TEXAS A&M UNIVERSITY
Technology Services

Audio Video Standards

"Play Book"

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Contents

Introduction

Intent of this document is to provide guidance regarding Audio Video technology for Texas A&M university. This document will be evolving as technology changes and customer needs evolve.

- First section is a narrative of what the A/V Standards Working Group felt should be considered for "basic" A/V installs for conference rooms and learning environments.
- Second section are A/V integration guidelines with answers to typical installation questions regarding A/V technology.
- Third section Part 1-3 will be used as guidelines for any RFP sent out to A/V integrators to ensure they know what TAMU's unified expectations are for integration services requested.
- The "A/V Standards Working Group" involved in the creation of this document are credited on the last page.

Please ensure you review the footer for the most updated version of this document before using information for any A/V related projects.

Conference Room Descriptions

Huddle Room

Used for brainstorming sessions and collaborative work between smaller groups in the office. Typically, not larger than 150 sqf. Generally, sits 2-6 people that would be used for ad hoc meetings or other last minute gathering spot and/or when people need privacy.

Typical Technology

- **Display:** 55"- 65" display on an articulating wall mount inside a recessed display back box **or** with a credenza directly underneath if display protrudes more than 4" from wall (ADA requirements).
- **Display source:** Wireless video share/collaboration device mounted behind display **and** HDMI port with cable in a single gang receptacle (Aff 12-18") directly under the display, near or behind credenza.
- **Camera:** Not required.
- **Audio:** Built in speakers on the display.
- **Microphones:** Not required.
- **Technology Control:** Handheld remote that comes with display.
- **In room PC**: Not required.
- **Telephone:** If required it should be stand-alone conference style on table.

- **A/C Power: Minimum**, 1 dedicated circuit, single gang A/C receptacle behind display.
- **Network Receptacle**: Quad receptacle with at least 1 active jack behind display.
- **WAP: Sufficient** coverage for room. (Contact wireless networking group for antennae coverage survey)
- Estimated technology integration price range: **Roughly $5k - $8k.**

<u>**Additional options**</u>:

- USB video conferencing PTZ camera, microphones, and speakers.
- In room PC.
- Contact the Technology Services A/V design team for additional possible options.

Small Meeting Room

Typically, 150-200+ sqft, used for small groups (4-8 people) to review content, conduct a webinar, or gather on scheduled or short notice to get the day-to-day work done. Integrated with basic presentation and video conferencing needs, perfect for project meetings, webinars, and when people need privacy. This type of room layout is dynamic and changing. Depending on the actual need of room it can be configured similar to a huddle room or medium/large conference room.

<u>**Typical Technology**</u>

- **Display:** 65"- 75" display on an articulating wall mount inside a recessed display back box <u>**or**</u> with a credenza directly underneath if display protrudes more than 4" from wall (ADA requirements).
- **Display source:** Wireless video share/collaboration device mounted behind display <u>**and**</u> HDMI port with cable in a single gang receptacle (Aff 12-18") directly under the display, near or behind credenza. <u>**Or**</u> at tabletop through cable cubby
- **Camera:** USB PTZ camera mounted below display, eye level to individuals in a seated position.
- **Audio:** Built in speakers on the display or soundbar under display.
- **Microphones:** built into USB PTZ camera mounted below display.
- **Technology Control:** Hard button control at entry <u>**or**</u> touch panel control panel on table.
- **In room PC**: Technical Services supported micro-PC mounted behind display with HDMI/Display Ports, USB, Wi-Fi Capability and wireless mouse and keyboard at tabletop.
- **Telephone:** If required it should be a separate conference style device sitting in the middle of a table and/<u>**or**</u> programmed into an audio processor and controlled through a tabletop touch panel.
- **A/C Power receptacles:** Minimum, 2 dedicated circuits, single gang A/C receptacle behind display <u>**and**</u> 1 AC power receptacle in cable cubby on tabletop.
- **Network Receptacle:** Quad receptacle with at least 2 active jacks behind display.
- **WAP: Sufficient** coverage for room. (Contact wireless networking group for antennae coverage survey)
- Estimated technology integration price range: **Roughly $9k - $20k.**

<u>**Additional options**</u>:

- Tabletop Cubby with 1-RJ45, 1-HDMI, 1-USB, 2 - AC Receptacles
- Distributed ceiling mounted speakers
- Ceiling tile microphones
- Interactive display
- Contact the Technical Services A/V design team for additional possible options.

Medium/Large Meeting Room

Typically, 300+ sqft, used for scheduled team meetings of 8 to 20 people, client meetings and other gatherings that require multimedia experience including access to real-time information, control of a video conferencing system (software or hardware) and video from multiple sources.

Typical Technology

- **Display:** 1-2-80"-98" display(s) on an articulating wall mount inside a recessed display back box **or** with a credenza directly underneath if display protrudes more than 4" from wall. (ADA requirements). **or** 5400 Lumen (or higher depending on environment) projector with ceiling mount and electric drop-down screen.
- **Display sources**: A/V multi-input switcher for typical sources: HDMI laptop input at table, wireless video share/collaboration device and in room PC mounted behind display, video conferencing system (software application or hardware codec). Preferred all in one video unit with built-in video switching, control, rs232, IO, Relays, AV subnet.
- **Camera:** 1-2 USB PTZ camera mounted below display, eye level to individuals in a seated position with IP or RS232 control via touch panel. Typical location of front and rear of room.
- **Audio:** Distributed mono ceiling speakers. Audio should be capable of auto calibration between speakers and microphones for Acoustic Echo Cancellation and active sound masking.
- **Microphones:** Ceiling tile speaker **and/or** Hardwired tabletop microphones with built in mute buttons
- **Technology Control:** Hardwired 7-10" Tabletop touch pad control panel
- **In room PC**: Technical Services supported micro-PC mounted behind display or inside rack location with HDMI/Display Ports, USB, Wi-Fi Capability and wireless mouse and keyboard at tabletop.
- **Telephone:** Separate conference style device sitting in middle of table **and/or** programmed into an audio processor and controlled through tabletop touch panel.
- **A/C Power receptacles:** Minimum, 2 dedicated circuit, single gang A/C receptacles behind display(s) or above projector **and** 2 power receptacles in cable cubby on tabletop **and** minimum 2 Minimum, 2 dedicated circuit, single gang A/C receptacle inside rack location (power needs will change based on specific integration.
- **Furniture**: Rolling equipment rack appropriately sized for equipment, ventilation, and room décor. Typical type credenza with rack or rolling rack cabinet.
- **Tabletop Cable Cubby:** 2-RJ45, 2-HDMI, 2-USB, 4 - AC Receptacles
- **Network Receptacle:** Quad receptacle with at least 2 active jacks behind display **and/or** above projector. There are a minimum 2 active jacks located each at tabletop cubby, and rack location.
- **WAP: Sufficient** coverage for room. (Contact wireless networking group for antennae coverage survey)

- Estimate technology integration range: Roughly $40k-$75K and up.

Additional options:

- Additional cameras
- Additional displays
- Interactive Electronic Whiteboard or Whiteboard camera with standard whiteboard
- Confidence Monitor: Presenter display
- Room Calendar: One 10" scheduling panel per entrance located outside of room one.
- Environmental Controls: Occupancy Sensor control of lights and shades.
- Contact the Technical Services A/V design team for additional possible options.

Specialty Conference Room

Rooms requiring more functionality to accommodate needs for incubating ideas, war room meetings, executive level meetings requiring more security, encryption, reliable connections, privacy.

Typical Technology

- **Display:**
    - One video wall main display appropriately sized for pixel pitch and room size.
    - 2-80" interactive touch displays on articulating wall mounts inside a recessed display back box **or** with a credenza directly underneath if displays protrude more than 4" from wall. (ADA requirements). **or** 5400 Lumen (or higher depending on environment) projector with ceiling mount and electric drop-down screen.
- **Display source**: A/V multi-input switcher for typical sources: HDMI laptop input at table, wireless video share/collaboration device and in room PC mounted behind display, video conferencing system (software application or hardware codec). Preferred all in one video unit with built-in video switching, control, rs232, IO, Relays, AV subnet.
- **Camera:** 2 USB PTZ camera mounted below display, eye level to individuals in a seated position with IP or RS232 control via touch panel. Typical location of front and rear of room.
- **Audio: Audio:** Distributed mono ceiling speakers. Audio should be capable of auto calibration between speakers and microphones for Acoustic Echo Cancellation.
- **Microphones:** Ceiling tile speaker **and/or** Hardwired tabletop microphones with built in mute buttons
- **Technology Control:** Hardwired 7-10" Tabletop touch pad control panel
- **In room PC**: Technical Services supported micro-PC mounted behind display or inside rack location with HDMI/Display Ports, USB, Wi-Fi Capability and wireless mouse and keyboard at tabletop.
- **Telephone:** Separate conference style device sitting in middle of table **and/or** programmed into an audio processor and controlled through tabletop touch panel.
- **Video Conferencing**: Conferencing device capable of encrypted SIP calls and remote management via centrally managed services.

