment must be provided with signal and/or control cabling, whether or not specifically shown on the conduit and wiring drawings. The overall cable diameter is shown in inches.

1. Loudspeaker lines, general. Unshielded two conductor twisted pair, bare or tinned copper stranded conductors PVC insulated, overall PVC jacket.  
Acceptable: Belden 5T00UP or West Penn C210 (10 gauge, 0.356"), Belden 9412 or 8477 (12 gauge, 0.370"), Belden 9411 or 8473 (14 gauge, 0.322"), Belden 9410 or 8471 (16 gauge, 0.254")
2. Microphone and line level permanently installed audio circuits. If cable will be flexed on a regular basis use portable cable below. Tinned stranded copper conductors, foam polyethylene insulated; 13 pF/ft capacitance; AES/EBU rated; twisted pair; foil aluminum-polyester shield, 24 AWG stranded tinned copper drain wire; PVC jacket; overall diameter, 0.177".  
Acceptable: Belden 1800B or Belden 1696A
3. Portable microphone and line level audio cables. Bare copper stranded 24 AWG conductors, foam polyethylene insulated; 13 pF/ft capacitance; AES/EBU rated; twisted pair; bare copper French braid shield for 95% coverage; PVC jacket. Use entire braid shield for shield termination. Do not use just the drain wire. Shield terminations made using just the drain wire will be rejected.  
Acceptable: Belden 1800F
4. Individually Shielded and Jacketed Multi-Pair, 24 gauge. CMG rated. Tinned copper 24 gauge stranded conductors, foamed polyethylene insulated, twisted pairs; 13 pF/ft capacitance; AES/EBU rated; each pair individually shielded with aluminum polyester shield, 24 AWG stranded copper drain wire; each pair individually PVC jacketed; overall aluminum polyester shield, 24 AWG stranded copper drain wire; PVC overall jacket.  
Acceptable: Belden 1803F (4 pair), Belden 1805F (8 pair), Belden 1806F (12 pair), Belden 1850F (16 pair), Belden 1852F (24 pair), Belden 1854F (32 pair)
5. Permanent Link Ethernet cable. Enhanced Category 6, bonded pair, solid bare copper conductors, 23 or 24 AWG, 4 pair, Unshielded Twisted Pair (UTP), use for all Permanent Links where Category 5 (CAT 5) or Category 5e (CAT 5e) cable is specified, use EIA/TIA 568B color code, terminate in approved CAT 6 rated connectors with no more than 1/2" exposed wire past end of jacket, test link after installation and provide printed certification of performance to a minimum CAT 5e level (CAT 6 preferred) for every link by wire number.  
Acceptable: Belden 1872A or 7851A
6. Ethernet Patch cable. Enhanced Category 6, bonded pair, stranded tinned copper conductors, 24 AWG, 4 pair, Unshielded Twisted Pair (UTP), use for all Patch Cords where Category 5 (CAT 5) or Category 5e (CAT 5e) cable is specified, use EIA/TIA 568B color code, terminate in CAT 6 rated "RJ-45" plugs with strain relief for both jacket and individual conductors, test patch cable before installation and provide printed certification of performance to a minimum CAT 5e level (CAT 6 preferred), test complete link consisting of a patch cable at each end of a Permanent Link and provide printed certification of performance to a minimum

CAT 5e level (CAT 6 preferred)

Acceptable: Belden 1875GB

7. Video Baseband Cables. Use cables with the appropriate NEC rating not less than CMR, including plenum versions of the specified cables where required. Custom Lengths in excess of 1000' are required. Splicing is not allowed.
  - a. Precision Digital Miniature 75 Ohm coaxial cable for rack or console video interconnections up to 700 feet and BNC Longitudinal Time Code connections. Use red, green, blue, and orange insulation colors to code RGBS circuits respectively. Cable to be NEC rated CMR.  
Acceptable: Belden 1505A, Gepco VPM 200
8. Video Baseband Cable. Precision Digital 75 Ohm coaxial cable for all runs in excess of 700 feet, but less than 900 feet. Use red, green, blue, and orange insulation colors to code RGBS circuits respectively. Cable to be NEC rated CMR.  
Acceptable: Belden 1694A, Gepco VSD2001
9. Video Baseband Cable. Precision Digital 75 Ohm coaxial cable for all runs in excess of 900 feet, to but less than 1300 feet. Use red, green, blue, and orange insulation colors to code RGBS circuits respectively. Cable to be NEC rated CMR.  
Acceptable: Belden 7731A, Gepco VHD1100
10. Television RF Cable.
  - a. Quad shield RG-11 style. Cable to be listed for use in application. Jacket labeled for UL class, and with footage markers.  
Acceptable: Comm/Scope F11SSVR, Times Fiber 2262
  - b. Quad shield RG-11 style, Plenum Rated. Jacket labeled for UL class, and with footage markers. Cable to be listed for use in plenum and vertical riser applications.  
Acceptable: Comm/Scope 2287K, GepCo 7287TK, Belden 1153A
  - c. RG-6, Quad Shield, Foam Dielectric, Riser rated. Jacket labeled for UL class, and with footage markers. Cable to be listed for use in application.  
Acceptable: Comm/Scope F6SSVR
  - d. Plenum rated, Quad Shield RG-6 type coaxial cable with a solid 20 AWG copper-covered steel center conductor. Jacket labeled for UL class, and with footage markers. Cable to be listed for use in application.  
Acceptable: Comm/Scope 2227K
11. RGB and RGBHV Bundled Video Baseband Cables. Use cables with the appropriate NEC rating not less than CMR, including plenum versions of the specified cables where required. Splicing is not allowed.
  - a. Precision Miniature 75 Ohm coaxial cable for RGBHV video interconnections to inter-rack patching and runs up to 60 feet.  
Acceptable: Belden 1279R.

- b. Precision Miniature 75 Ohm coaxial cable for RGBHV video interconnections in excess of 60 feet, but less than 300 feet. Cable to be NEC rated CM\*.  
Acceptable: Belden 7796A
- c. Precision 75 Ohm coaxial cable for all runs in excess of 300 feet, but less than 500 feet. Cable to be NEC rated CMR. Acceptable: Belden 7712A
- 12. Twisted Pair Video Cable
  - a. Low Skew UTP: Category 5e, 24 AWG bonded pairs solid bare copper conductors, non-plenum, polyolefin insulation, skew 9.0ns/100m nominal, rip cord, PVC jacket. Belden "Video Twist" 7988R
- 13. AMX Ax-Link or Crestron Cable. Use cables with the appropriate NEC rating not less than CMR, including plenum versions of the specified cables where required. Splicing is not allowed.
  - a. 22 AWG shielded data pair, 18 AWG power pair.  
Acceptable: Belden 1502R, Belden 1502P, West Penn 77350, Liberty AXLINK
- 14. Witness Timer Cabling: Provide cable required for wiring all witness timer displays. Acceptable products: Belden 8489, 4 conductor, 18 AWG, unshielded non-twisted multi-conductor cable. Use for both portable and permanently installed devices.
- 15. Plenum Rated, Four-strand Single Mode fiber Cable: Optical Cable Corporation BX04-060K-SLS-900-OFNP.

B. Cable Connectors. Employ only new first quality connectors, assembled, wired, and installed according to the manufacturer's instructions. Do not mount connectors in inaccessible locations, or employ to splice cables. Connectors shall typically be keyed to prevent mis-insertion, and include strain relief mechanisms that firmly grip the cable jacket. All audio, video, and control connectors not a part of manufactured equipment (BNC, XLR, phono, video patch, card edge, multipin, spade lug, etc.) shall have gold plated contacts. Exceptions: 1/4" phone jacks and audio patch plugs, loudspeaker connectors.

- 1. XLR Connectors. Per IEC-268 standard, all XLR connectors, within equipment or out, shall be wired pin 2 hot (high), pin 3 low, and pin 1 screen (shield). At no time connect the XLR case or body to pin 1 on a connector not part of equipment. Constructed of metal shells and bodies and a non-hydroscopic dielectric.  
Acceptable: Neutrik NC3MX-B male cable, Neutrik NC3FX-B female cable, Neutrik NC3MRC-B male right angle cable, Neutrik NC3FRC-B female right angle cable, Neutrik NC3MD-L-1-B male chassis, Neutrik NC3FD-L-1-B female chassis, for 3 pin connectors, or equivalent by Switchcraft.
- 2. RCA Phono Connectors. 75 ohm; Nickel plated brass body; gold plated contacts.  
Acceptable: Canare RCAP series.
- 3. Phone Connectors. Plugs black metal handle; gold plated contacts. Jacks latching with black metal shell nickel contacts.  
Acceptable: Neutrik NC2C-B (1/4" tip/sleeve plug), Neutrik NC3C-B (1/4" tip/ring/sleeve plug), Neutrik NJ3FP6C (1/4" tip/ring/sleeve latching jack).

4. Audio Patch Panel Connectors.  
Acceptable: Audio Accessories, Switchcraft, ADC, Neutrik
5. BNC Connectors. 75 ohm; Nickel plated brass body; gold plated brass contact pin.  
Acceptable: Canare BCP series.
6. Speaker connectors.  
Acceptable: Neutrik Speakon series.
7. Multipin Connectors.  
Acceptable: Whirlwind, Gepco, Lemo, Ramlatch, or to match manufactured product.
8. Permanent Link Ethernet Connectors. Must meet or exceed TIA/EIA-568-B.2.1 Category 6 standard.  
Acceptable: Panduit Mini-Com TX-6 Plus Jack Module CJ688TP
9. Ruggedized Permanent Link Ethernet Connectors. Must meet or exceed TIA/EIA-568 Category 5e standard.  
Acceptable: Neutrik Ethercon NE8FDV-Y110-B
10. Ruggedized Ethernet Patch Cord Shells. Install over "RJ-45" plug that meets or exceeds TIA/EIA-568-B.2.1 Category 6 standard  
Acceptable: Neutrik Ethercon NE8MC-B
11. 25 pair "RJ-21" connector.  
Acceptable: Tyco Electronics/AMP 1-558693-1 CHAMP SYSTEM 5. Provide model with 180 degree strain relief cover.
12. Wire Ferrules. Pluggable terminal strips or other connectors which could accept bare wire ends must have the wires terminated first using properly crimped color coded insulated wire ferrules. Bare wire ends directly into a connector that does not use solder or crimp connections are not acceptable. Install ferrules with manufacturer approved crimp tool.  
Acceptable: American Electrical Insulated Wire Ferrules or equal.

