This BULLETIN describes a (Document Clarification), which may affect the Contract (Sum and/or Time). The Contractor is requested to respond to this Bulletin in writing to the Architect per the agreed upon Procurement Plan. When pricing is approved this Bulletin (will become) an authorization (or) a directive to change the work.

Description:

Bulletin 005 was issued after the bid date by A&E for the re-bid of the Audio Visual component of the building. Reference General Contractor’s "AV re-bid package" for additional procurement information.

Contractor’s Response:

The projected extension of the Substantial Completion Date, due to the change specified by this Bulletin, would be _____ days.

Initiated By: A&E

Prepared By: A&E

Drawings Affected:
TA series drawings
EPS sheets 1-12, 1-13, 1-22, 1-23, 1-32, 1-33
(Also Ref. ACE memo)
TN sheet 1-12, 1-13
ASK-013

Attachments:
Bulletin 005

Distribution: per Electronic file distribution

Project Manual Sections Affected:
11 52 13 - Projection Screens, 11 61 45 - Motorized Rigging, 26 51 01 - Lighting Systems, 27 51 17 - AV Systems
SECTION 11 52 13 - PROJECTION SCREENS

PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes:
      1. Manually operated, front-projection screens.
      2. Electrically operated, front-projection screens and controls.
   B. Related Requirements:
      1. Section 115213.19 "Rear Projection Screens."

1.2 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings: Show layouts and types of front-projection screens. Include the following:
      1. Location of seams in viewing surfaces.
      2. Anchorage details, including connection to supporting structure for suspended units.
      3. Location of wiring connections for electrically operated units.
      4. Wiring diagrams for electrically operated units.

PART 2 - PRODUCTS

2.1 MANUALLY OPERATED, FRONT-PROJECTION SCREENS
   A. General: Manufacturer's standard spring-roller-operated units, consisting of case, screen, mounting
      accessories, and other components necessary for a complete installation.
      1. Tab Tensioning: Provide units that have a durable low-stretch cord, such as braided polyester, on
         each side of screen that is connected to edge of screen by tabs to pull screen flat horizontally.
   B. Surface-Mounted, Metal-Encased, Manually Operated Screens without Tab Tensioning: Units designed
      and fabricated for surface mounting on wall or ceiling, fabricated from formed-steel sheet not less than
      0.027 inch (0.7 mm) thick or from aluminum extrusions; with flat back design and vinyl covering or
      baked-enamel finish. Provide units with matching end caps and concealed mounting.
      1. Dalite Model C with CSR or approved equal
   C. Recessed - Mounted, Metal-Encased, Manually Operated Screens without Tab Tensioning: Units designed
      and fabricated for surface mounting on wall or ceiling, fabricated from formed-steel sheet not less than
      0.027 inch (0.7 mm) thick or from aluminum extrusions; with flat back design and vinyl covering or
      baked-enamel finish. Provide units with matching end caps and concealed mounting.
2.2 ELECTRICALLY OPERATED, FRONT-PROJECTION SCREENS

A. General: Manufacturer’s standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation.

1. Controls: Remote, key-operated three-position control switch for the following rooms:
   - Sitting Stair 206 – Switch control located in AV rack in room 0123
   - Medium Classroom 0337 – Switch control located at West end of room
     a. Provide locking cover plates for switches.
     b. Provide key-operated, power-supply switch.

2. Controls: Remote, Low Voltage Controls wiring for control via Extron AV system provided by others for the following room:
   - Inspiration Hall 201 – Wire low voltage wire to AV rack in room 0301A

3. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, and positive-stop action to prevent coasting.

4. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8-inch- (9.5-mm-) diameter metal rod with ends of rod protected by plastic caps.

5. Tab Tensioning: Provide units that have a durable low-stretch cord, such as braided polyester, on each side of screen that is connected to edge of screen by tabs to pull screen flat horizontally.