- **A/C Power receptacles:** Minimum, 2 dedicated circuit, single gang A/C receptacles behind display(s) or above projector **and** 2 power receptacles in cable cubby on tabletop **and** minimum 2 Minimum, 2 dedicated circuit, single gang A/C receptacle inside rack location (power needs will change based on specific integration.
- **Furniture**: Rolling equipment rack appropriately sized for equipment, ventilation, and room décor. Typical type credenza with rack or rolling rack cabinet.
- **Tabletop Cable Cubby**: 2-RJ45, 2-HDMI, 2-USB, 4 - AC Receptacles
- **Network Receptacle:** Quad receptacle with at least 2 active jacks behind display **and/or** above projector. There are a minimum 2 active jacks located each at tabletop cubby, and rack location.
- **Room Calendar**: One 10" scheduling panel per entrance located outside of room one. One ethernet drop needed per scheduling panel.
- **Additional Infrastructure:** Environmental Controls: Occupancy Sensor control of lights and shades. Wall blocking plywood to accommodate heavier displays and video wall. Preferred inset A/V wall box/steel strapping with conduit knockouts for electrical and data drops. Inset display into wall ex. Pony wall etc. Soundproof ceiling tiles and acoustic paneling on side walls.

Additional options:

- Contact the Technical Services A/V design team for additional possible options.

Drawings

This space is saved for Architectural drawings including RCP, FP and Conduit risers. Please contact Technology Services: University Audio VIsual Services for further details.

Learning Space Descriptions

Learning Pod

Used for brainstorming sessions and collaborative work between smaller groups in the office. Typically, not larger than 150 sqf. Generally, sits 2-6 people that would be used for ad hoc meetings or other last minute gathering spot and/or when people need privacy.

Typical Technology

- **Display:** 55"- 65" display on an articulating wall mount inside a recessed display back box **or** with a credenza directly underneath if display protrudes more than 4" from wall (ADA requirements).
- **Display source:** Wireless video share/collaboration device **and** HDMI port with cable in a single gang receptacle (Aff 12-18") directly under the display, near or behind credenza.
- **Camera:** Not required.
- **Audio:** Built in speakers on the display.
- **Microphones:** Not required.
- **Technology Control:** Handheld remote that comes with display.
- **In room PC**: Not required.
- **Telephone:** If required it should be a stand-alone conference style device sitting in the middle of table.
- **A/C Power: Minimum**, 1 dedicated circuit, single gang A/C receptacle behind display.
- **Network Receptacle**: Quad receptacle with at least 1 active jack behind display.
- **WAP: Sufficient** coverage for room. (Contact wireless networking group for antennae coverage survey)
- Estimated technology integration price range: **Roughly $5k - $8k.**

Additional options:

- Contact the Technical Services A/V design team for additional possible options.

Lecture Halls/Auditorium:

Typically, 100-400 + seat capacity, used for traditional teaching pedagogies and other gatherings that require multimedia experience including access to real-time information, control of video from multiple sources.

Typical Technology

- **Display:** Video Wall 164" diagonal video wall, w/ VC controller, wall mount, trim, cables, and spares, calibrate and test
- **Display source**: A/V multi-input switcher for typical sources: HDMI Laptop input at lectern, wireless video share/collaboration device and in room PC in rack, video conferencing system (software application or hardware codec). Preferred all in one video unit with built-in video switching, control, rs232, IO, Relays, AV subnet.

- **Camera:** 3- PTZ IP Camera's mounted in the most optimal positions to capture audience and presenter locations with IP or RS232 control via touch panel. Typical location front and rear of the room.
- **Audio:** Distributed mono ceiling pendant speakers calibrated between speakers and microphones for Acoustic Echo Cancellation, engineered for room size. The Digital Signal Processor should include Dante and AES67 inputs and outputs.
- **Microphones:** Combination of wireless handheld, lavalier, and lectern gooseneck microphones for presenters, ceiling tile array microphones **and/or** push to talk microphones for audience.
- **Technology Control:** Hardwired 7-10" Tabletop touch pad control panel at lectern for presenter and 1-2 wall mounted touch pad control panel for room environmental controls (e.g., lights & shades)
- **Lecture Recording**: Please consult with the A/V design team to assess lecture recording needs.
- **In room PC**: Technical Services supported micro-PC mounted in presenter lectern or inside rack location with HDMI/Display Ports, USB, Wi-Fi Capability and wireless mouse and keyboard at lectern
- **Telephone:** If required it should be programmed into an audio processor.
- **A/C Power receptacles**: Minimum 2 AC dedicated power receptacles at each display (Video wall requires multiple AC Outlets with dedicated breaker) and projector location. Minimum 4 receptacles located at rack/lectern location for power distribution devices with each pair of receptacles being each on an individual circuit. (Power needs will change based on specific integration).
- **Furniture**: Lectern with Smart Touch Confidence Monitor and capability to hold rack-mountable equipment sized appropriately. Additional racks located in rooms and or remote locations may be required. Racks to be sized according to type and quantity of equipment with sufficient heat disbursement. All racks will adhere to A/C Power receptacle and Data requirements.
- **Network Receptacle:** Quad receptacle with at least 2 active jacks behind display(s) **and/or** above projector. Minimum 2 active receptacles located at each lectern and rack location. Layer 3 switch in equipment rack.
- **WAP:** Sufficient coverage for room. (Contact wireless networking group for antennae coverage survey)
- **Room Calendar:** Room Calendar: One 10" scheduling panel per entrance located outside of room. One data drop needed per scheduling panel.
- Estimate technology integration range: **Roughly $100k-$300K**

Additional options:

- Interactive electronic Whiteboard or Whiteboard camera with standard whiteboard
- Contact the Technical Services A/V design team for additional possible options.

Standard Classrooms

Typically, 20-100 seat capacity, With the ability to modify seating arrangement or seat grouping with fixed, or movable seats for different setups. Typically, the seating number will not change. Used for

lecture style teaching pedagogies and other gatherings that require multimedia experience including access to real-time information, control of video, and audio sources.

Typical Technology

- **Display:** 1-3 video projectors or video walls sized appropriately using display size calculations. Display(s) on an articulating wall mount inside a recessed display back box **or** with a credenza directly underneath if display protrudes more than 4" from wall. (ADA requirements). **or** 5400 Lumen (or higher depending on environment) projector with ceiling mount and 16:10 format electric drop-down screen appropriately to match video displays.
- **Display source**: A/V multi-input switcher for typical sources: HDMI laptop input at lectern, wireless video share device, in-room pc, document camera. Video receiver units required for each display. Preferred all in one video unit with built-in video switching, control, rs232, IO, Relays, A/V subnet.
- **Camera:** 2-USB PTZ IP Camera's mounted in the most optimal positions to capture audience and presenter locations with IP or RS232 control via touch panel. Typical location front and rear of the room.
- **Audio:** Distributed mono ceiling pendant speakers calibrated between speakers and microphones for Acoustic Echo Cancellation, engineered for room size. The Digital Signal Processor should include Dante and AES67 inputs and outputs.
- **Microphones:** Combination of wireless handheld, lavalier, and lectern gooseneck microphones for presenters ceiling tile array microphones **and/or** push to talk microphones for audience.
- **Technology Control:** Minimum 7" lectern touch pad control panel.
- **In room PC**: Technical Services supported micro-PC mounted behind display or inside rack location with HDMI/Display Ports, USB, Wi-Fi Capability and wireless mouse and keyboard at lectern.
- **Telephone:** Not required.
- **A/C Power receptacles**: Minimum 2 AC dedicated power receptacles at each display and projector location. Minimum 4 receptacles located at rack/lectern location for power distribution devices with each pair of receptacles being each on an individual circuit. (Power needs will change based on specific integration).
- **Furniture**: Lectern with Smart Touch Confidence Monitor and capability to hold rack-mountable equipment sized appropriately. Additional racks located in rooms and or remote locations may be required. Racks to be sized according to type and quantity of equipment with sufficient heat disbursement. All racks will adhere to A/C Power receptacle and Data requirements.
- **Network Receptacle(s):** Quad receptacle with at least 2 active jacks behind display(s) **and/or** above projector. Minimum 2 active jacks located in each rack location
- **WAP:** Sufficient coverage for room. (Contact wireless networking group for antennae coverage survey)
- **Room Calendar**: One 10" scheduling panel per entrance located outside of room. One data drop needed per scheduling panel.
- Estimate technology integration range: **Roughly $42k-$150K**

Additional options:

- Interactive electronic Whiteboard or Whiteboard camera with standard whiteboard
- Additional PC monitor
- Contact the Technical Services A/V design team for additional possible options.

Active Learning Studios:

Typically, 50-216 seat capacity, used for active learning pedagogies with faculty to student engagement and student to student team engagement (Pods) that require multimedia experience including access to real-time information, control of video from multiple sources.