## **2.04 AUDIO SYSTEM INPUT SOURCES**

- A. Desk Units. Mount desk units and components as shown in drawings. All patch cables between the floorbox and the equipment in the portable dais units should be neatly dressed to provide an aesthetically pleasing appearance. Mount desk units using mounting plate and so that connectors are accessible for servicing, without having to remove the unit from its permanently-mounted position. Coordinate with the AOC to provide sufficient space and access:
  1. Desk unit: Rane CLU (Qty. 47)
  2. Desk unit mounting plate: BobCo CLU mounting plate: Phone (720) 272-7766 (Qty. 47).
  3. Use DB-15 with spring-latches as required (possible Amp part numbers for the spring latch are 745779-3 (bulk), 745779-2 (two/bag), 745255-3 (bulk) or 745255-2 (two/bag))

- B. Top Dais Member Microphone Plate: Refrain from drilling new holes in furniture wherever possible. Obtain prior approval on layout from the Committee before commencing with microphone plate installation.
1. Plate: Provide custom 1/8" thick polished brass (with clear coat) microphone base/control panel (Qty. 31)
  2. Shock/Swivel Mount: Shure 400SM with A400SW1/2 swivel. Ensure fit with AT microphone and provide current production model shock mount using 55 durometer rubber. (Qty. 31)
  3. "Talk" Switch: EAO 31-151.0252 and EAO 31-953.7 lens. (Qty. 31).
  4. 12 VDC white LED: EAO 10-2309.1069 (Qty. 31)
  5. RJ-45 Connector: AMP KL Series Category 6 110Connect Modular Jack or equivalent. Must meet or exceed TIA/EIA-568-B.2.1 CAT6 standard. (Qty. 31)
- C. Chairman's "Private" and "Mute All" Panel:
1. Provide 1/8" thick polished brass panel with clear coat at Chairman's position as shown on drawings.
  2. Switch: EAO 31-151.025 and EAO 31-953.7 lens. (Qty. 2).
  3. 12 volt T1-3/4 Midget Grove Multi-LED Lamp: EAO 10-5309-3202 (Qty. 2)
- D. Lower and Portable Dais Member Panels: AOC shall construct custom "gallery" woodwork on the lower and portable dais units for Member plates to mount as shown in drawings. Contractor should provide a "disconnect" that allows all soldered connections to Member panel device to be easily disconnected for servicing.
1. Brass Panels: Provide custom panel with microphone shock mount. Panel shall contain engraved and black filled lettering saying "TIME REMAINING" using a sans-serif font. Acceptable Products: BobCo USC-B1 (Qty. 16)
  2. RJ-45 Connector: AMP KL Series Category 6 110Connect Modular Jack or equivalent. Must meet or exceed TIA/EIA-568-B.2.1 CAT6 standard. (Qty. 16)
  3. "Talk" Switch: NKK LB15SKG01-5C12-JB (Qty. 16). Provide with clear label indicating the word "TALK" using sans-serif font. Provide sample of label to Consultant prior to installation.
    - a. Use FASTON terminals to provide an easy disconnect for servicing. Insulated terminals are preferred, but verify fit prior to ordering. Acceptable Products: Tyco/AMP Insulated 2-520084-2 (Mouser part #571-25200842) or Tyco/AMP Uninsulated 640923-1 (Mouser part #571-6409231)
  4. Microphone XLR Connector: Neutrik NC3FX-SPEC Stock connector ships with silver contacts. Provide replacement insert with gold plated contacts. (Qty. 16).
    - a. Use Mogami 2697 cable between CLU and Member panel.
    - b. To provide a disconnect for ease of servicing, use Switchcraft TA3M wired at the panel end, and Switchcraft TA3F at the CLU end. Connectors should reside inside the "gallery" for ease of access.
  5. Loudspeaker: Mount loudspeaker (with grille cloth) to desk panel as shown in drawings. Acceptable Products: Audax AP100Z0 4" driver (Qty. 16)

- E. Desk Units for Witness Table: Provide low-profile portable desk unit with integrated loudspeaker, microphone input, push-to-talk switch and timer display. Coordinate with manufacturer to ensure that integrated timer display is compatible with other witness timer displays (see below).
  - 1. Rane LPCLU (Qty. 4)
  
- F. Gooseneck Microphones:
  - 1. Microphone: Audio-Technica U857QL gooseneck microphone. (Qty. 51).
  - 2. Metal Windscreen: Audio-Technica AT8104A\*2 (Qty. 51)
  
- G. Ambient Microphone. Mount in plate at rear wall camera location.
  - 1. Crown PZM-10 color: black (Qty. 1)
  
- H. Portable Auxiliary Microphone System:
  - 1. Audio Technica AT U857QL gooseneck condenser microphone with AT 8666RSP base and AT8104A\*2 metal windscreen. Provide ready with 3-pin XLR connectors to interface to the portable case microphone input jacks. (Qty. 16).
  - 2. Microphone Cables. Provide Velcro tie raps at the male end of each cable.
    - a. Provide 25' Belden 1800F cable with black Neutrik connectors with gold plated contacts. (Qty. 16).
  - 3. Portable Equipment Case
    - a. Equipment Case. Modify case to support rear rack rails. Acceptable Products: ProTec 2 space rack gear PRO PAC case w/ strap handle: 114-R2 (Qty. 2).
    - b. CobraNet I/O Frame. Mount one in each portable equipment case. Modify power cable so that one end is hard-wired directly to the panel mounted outlet. Acceptable Products:
      - 1) I/O Frame: Peavey Electronics CAB8i (Qty. 2)
      - 2) Wire microphone inputs to CV inputs as shown in drawings using 2 1.6MOhm metal-film resistors per input.
    - c. Rack-mounted Connector Panel: Provide one rolled edge connector panel within each portable equipment case as detailed in drawings. Provide large label on each panel indicating ID number for each case with the following text: "ID: XXXX" where XXXX equals the switch settings for the CAB in the case. (Qty. 2)
    - d. Panel-Mounted Euro-style Power Plug: Corcom 1EF1F (Qty. 2)
    - e. Provide Power Cable with Euro-style connector ends. (Qty. 2)
  
- I. Wireless Microphone System
  - 1. Shure U124S/Beta87A Combo Unit (Qty. 1)
  - 2. Shure WL-184 Lavalier Element (Qty. 1)
  - 3. Shure UA830 Active Remote Antenna Kit (Qty. 2) mount on sides of hearing assistance emitter.

- J. Playback Devices
  - 1. Dual-well Cassette Deck: Denon DN-780R (Qty. 1)
- K. Audio Summing Network:
  - 1. (MIX1) RCA to Euro Block: Extron ASA 121 (Qty. 1)
  - 2. (MIX2) screw terminals: Radio Design Labs STD-10K (Qty. 4)

## **2.05 AUDIO SYSTEM DIGITAL SIGNAL PROCESSING UNIT AND ACCESSORIES**

- A. Digital Signal Processing Unit:
  - 1. Hardware: Peavey NION n6 (Qty. 5). Connect both the main and redundant CobraNet connections to the specific Ethernet switch ports shown in functional diagram.
  - 2. Wiring: Cabling for X-DAB connection between units must be Shielded Twisted Pair cable certified for the Category 6 performance, with overall cable length not exceeding 12'. (Qty. 5)
  - 3. Additional Software: Peavey Electronics ControlManager (Qty. 1)
- B. Room Controller
  - 1. Provide a rack-mounting computer meeting the following minimum configuration specifications: 1U rackmount w/ dual on-board NIC, Intel Pentium4 2.8GHz, 1GB DDR, CD-ROM, and 3<sup>rd</sup> party versa rails, with Windows XP Professional (w/ Service Pack 2) OS installed. Acceptable Products: Dell PowerEdge 850 (Qty. 1)
- C. KVM
  - 1. Producer's Station USB keyboard: Grandtec USA The Virtually Indestructible Keyboard USB (Qty. 1)
  - 2. Producer's Station USB optical mouse with scroll wheel (Qty. 1)
  - 3. USB KVM extender via CAT5: Network Technologies Inc XTENDEX™ USB-C5 to audio system room controller (Qty. 1)
  - 4. Audio Rack KVM Drawer: PS/2 Rack-mount 17" LCD KVM drawer with real mouse. Acceptable Manufacturers: Network Technologies Inc. RACKMUX-P17-MP (Qty. 1)
  - 5. Provide with all cables and connectors necessary for a functioning system.
- D. CobraNet Input/Output Boxes
  - 1. Peavey Electronics CAB-8i (Qty. 2)
  - 2. Peavey Electronics CAB-16o (Qty. 1)

## **2.06 AUDIO SYSTEM LOUDSPEAKERS**

- A. Top Dais Loudspeakers:
  - 1. EAW USC31a (Qty. 31)



- B. Audience Loudspeaker: Paint and supply with grill cloth to match wall color as directed by Owner.
  - 1. Duran Audio Ivx-DC115 in mtd inside 1b enclosure (Qty. 2)
  - 2. Duran Audio Intellivox 1b mounting hinge and flat hanging bracket (Qty. 2)
- C. Overflow Loudspeaker:
  - 1. Desktop powered loudspeaker with front panel volume and power controls.  
Acceptable products: JBL LSR6325P (Qty. 1)
- D. 2 in, 1 out, Powered Audio Monitor Panel
  - 1. Wohler Technologies AMP-1A (Qty. 1)
- E. Staff Office “Squawk Box”: Coordinate in advance with House Information Resources to ensure that the appropriate wiring is available at the rack location for connection to the existing squawk boxes.

## **2.07 PRESS FEED**

- A. Replace all XLR connectors on the existing press feed panels (O.F.E.). Use black Neutrik connectors with gold plated contacts. Verify integrity of existing wiring. If wires are found to be defective, replace with new cable. (Qty. as required)
- B. Distribution Amplifier with transformer-isolated outputs.
  - 1. ATI DA2016 (Qty. 2)

## **2.08 NETWORK INFRASTRUCTURE COMPONENTS**

- A. Ethernet Switching Components:
  - 1. Gigabit Switch. Provide stackable, multi-layer, managed 8-port switch with 6 auto-sensing 10/100/1000 ports and 2 dual-personality ports for 10/100/1000 or mini-GBIC connectivity. Recess switches.
    - a. Hewlett Packard ProCurve Switch 6108 J4902A (Qty. 1)
  - 2. Provide stackable, multi-layer, managed 26-port switch with 24 auto-sensing 10/100 ports and 2 dual-personality ports for 10/100/1000 or mini-GBIC connectivity. The switch shall be IEEE 802.3af compliant for Power over Ethernet and provide up to 15.4W per port. Mount in main audio equipment rack. Recess switch and cover with see-through tamper-proof rack plate.
    - a. Switch: Hewlett Packard ProCurve Switch 2626-PWR J8164A (Qty. 5)
  - 3. 26-port Ethernet Switch. Provide stackable, multi-layer, managed 26-port switch with 24 auto-sensing 10/100 ports and 2 dual-personality ports for 10/100/1000 or mini-GBIC connectivity. Recess switches.
    - a. Hewlett Packard ProCurve Switch 2626 J4900B (Qty. 1)
  - 4. HP ProCurve Gigabit-LX-LC Mini-GBIC for Hearing Room: Hewlett Packard J4859B (Qty. 2) Turn second mini-GBIC over to the COR for use in the future House Media Center.