B. Surface-Mounted, Metal-Encased, Electrically Operated Screens with Tab Tensioning: Motor-in-roller units designed and fabricated for surface mounting on wall or ceiling, fabricated from formed-steel sheet not less than 0.027 inch (0.7 mm) thick or from aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide with matching end caps and concealed mounting.

1. Dalite Tensioned Cosmopolitan Electrol - Electric Screen or approved equal

2.3 FRONT-PROJECTION SCREEN MATERIAL

A. Matte-White Viewing Surface: Peak gain of not less than 1, and gain of not less than 0.8 at an angle of 60 degrees from the axis of the screen surface.

1. Dalite Da-Mat or approved equal

B. Material: Vinyl-coated, glass-fiber fabric or vinyl sheet, or approved equal.

C. Seamless Construction: Provide screens, in sizes indicated, without seams.

D. Edge Treatment: Black masking borders.

E. Size of Viewing Surface:
   1. Type A: 45 by 72 inches (qty 6)
2. Type B: 87 by 139 inches (qty 2)
3. Type C: 144 by 192 inches (qty 1)
4. Type D: omitted
5. Type E: 60 by 96 inches (qty 2)
6. Type F: 180 by 288 inches (qty 2).
7. Projection screen type sizes and locations shown in “TA” set of plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install front-projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.

1. Install low-voltage controls according to NFPA 70 and complying with manufacturer's written instructions.

   a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

2. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.

END OF SECTION 11 52 13
SECTION 11 52 13 - PROJECTION SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manually operated, front-projection screens.
   2. Electrically operated, front-projection screens and controls.

B. Related Requirements:
   1. Section 115213.19 "Rear Projection Screens."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show layouts and types of front-projection screens. Include the following:
   1. Location of seams in viewing surfaces.
   2. Anchorage details, including connection to supporting structure for suspended units.
   3. Location of wiring connections for electrically operated units.
   4. Wiring diagrams for electrically operated units.

PART 2 - PRODUCTS

2.1 MANUALLY OPERATED, FRONT-PROJECTION SCREENS

A. General: Manufacturer’s standard spring-roller-operated units, consisting of case, screen, mounting accessories, and other components necessary for a complete installation.

   1. Tab Tensioning: Provide units that have a durable low-stretch cord, such as braided polyester, on each side of screen that is connected to edge of screen by tabs to pull screen flat horizontally.

B. Surface-Mounted, Metal-Encased, Manually Operated Screens without Tab Tensioning: Units designed and fabricated for surface mounting on wall or ceiling, fabricated from formed-steel sheet not less than 0.027 inch (0.7 mm) thick or from aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide units with matching end caps and concealed mounting.

   1. Dalite Model C with CSR or approved equal

C. Recessed - Mounted, Metal-Encased, Manually Operated Screens without Tab Tensioning: Units designed and fabricated for surface mounting on wall or ceiling, fabricated from formed-steel sheet not less than 0.027 inch (0.7 mm) thick or from aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide units with matching end caps and concealed mounting.
1. Dalite Advantage Manual with CSR or approved equal

2.2 ELECTRICALLY OPERATED, FRONT-PROJECTION SCREENS

A. General: Manufacturer’s standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation.

1. Controls: Remote, key-operated three-position control switch for the following rooms:
   - Sitting Stair 206 – Switch control located in AV rack in room 0123
   - Medium Classroom 0337 – Switch control located at West end of room
     a. Provide locking cover plates for switches.
     b. Provide key-operated, power-supply switch.

2. Controls: Remote, Low Voltage Controls wiring for control via Extron AV system provided by others for the following room:
   - Inspiration Hall 201 – Wire low voltage wire to AV rack in room 0301A

3. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, and positive-stop action to prevent coasting.

4. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8-inch- (9.5-mm-) diameter metal rod with ends of rod protected by plastic caps.

5. Tab Tensioning: Provide units that have a durable low-stretch cord, such as braided polyester, on each side of screen that is connected to edge of screen by tabs to pull screen flat horizontally.