Typical Technology

- **Main Display:** 1-3 choice of 16x10 video projectors or video walls sized appropriately using display size calculations. May use perimeter displays and/or displays at tables in addition.
- **Pod video displays**: 1-2 50"-75" displays on a flat wall mount. If the display is mounted to the table, the display should be sized accordingly. The edge of the display should not exceed the table width.
- **Drop Down Screen (if using a projector)**: Drop down screen in 16:10 format sized appropriately to match main video displays.
- **Display source**: AV multi-input switcher for typical sources: Laptop, Wireless Share, Room PC, Video Conferencing System. Video receiver units required for each display. Preferred all in one video unit with built-in video switching, control, rs232, IO, Relays, AV subnet, Dante or AES6
- **Pod source**: Each pod equipped with wireless video share device and/or wired sharing locally to table or optionally central to main studio displays.
- **Camera:** 2-USB PTZ webcams mounted under or to the side of the display with IP or RS232 control via touch panel. Typical location front and rear of the room.
- **Audio:** Distributed mono ceiling can speakers calibrated between speakers and microphones for Acoustic Echo Cancellation, engineered for room size. The Digital Signal Processor should include Dante and AES67 inputs and outputs.
- **Microphones:** Combination of wireless handheld, lavalier, and lectern gooseneck microphones for presenters, ceiling tile array microphones **and/or** push to talk microphones for audience.
- **Technology Control:** Minimum 10" Tabletop touch pad control panel located at lectern.
- **In room PC**: Technical Services supported micro-PC mounted behind display or inside rack location with HDMI/Display Ports, USB, Wi-Fi Capability and wireless mouse and keyboard at tabletop.
- **A/C Power receptacles**: Minimum 2 dedicated AC power receptacles at each display, projector location and Pod. Minimum 4 receptacles located at rack/lectern location for power distribution devices. (Power needs will change based on specific integration).
- **Furniture**: Lectern with capability to hold rack-mountable equipment sized appropriately. Additional racks may be needed at remote locations. Extra racks to be sized according to type and quantity of equipment. Any additional rack will adhere to A/C Power receptacle and Data requirements.
- **Network Receptacles**: Quad receptacle with at least 2 active jacks behind display **and/or** above projector. Minimum 2 active jacks located each at lectern, Pod, and rack location
- **WAP:** Sufficient coverage for room. (Contact wireless networking group for antennae coverage survey)

- Estimate technology integration range: **Roughly $90k-$300K**

Additional options:

- Interactive electronic whiteboard or whiteboard camera for multiple whiteboards
- Pod Camera: Each pod has one USB collaboration camera. (Need to look at use case)
- Pod Control: 7" Tabletop touch pad control panel (optional as needed)
- Room Calendar (optional): One 10" scheduling panel per entrance located outside of room. One data drop needed per scheduling panel.
- Second PC monitor

Specialty Spaces

Typically, 20-40 room capacity (seats not present), used for classes that do not resemble traditional lecture halls, classrooms, or active learning spaces. Typically contain specialized equipment or features unique to the instruction taking place, but still require equipment for multimedia presentation or playing audio. Examples include weight rooms or other athletic facilities, dance studios, and theaters/production areas. The more permanent the furniture and hardware, the closer these rooms are to a standard classroom.

Typical Technology

Permanent install

- **Display**: 1-display(s) on an articulating wall mount with a credenza directly underneath if display protrudes more than 4" from wall. (ADA requirements). **or** 5400 Lumen (or higher depending on environment) 16x10 black projector with ceiling mount and electric drop-down screen. Size of display **and/or** screen will depend on rooms size. Black projectors are low profile specifically for performance spaces
- **Display source**: In room PC and wireless video share/collaboration device behind display **and** HDMI port with cable in a single gang receptacle (Aff 12-18") in a convenient location for the specific space.
- **Camera**: Not Required
- **Audio**: Drop tile ceilings are not always present. Two pole mounted powered speakers can be placed on walls for exposed ceiling rooms; pendant speakers can also be used. For drop tile ceilings, distributed mono ceiling speakers.
- **Technology Control**: Handheld remote for display or projector
- **In room PC**: Technical Services supported micro-PC mounted behind display with HDMI/Display Ports, USB, Wi-Fi Capability and wireless mouse and keyboard in a convenient location for the specific space.
- **Telephone**: Not required
- **A/C Power receptacles:** Minimum, 2 dedicated circuit, single gang A/C receptacles behind display(s) **or** above projector **and** 1 power receptacle (Aff 12-18") in a convenient location specific to the space for "bring your own" devices (e.g. Laptops, media players, etc.). (Power needs will change based on specific integration).

- **Networking:** Quad receptacle with at least 2 active jacks behind display(s) **and/or** above projector and instructor station (lectern) if present
- **Furniture:** Instructor desk to suit the room ranging from mobile lectern for mouse and keyboard to full size desk with rack for A/V equipment depending on specific integration.
- **Network Receptacle(s):** Quad receptacle with at least 2 active jacks behind display(s) **and/or** above projector. Minimum 2 active jacks located in each rack location
- **WAP:** Sufficient coverage for room. (Contact wireless networking group for antennae coverage survey)
- Estimate technology integration range: **Roughly $10k-$100K**

Additional options:

- PTZ camera and instructor microphone for remote learning/recording, AV multi-input switcher, touch panel room controls

Mobile Option

If permanent A/V installations are not practical due to potential damage or placement issues (e.g., gym activities or no place to mount equipment in production area), a mobile solution (e.g. Rolling cart) is appropriate.

- **Display**: Large format display on rolling cart
- **Display source**: In room PC mounted behind display **and** HDMI port with cable with wireless mouse and keyboard on a shelf located on the rolling cart
- **Audio**: Built in speakers on the display or soundbar under display.
- **Technology Control**: Handheld remote that comes with display.
- **Network Receptacle(s):** Quad receptacle with at least 2 active jacks in a convenient location for rolling carts.
- **A/C Power receptacles:** Minimum, 2 dedicated circuits, single gang A/C receptacles in a convenient location for rolling carts. (Power needs will change based on specific integration).
- **WAP:** Sufficient coverage for room. (Contact wireless networking group for antennae coverage survey)
- Estimate technology integration range: **Roughly $3k-$10K**

Additional options:

- wireless video share/collaboration device
- Interactive touch panel with integrated conferencing (Neat Bars, Neat Boards, Logitech Rally appliances)

Drawings
This space is saved for architectural drawing including RCP, FP and Conduit riser. Please contact Technology Services: University Audio Visual Services for further details.

Audio Video Integration Guidelines

Display Installation.

    a.   Follow all ADA guidelines and provided formulas for mounting heights.

        a.   Required infrastructure:

             i.   Steel strapping or plywood backing is required and should be noted in scope for any display over 50lbs

             ii.   "Zip" style togglers to be used in at least 2 points of contact when using steel studs.

             iii.   Appropriately rated Lag bolts to be used in any wood framing structure.

             iv.   No drywall "soft" anchors to be used.

Display Size Calculations

Standard Formula:

Screen Height = Distance to furthest viewer/ 6.

For example, if the furthest seat away from the screen in your room is 18'. Simply divide 18' by 6 which equals 3'. So, the height of your screen should be a minimum of 3' or 36" tall. Then, simply do an internet search for different tv sizes and read the dimensions of the display. You'll find that a 70" display is 36" tall, so this room should have a minimum 70" display.
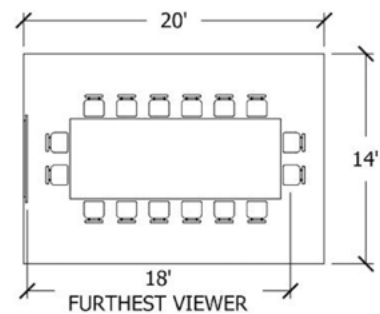
Analytical Decision Making (Detailed investigation of content): Screen Height = (Vertical image resolution x Distance to furthest viewer)/3438

For example, SH= (1080x18)/3438 equals Screen Height = 5.7' or 68"

Then using a 16x9 formatting for most displays use the following formula.

$$\frac{16}{9} = \frac{x}{68}$$

$$16 \times 68 = 1088$$

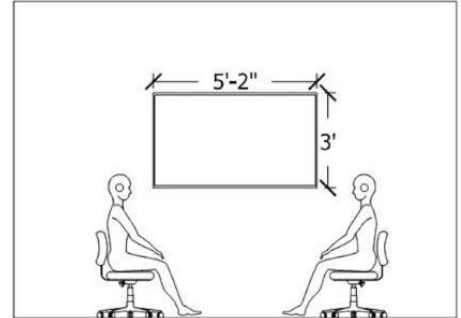$$\frac{1088}{9} = 120$$

The minimum width of our screen is 120". Now that we know the screen height (68") and screen width (120"), we can use Pythagorean's Theorem (a2+b2=c2) to calculate the diagonal.

$$68^2 + 120^2 = x^2$$
$$4624 + 14400 = x^2$$
$$19{,}024 = x^2$$
$$\sqrt{19{,}024} = x$$
$$138 = x$$

In this example, Analytical Decision Making (e.g. detailed investigation of content) will require a minimum of a 138" screen as opposed to a 70" display for the same size room if we will be performing detailed investigation of content.