- B. Ethernet Patch Panels
  - 1. 24-port Panel (RJ45 Patch Panel 1): Panduit # DP245E88TG 24 port angled patch panel supplied with 110 termination on back panel. (Qty. 1)
  - 2. 48-port Panel (RJ45 Patch Panel 2): Panduit # DP485E88TG 48 port angled patch panel supplied with 110 termination on back panel. (Qty. 3)
- C. Surface Mount RJ45 Box mounted at dais for connections to desk units:
  - 1. Where cable raceway is installed, provide 2-gang panels with 4 RJ-45 modules each for connections to desk units (Qty. as required). Where a cable raceway is not installed, provide Panduit CBX2BL-A surface mount RJ45 boxes. (Qty. as required)
  - 2. RJ-45 module inserts: Panduit Mini-Com TX6 plus CJ688TPBL (Qty. as required)
- D. Wire Managers
  - 1. 1U Wire Managers: Panduit WMPSE (Qty. 4)

## **2.09 MISCELLANEOUS AUDIO SYSTEM EQUIPMENT**

- A. Witness Timer System: Provide infrastructure, cabling, connectors and equipment necessary to provide individual witness timer displays at each Member position and at the Witness Table and Clerk's position. Contractor should be prepared to make custom cable assemblies as required to connect from D'San equipment to house standard XLR jacks.
  - 1. Witness Timer Console: D'San Limitimer PRO2000 (Qty. 1)
  - 2. Witness Timer Display: D'San Limitimer PSL-1-VF jumpered for old style use (Qty. 32)
  - 3. Witness Timer Display, No Front Panel: D'San Limitimer PSL-1-VF display w/ no front panel and jumpered for old style use (Qty. 16) Provide circuit board and red lens only.
  - 4. Power Boosters PSL-PB for signal distribution to individual timers. Provide with phoenix or screw-on connectors. (Qty. 7).
- B. Assistive Listening System. Provide all cables, adapters, terminating resistors and mounting hardware required to implement a fully functional system. Ensure that RF cable lengths between the transmitter and each emitter panel are equal. Coil extra wire for shorter cable run neatly. Provide white components wherever possible. Acceptable Products:
  - 1. Infrared Transmitter: Sennheiser SI 1015N/T (Qty. 1)
  - 2. Blank Module: Sennheiser GA1031CC (Qty. 1)
  - 3. Emitter Panel: Sennheiser SZI 1015 (Qty. 2) with (Qty. 2) GZG 1029 panel mount and (Qty. 2) GZP 10 swivel
  - 4. Single Channel Receiver: Sennheiser RI 250 (Qty. 5)
  - 5. Charging Base for Receiver Batteries: Sennheiser L 151-10 (Qty. 1)
  - 6. Charging Base Power Supply: Sennheiser NT 2013 (Qty. 1)

- C. Teleconferencing Interface: Coordinate in advance with House Information Resources to ensure that a phone line is available at the rack location at the time of installation.  
Acceptable Products:
1. Single Channel Echo Cancellor: Gentner GT-1524 (Qty. 1). Provide with remote control unit.

## **2.10 COMMITTEE ROOM VIDEO PRESENTATION SYSTEM**

- A. Twisted Pair Video Switcher. (SW-1). Provide 8 input x 8 output wideband matrix twisted pair video switcher in a 1RU mountable frame. Unit shall provide for software grouping of video and provide remote control functionality by means of a RS-232 serial communications interface. Acceptable Products:
1. Extron TPX 88 (Qty. 1)
- B. Twisted Pair Video Transmitters. RGBHV video transmitters. Use skew free UTP cable wire according to TIA/EIAT 568A standard. Supply with mounting hardware as required.
1. (TP TX) Panel-mounted RGBHV to twisted pair video in 3.5mm stereo audio input. Transmitter powered remotely from rack room. Extron MTP T 15HD A D color: black. (Qty. 2)
  2. 6' VGA with 1/8" audio cable (Qty. 2)
  3. (TP TX2) Rack-mountable transmitter with RGBHV input and loop through with stereo audio input. Extron MTP T 15HD A (Qty. 4)
  4. Rack Mount: Extron RSB 123 (Qty. 1)
- C. Twisted Pair Video Receivers. RGBHV video receivers. Use skew free UTP cable wire according to TIA/EIAT 568A standard. Supply with mounting hardware as required.
1. (TP RX) Panel-mounted twisted pair to RGBHV receiver powered remotely from rack room. Extron VTR001 MAAP color: black. (Qty 23)
  2. (TP RX2) Rack-mountable receiver with adjustable peaking: Extron MTP R 15HD A (Qty. 1)
  3. (TP RX3) Twisted pair to RGBHV receiver powered remotely from rack room. Extron VTR001 MAAP color: black. (Qty 2)
  4. Rack Mount: Extron RSF 123 (Qty. 1)
- D. Video Scan Converter. (SCONV). Provide scan converter with RGBHV, and genlock inputs, SDI output and shall be controllable via RS-232. Acceptable products:
1. Extron VSC 700D (Qty. 1)
- E. Video Scaler. (SCALER). Provide scaler with RGB, Y/C, composite and SDI inputs. Unit shall provide switching functions via RS-232 remote control port. Acceptable Products:
1. Extron DVS 304 D with power supply. (Qty. 1)

- F. Video Scaler. (SCALER 2). Provide scaler with Y/C and composite inputs and RGB output. Unit shall provide switching functions via RS-232 remote control port.  
Acceptable Products:
1. Extron IN1502 and power supply. (Qty. 2)
- G. Plasma Display. Provide high-resolution 61” diagonal plasma display panel with maximum display resolution of 1365 pixels horizontal by 768 pixels vertical in a 16:9 aspect ratio. Unit shall accept standard VGA 4:3 aspect ratio signals from 640x480 through 1280x1024 as well as XGA wide signals up to 1365x768 with variable refresh rates up to 75Hz. Unit shall provide three RGBHV inputs, two composite inputs, one s-video input and two high definition component inputs as well as a RS-232 communications interface for remote control functionality. An internal scaling engine shall be utilized to format input signals to fit the display area. Provide with articulating dual swing arm capable of rotating 90 degrees. Acceptable Products:
1. NEC PX-61XM4A (Qty. 2)
  2. Chief Manufacturing PDR-2043 series dual swing-out arm mount (Qty. 2)
  3. Chief Manufacturing PAC400 90 degree rotation adapter (Qty. 2). Provide with any necessary hardware for a fully functioning system as recommended by mount manufacturer
  4. IR reduction film to eliminate hearing assistance system interference. Installation by qualified personnel.
- H. Portable 15” Display: Provide Active Matrix TFT/LCD monitor with 15” diagonal and native resolution of 1024H x 768V pixels. Locate at Chairman’s, Witness Table, Clerk and Stenographer’s positions. Acceptable products:
- a. NEC Multisync LCD1570 NX (Qty. 6)
- I. Video Sync Generator. (VSG). Provide a sync generator with two independent analog black burst outputs, and genlock input for slave operation, if desired. Acceptable Products:
1. Evertz 5600MSC (Qty. 1)
- J. Analog Video Distribution Amplifier. (VDA). Provide analog 1 x 4 composite video distribution amplifier. Acceptable Products:
1. Evertz 7700 ADA+3RU (Qty. 4)
- K. Twisted Pair Distribution Amplifiers
1. 4-channel Distribution Amplifiers (TP DA4). Extron MTP DA4 (Qty. 1)
  2. 8-channel Distribution Amplifiers (TP DA8). Extron MTP DA8 (Qty. 3)
- L. VGA Distribution Amplifiers
1. 2 Channel VGA Distribution Amplifier (VGA DA2). Provide one input, two output VGA distribution amplifier with >300MHz video bandwidth and <1ns rise time. Acceptable Products: Altinex Sidekicker. (Qty. 2)

2. 4 Channel VGA Distribution Amplifier (VGA DA4). Provide one input, four output VGA distribution amplifier with >300MHz video bandwidth and <1ns rise time. Provide with companion power supply. Acceptable Products: Communication Specialties QuadSplit (1304) with rack-mount. (Qty. 1)
  3. 8 Channel VGA Distribution Amplifier (VGA DA8). Provide one input, eight output VGA distribution amplifier with >300MHz video bandwidth and <1ns rise time. Provide with companion power supply. Acceptable Products: Communication Specialties OctoSplit (1308) with rack-mount. (Qty. 1)
  4. 10 Channel VGA Distribution Amplifier (VGA DA10). Provide one input, ten output VGA distribution amplifier with >300MHz video bandwidth and <1ns rise time. Provide with companion power supply. Acceptable Products: Communication Specialties DeciSplit (1310) with rack-mount. (Qty. 3)
- M. DVD Recorder/VCR. Provide single tray digital versatile disc recorder capable of DVD-Audio, DVD-Video, DVD-RAM, DVD-R, Video CD, CD, CD-R, CD-RW and progressive scan output. Unit shall also provide VCR record and playback capabilities. Unit shall also provide video output as component, S-video and composite signals simultaneously. Provide rack mount/shelf for unit to be securely mounted in equipment rack. Acceptable Products:
1. Panasonic DMR-ES45VS (Qty. 1)
- N. Active RF Distribution Devices. Provide multi-port amplified splitters with passband of 52-1000mHz and noise figure of 3.5 maximum. Provide with power supply as required. Acceptable products:
1. Viewsonics VSA 600 series, 4-port version (Qty. 1)
- O. NTSC TV and Cable Tuner
1. Extron AVT100 with rack kit (Qty. 1)
- P. Closed Caption Decoder (CC)
1. Link Electronics PCD-85R (Qty. 1)

## **2.11 VIDEO PRODUCTION SYSTEM**

- A. General: Video production system shall comprise robotic cameras, production switcher, distribution, transmission, test and monitoring components. System to be SDI based and convertible to 16:9 / 4:3 aspect ratios. System to interface to the Video Presentation system.
- B. Production Switcher. (PROD SWR). SDI production switcher with 8 primary SDI inputs plus black and background, 2 key busses, multi-level effects, look ahead preview, linear keyers, single downstream keyer, fade to black and an effects transition memory system with 100 memories. Switcher to have input auto timing for +/- .5 TV line. Wipe system with 24 patterns and additional modifiers and pattern memory. System to include tally and GPI. Program editor port to trigger primary input

8 to air. Quantities as shown.