B. Surface-Mounted, Metal-Encased, Electrically Operated Screens with Tab Tensioning: Motor-in-roller units designed and fabricated for surface mounting on wall or ceiling, fabricated from formed-steel sheet not less than 0.027 inch (0.7 mm) thick or from aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide with matching end caps and concealed mounting.

1. Dalite Tensioned Cosmopolitan Electrol - Electric Screen or approved equal

2.3 FRONT-PROJECTION SCREEN MATERIAL

A. Matte-White Viewing Surface: Peak gain of not less than 1, and gain of not less than 0.8 at an angle of 60 degrees from the axis of the screen surface.

1. Dalite Da-Mat or approved equal

B. Material: Vinyl-coated, glass-fiber fabric or vinyl sheet, or approved equal.

C. Seamless Construction: Provide screens, in sizes indicated, without seams.

D. Edge Treatment: Black masking borders.

E. Size of Viewing Surface:
   1. Type A: 45 by 72 inches (qty 6)
2. Type B: 87 by 139 inches (qty 2)
3. Type C: 144 by 192 inches (qty 1)
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6. Type F: 180 by 288 inches (qty 2).
7. Projection screen type sizes and locations shown in “TA” set of plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install front-projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.

1. Install low-voltage controls according to NFPA 70 and complying with manufacturer's written instructions.

   a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

2. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.

END OF SECTION 11 52 13
SECTION 11 61 45 – MOTORIZED RIGGING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Related Documents
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. Governing Clause
1. For the sake of brevity, these specifications shall omit phrases such as "Contractor shall furnish and install", "unless otherwise indicated or specified", etc., but these phrases are nevertheless implied. Mention of materials and operations requires the Contractor to furnish and install such materials and perform such operations completely to the satisfaction of the owner's representative.

C. Scope of Work
1. One company shall be responsible for the installation of all aspects of the stage rigging equipment. Work under this section shall include furnishing all labor, materials, tools, transportation services, supervision, etc., necessary to complete installation of the stage rigging equipment as well as any other items as herein listed, all as described in these specifications, as illustrated on the accompanying drawings; or as directed by the Owner's Representative. Work includes the following:
   a. Motorized Rigging

D. Substitutions:
1. Specific items of equipment are specified by trade names. It has been determined by the systems designer that these are the particular items desired by the Owner and establish a standard of quality, equipment function and/or process. It is not the purpose or intent of these documents to eliminate competitive bids. In order to allow proper and fair comparison of pricing, contractors are required to submit their base bid price on the specified equipment. A contractor may submit an alternate bid based on equipment different from that specified only if that Contractor has received prior approval in writing from the Architect at least 10 days prior to bid. Accompanying each request shall be a letter specifically detailing each substitution including catalog data, specifications, operative samples, technical information, drawings, performance and test data, and complete descriptive and functional information to assist in a fair evaluation. Failure to submit any substitution for prior approval or not providing sufficient data for evaluation shall require the exact item specified to be furnished. Architect's approval of a substitution for bid purposes will not relieve the contractor from the responsibility of meeting all specification criteria. If an approval of a substitution is granted, the Contractor shall be fully responsible for any and all changes (wiring, power, distribution, support structure, etc.) such substitution shall require.

E. Defective or Non-approved Materials
1. Should any equipment be found defective, not meeting specifications, or that which has not been approved in writing by the Architect shall, upon discovery (including any time within the period of the guarantee), be replaced with the specified equipment or material at no additional cost.

F. Guarantee
1. The Contractor shall guarantee all of the work that is performed under this contract, including all materials, and workmanship, for a period of three (3) years from the date of full acceptance of the work in accordance with the following conditions.