Height of display mounted above finished floor

Measure the distance from the floor to your eyes to find out how high you'll be sitting. Regarding viewing angle, according to the Society of Motion Picture and Television Engineers, you need the display to be mounted for a viewing angle of not more than 30 degrees. Most people, however, casually sit between 10 to 15 degrees reclined.

As a rule, a 42" television should be mounted about 56 inches from floor to display center, a 55" display should be around 61 inches, a 65" display should be around 65 inches' floor to center, and a 70" display should be mounted about 67 inches to the center of the screen.

Sample Conduit Riser Diagram
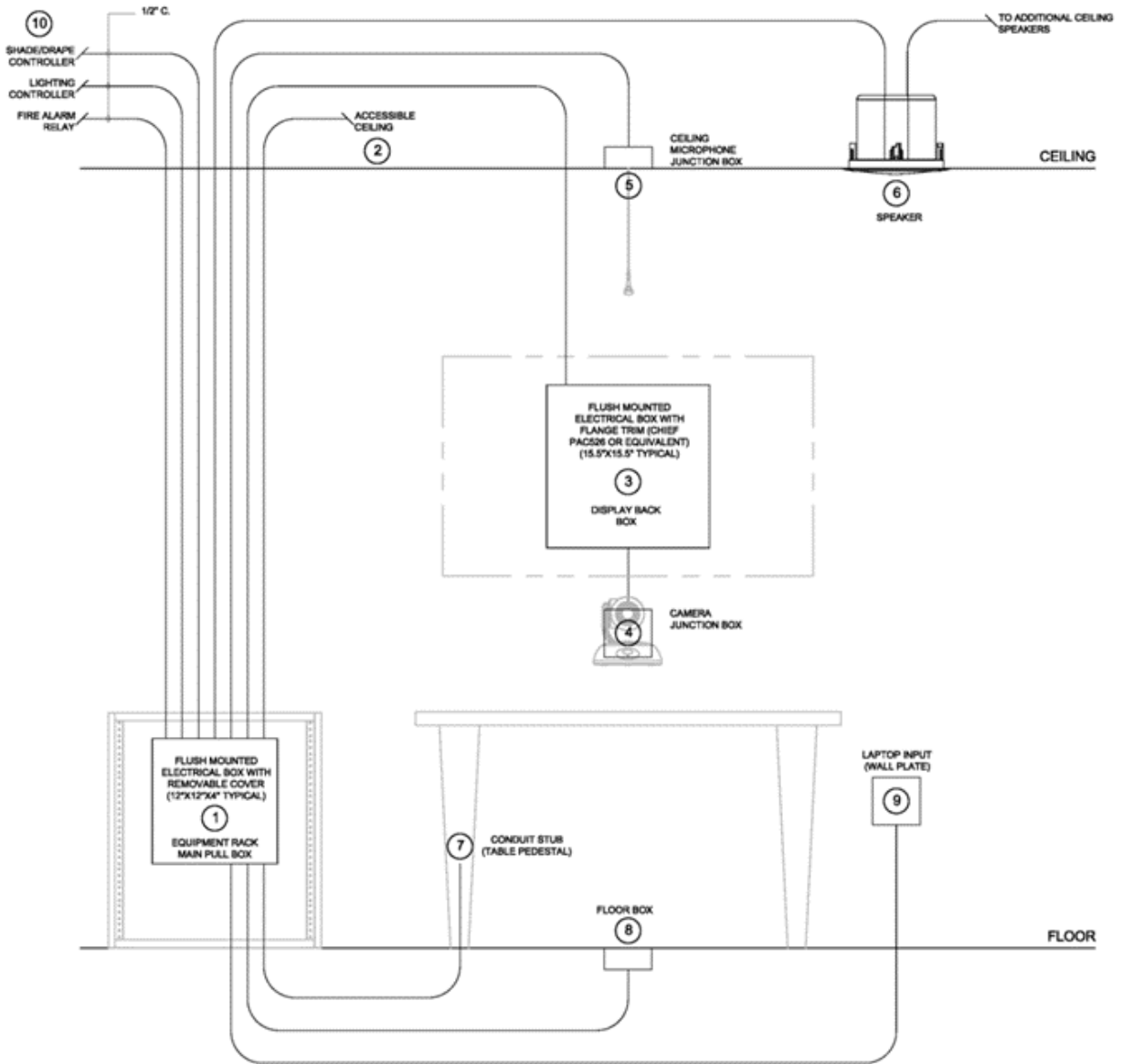
TYPICAL AV CONFERENCE ROOM CONDUIT RISER DIAGRAM
NO SCALE

ADA Considerations

The Americans with Disabilities Act requires that 'reasonable accommodations' be made for students with disabilities. This will include but not be limited to the following:

- Ensuring all students can take part in & benefit from all programs and services.
- Providing students with disabilities the same opportunities & experiences other students enjoy.
- Making sure the quality of services & benefits provided is equal to those received by everyone.
- Emphasizing classroom accessibility and providing the proper equipment to increase the student's comfort and chances for success.

Display Mounting: ADA Standards (307: Protruding Objects) Objects with leading edges more than 27 inches (685 mm) and not more than 80 inches (2030 mm) above the finish floor or ground shall protrude 4 inches (100 mm) maximum horizontally into the circulation path. Elements (Displays)located on circulation paths, including operable elements, must comply with requirements for protruding objects.
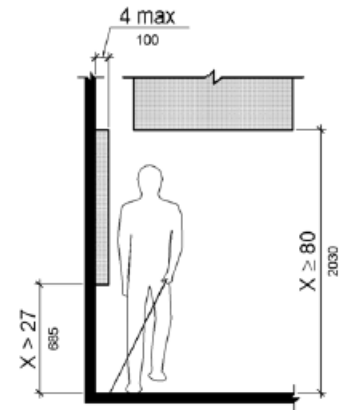
Installing a credenza under the protruding display will allow for an exception to this standard.

Large Format Touch Displays (Smart Boards, Neat Boards, Samsung Flips, etc.): Touch displays should be installed on a height adjustable mount that allows adjustment to ADA requirements for Kiosks (i.e., maximum height of 48 inches and minimum height of 15 inches). Height adjustment control should always be reachable by the same standards (min 15" max 48")

Input Plates: A common Audio Video input plate wall mounting height is 18 inches AFF, which matches typical power outlet heights.

Touch Panel Control: All touch panel controls can have a maximum height of 48 inches AFF and a minimum of 15 inches AFF.
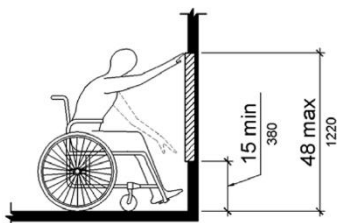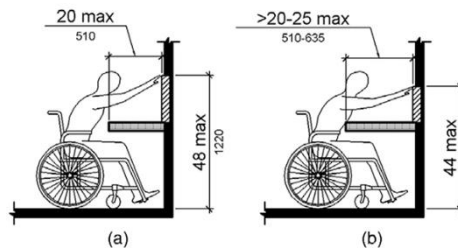
Figure 308.2.1
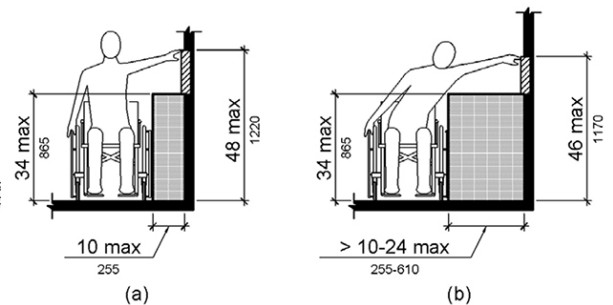Unobstructed Forward Reach

Figure 308.2.2
Obstructed High Forward Reach

Figure 308.3.2
Obstructed High Side Reach

Assistive listening

Assistive listening systems shall be provided in accordance with 219 and shall comply with 706. Section 219 of the ADA law discusses signage that must be posted alerting patrons to the availability of hearing assistance devices in assembly areas. Section 706 lays out technical requirements for the systems that must be supplied. In particular:

- **706.2** Receiver Jacks. Receivers required for use with an assistive listening system shall include a 1/8 inch (3.2 mm) standard mono jack.
- **706.3** Receiver Hearing-Aid Compatibility. Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neck loops.
- **706.3** Receiver Hearing-Aid Compatibility. Neck loops and headsets that can be worn as neck loops are compatible with hearing aids. Receivers that are not compatible include earbuds, which may require removal of hearing aids, earphones, and headsets that must be worn over the ear, which can create disruptive interference in the transmission and can be uncomfortable for people wearing hearing aids.
- **706.4** Sound Pressure Level. Assistive listening systems shall be capable of providing a sound pressure level of 110 dB minimum and 118 dB maximum with a dynamic range on the volume control of 50 dB.
- **706.5** Signal-to-Noise Ratio. The signal-to-noise ratio for internally generated noise in assistive listening systems shall be 18 dB minimum.
- **706.6** Peak Clipping Level. Peak clipping shall not exceed 18 dB of clipping relative to the peaks of speech. The ADA also contains specific requirements for assistive listening receivers in facilities. This applies to assembly areas "where audible communication is integral to the use of the space." These include (but are not limited to): "classrooms, lecture halls, courtrooms, public meeting rooms, public hearing rooms, legislative chambers, motion picture houses, auditoria, theaters, playhouses, dinner theaters, concert halls, centers for the performing arts, amphitheaters, arenas, stadiums, grandstands, or convention centers."