1. Videotek Digital prodigy system with DPG-I Frame, RCU-DPG control panel and DPG-601 input module. Order with serial editor port. (Qty. 1)
- C. Virtual Monitor Wall Processor. (VMW). High-resolution modular multi-image processor with clock, tally and source ID functions. Integrated system to be configurable and software programmable for set-up, display windowing configuration, display window preset selection and maintenance. Internal bandwidth of up to 1600 x 1200 pixels. Each input to be equipped with de-interlacing and scaling engine with full frame synchronization for all sources. Each image to be scaleable from 5% of the original size to full screen at 1600 x 1200 pixels. Tally, Clock, Timer and source ID graphic elements to be keyed digitally at pixel precision. Output pixel rate shall be independent of the source, and scalable to all common display standards. System shall provide internal monitoring and display of input signal fault conditions. Provide redundant power supplies. Provide manufacturer's configuration software. Provide remote control panel for selection of preset display layouts, single key access to frequently used functions such as full screen selection, input aspect ratio and underscan/overscan display mode of any displayed window. Integrate Tally function with PROD SWR(s).
1. Miranda Technology Kaleido-K2 base system 4 RU Frame, MWO-HR Output Module, MWA-GPI GPI Inputs/Outputs Module, MWA-CPU CPU Assembly, Kaleido-RCP Remote Control Panel And Layout Editor Software), with three (3) MWI-SDI Serial Digital Input modules, rack mount kits and redundant power supply option.
  2. Progressive RGBHV Input Card: Miranda Technology Kaleido K2 RGBHV input card with (2) Analog RGBHV inputs, Resolution from 640 x 480 to 1600 x 1200 NI signals - MWI-VGA (Qty. 1)
  3. 16 Channel Analog Stereo Audio Input Module- MWI-SA (Qty. 1)
- D. PRODUCER'S DISPLAY. High resolution 31.5" diagonal TFT display panel with maximum display resolution of 1366 pixels horizontal by 768 pixels vertical. Unit shall provide at least one RGBHV/computer input, as well as a RS-232 interface for remote control functionality. An internal scaling engine shall be utilized to format input signals to fit the display area. Acceptable Products:
1. NEC LCD 3210-BK-IT support (Qty. 1).
  2. Tilt Wall Mount: Chief MTR-6045 (Qty. 1)
- E. Rack Mount Audio/Video Monitor (AUDIO/VIDEO VIDEO MONITOR). Compact rack mountable LCD color monitor. Unit shall provide 2 switchable composite video inputs and 4 analog audio inputs. Unite shall have native 16:9 aspect ratio adjustable to 4:3 aspect ratio. Acceptable Products:
1. Panorama VAMP-24 (Qty. 1)
- F. Cameras. (CAM). Camera system shall include cameras, option module(s), full remote control lenses, OEM interface cable(s), pan/tilt units, power supplies, cabling and

accessories for a fully functional system. Camera system to be DSP based using three 2/3" IT CCD imagers and provide standard and wide aspect ratio operation. Lens Mount to be 2/3" bayonet. Sensitivity - 2,000 lux @ f/9.5, Minimum Sensitivity 1.5 lux. S/N - 65 dB with DNR on. Horizontal Resolution - 750 lines. Registration error less than 0.05%. Detail Correction- Advanced horizontal and vertical. White Balance: Two memory automatic correction, 3200K, 5600K, fine manual adjustment & automatic tracking white, black balance fully automatic. Shutter Speeds - Synchro Scan: 60.58 Hz to 15.75 kHz with standard positions: Off, 1/100, 1/250, 1/500, 1/1000, 1/2000, 1/4000 & 1/10000. Gain – with AGC and manual from 0 to +30. Iris Control – Automatic, and manual through external control. pan/tilt head to store 50 pre-set positioning memories and 10 Pan/Tilt Tracing Memories. Tilt range -  $\pm 95$  degree tilt angle. Pan range - 300 degrees, with 25 degrees per second maximum pan speed, and 10 degrees per second maximum tilt speed. Absolute Positioning accuracy of  $\pm 5$  minutes. Acoustical noise: less than NC30 level. Lens- 20X fully motorized, 2/3" bayonet mount. Provide protocol converters as necessary to allow pan/tilt head to communicate with camera control panel. If pan/tilt head listed below is not available at the time of bid award, supply Panasonic AW-PH400 and all required accessories.

1. Panasonic AW-E800A Camera with AW-PB304 SDI output card, AW-PH405 pan/tilt head with custom wall/ceiling mounts as required, AW-CA50XXX series camera to pan tilt interface cable. (Qty. 5)
2. Fujinon A20X8.6MD 20X zoom lens (Qty 4)
3. Fujinon A20x8.6EMD lens with 2X extender (Qty. 1)
4. Camera Power Supplies: Panasonic AW-PS300 power supply. Rack mount according to manufacturer's recommendations (Qty 5)

G. Camera Controller. (MFC). Controller for integrated camera and pan/tilt/lens system to Control 5 pan/tilt heads and 5 camera systems. Provide full pan/tilt/lens controller with camera setup and operational control. Provide Full CCU functions. System to store 50 preset positions plus iris and white balance settings for each camera, and store 10 tracing memories (pan/tilt and zoom focus pattern) per camera. Order with new firmware to allow for remote control operation and current production controller with new potentiometers. Quantities as shown.

1. Panasonic AW-RP655AN (Qty. 1)
2. Power Supply: Panasonic AW-PS505A power supply. Locate at Producer's Station desk manufacturer's recommendations (Qty 1)

H. Video D/A converter. (SDI D/A 2). Single card component SDI to analog composite video converter with optional on-board frame synchronizer (FS) module option. Provide external "T" connector and loop for reference inputs.

1. Evertz Microsystems 7736CEM+3RU with S option (Qty. 1)

I. Digital Distribution Amplifier (DDA) 1x4 SDI with re-clocking.

1. Evertz Microsystems 7700DA+3RU (Qty. 1)

- J. Hearing Room Fiber Optic Equipment –Input and Output to be 1310 nm. Provide 20 dB optical link budget. Provide 15 slot 3RU frame and redundant power supplies and the following cards.
1. Multiframe and power supply, with optional second redundant power supply: Evertz Microsystems 7700FR-C with 7700PS (Qty. 1)
  2. Triple SDI Electrical to Optical Converter (SDI FTX 1): Evertz Microsystems 7705EO13-3+SC+3RU (Qty. 2).
  3. Single SDI Quad Analog Audio Electrical to Optical Converter (SDI FTX 2): Evertz Microsystems 7707VAT13-A4+SC+3RU (Qty. 1)
  4. Single SDI Quad Analog Audio Fiber Optical to Electrical Converter (SDI FRX 2): Evertz Microsystems 7707VAR-A4+SC+3RU (Qty. 1)
  5. RGBHV Optical to Electrical Converter (RGBHV FRX): Evertz Microsystems 7707RGRB+SC+3RU (Qty. 1)
  6. Multi RS232/422 Fiber Data Transceiver and A/V receiver (DATA FRX): Evertz Microsystems 7707CVDR13-F2-A4+3RU+SC (Qty. 1)
- K. House Recording Studio Fiber Optic Equipment –Input and Output to be 1310 nm and provide 20 dB optical link budget. The following equipment shall be turned over to the Contracting Officer for future use in the House Media Center.
1. Multiframe and power supply, with optional second redundant power supply: Evertz Microsystems 7700FR-C with 7700PS (Qty. 1)
  2. Triple SDI Optical to Electrical Converter (SDI FRX 1): Evertz Microsystems 7705OE-3+SC+3RU (Qty. 2)
  3. Single SDI Quad Analog Audio Fiber Optical to Electrical Converter (SDI FRX 2): Evertz Microsystems 7707VAR-A4+SC+3RU (Qty. 1)
  4. Single SDI Quad Analog Audio Electrical to Optical Converter (SDI FTX 2): Evertz Microsystems 7707VAT13-A4+SC+3RU (Qty. 1)
  5. RGBHV Optical to Electrical Converter (RGBHV FTX): Evertz Microsystems 7707RGRB+SC+3RU+ST (Qty. 1)
  6. Multi RS232/422 Fiber Data Transceiver and A/V receiver (DATA FTX): Evertz Microsystems 7707CVDR13-F2+3RU+SC (Qty. 1)
  7. Digital to Analog Converter (SDI D/A 2): Evertz Microsystems 7735CEM+3RU with S option (Qty. 1)
- L. Camera and Production Switcher Control Serial Transmission System
1. RS232 to RS422 Converter: Provide serial RS232 to RS422 converter and power supply.
    - a. B&B electronics 4WSD9R (Qty. 1)

## 2.12 CONTROL SYSTEM

- A. The remote control system shall be a “master to master to slave” networked control system that is capable of being extended to future added systems across the property. System equipment to be sourced from a single manufacturer from the below list of



acceptable products. OBTAIN A MASTER QUOTE FROM THE MANUFACTURER FOR SYSTEM EQUIPMENT AS SPECIFIED IN THE CONSTRUCTION DOCUMENTS.

- B. Remote Control Master – “Master to master” network based technology for data transmission of control signals. Capacities of a minimum of 250,000 separate functions.
  - 1. AMX NXI NI-3100 Integrated Controller with AMX PSN 2.8 power supply (Qty. 1)
- C. Programming Software - Programming connection by windows compatible software provided. Interconnection of the programming computer by means of RS-232 or network interface. Provide original and 2 copies programming software and software source code to Owner. PROGRAMMING OF REMOTE CONTROL SYSTEM TO BE WRITTEN AND TESTED BY A FACTORY CERTIFIED PROGRAMMER.
  - 1. AMX Netlinx
- D. Remote Touch Screen Interface (TOUCHPANEL) – Programmable display with touch sensitive overlay. Display backlight with sensing for variable room lighting conditions. Wired or wireless connection to master and/or slave by remote control buss or by network with looping capabilities. Provide power supply, battery pack, rack mount and/or kick-stand as necessary to supply 2 fully functional touchscreen systems. Acceptable products:
  - 1. Portable/Wireless/Table -Mounted “Hard Wired” Touchpanel: AMX NXT-CV10 (Qty. 2)
  - 2. Power supply for touchpanel: AMX PSN2.8 Power Supply (Qty. 2)
  - 3. Tabletop battery base including 1 battery for up to 4 hours of continuous operation: AMX NXA-BASE/1 (Qty. 1)
  - 4. Wireless interface card: AMX NXA- WC80211b/CF (Qty. 1)
  - 5. Second battery pack for touchpanel: AMX NXT-BP (Qty. 1)
  - 6. Battery charger for NXT batteries: AMX NXT-CHG (Qty. 1)
- E. Wireless Access Point – IEEE802.11b compliant wireless access point. Unit shall provide sufficient range for touchpanel operation at any location inside the hearing room; contractor shall supply additional WAP in hearing room if coverage is insufficient with a single WAP. Acceptable products.
  - 1. AMX NXA-WAP200G (Qty. 1)

## **2.13 RACKS, INTERFACE PLATES AND CABLING**

- A. Equipment Racks
  - 1. Provide side panels and miscellaneous vents, blank panels, power strips, fans, work lighting, power conditioning and casters as required for one complete rack assembly.
    - a. Audio Rack. Provide 31” deep, 44RU equipment rack.