2. Warranty shall be in effect on materials and equipment for three years from the date of system commissioning under the following conditions:
   a. Maintaining the warranty in effect requires annual inspection of the system by a factory trained and certified contractor. Continuing annual inspection is strongly encouraged.
   b. The three-year warranty is contingent upon annual inspection at the end of the first and second years of service. The end user is responsible for making arrangements for each inspection with the contractor identified on the Motor Controller or a factory certified inspector/installer.
   c. In the event annual inspection is not requested and performed at the end of the first or second year of service, the warranty shall become void at the end of that year of service.
   d. Each warranty inspection report must be sent to the factory by the inspecting contractor within 10 days of completing the inspection.

3. Nothing in this guarantee shall cause repair or replacement by the Contractor where negligence, neglect or improper operation by the Owner has caused the failure of any equipment installed under this contract.

G. Discrepancies
1. All equipment shall be sized to fit properly. The exact measurements are the responsibility of the Contractor. If there are discrepancies in the specifications, the Contractor shall ask for a clarification from the Architect. If no clarification is requested, the Architect's judgment shall rule.

H. System Integrator
1. The Contractor may utilize a System Integrator to coordinate and assist in the installation of all aspects of the motorized rigging equipment as specified in this section. This shall include but not be limited to all motorized rigging and miscellaneous equipment. The following companies have prior approval as System Integrator:
2. In order to be considered as a System Integrator on this project, each Contractor requesting approval must submit to the Architect at least ten (10) days prior to the date of bid opening a letter expressing his intent to bid. This letter shall include a list of at least five (5) projects of similar size and scope completed by this firm within the last five (5) years. Inspection of one completed installation may be requested by the Architect/Engineer's Representative prior to consideration of request to bid. The System Integrator shall have been in business under the same name for five (5) full years preceding the date of this bid doing work similar to the type specified. ETCP certification in theatre rigging is required by the lead installer or project manager of the System Integrator to receive approval to bid. Verification of this certification must be provided to be considered for approval. The decision of the Architect as to the capability of the Bidder to successfully complete and maintain the system based on this pre-qualification information shall be final.
3. Pre-Bid request letter shall include a statement that all major items of equipment shall be bid and supplied as specified, or shall contain details of all proposed substitute equipment for review by the Architect/Engineer's Representative. Substitute equipment items to include specifications, parts numbers, and details of interconnection to proposed system. The decision of the Architect as to the acceptability of substitute equipment shall be final.
4. The System Integrator shall employ only fully trained stage riggers and mechanics, for the erection of the stage equipment. The stage riggers shall be completely familiar with the type of equipment to be installed. A competent job superintendent shall be on the job at all times when work is in progress. The job superintendent must be ETCP certified in theatre rigging. A copy of the certification must be furnished to the General Contractor prior to the start of the installation.
1. For the purposes of establishing a standard of quality desired on this project, the rigging hardware products of Electronic Theatre Controls of Middleton, Wisconsin are specified.

2. All other companies must receive prior approval to bid this project. Please refer to the section regarding substitutions.

J. Documentation

1. SHOP DRAWINGS: Shop drawings and equipment data sheets shall be submitted to the Architect under general provisions within 45 days after award of the contract. Failure to comply with this 45 day requirement shall be cause for disqualification of the selected Contractor and cancellation of contract without cost to the owner, on the basis that the selected Contractor does not have the ability or intention to comply with the specifications. Approval of submitted equipment shall be obtained prior to equipment purchase or fabrication. If shop drawings are rejected, correct and resubmit in the manner specified. All shop drawing information shall be submitted at the same time; no partial submittal shall be accepted. Drawings shall indicate complete details, dimensions, product types and locations of all equipment, clearances required, guides, cables, sets, Contractor fabricated equipment, and all other details required to completely describe the work to be performed. Submittals drawings shall be presented at a scale not less than 1/4" for equipment layouts and ½" = 1'-0" for equipment details, mounting and other details. Each sheet shall allow space for approval stamps and have the name of the project, the contractors and/or the supplier's name, address telephone number, and the date submitted. Submit the following items for Architect's approval, prior to fabrication:
   a. Stage plan view
   b. Stage side section view
   c. Gridiron layout indicating all stage equipment
   d. Electrical riser diagrams indicating the necessary power and control wiring for all rigging equipment and systems
   e. Plan and elevation views indicating all power, motor and control hardware locations and layout
   f. Provide full dimensions for panel layouts with finishes and materials for all custom panels
   g. Details of installation and erection, including adjoining conditions and necessary clearances
   h. Indication by arrow and boxed caption of each variation from contract drawing and specifications, except those indicated as acceptable in specifications or on drawings