Seating Capacity	Minimum #of Receivers Required	Minimum #Number of Receivers Required to be Hearing-aid Compatible
50 and under	2	2
51-200	2, plus 1 per 25 seats over 50	2
201-500	2, plus 1 per 25 seats over 50	1 per 4 receivers
501-1000	20, plus 1 per 33 seats over 500	1 per 4 receivers
1001-2000	25, plus 1 per 50 seats over 1000	1 per 4 receivers
2001 and over	55, plus 1 per 100 seats over 2000	1 per 4 receivers

Audio-Video Systems Integration Standards used for RFP

(Sections 27 40 00) (This section should be pasted directly into any outgoing RFP or bid packet)

Part 1 - General

1.1 Related Documents

    a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

    a. Section includes furnishing, installing, testing and documenting audio-visual systems for multi-use, seminar and team center rooms at any Texas A&M systems location.

    b. Audio-Visual Systems shall consist of systems with various configurations per the AV Room Type Device Schedules and the design specifications and drawings.

    c. These systems include some or all of the following:

        a. Wall mounted, ceiling mounted, and ceiling hung speaker systems.

    d. Wall mounted flat screen video displays.

    e. Audio input/output panels, microphones, wireless microphone systems, mixers, switchers, audio processors and amplifiers.

    f. Video input/output panels, PTZ cameras, signal extenders, switchers, and scalers.

    g. Video conferencing codecs, microphones, cameras, mounts, and cables.

    h. Programmable audio-visual remote and automated control system and associated support devices for controlling audio and videos systems, etc.

    i. Floor, wall and desktop connection hubs for audio, video, broadband, LAN, remote control signaling, computer and power connections.

    j. Termination, collector and pull junction boxes.

    k. Flat screen video display mounting systems.

    l. Wiring and connectors.

1.3 Overview

    a. The work detailed by these specifications and drawings has been specified to meet certain requirements for performance. Some information, such as exact equipment models, layout, wire routing, additional conduit, and power requirements, etc. has been omitted. It shall be the responsibility of the Contractor to translate these specifications and drawings into a complete design package containing all necessary elements for a complete turnkey installation including all material, labor, warranties, shipping and permits.

    b. General elements of the work shall consist of but not limited to:

        1. Procure all permits and license required to complete this installation.

        2. Submission of Pricing Forms for all equipment, materials, and labor.

        3. Attend pre-construction/pre-submittal meeting with Owner and Consultant to review design package for the Audio-Video Systems.

4. Prepare schedule of work.
5. Submittal preparation and processing prior to ordering equipment.
6. Attending submittal review meeting.
7. Provide materials necessary to complete the Audio-Video Systems.
8. Coordinate receipt of owner furnished equipment.
9. Perform installation according to contract documents and manufacturers recommendations.
10. Protect new facilities finishes and equipment.
11. Maintain construction materials and refuse within the area of work.
12. Clean the work area at the end of each day.
13. Provide system software and programming and other materials necessary for the Audio-Video Systems to function by standard industry practices.
14. Program Audio-Video Systems and load with user define text and specified operations per design specifications and drawings.
15. Perform initial testing, programming, and adjustments with written reports.
16. Make final adjustments, calibrations and programming modifications as directed by the Owner and Consultant.
17. Demonstrate all systems for final acceptance.
18. Preparation of O&M manuals and as-built documents for Owner's use.
19. Providing training for Owner's staff, facility personnel and technical staff.
20. Providing warranty service for a period of one year from acceptance date.
21. Provide extended system support.

1.4   Definitions

a. AVS: Audio-Visual System.
b. OWNER: Texas A&M
c. CONTRACTOR: Contractor or subcontractor providing and installing the Audio-Visual System.
d. PROJECT: TBD
e. PROVIDE: Furnish, install, commission, test, and warrant.
f. WORK: Action required to furnish, install, commission, test and warrant the Audio-Visual Systems.
g. COMPONENT: Any individual item of equipment or material which is an element of the Audio-Visual Infrastructure System.
h. ZONE – Separate parallel signal path with independent processing and alternate program capabilities.
i. AGC: Automatic gain control.
j. CCD: Charge-coupled device.
k. MPEG: Moving picture experts' group.
l. NTSC: National Television System Committee.
m. UPS: Uninterruptible power supply.

1.5   Performance Requirements

a. These specialized AVS systems are designed to efficiently support the Owner's various facilities and activity areas in a manner which can be proficiently managed by the staff. Work shall include the complete turnkey installation and commissioning of these systems per the following specifications and drawings.

b. Warranty
    a. Lifetime integration craftsmanship
    b. One year initial without TAMU staff touching contracted work or equipment.

c. RMA responsibility
    a. Customer ships back items
    b. Displays, projectors, removal, and reinstallation of any item to be done by contractors

d. Advanced replacement of parts
    a. Within 48 hours

1.6   Submittals

a. Product Data:
    1. List all system components including manufacturer and model number.
    2. Manufacturer's literature sheets for all materials and equipment, including warranty information, recommended preventative maintenance and spare part inventory recommendations. Literature containing more than one device shall be clearly marked to delineate item(s) included in the Work.
    3. Clearly indicate color or special finishes.
    4. Correlate products with intended use in Project.

b. Pricing Forms: Contractor shall submit completed pricing form that includes an itemized listing of all equipment, materials and labor required for the installation of the system as specified herein for Change Order pricing. The listing shall contain item descriptions, item model number, quantity, unit cost and extended labor, material and installation cost required to provide a complete and functional system. Note that Schematics show rooms both with and without Video Conferencing functionality; provide itemized pricing by room for both options.

c. Shop Drawings:
    1. Reproducing Contract Documents for shop drawing is not acceptable.
    2. Shop drawings to include the following:
    3. Drawing legend sheet describing all symbols used in the drawings.
    4. Floor plans with all devices and wiring raceway depicted.
    5. Wire runs with tags for type, gauge, quantities, and cable identifiers.
    6. System riser diagram indicating all field devices, riser paths and room designations.
    7. Block diagram for each system showing all equipment and signal pathways.
    8. Point schedules defining interconnection of all inputs and outputs for all equipment including data connections and other systems with cable identifiers.
    9. Elevations of equipment racks and teaching consoles.
    10. Fabrication shop drawings for all custom components.
    11. Diagrams for power, signal, control wiring and grounding.

12. Include plans, elevations, sections, details, and attachments to other work.
    d. Coordination Drawings: Reflected ceiling plans, drawn to scale, with ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated, using input from installers of the items involved. Provide similar elevation drawings for wall-mounted items.
    e. Samples: Provide as requested for colors and texture coordination.
    f. Partial submittals shall not be acceptable without prior approval by Owner.
    g. No portion of the work shall commence, or equipment ordered until the Owner has approved the submittals.
    h. The Contractor shall not be relieved from any contract-required responsibility by the Owner's approval of submittals.
    i. Nothing in the specification shall relieve the Contractor of system package design responsibility, including, but not limited to, all equipment furnished under this Contract. The Contractor is, in all cases, solely responsible for the performance of the delivered AVS, and for furnishing complete system documentation for every part of the system.
    j. Extended AVS Support. Provide pricing for AVS hardware and software support including necessary reconfiguration and database changes for years 2 through 5.
    k. Resubmitting.
        1. Make corrections or changes in Submittals as required by the Consultant's stamp instructions and attached comments and resubmit.
        2. Identify changes on resubmittals by clouding. Only indicated changes will be reviewed when resubmitted.
        3. Added drawings shall be clearly identified.
        4. Contractor shall be responsible for project delays caused by rejected submittals.
        5. Consultant shall be compensated for additional services for submittals rejected more than twice. The amount of such compensation shall be incorporated by change order and withheld from the Contractor 's Application for Payment.

1.7   Quality Assurance
    a. Installer Qualifications:
        1. The Contractor performing the installation shall have a minimum of 5 years' experience in the installation of AVS systems of similar size and scope.
        2. Owner's representative may make such investigations as deemed necessary to determine that the Contractor is responsive, responsible, and qualified in the area of work contemplated by the Contract. In this regard, the Contractor shall furnish the Owner such information as requested for this purpose. Information and data may include (but not necessarily be limited to): Date of organization and/or incorporation and number of years engaged in this business under present firm's names; list of major equipment owned by the company; list of principal personnel who will be involved in the execution of this contract with the experience and qualifications of each person.
        3. Contractor shall have local in-house engineering and project management capability consistent with the requirements of this project. The Contractor shall provide a project

manager that shall be the same individual throughout the project and shall be the person responsible for system programming, preparation of Operation and Maintenance Manuals, Training, Programs, Schedules and Test Protocols, documentation of system testing, maintenance of record drawings and coordination and scheduling of all labor.