- 1) Middle Atlantic MRK-44-31 frame (Qty. 1); provide with locking door (key all locks alike)
  - 2) Middle Atlantic SPN-44-312 side panels (Qty. 1 pair)
  - 3) Middle Atlantic MV-10T vented fan 10" top (Qty. 1) for Audio Rack
  - 4) Middle Atlantic Guard 10 Fan Guard (Qty. 1) for Audio Rack
  - 5) Middle Atlantic CBS-MRK-31 Caster Base (Qty. 1)
  - 6) Uninterruptable Power Supply. (UPS-2) APC SMART-UPS 1500 RM 2 (Qty. 1) Mount in Audio Rack.
- b. AV Rack. Provide 26" deep, 37RU equipment rack on casters. To maintain lowest profile possible, provide with no top, doors or sides.
- 1) Middle Atlantic Slim 5-37-26 frame (Qty. 1)
  - 2) Middle Atlantic CBS-5-26 Skirted Caster Base (Qty. 1)

**B. Producer's Station Desk**

1. Millwork: Provide a custom console(s) constructed by expert craftsman in a fully qualified cabinet shop regularly in business for furniture work, to house audio, video, control, and other equipment. Construct the console to meet the requirements of the American Woodworking Institute (AWI) "Premium" quality grade. The primary structural material shall be 7- or 9-ply birch veneered hardwood plywood, I-III (AWI) or A-C (APA) grade, 0.75" (19 mm) thick; 3/4" thick medium density fiberboard may be employed for non-structural parts. All surfaces shall be covered veneer matching any existing furniture. Submit sample for approval. Hidden surfaces shall be covered with plastic laminate to equalize stress in liner or finish color. Edges shall be covered with plastic laminate; edge banding shall be hardwood covered with laminate and/or solid white oak (clear lacquer finish). Solid unfinished poplar may be used for bracing, blocking, and other miscellaneous uses where not visible from the regular operator positions. Steel beams or plates may be employed, typically as rectangular tube stock for console or desk support; steel shall be deburred, cleaned, primed, and painted two coats flat enamel. Grind any welds smooth. Where necessary, install steel rack mounting rails similar to those specified for Equipment Racks, with drilled and tapped mounting holes, in all rack and "turret" bays, or install prefabricated Middle Atlantic Products SRS2-12 slide out rack bays where shown. Rails shall be deburred, cleaned, primed, and painted flat black epoxy. Fill unused panel space with vent or blank panels of 3/16" thick brushed black anodized aluminum. Mask space around equipment not rack mounted (such as monitors) with aluminum panels of similar finish, bonded to 1/2" MDF. (Qty. 1)
2. Hardware: Hardware shall be nickel plated steel or stainless steel. Fastener drives shall be Phillips or Allen exclusively. Exposed hardware shall be black oxide finish. Employ threaded brass inserts to receive bolts wherever parts such as wood access or structural panels, steel flanges, and rack mounting rails, may be secured to wood panels and/or subjected to future assembly or disassembly. AC power distribution and grounding requirements shall be as stated elsewhere in this specification. For routing between sections of console, metal wireways (Wiremold 3000, 4000, or AL3100), conduit, and armored flex shall be used for

shielding and protection of circuits. Use matte black plastic grommets for cable routing between console top and internal equipment. Submit detailed shop drawings for approval, showing construction of all joints and parts. (Qty. as Required)

- C. Surge Suppression: New Frontier PF-420 (formerly SX20NE-Quad) surge suppressor (Qty. 2) to protect rack-based equipment. When ordering custom designed model, send PO with attention to Michael McCook at SurgeX. Locate one box in Room 112 and the second in AV rack room adjacent to 1336B.
- D. Cabling
  - 1. All miscellaneous wires, cables, connectors, pads, summing networks, transformers, blanks, vents, casters, terminal strips, hardware, relays, etc. to satisfactorily wire the system as defined in this specification.
- E. "Mute" Panel: Provide switch that prevents chair arm from mistakenly engaging mute switch. Obtain prior approval on layout from the Committee before commencing with switch panel installation.
  - 1. Plate: Provide 1/8" thick polished brass panels with clear coat at Chairman's position and at Ranking Member's position as shown on drawings. (Qty. 2)
  - 2. Momentary Mute Switch: EAO 61-8410.22 with the 61-9671.2 red button, 61-1100.0 universal momentary push button actuator and 61-9930.0 square black bezel. (Qty. 2)
  - 3. 12 VDC white LED: EAO 10-2309.1069 (Qty. 2)
- F. Miscellaneous Dais Connector Panels: Provide 1/8" thick polished brass panels with clear coat for all VGA and VGA/witness timer plates at dais. Obtain prior approval on layout from the Committee before commencing with switch panel installation. (Qty. as required)
- G. Fiber Optic Security Disconnect: Provide complete 24 strand 9 $\mu$  single-mode fiber security disconnect system from OFE fiber to terminal equipment. Connectors to be 12 position MTP. All terminations to be Super PC polished. Provide in addition to specified assemblies, any miscellaneous materials to properly dress and protect fiber within enclosures and at demarcation point with Owner's Fiber. Coordinate fiber work with House Information Resources to ensure that the appropriate fiber has been installed, and that distance between the fiber disconnect and the rack-mounted equipment is acceptable.
  - 1. NEMA enclosures as detailed in drawings.
  - 2. Fiber optic splice organizer: SystiMax 700025588 (Qty. 1)
  - 3. MPO panel SystiMax 760015412 (Qty. 1)
  - 4. SC-MTP cassette module 760039784. (Qty. 2)
  - 5. Jumper Cable assembly. MTP to MTP 1' assembly with pins removed to allow mating through coupler. SystiMax FPCWMPMP9A-PF001 (Qty. 2)

6. Coupler. Female to female MTP 12 fiber coupling – FiberDyne part No. FAMTP-MM (Qty. 2)
  7. Fiber cables from SC cassette module to terminal equipment. SystiMax (2) FPC-WMXLC9A-PF003
- H. Analog Security Disconnect: Air gap disconnect for analog wiring leaving the hearing room. See panel drawing for details.
1. Wireworks G231CM on panel
  2. Wireworks G231CF on panel
  3. Wireworks 2' jumper cable with connectors, all pins wired.
- I. Analog Back-up System Connection Panel: Provide panel containing analog back-up system connection and switches.
1. Switch: Alcoswitch MTL206N, Tyco Electronics #3-1437559-7 (Qty. 2)
- J. Miscellaneous Connector Panels: Provide connector panels as shown on drawings. Verify panel prior to fabrication. Provide all components and connectors required for all panels as shown in drawings.

## **2.14 MISCELLANEOUS**

- A. Provide, as a separate cost, pricing for a one year service contract for the complete system to commence upon expiration of the warranty period. Include at least two service inspections scheduled at regular intervals to maintain the system at its original operating condition by means of preventive and corrective maintenance and adjustment. Provide at least four (4) hours on site for the number of engineers/technicians required to perform this work. Include in the coverage all material, labor, and travel expenses anticipated, which may be itemized as a limitation.
- B. Submit separate pricing for "on-call" service, both on site and in shop, including rates, minimums, travel time charges, and general service policies.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Execute all work in accordance with the NEC, NESC, and with all local and state codes, ordinances, and regulations.
- B. Coordinate work with all other trades to avoid causing delays in construction schedule. Expedite the delivery of equipment and materials and provide additional labor if required to meet the construction schedule.
- C. The process of acceptance testing may necessitate the moving or adjustment of certain components; perform without claim for additional payment. Controls not user operated

must be covered or locked after final adjustment; provide and install all locks and covers. Shafts shall be slotted for screwdriver adjustment.

- D. All installation work shall be performed by experienced technicians, skilled and practiced in the proper techniques required for the activity involved.
- E. Mount all equipment to be installed over public areas in a manner adequate to support the equipment loads with a minimum safety factor of five, using methods recommended in the referenced Handbook for Riggers and in JBL Technical Notes Volume 1, Number 19. Use attachment hardware with a minimum SAE Grade 5 load rating. Do not use formed eye bolts or lag screws for support of suspended equipment.
- F. Choose colors and finishes of all exposed and custom fabricated items and labels to blend in with the surroundings as approved by the Owner.
- G. Install equipment in accordance with manufacturers' recommendations. Ensure that levels and impedances are properly matched between components. Verify that projector distances and lenses are appropriate for the corresponding screen sizes.
- H. Wireless Systems:
  - 1. Ensure that all wireless systems operate on different frequencies from each other and from any other transmitters in the area.
  - 2. Coordinate frequency selection for compatibility with local RF environment.

### **3.02 MECHANICAL**

- A. All equipment and enclosures shall be aligned, matched, true, plumb and square. All equipment, except portable equipment, shall be permanently attached and held firmly in place. Supports shall be designed to support loads with a safety factor of at least three, without sag or deflection.
- B. Install equipment into racks and furniture consoles and fully wire and test before delivery to the job site. If it is impractical to ship certain items installed in a console or rack, assemble, wire, and test in shop; then remove, ship separately, and reinstall at site. Permanently mount all equipment; no equipment shall be installed loose or secured or suspended only by signal or power cables. Panels or equipment mounted on rear rack rails shall not block clear access to the rear of any front mounted components or their wiring. Mount racks on four inch nominal hardwood risers, primed and painted one coat latex enamel paint, when installed on steel or concrete floors, unless the rack is required to be equipped with wheels.
- C. Provide ventilation adequate to keep the temperature within the rack(s) below 100 degrees F. Provide an approved low noise ventilation fan in each rack only if the temperature in the rack rises above 100 degrees when powered continuously for five hours.

- D. Cover edges of cable pass-through holes in chassis, racks, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.

### 3.03 WIRING

- A. Coordinate the final connection of power and ground wiring to junction box(es). Power and ground wiring shall be hardwired directly to power contactors and ground busses to ensure uninterrupted operation.
- B. Execute wiring in strict adherence to A Clean Audio Installation Guide, Allen H Burdick, Benchmark Media Systems, Inc., (800) 262-4675, (available on the World Wide Web at <http://www.benchmarkmedia.com/>); Audio System Design and Installation, Phillip Giddings, Sams, 1990, ISBN 0-672-22672-3; "Recommended Wiring Practices", Sound System Engineering (2nd Edition), Davis and Davis, Sams, 1987, ISBN 0-672-21857-7; "Cabling", Sound Reinforcement Handbook (2nd Edition), Gary Davis & Ralph Jones, Hal Leonard, 1989, ISBN 0-88188-900-8; and performed to the highest standards of acknowledged industry and professional practice.
- C. Take whatever precautions are necessary to prevent and guard against electromagnetic and electrostatic hum. For permanently installed line level audio circuits, ground cable shields at the output of the source device and float at the input of the destination device. If RF interference is encountered, place an RC network between the floated shield and the input ground.
- D. All wire, after being cut and stripped, shall have the wire strands twisted back to their original lay and terminated by approved soldered or mechanical means. No bare wire ends are acceptable. Cables terminated in pluggable terminal strips or other connectors which could accept bare wire ends shall have the wire ends first terminated in properly crimped color coded insulated wire ferrules. Use red insulated ferrules for signal hot, black for signal return, and green for shield or ground terminations. Cables with wire shields, braid or wound, must use all the wire conductors for shield termination, and not just a drain wire or some of the shield strands. Connections not following this requirement will be rejected. Foil shielded cables only provided with a drain wire must use the drain wire for shield termination. Fold shields or drain wires not connected back over the cable jacket and cover with heat shrinkable tubing; do not cut off unused shields or drain wires. Dress the shield or drain wires with Teflon tubing, and install heat shrinkable tubing over the junction of the fanout and outer jacket.
- E. Exercise care in wiring; damage to cables or equipment will not be accepted. Isolate cables of different signal types or levels, and separate, organize, and route cabling to prevent crosstalk or feedback oscillation in any amplifier section. In all cases, separate wiring for microphone signals, audio line level signals, loudspeakers, video, control, RF, and power into groups.

- F. Rack Wiring. Looking at the rack from the rear, locate AC power, digital and DC control, and loudspeaker wiring on the left; microphone, line level Audio, IF, RF, and other wiring on the right. Run wiring vertically in adequately sized plastic raceways, or employ an equivalent bundling and support system, to maintain a clear and organized appearance. Neatly tie horizontally routed wiring to equipment in manageable bundles, with cable lengths cut to minimize excess but sufficient to allow ready service, testing, or replacement of connectors. Provide a horizontal support bar system for large bundles. Route AC cords directly to the side of the rack, under or over the equipment chassis, and then back to the power outlets, tying the excess cord only at the side of the rack. Organize cabling so that signal and AC cords are in the least possible proximity.
- G. All wiring and connections shall be completely visible and labeled in the rack. Resistors employed in the system external to equipment shall be metal film 1% tolerance, wattage as required for the application (but in no case less than 1/4 watt), and fully visible and not concealed within equipment or connectors (other than RC networks for RF rejection).
- H. No splices shall exist in any length of cable run, unless specifically shown on the contract drawings at a designated junction enclosure. All cables shall originate and terminate at active or passive devices. Where several devices are in close proximity, utilize approved housing-to-housing connectors and adapters; all such adapters shall be rotational.
- I. Do not wire any cables with a polarity reversal between connectors, end for end, unless required by the manufacturer for operation. Connect all loudspeakers electrically in phase and of consistent polarity, using the same wire color code for loudspeaker wiring throughout the project. Note that different manufacturers employ differing color coding conventions for driver terminals. Wire all drivers - cone, compression, ribbon, or any other type - so that a positive voltage at the power amplifier "+" terminal causes a positive acoustic pressure out of the driver/enclosure system.
- J. For cables terminating at an interface or connection plate mounted on or in an enclosure, dress cables so as to allow removal of the plate from the enclosure and sufficient cable length for service or re-termination. In these circumstances, the plate shall set on the floor or freely swing clear.
- K. Install cables without sharp bends or distortion. Where limited clearance prevents the manufacturer's recommended minimum bend radius from being observed, such as in junction boxes, provide a right angle or similar connector.
- L. All expansion loops must be neat, and roughly the same size to provide for ease of servicing in the future.

- M. In pulling cable, do not bend to less than the manufacturer's recommended radius. Employ temporary guides, sheaves, rollers, or other tools to prevent excessive tension or abrasion to the cable(s). Pull cable with tensions, tools, and lubricants recommended by the manufacturer.
- N. Prepare television system semi-rigid cable in accordance with manufacturer's recommendations, with approved coring, cleaning, preparation and assembly tools. Do not score center conductor; utilize tubing cutters to trim the outer conductor. Completely de-burr all conductors. Utilize approved center conductor cleaning tool; degrease the connector and cable prior to termination. Torque connectors to the manufacturer's recommended values.
- O. All coaxial or triaxial video or RF connections to plates or panels in boxes, pedestals, racks or any similar location with limited clearance, that would prevent that the associated cable manufacturer's minimum bend radius from being strictly observed shall be provided with the appropriate right angle or similar adapter as appropriate.
- P. All cable installed under this specification which is to be terminated by others for "future" or Owner Furnished Equipment (OFE) in racks, shall be provided with ten (10) feet of slack when dressed to the location of future or OFE equipment. All cable installed under this specification which is to be terminated by others, shall be provided with twenty (20) feet of slack when ending in a rack enclosure. All cable provided under this specifications, to be terminated by others, shall be provided with fifty (50) feet of slack when terminating in an equipment room without a clear point of demarcation, or in a group of racks where the destination is not known.
- Q. Fiber Optic Cables
1. Adhere to the previous guidelines for Cable Installation in Duct Banks.
  2. Consult Sumitomo document #SP-F01-001, issue 2, for installation.
  3. All fiber splicing shall utilize the fusion splice method. The maximum allowable loss per fusion splice shall be 0.2 dB average.
  4. The bend radius shall be no less than manufacturer's specifications.
  5. The total degrees of turn shall be no more than the manufacturer's specifications.
  6. The pull force shall be no more than the manufacturer's specifications.
  7. When each cable reel arrives from the manufacturer, it shall have a Factory Lot test report attached to it. Factory Lot test reports, for example: Belden Wire & Cable Company Fiber Tracking System, shall be copied to the owner and their representatives upon acceptance of the cable on the site.
  8. The use of the cable shall be tracked from the reel to each pull. Paperwork, in chart form, shall include the Reel Number, Code ID, and each conduit designator and description that includes cable from the specific reel.
  9. Splices, terminations, and any patching shall take place after the location has been declared "Dust Free" or "Clean". Special care shall be taken to ensure the integrity of the fiber and connection(s) when these conditions cannot be met. Fiber found to be broken in the length of the run after the pull shall be deemed to



be damaged during the installation process and replaced at the expense of the installer.

R. Network Wiring:

1. Unless specifically called out for a connection, all data cabling is to be Unshielded Twisted Pair (UTP). The minimum acceptable performance rating for UTP and all associated connectors is Category 5e (CAT 5e), components certified as meeting the CAT 6 proposal are preferred. All completed Links including all components making up a complete interconnection link between two Ethernet components shall be tested after installation and certified to meet or exceed CAT 5e AND Gigabit Ethernet performance requirements. Full test results for every complete Link, Permanent Link, and Patchcord must be made available in printed form as part of the Record Documentation before Acceptance Testing.
2. No UTP cable may exceed 90 meters in length. All permanently installed UTP must be 4 pair solid wire, and terminated according to the connector manufacturer's instructions in outlets certified as meeting CAT 5e or better specifications. In no case may solid wire UTP be terminated in RJ-45 plugs.
3. All UTP patch cords must be factory made and certified by their manufacturer as meeting at least CAT 5e performance. These patch cords must be made with 4 pair stranded wire. With the exception of the patch cords connected to the Desk Units, all other patch cords must be provided with strain relief boots. The patch cords that connect to the Desk Units must not have boots since there is not space for a connector with a boot at the Desk Unit end of the patch cord. The UTP patch cords connected to the Desk Units must be made with Belden MediaTwist Patch Cord (stranded) cable.
4. All UTP wiring shall follow the EIA/TIA 568B color code.
5. Under no circumstances may more than 1/2" of the pairs in a UTP be untwisted as terminated in a connector, nor may more than 1/2" of a pair be exposed past the end of the jacket of the UTP.
6. Interconnections between Ethernet switches may require that the patch cord at one end be a crossover cable. If the switches in question require a crossover cable for proper operation, supply the appropriately wired cable at one end. All crossover cables must be prominently marked indicating they are not normal straight through cables.

7. All UTP cabling must be installed following industry standard minimum spacing requirements as given in the following table.

<b>Condition</b>	<b>&lt;2kVA</b>	<b>2-5kVA</b>	<b>&gt;5kVA</b>
Unshielded power lines or electrical equipment in proximity to open or non-metal pathways	5 in. (12.7 cm)	12 in. (30.5 cm)	24 in. (61 cm)
Unshielded power lines or electrical equipment in proximity to grounded metal conduit pathway	2.5 in. (6.4 cm)	6 in. (15.2 cm)	12 in. (30.5 cm)
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to grounded metal conduit pathway	N/A	6 in. (15.2 cm)	12 in. (30.5 cm)
Transformers and electric motors	40 in. (1.02 m)	40 in. (1.02 m)	40 in. (1.02 m)
Fluorescent lighting	12 in. (30.5 cm)	12 in. (30.5 cm)	12 in. (30.5 cm)

8. Ordinary plastic cable ties must never be used on UTP cabling. Plastic cable ties or anything else that can pinch the jacket of the UTP must be avoided. Use Velcro strap type ties as required but preferably not more often than once every 10 feet.
9. UTP cables must never be combed out neatly so that they run parallel to each other. Such a practice can cause Alien Crosstalk between the cables that run next to each other. Instead let the UTP cables run with a loose and random lay.
10. UTP cables must never be bundled snugly together.
11. UTP cables installed in Conduit or other wire ways must never exceed 40% fill.
12. UTP cables must never have more than 25 lbs. (or the manufacturer's maximum recommended pull force if lower) of force applied while pulling into conduit or at any other time during installation.
13. UTP cables must never be bent sharper than a 1" radius (2" diameter) bend even if straightened out afterwards. The only exception to this is the Belden MediaTwist patch cord at the Desk Unit that is designed to allow a sharper bend.
14. 25 pair connector to be terminated using Champ portable hand operated tool 229451-2. Refer to drawings for specific pin-out Follow recommended termination of six 4-pair cable pin-out and strain relief from Tyco Electronics/AMP instruction sheet 408-3381 Rev. B or newer.