4. Contractor shall be or have direct relations with their subcontractors, an authorized manufacturer's representative for all products they furnish or install.

5. Contractor shall have a local organization capable of providing maintenance and service for the specified system. Facility shall be no more than 100 miles from Owner's site.

6. Contractor shall be capable of providing emergency service on a 24-hour, 7 days a week basis.

b. Conflicts:

1. In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify in writing to consultant of any such occurrences before the purchasing of any equipment, materials and/or installation. The Consultant will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to design changes, equipment, materials and/or installation changes. In any event, Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications.

c. The Contractor shall provide all materials, equipment, and installation in compliance with the latest applicable standards from ANSI, ASTM, FCC, IEEE, NCTA, NEC, NEMA, NFPA, REA, TIA/EIA, and UL including but not limited to:

1. American National Standards Institute (ANSI).
2. ANSI T1.404 (DS3) and CATV Applications.
3. American Society for Testing And Materials (ASTM).
4. American with Disabilities Act (ADA).
5. EIA/TIA-569 Standard, Commercial Building Standard for Telecommunications Pathways and Spaces.
6. EIA/TIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
7. National Cable Television Association (NCTA).
8. NCTA-02 NCTA Recommended Practices for Measurements on Cable Television Systems.
9. National Electrical Code (NEC) (Latest revision and pertinent addendums).
10. Article 250, Grounding.
11. Article 300, Part A. Wiring Method.
12. Article 310, Conductors for General Wiring.
13. Article 800, Communication Systems.
14. National Fire Protection Association (NFPA) Publications (Latest revisions and pertinent addendums).
15. Underwriters Laboratories (UL).

d. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

e. NECA 1 Good Workmanship in Electrical Contracting.

1.8 Project Conditions

a. Environmental Limitations: System components shall be equipped and rated for the environments where installed.

   1. Environmental Conditions.

      I. Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

      II. Interior, Controlled Environment: System components installed in conditioned interior environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, non-condensing.

      III. Interior, Uncontrolled Environment: System components installed in non-conditioned interior environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, non-condensing.

      IV. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C)] dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick.

1.9 Project Coordination and Plan

a. Contractor shall submit a project plan detailing the steps and associated timeframe to meet the General Contractor's schedule requirements. Project plan should include benchmarks for items such as regular project meetings, equipment order and delivery, installations, configuration, and calibrations, testing and burn-in, training, substantial completion notification, testing and final acceptance.

b. Contractor assumes total responsibility for coordinating with building trades or other parties as may be identified by the General Contractor.

c. Coordinate size and location of conduit systems, back boxes, and provisions for electrical power to equipment of this Section.

d. The Contractor must obtain written permission from the General Contractor prior to routing and/or installing cable, equipment, or service through the facility.

e. E contractor shall prepare the installation schedule to coordinate sequencing, dependencies and priorities of the system installation including work by other trades.

1.10 Commissioning

a. Commissioning of systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Agent. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Execution Requirements,

Section 01770, for substantial completion details. Refer to Section 01810, Commissioning, for detailed commissioning requirements."

b. The commissioning process requires Submittal review. Division 01 is alerted to the Submittal review requirements in Section 01810.

c. The commissioning process requires Submittal review simultaneously with engineering review. Division 01 is alerted to the Submittal review requirements in Section 01810.

d. This project will have selected building systems commissioned. The Equipment and Systems to be commissioned are specified in Section 01810. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01810. A Commissioning Agent, whose services will be provided by the Owner, will direct the commissioning process.

e. The commissioning process requires meeting attendance. Division 01 is alerted to the meeting requirements in Section 01810.

f. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Section 01810, Commissioning, for further details.

g. System verification testing is part of the Commissioning Process. Verification testing shall be performed by the contractor and witnessed and documented by the Commissioning Agent. Refer to Section 01810, Commissioning, for system verification tests and commissioning requirements.

h. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 01770, Execution Requirements, for contractor training requirements. Refer to Section 01810, Commissioning, for further contractor training requirements.

   a. Any and all Live training will be recorded for future training
   b. Any training hard copy and or digital copy can be reproduced for future training needs of owner.

1.11   VPAT

Vendors should follow University guidelines for Electronic and Information Resource (EIR) Accessibility compliance. Details may be found at the link below.

EIR Accessibility in Texas A&M Procurement (tamu.edu)
Path:https://itaccessibility.tamu.edu/procurement/vpats_in_procurement.php

Existing Voluntary Product Accessibility Templates and approved EIR Accessibility Exceptions may be found in the Accessibility Conformance Evaluation (ACE) tool database linked below.
Link

Path: https://it.tamu.edu/policy/it-accessibility/tools/vpats.php

Part 2 – Products

Product selection by integrators must follow the basic guidelines below. Consumer and in most cases

prosumer grade products are not acceptable. Minimum warranty needs are 1 year however, expectation is for 3-year warranty on all products

2.1   Manufacturers

a. Manufacturer substitutions are not allowed except where products are phased out by the manufacturer and no longer available. All substitutions must be approved by Texas A&M and must be used in the order provided.

2.2   Audio Video Types

a. Coordinate with owner to develop basis for control system GUI "look and feel" for all A/V room types. Review and coordinate all preliminary and final system programming with Owner. Refer to APPENDIX 1 for the initial programming guide.

b. Final programming A/V source code to remain property of Owner. Provided copies of all A/V room types compiled and uncompiled source code, to Owner for backup and future reference as part of the Final Acceptance.

2.3   Audio Video Control Systems

a. Models and count as required by schematic control requirements. Include all necessary interconnecting cables and connectors.

b. Approved manufacturers. Priority manufacturer 1 should be used unless the change is approved in advance by Technology Services - University Audio Visual Services.
    1. AMX
    2. Crestron – only with prior approval
    3. Extron – only with prior approval

2.4   Wired Microphones

a. Priority manufacturer 1 should be used unless the change is approved in advance by Technology Services - University Audio Visual Services.
    1. Shure Electronics.
    2. AKG – only with prior approval
    3. Sennheiser – only with prior approval

2.5   Wireless Microphone

a. Priority manufacturer 1 should be used unless the change is approved in advance by Technology Services - University Audio Visual Services.
    1. Shure Electronics
    2. AKG – only with prior approval
    3. BiAmp – only with prior approval

b.   Frequency ranges: G50 470-534 MHz or H50 534-598MHz

2.6   Lectern Microphones

a. Priority manufacturer 1 should be used unless the change is approved in advance by Technology Services - University Audio Visual Services.
    1. Shure Electronics.
    2. AKG – only with prior approval
    3. Sennheiser – only with prior approval

2.7   Ceiling Microphones
a.   Approved Products:
1.   Biamp
2.   Shure Electronics
3.   Sennheiser

2.8   Microphones Mixer
a.   Approved Products:
1.   QSC
2.   Radio Design Labs
3.   Shure Electronics
4.   Behringer
5.   Yamaha
6.   Mackie
7.   Soundcraft
8.   Mackie

2.9   Conferencing Equipment
a.   Web Video Conferencing: Priority manufacturer 1 should be used unless the change is approved in advance by Technology Services - University Audio Visual Services.
1.   Legrand Vaddio
2.   Logitech Rally
3.   Neat
4.   Aver USA
b.   SIP Video Conferencing: Priority manufacturer 1 should be used unless the change is approved in advance by Technology Services - University Audio Visual Services.
1.   Cisco
2.   Polycom – only with prior approval

2.10   Projection Screens
a.   Approved manufacturers:
1.   Da-lite: must have Low Voltage Contact Closure control. Sized per drawing. Verify ceiling heights for Black Drop. Non-tab tensioned.

2.11   Flat Screen Display Backbox and Mount
a.   Approved products in order of preference:
1.   Chief Mounts
2.   Peerless Mounts
3.   Spectrum

2.12   Displays
RS232 control, Minimum of 2- HDMI in, Minimum resolution: WUXGA 1920x1200 or 4K 4096x2160 (Must support 1920x1080p 60Hz), Audio Output via Fiber, RCA or TRS

    a.   Approved products:
1. Samsung
2. Panasonic
3. Sony
4. LG
5. Neat

2.13   Ceiling Box for projector
    a.   Approved products:
1. FSR
2. Chief
3. Peerless

2.14   Projector
    a.   Approved products in order of preference:
1. Panasonic
2. NEC- only with prior approval
3. Sharp- only with prior approval

    b.   Specifications: Laser preferred, RS232 control, Minimum of 2- HDMI in, Minimum resolution: WUXGA 1920x1200 or 4K 4096x2160 (Must support 1920x1080p 60Hz), Audio Output via Fiber, RCA or TRS.

2.15   Projector Mounts
    a.   Approved manufacturer in order of preference:
1. Chief
2. Peerless

2.16   Scan Converters
    a.   Approved manufacturer:
1. Extron
2. Kramer

2.17   USB Video Capture for in room PC's
    a.   Approved manufacturer:
1. Magewell
2. Extron

2.18   Speakers 70V, 8 ohm or SIP.
    a.   Approved manufacturers:
1. JBL
2. Biamp
3. Atlas
4. Shure

2.19   Document Cameras
    a.   Approved Manufacturer:
        1.   Elmo
        2.   Wolfvision
        3.   Sony

2.20   Cable Cubby
    a.   Approved manufacturers:
        1.   Extron
        2.   AMX
        3.   Crestron

2.21   Power Conditioner
    b.   Approved manufacturers:
        1.   Furman M-8Lx Power Conditioner with lights.
        2.   Surge
        3.   APC
        4.   Triplite

2.22   Digital Scheduling Panels
    a.   Approved products must work with Ad Astra:
        1.   Crestron
        2.   AMX-only with prior approval

2.23   Floor Boxes
    a.   Approved manufacturers:
        1.   LeGrand
        2.   FSR

2.24   Lecterns
    a.   Approved manufacturers:
        1.   Exact Furniture
        2.   Spectrum Furniture- only with prior approval
        3.   Marshall- only with prior approval
    b.   Optional Features:
        1.   Cut outs for: Cable Cubby, monitor
        2.   Keyboard and mouse drawer.
        3.   Document Camera drawer.
        4.   Lockable storage drawer.
        5.   19” rack rails for power conditioner, media converters, VCR, etc.
        6.   Shelf for PC.
        7.   Removable rear access panel.
        8.   Lockable cabinet doors.
        9.   4” hidden wheels
        10. Finish: Coordinate with Architectural.

11. Fans

2.25   A/V Connection Plates

a. Provide types, sizes and configuration per drawings and schedules with the following minimum features:

1. Stainless steel or silver anodized aluminum.
2. Engraved legends.
3. Solder, pig tail style connection and connectors as required.
4. Pass-through not acceptable.

b. Approved manufacturers:

1. Data Pro
2. Covid
3. Extron
4. Liberty
5. Legrand

2.26   Electronics Equipment Rack

a. Approved manufactures and models:

1. Middle Atlantic Products.

b. Provide quantities per drawings and schedules with the following or equivalent features:

1. Welded CRS construction using 14-, 16- and 18-gauge material.
2. Powder coated finish.
3. Key locking front and rear door with vents.
4. 11 ga rack rails tapped with 10-32 mounting holes at standard EIA spacing that complies with TIA/EIA-310-D.
5. Rear top and bottom KO panel.
6. Top and bottom front and side slotted vents.
7. Sized to house all equipment indicated, plus spare capacity.
8. Fill empty rack spaces with blank panels.
9. Ventilation: A low-noise fan for forced-air cabinet ventilation. Fan shall be equipped with a filtered input vent and shall be connected to operate from 105 to 130 VAC/60 Hz; separately fused and switched; arranged to be powered when main cabinet power switch is on.
10. Service Light: At top rear of rack with an adjacent control switch.
11. Vertical Plug Strip: Grounded receptacles, 6 inches (1524 mm) o.c.; the full height of rack.
12. Maintenance Receptacles: Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.
13. Wheels: Sufficient to provide mobility in the event of an impending storm. When applicable
14. 19 inches

2.27   Equipment Rack Shelves

a. Acceptable manufactures and models:

        1. Middle Atlantic Products.
- b. Rack shelves for head-end equipment not designed for rack mounting with the following specifications:
  1. 16-gauge aluminum or steel construction.
  2. Choose the exact model for depth and required load.

2.28 Cables

- a. Provide types and quantities per drawings and schedules.
- b. Conductor Sizing:
  1. Insulation shall be rated for a minimum of 300 volts.
  2. Wire types and minimum sizes:
     a. 70 Volt Speaker Cable - 16 AWG, twisted, stranded CL2/CL2P.
     b. Low Impedance Speaker Cable – minimum 12 AWG, twisted, stranded CL2/CL2P.
     c. Microphone Level Cable - 22 AWG, with 22 AWG drain wire, shielded, twisted, stranded CL2/CL2P.
     d. Line Level Cable - 22 AWG, with 22 AWG drain wire, shielded, twisted, stranded CL2/CL2P.
     e. Low Voltage Control Cable - 18 AWG twisted, stranded CL2/CL2P.
     f. CAT-6 – low skew type.
     g. Digital Media – Per manufacturer (AMX)
  1. Minimum acceptable AVS systems wiring performance standards shall be as follows:
     a. Speaker cable - Per ANSI WC57 standard test.
     b. CAT-6 - Per ANSI/TIA/EIA-568-8.1 standard test.
     c. Fiber optic cable - Per ANSI/TIA/EIA-568-B standard test.
     d. RS 232 - Per ANSI/ WC66 standard test.
     e. Line level shielded audio cable - Per ANSI WC66 standard test.
     f. Microphone level shielded audio cable - Per ANSI WC66 standard test.
     g. Video coax cable - Per ANSI/TIA/EIA–TSB-67standard test.
     h. Multi-conductor control cable - Per ANSI WC57 standard test.
- c. Approved manufacturers:
  1. Liberty
  2. Belden Inc., Electronics Division.
  3. West Penn Wire/CDT; a division of Cable Design Technologies, Inc.
  4. Corning
  5. Crestron
  6. Ortronix

2.29 Cable Connectors

- a. Approved manufacturers:
  1. BTX.
  2. Liberty
  3. Switchcraft

2.30   Interactive Electronic Whiteboard
    a. Approved manufacturers:
        1. SMART Technologies
        2. Samsung flip
        3. Neat Board
        4. Promethean

2.31   Whiteboard Camera
    a. Approved manufacturers:
        1. Logitech Scribe
        2. Huddly Canvas

2.32   Lightboard
    a. Approved manufacturers:
        1. eGlass by hovercam

2.33   Assisted Listening
    a. Approved manufacturers:
        1. ListenTech
        2. Williams Sound

2.34   Amplifier
    a. Approved manufacturers:
        1. Crown
        2. Crestron
        3. BiAMP
        4. QSC

2.35   Digital Sound Processors
Approved manufacturers:

        1. BiAmp
        2. QSC
        3. BSS- only with prior approval

2.36   Wireless video share/collaboration device
    a. Approved manufacturers:
        1. Mersive Technologies

Part 3 -   Execution

3.1   Constructions Meetings
    a. The Consultant and/or Owner will hold regular construction meetings to review the installation schedule. It is mandatory that the Contractor's project manager attend each meeting.

3.2   Site Inspection
a.   Continuously verify that the site conditions are in agreement with the Contract Documents and the AVS design. Notify the Owner's representative immediately of conditions that affect the performance of the installed system.
b.   Coordinate any required work that is not specified in the Contract Documents.

3.3   Coordination
a.   Adequate conduit and back boxes are provided for the specified system installation.
b.   Adequate power has been provided for the specified system installation.
c.   Verify mounting location of all devices with Owner prior to installation.

3.4   General
a.   The Contractor shall be responsible for providing all wire and cable as required for complete and operational system.
b.   All cables must be continuous from device location to the final point of termination. No mid-run cable splices will be allowed.
c.   Make connections and splices with solderless devices that are mechanically and electrically secure in accordance with manufacturer's recommendations.
d.   The cable installation techniques shall be such that the mechanical and communications characteristics of the cables are not degraded at the time of installation. Any special environmental requirements for equipment shall be specified.
e.   Wiring Method: Install cables in raceways except in accessible indoor ceiling spaces, in hollow gypsum-board partitions, and as otherwise indicated. Conceal raceways and wiring except in unfinished spaces.
f.   Distribution of the cabling will be accomplished through cable trays, J-hooks, cable runways, conduit raceways, ducts, core holes, extended columns, false half columns and plenums. Horizontal cable segments will be placed in cable trays and when they leave cable trays will be supported by distribution rings. Where cables converge at equipment room locations, they will be supported by cable runways and distribution rings. All cable placements shall be based on the enclosed drawings.
g.   The Contractor shall not place wiring in the same conduit or raceway with wire for electrical power distribution.
h.   Connectors to all devices in the system shall be protected against moisture. Approval of the method shall not relieve the Contractor of full responsibility for proper application and workmanship of the materials in the manner specifically approved. All connector threads shall be treated with an approved silicone lubricant.
i.   The Contractor shall be responsible for providing approved grounds for all AVS system equipment per the manufactures recommendations. The Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes, and framework. All ground connections shall consist of a minimum of 12 AWG copper wire and shall be supplied from an approved building ground and bonded to the main electrical ground. Contractor must notify the Owner prior to making any changes in submitted system design and/or installation.

j. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

k. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

l. Grounding: Provide independent-signal circuit grounding per practices published by the manufacturer.