### 3.04 CONNECTIONS

- A. Make all joints and connections with rosin core solder or with mechanical connectors approved by the Consultant. Where spade lugs are used, crimp properly with ratchet type tool. Spade lugs shall be gold or nickel plated to match the receiving binding post or terminal. DC, control, and loudspeaker wiring shall connect via terminal blocks (Phoenix Contact MBK 2.5/E or MBK 5/E mounted on NS 35/7.5 DIN mounting rails, or approved equal); all terminal blocks shall be fully exposed, labeled, and mounted on 1/2" birch veneer plywood board primed and painted two coats latex enamel. Microphone, Audio line, video, time code, MIDI, RF, and digital signal or control wiring shall be continuous and unbroken from connector plate/chassis to chassis/patch panel, unless a terminal, connector, or other splice is explicitly shown on the contract drawings.
- B. Make all solder connections with rosin core solder; employ temperature controlled soldering irons of wattage appropriate to the specific work involved. Soldering guns or unregulated irons are unacceptable.
- C. Pluggable terminal strips or other connectors which could accept bare wire ends must have the wires terminated first using properly crimped color coded insulated wire ferrules. Bare wire ends directly into a connector that does not use solder or crimp connections are not acceptable. Install ferrules with manufacturer approved crimp tool.
- D. Conventional non-ratcheting crimping tools are not acceptable.
- E. Make all connections with connectors specified herein. Employ XLR and BNC connectors wherever possible in preference to screw terminals, terminal strips, or phono connectors. All connectors employed shall be designed specifically for the cable in use.
- F. Make connections to loudspeaker transformers with properly sized closed end connectors crimped with factory approved ratchet type tools, or terminal blocks.
- G. All coaxial connectors shall be crimped with the appropriate hexagonal die crimp tool correct for the combination of cable and connector. Non-ratcheting type crimping tools are not acceptable; the presence of such tools on the job site shall be interpreted as evidence of mechanical connections incorrectly made, and provide sufficient grounds for rejection of all mechanical connections in the system.
- H. "Electrical" adhesive backed tape is not acceptable for any purpose whatsoever. Adhesive cable tie anchors are only acceptable when employed for routing, not support; in any case do not fasten anchors to any equipment chassis.
- I. Do not employ connector adapters. Wire nut or "Scotchlock" connectors are not acceptable for any purpose.

### **3.05 LABELING**

- A. Provide engraved plastic Lamicoid (or similar) identification labels at the front and rear of all equipment mounted in racks. Install labels in a neat, plumb, square, and permanent manner. Mount labels on the equipment rack, not on the equipment, or on blank rack panels if so directed. Where the rack vertical frame has a slightly recessed mid section, match label width to the recessed section width. Similarly, provide engraved labels at the rear only of equipment mounted in furniture consoles or frames. Equipment labels should have two items of information; the first identifying the equipment type, i.e., "POWER AMPLIFIER"; and the second showing the wiring diagram code, i.e., "PA-29".
- B. Provide engraved Lamicoid labels on each rack rear door or console access panel, reading "No user serviceable parts inside; refer service to qualified technician."
- C. Unless otherwise noted, engraving on plates, panels, and labels shall be 1/8" high, and the typeface, sans serif. Use white letter fill on dark panels or push-buttons, and black fill on stainless steel or brushed natural aluminum plates or light-colored push-buttons. Fill safety or operational warning labels orange.
- D. Embossed labels are not acceptable for any purpose.
- E. Label all cables except patch cords at both ends with indelible color-coded labels. Labels shall be direct hot stamp or factory stamped, closed sleeve types: Brady B-321 Porta-Mark, National Dynamics Hotmarker, T & B or Markwick heatshrink markers, or adhesive strip labels only if protected by transparent heat-shrinkable tubing. Handwritten or self-laminating labels are not acceptable. Include sample of proposed label system with submittals. Employ an alphanumeric cable code identifying the signal type by letter: microphone = M; data = D; line level analog Audio = L; loudspeaker level = S; video = V; control = C; intercom = IC; Audio network = N; etc., with a unique identifier for each cable. Locate labels within 2" of the connectors, consistent with regard to orientation, dress, and distance from the connector. For connections to in-room panels or floorboxes, label on cable should match panel engraving. For connections to portable equipment, label on cable should match device engraving.
- F. Label each terminal strip with a unique identification code in addition to the numerical labels for each terminal (Phoenix Contact BN series). Show terminal strip codes on the system wiring diagrams.

### **3.06 SYSTEM STARTUP**

- A. Preliminary. Verify the following before beginning actual tests and adjustments on the system:
  - 1. All electronic devices are properly grounded.

2. All powered devices have AC power from the proper circuit. All dedicated AC power circuits are properly wired, phased, and grounded.
3. Insulation and shrink tubing are present where required.
4. Dust, debris, solder splatter, etc. is removed.
5. All cable is dressed, routed, and labeled; all connections are properly made and consistent with regard to polarity.

B. Grounding System Tests.

1. Measure the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.
2. Verify that the Architect of the Capitol has connected the technical ground to building ground at only one location with 4 AWG or larger wire.
3. Measure the DC resistance between the signal ground at any connector plate and the conduit system.
4. Identify and correct any problems if within the Audio System scope of work; notify the Owner if a problem is in a related area of work.

C. System shall be completely free of hum, parasitic oscillation, ground loops, RF interference, and any audible noise and distortion problems.

D. Video Timing and Phasing shall be achieved using the fewest delay lines, delay distribution amplifiers and other delay devices possible. At all times, match cable lengths between like paths to minimize timing errors. To the maximum extent possible, utilize precisely cut cables to achieve correct timing and phasing.

E. Although some delay units (active or passive) may be shown on the drawings to achieve the required video timing, the Contractor shall be responsible for providing all such units that may be required to meet these performance specifications. In all cases, minimize the number of delay lines. Keep cable lengths equal to achieve timing.

F. Cable and Fiber. Test all cables as installed for shorts between conductors or to building ground and opens. Certify all data cables to Category 6 (Draft 9a) or better using a tester capable of 350 MHz measurements such as Fluke DSP-4300, Agilent WireScope 350 or equivalent. Certify all optical fiber for TIA 568A and ISO 11801 compliance. Measure the loop resistance of all loudspeaker cables. Document all tests and complete measurement results including wire number, date, test equipment used, operator, and test results. If any problems are detected in testing, correct the problem, and retest.

G. Audio System Tests. Perform the following tests and adjustments, supplying all test equipment required. Set for slow meter damping and A or Linear weighting as required. Make corrections necessary to bring the system(s) into compliance with the specifications.

1. Measure and record the impedance of each loudspeaker line circuit terminating at the equipment rack, with loudspeakers connected, over the entire frequency range from 20 Hz to 20 kHz.
2. Adjust the gain of each active device to provide optimum signal-to-noise ratio and 18 to 20 dB headroom. Record input and output levels at each step in the signal chain.
3. Measure and record overall system hum and noise level of each mic or line amplifier with controls set so that -50 dBu microphone input or +4 dBu line level input would drive the system to full amplifier output. Terminate inputs with appropriately sized shielded resistors (150 ohms typical) for this test.
4. Measure and record system electrical frequency response for each input channel through power amplifier output with all filters and equalization bypassed in the DSP. Deviation shall not exceed  $\pm .75$ dB within the range 20 Hz to 20 kHz.
5. Check system to assure freedom from oscillation or stray RF pickup. Check all inputs without signal and with 500 Hz sine wave driving system to full average output. Detect unwanted signals on oscilloscope at rack termination and over single loudspeakers connected at the farthest distance from the rack for each loudspeaker line.
6. Apply a sinusoidal sweep signal to each loudspeaker system, sweeping from 50 to 5000 Hz at a level 10 dB below full amplifier output, and listen for rattles or objectionable noise. Correct any rattles or noise that is discovered.
7. Check the polarity of all loudspeakers with an electronic polarity checker, and by applying music program or pink noise signal to the system while walking through the transition areas of coverage from one loudspeaker to the next. Transition should be smooth with no apparent shift in source from one loudspeaker to the next.

#### H. Video System Tests:

1. Verify performance of all video connecting cables, as specified herein. Continuity tests are not acceptable. Passive paths shall be tested by sweep or multiburst signals. Digital paths shall be tested for BER. Replace any defective cable without claim prior to continuing tests.
2. Perform video signal parameter tests on individual items of equipment, and the work as a whole in accordance with EIA, SMPTE and AES Recommended Practices and other recognized standards as listed under REFERENCES.
3. Projection Systems Performance
  - a. Verify optical performance of projection devices to ANSI Standards using standard test signals connected directly to the device under adjustment.
  - b. Set devices level and true prior to adjustment, and mark positions for future reference.
  - c. Complete device's optical adjustments for focus, centering, geometry and registration prior to applying any electronic corrections.
  - d. Do not under any circumstances apply corrections at signal sources to compensate for errors in device alignment or adjustment, or timing errors in source material.