3.5   Identification, Labeling and Documentation

a. The Contractor shall label all termination devices, panels, enclosures and equipment rooms. The Contractor will mark each unit with permanently attached markings that will not impair the equipment or present a hazard to maintenance personnel.

b. Place wire identification numbers ½" from each end of all conductors by using sleeve type heat shrinkable markers. Install markers to be readable from left to right or top to bottom. Wire numbers shall be computer printed (Brady TLS2200 with Permasleeve cable marking labels or equivalent). Handwritten labels are not acceptable.

c. Mark all spare conductors.

d. Contractor to maintain a progress set of design documents on the Project site. These documents shall be updated daily to reflect the current condition of the work and available for review by the Consultant and Owner when requested.

e. If changes occur prior to acceptance testing altering the documentation previously furnished. The Contractor shall formally update and reissue the relevant documentation to the Consultant and Owner.

f. Consultant and Owner will review all documentation for accuracy and completeness and may reject substandard submittals.

g. The Contractor shall establish and maintain complete system documentation, including documentation procedures, operational information, configuration information and drawings. Documentation shall include the following:

    1. Floor plan drawings indicating device locations, unique system point numbers with device legends indicating manufacturers and model numbers for each device.

    2. The unique system point number of a device shall identify either through the software or hardwire connection, the specific device or group of devices associated with the unique point number in the system.

    3. Floor plan drawings indicating conduit and wire routing and junction box locations.

    4. Wire routing shall include cable identification and terminal strip numbers.

    5. Mounting details for all equipment and hardware.

    6. Functional block diagrams for each system.
       Wiring details showing rack elevations, equipment wiring and terminations and inter-rack wiring.

3.6   Field Quality Control

a. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.

b. Pre-testing: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements.

c. Test Schedule: Schedule tests after pre-testing has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.

d. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

e. Remove and replace malfunctioning items and retest as specified above.

f. Record test results for each piece of equipment.

g. Re-test: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.7   Adjusting

a. Speaker Systems

1. Equalize speaker systems flat from 80 Hz to 2 KHz with a 2dB per octave roll-off thereafter. Program a high pass filter at 60Hz with 12dB per octave roll off and a low pass filter 15

    a. Technical operation, adjustments, and programming.

    b. System features and programming.

    c. Review of as-built drawings.

    d. Provide a hands-on training with Q & A session

2. Use a minimum of three measurement locations in the system's intended coverage area to calibrate the system response.

3. Verify system gain and amplifier levels.

4. Verify speaker polarity.

5. Adjust appropriate speaker delays.

6. Set and adjust limiters.

7. Contractor shall provide for calibration of the system:

    a. Sound analyzer (SmartLive, TEF SoundLab, Meyer's SIM or equivalent) with trained operator for adjusting and verifying delay timing, cabinet aim and equalization.

    b. Suitable calibrated microphone.

    1. The Contractor shall coordinate this testing and calibration. It is anticipated that this work will take 1 hour per classroom. It will be necessary to have a quiet room during these times.

    2. Contractor to record all measurements, settings, and adjustment for inclusion in the O&M manuals.

3. The contractor shall provide Wireless Microphone Channel Set Up to Adjustments ensuring frequencies do not interfere with each other or other pre-installed systems

b. Adjust limit switches on electric operated projection screens.

c. Adjust back focus on all video cameras.

d. Occupancy Adjustments: When requested within 12 months following the date of Substantial Completion, provide on-site assistance in adjusting systems to suit actual occupied conditions and to optimize performance of the installed equipment. Tasks shall include, but are not limited to, the following:

    1. Check cable connections.

    2. Check proper operation of equipment.

    3. Adjust all presets; consult Owner's personnel.

    4. Recommend changes to the AVS to improve Owner' utilization of the system.

    5. Provide a written report of adjustments and recommendations.

3.8   Training

a. AVS training shall be provided for the operator/user and technical staff. Operator/user training shall minimally consist of 1 each 1-hour sessions per room of unique design. Technical operation and maintenance training session shall minimally 1 each 1-hour sessions per room of unique design.   Training sessions to be coordinated with the Owner and scheduled prior to the first day of technology use, throughout the 1-year warranty period.

b. The complete operation and maintenance manuals and preliminary as-built drawings shall be delivered to the Owner one week prior to the training sessions.

c. Operator/user training shall minimally consist of:

    1. Provide custom system specific printed reference material for each trainee that documents and explains in layman's terms:

        a. System block diagram.

        b. Normal day-to-day operation.

        c. Operator selectable features.

        d. Provide hands-on training with Q & A session.

    2. Provide and review a custom, system specific, quick reference guide for inexperienced operators.

d. Technical Operations and Maintenance training shall consist of:

    1. The technical explanation shall be sufficiently thorough that: staff personnel shall be able to make any programming changes required, analyze malfunctions and make equipment substitutions or bypasses necessary to maintain system operation except for the malfunctioning equipment or circuits.

    2. Provide printed reference material for each trainee that documents and explains in technical terms:

        a. System block diagram with technical features.

        b. Technical operation, adjustments, and programming.

        c. System features and programming.

        d. Review of as-built drawings.

e.   Provide hands-on training with Q & A session.

3.9   Warranty

a.   The Contractor shall warrant the system for parts and labor for one (1) year. Warranty commences at the time of final project completion and acceptance by Owner. Nothing shall be construed to limit this obligation to a shorter period.

b.   Warranty service shall be rendered on-site by request of Owner to repair or replace any defective materials, equipment, and workmanship without cost to the Owner, unless the Owner has previously given the Contractor a written acceptance of such condition.

c.   The Owner shall give prompt notice of the defect(s) either verbally or in writing to Contractor.

d.   Perform preventative maintenance during the warranty period, which includes:

1.   Cleaning and inspection of all devices every 6 months.
2.   Clean and vacuum console and rack equipment every 6 months.

e.   Service technician performing service / warranty work shall check-in and out with Owner for each visit.

f.   Provide a written report to Owner documenting any work performed during the warranty period within 24 hours of such event. Report shall detail work performed, equipment repaired or replaced, etc.

g.   Provide loner equipment that is equivalent to malfunctioning equipment for any equipment not field repairable.

h.   Repair or Replacement Service.

1.   Repair or replacement service during the warranty period shall be performed 7 days a week, 24 hours a day and with a 4-hour response time.
2.   Emergency repair or replacement service during the warranty period shall be performed 7 days a week, 24 hours a day and with a 1-hour response time.
3.   If the Contractor cannot restore system operation during the warranty period within 2 business days of the system failure, the Owner reserves the right to require the Contractor to provide on-site manufacturer's service technicians at no additional cost.
4.   The Owner reserves the right to expand or add to the system during the warranty period using firm(s) other than the Contractor for such expansion without affecting the Contractor's responsibilities, provided the expansion is performed by an authorized dealer for the affected equipment.

3.10   Substantial Completion

a.   Work must meet the following requirements to qualify for the Owner's consideration of Substantial Completion:
1.   All AVS devices shall be fully installed, powered, online and fully operational.
2.   All sub-system interfaces must be complete and operational.
3.   All training complete.
4.   Owner may utilize the system for its designed intent.

b.   Contractor will provide a list of remaining work items and approximate completion date.

c.   Contractor will certify in writing that all remaining work is minor in nature and will be completed in less than 30 days.

3.11 Testing Requirements

a. The Contractor shall perform sample tests in the presence of the Consultant and Owner. Performing the testing procedures specified herein assures that the communication cabling and system electronics meets the performance characteristics specified.

b. All testing shall comply with EIA/TIA Standards and that of the equipment manufacturers. If testing indicates that the performance characteristics are not met, the test shall be failed test and any other test that may be affected by the modification and/or repair shall be rerun and verified.

c. Test equipment will be provided by the Contractor to test and to certify the 100% operational condition of all materials and equipment.

d. The Contractor shall prepare and submit all test procedures and data forms for the pre-installation, post installation and subsystem test to Owner. The test procedures shall have Owner approval before the tests.

3.12 System Check out and Verification

a. Verify continuity of cabling between field devices and controllers.

b. Commission all devices from field to front end.

c. Contractor supplied "As Built" Drawings shall show conduit routing.

d. Review all as-built documentation and Operation and Maintenance manuals with Owner. Revise and reissue as required.

e. Demonstrate proper sequences of operation for all devices.

3.13 Final Acceptance of Systems

a. Each area of construction completed and submitted as complete shall meet the following criteria under testing:

   1. System must meet all specifications as described in these instructions.
   2. Operational prints, manuals, signal logs, and as built prints must be furnished.
   3. Visual testing and signal verification will be conducted at random locations to determine that equipment performs satisfactorily.

b. Specifications set forth for construction of the system have been devised in order to ensure system compatibility and performance. Compliance to these specifications will be determined during periodic observances of construction. Repeated failure to comply with the specification will be considered before the initial acceptance phase of the plant commences.

c. Within ten days receipt of the final acceptance notice, the Owner's representatives shall schedule and perform the final inspection. When the work is found acceptable under the contract documents and the contract is fully performed, declare the project complete.

3.14 Pricing Forms

a. In addition to all other required bid forms, Contractor shall prepare and present to Owner and Owner's representative pricing based on the requirements of this and other Division 28 specifications and complementary drawings.

b. Pricing shall include the list of equipment and labor in tabular form including part number, item description, unit price, number of units, extended price and totals. The pricing shall breakdown the material and labor in the categories.

c. Contractor shall provide Service Agreement pricing levels for terms of 1, 2 and 3 years. Breakout service pricing levels by response times of within 2 hours, 24 hours, or more than 24 hours.

END OF SECTION

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