- e. Set brightness and contrast using reference test signals connected directly to the device. Adjust gray scale and gray scale tracking using ramp or stair step test signals. Set overall brightness and contrast with pluge and white flag signal.
  - f. Reconnect the projection devices to the system as a whole and verify performance of completed installations. Check that registration has not been affected by timing errors occurring elsewhere on all sources. Verify that source signal levels are consistent, and match the reference levels set by the standard test signals. Correct any deficiencies noted.
  - g. Record Lamp or CRT operating hours at conclusion of adjustments.
4. CATV Performance: Check all paths and outlets for appropriate compliance with the Performance Standards. Measure levels at all feeder termination points. Compare actual values to design calculations and investigate any difference of more than 2 db, rectify or justify these discrepancies to the satisfaction of the Owner. Where not specified, FCC Rules part 76.605 provisions for July 1, 1995 shall apply. In all cases, the more stringent of any referenced standard shall apply.
- a. Television Distribution System amplitude standards:
    - 1) Minimum visual sync-tip level: +3 dBmV
    - 2) Maximum visual sync-tip level: +10 dBmV
    - 3) Maximum amplitude difference between visual carriers 6 MHz apart: 2 db
    - 4) Maximum amplitude difference between any visual carriers: 7 dB
    - 5) Minimum visual/aural carrier ratio: 15 dB
    - 6) Maximum visual/aural carrier ratio: 17 dB
    - 7) Maximum FM station amplitude: -7 dBmV
    - 8) Minimum FM station amplitude: -20 dBmV
    - 9) Maximum variation between FM stations on adjacent channels: 3 dB
    - 10) Long-term variations in amplitude: 8 dB
  - b. Television Distribution System frequency standards:
    - 1) Visual frequency accuracy: +5 kHz of standard channel frequency
    - 2) Intercarrier frequency: 4.5 MHz, +/- 1 kHz
    - 3) FM frequency accuracy: +2 kHz of standard channel frequency.
    - 4) Television Distribution System flatness standards:
      - 5) Amplitude response within any TV channel: +0.5 dB (-0.75 MHz to +3.6 MHz from visual carrier)
      - 6) Amplitude response for entire spectrum (50 Hz - 750 MHz): 4 dB
  - c. Television Distribution System fault standards:
    - 1) Maximum hum or low-frequency variations: 2 % p-p
    - 2) Minimum visual carrier-to-noise ratio (4 MHz BW): 47 dB
    - 3) Maximum visual carrier-to-coherent spurious signal ratio (intermodulation): -53 dB
    - 4) Maximum Cross modulation ratio: -53 dB
    - 5) Maximum reflections within system: -40 dB
    - 6) Television Distribution System isolation:

- 7) Minimum drop-to-drop isolation: 25 dB
- d. Television Distribution System signal leakage:
  - 1) 15 uV/M maximum (at 100')
  - 2) Television Distribution System Video Standards:
  - 3) Chroma / Luma Delay: not more than 170 ns
  - 4) Differential Phase: not more than 8 degrees
  - 5) Differential Gain: not more than 10 %
  - 6) Sweep and balance reverse system path.
5. CATV Cable Testing: Each Trunk Cable line shall be inspected for proper termination:
  - a. Using a standard TV receiver connected to each outlet, observe picture quality. No visible components of cross modulation (windshield wiper effect), ghosting, noise, or beat interference shall appear on the screen of the receiver tuned to any normal signal.
  - b. Carrier-to-noise test shall employ an approved field strength meter. Measurements shall be made at the termination of each Trunk Cable and system extremity. With the normal levels in the system, the field strength meter shall be tuned to the picture carrier of each channel in turn and the meter reading noted. Tune the field strength meter to an unused portion of the spectrum within the passband, read the level of remaining noise in the absence of the signal and algebraically add the meter bandwidth correction factor. Record the difference between the two readings. Provide calculations or the manufacturer's data concerning the bandwidth correction factor.
  - c. System flatness, both forward and reverse, test shall employ an approved high level sweep transmitter receiver pair. Sweep measurements shall be taken at the termination of every branch line termination in the system. Where possible, record sweep results by photographic or computer data logging means.
6. Fiber Optic Testing
  - a. A power meter shall be used to test each strand for:
    - 1) Power: in dbm
    - 2) Loss per Unit Length: in dB.
  - b. Test results shall be bound and copied to the owner and their representatives. A strand-per-data file index shall be included. Additionally, the raw data, on 3.5" 1.44 MB IBM formatted diskette shall accompany the bound copies. Data files shall be accompanied with a strand-per-data file correspondence on each diskette. Other data transfer formats may be substituted by owner approval.
  - c. The binder shall also include the Factory Lot test reports, as well as the tracking information described previously.
  - d. Diligence shall be employed to produce efficient testing: i.e. connectors shall be checked with a microscope to determine whether a bad test run is a bad connector, bad termination, dirt, or a connector needing polishing.
  - e. Connectors shall remain capped, or otherwise protected, when not in use.



- I. Report. Upon completion of the initial tests and adjustments, submit a written report of tests to the Consultant along with all documents, diagrams, and record drawings required herein. The Report shall include the date of each test, pertinent conditions such as control settings, etc., test circuit, and test equipment employed. In addition, submit written notification that the installation has been completed in accordance with the requirements of the Contract Documents, and is ready for acceptance testing.

### **3.07 COMMISSIONING**

- A. Provide the following test equipment on site and available to the Consultant during commissioning. Assure scaffolding or other temporary access equipment is in place if needed for inspection.
  1. Tools, including screwdrivers, pliers, cutters, wire strippers, nut drivers, ratchet crimpers, heat gun, controlled temperature soldering unit, ladders, flashlights, measuring tapes, electric drills, long and short precision levels, etc.
  2. Time Windowed Acoustical Measurement System. Capable of swept sine wave measurements with constant time window versus frequency. Must be capable of time domain measurements, frequency domain measurements of both the fundamental and harmonics, Speech Transmission Index (STI) measurements, Noise Criteria (NC) measurements, and Maximum-Length Sequence (MLS) measurements with sequence lengths of up to at least 10 seconds.  
Acceptable: Gold-Line TEF-20 with laptop, external mouse, software, and accessories. Provide output transformer and line to mic level pad to interface TEF-20 output with balanced line and mic level inputs.
  3. Speech Transmission Index (STI) measurement device capable of rapid STI measurements.  
Acceptable: Laptop with external mouse, full duplex audio I/O, LEXSTI (freeware) software, and interface cables or devices as required to interface sound output with balanced line and mic level system inputs, and to interface with test microphone.
  4. Sound Pressure Level Meter. Meter shall meet ANSI S1.4 1971 Type 1 standards, with an octave band filter set and A, C, and Linear weighting filters. Provide stand for Type 1 microphone, and cables and interfaces to allow it to be used with the sound level meter, time windowed acoustical measurement system, or STI measurement device.
  5. Portable Audio Spectrum Analyzer. Handheld unit with graphical display and internal filter sets for standard third octave band response measurements.
  6. Sine Wave Generator. Output: +4 dBu, 5 Hz to 50,000 Hz with less than 0.03 % THD into any load.
  7. Pink Noise Source. Equal energy per octave bandwidth over the band 20 - 20,000 Hz,  $\pm 1$  dB (long-term average) at 0 dBu output. Stability:  $\pm 2$  dB per day.
  8. Multimeter. Measurement range, DC to 100,000 Hz, true RMS reading, 100 mV to 300 V, 10 ma to 10A, direct dB reading, frequency counter. Acceptable: Fluke 8060A or equal.
  9. Headphones.

10. Dual-trace oscilloscope - 100 MHz bandwidth, 1 mV/cm sensitivity, TV sync separator and delayed trigger circuit. Acceptable: Tektronix 2247A or equal.
11. Wireless Ethernet capable laptop with external mouse, RAMM software installed and tested, and wireless Ethernet access point compatible with laptop. Test compatibility of access point and laptop with the system, and ensure that wireless RAMM control of the MediaMatrix processor is working correctly before arrival of the Consultant.
12. OTDR configured for 62.5/125 multimode fiber at a wavelength of 1300nm: Tektronix Fibermaster OTDR; Tektronix Tekranger Mini-OTDR; GN Nettest Laser Precision CMA4000;GN Nettest Laser Precision TD-3486 Modular OTDR; or equal.
13. Fiber Power Meter. Acceptable: Noyes OPM 4-2D, Kingfisher KI 3600 or as approved
14. NTSC Television Generator. Acceptable: Tektronix TSG-170A or as approved
15. XGA Test Generator. Acceptable NTL, Extron or equal.
16. High Level Synchronous Sweep System. Acceptable: Wavetek 1855B/1865B, Wavetek Stealth, Tektronix, Calan, or equal. OR
17. Low Level Synchronous Sweep System equal to Advantest.
18. NTSC Television Waveform Monitor: Acceptable: Tektronix 1730, or equal.
19. NTSC Television Vectorscope: Acceptable: Tektronix 1720, or equal.
20. Digital Video Test Set. Acceptable: Tektronics, Sencore or equal.
21. Time Domain Reflectometer: Tektronix 1502B with paper tape recorder or equal.
22. Adapter and test lead kit to allow any of the above to be connected to any circuit or connector in the system.
23. Provide three portable UHF business band radios for use during acceptance testing. Radios should have a transmission range sufficient to cover entire project. Radios to include rechargeable batteries and charger along with "holster" for wearing on belt. Radios to be available for duration of testing process, including any follow-up visits required prior to final acceptance. Confirm that radio frequencies used are not in use elsewhere on project site.
24. Wire number machine as used to produce all the wire numbers for the project.

B. Have on site during acceptance testing all parts and components that may be required to make system repairs and minor modifications to bring the system in the Consultant's opinion into compliance with the Specification. At a minimum these parts shall include:

1. All types of connectors used in the system. Plus, straight and right angle XLR 3, 4, and 5 pin connectors of both sexes, straight and right angle ¼" phone 3 conductor connectors of both sexes, RCA connectors of both sexes, "F" connectors, and BNC connectors, even if not used in the system.
2. All types of wire used in the system.
3. All types of hardware used in the system, plus an assorted hardware kit.
4. All types of fuses used by equipment in the system.

C. Commissioning will include the operation of each major system and any other

components deemed necessary. Contractor will assist in this testing and provide the test equipment specified herein. Contractor shall provide at least one technician available for the entire commissioning period, at any time of the day, to assist in tests, adjustments, and final modifications. Furnish all labor, tools, and material required to make any necessary repairs, corrections, or adjustments.

- D. In the event the need for further adjustment or work becomes evident during acceptance testing, the Contractor will continue his work with a full labor complement until the system is acceptable, at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications, the Contractor will pay for additional time and expenses of the Consultant at the Consultant's standard rate in effect at that time, during and extension of the acceptance testing period.

### **3.08 CLEANING**

- A. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where Work has been completed unless designated for storage.
- B. Clean all areas around system equipment and be sure that the inside of each equipment rack is free of wire stripping and other debris.

### **3.09 INSTRUCTION**

- A. Provide six (6) hours instruction to Owner designated personnel on the use and operation of the system. This training must be provided in accordance with a schedule acceptable to the Owner. The instructor should be fully knowledgeable and qualified in system operation. The System Reference Manuals should be complete, approved, and on site at the time of this instruction.
- B. Upon completion of the Work, the Owner may elect to verify test data as part of the acceptance procedure. Provide personnel and equipment, at the convenience of the Owner, to reasonably demonstrate system performance and to assist with such tests without additional cost to the Owner.
- C. Videotape the instruction sessions for the future reference of the operators and maintenance personnel.
- D. Be present at the first formal use of the system.
- E. Three months after final acceptance, the Owner reserves the right to direct changes to the control system software. Such changes shall be made without additional cost to the Owner.

END OF SECTION