2. RECORD DRAWINGS AND DATA: Submit in accordance with General Provisions. Within 30 days of final test and completion of the installation, submit the following to the Architect:
   a. Three (3) complete sets of "as built and approved" drawings showing systems and elements as installed, including field modifications and adjustments
   b. Three (3) sets of maintenance data including a list indicating replacement parts lists for all items of equipment, wiring diagrams, control diagrams, any and all keys for cabinets, racks, key operated switches etc. and complete operation manuals.
   c. Three (3) Certificates of Guarantee

3. INSTRUCTION OF OWNER PERSONNEL: This contractor or his representative, fully knowledgeable and qualified in systems operation, shall provide four (4) hours of instruction to the Owner-designated personnel on the use and operation of this System. Designated instruction times shall be arranged through the Architect.

4. PERMITS: Obtain all permits necessary for the execution of any work pertaining to the installation, and conform in all trades with all applicable local codes and national codes. Obtain all permits necessary for operation of any equipment by the Owner.

5. CLEAN UP: It shall be the responsibility of this Contractor to remove all debris from the building or site caused by his operations to a common trash point or receptacle on the job site, as determined by the General Contractor.
PART 2 - PRODUCTS

2.1 GENERAL

A. No substitution without prior written approval shall be allowed.

1. Motorized Rigging
   a. ETC P1500E – CUSTOM MOTORIZE BATTENS PER PLANS (INCLUDES CONNECTOR STRIP)

2.2 QUICKTOUCH FIXED SPEED CONTROL SYSTEM

A. General
   1. The entire motor system shall be operated by a QuickTouch fixed speed controller. It shall be purpose-designed and fabricated to manage and operate motors specifically designed for overhead lifting. Each system shall incorporate mechanical, electrical and safety features that shall be inherent to this equipment and shall provide an engineered, efficient device to control the equipment. The mechanical, electrical and safety features of this control system shall establish the standard of quality, performance and safety by which motoring systems of other manufacture shall be evaluated.
   2. The QuickTouch Control System shall consist of a surface, flush or rack mounted primary control panel and up to three remote E-stop stations.
   3. The motoring system shall also include one QuickTouch Fixed Speed Remote control device with 30’ of flexible cable that may be attached to the system at the QuickTouch control panel.
   4. The controller shall include the following features:
      a. Key operated power switch
      b. LCD display for feedback/operating information
      c. Key operated motor load profile training/enable switch
      d. Latching motor selection buttons with rear illuminated naming tabs
      e. Rear illuminated hold-to-operate (dead-man) up and down operation buttons
      f. Dedicated E-stop button
      g. Outlet for wired remote
      h. Optional door
      i. Optional rack mount kit
   5. The control system shall only employ the QuickTouch controller, a power and control distribution infrastructure and the motors. A System that requires separate drive cabinets or motor-starters shall not be acceptable.

B. Enclosure
   1. The back box and face panel shall be fabricated from 16ga powder coated sheet steel specially formed to provide support for installation as well as support for all components installed within the housing.
   2. The QuickTouch face panel shall be printed with complete labeling information to identify the function of each of the buttons in the control station.
   3. The face panel shall identify the system as a QuickTouch controller for stage rigging.
   4. The face panel shall be shades of grey. The ring surrounding the E-stop button shall be safety yellow and shall be rear illuminated
   5. The steel panel to which all switches are mounted shall be removable via screws in the surface located underneath the face panel film.

C. LCD Screen
   1. The liquid crystal display shall be purpose designed to communicate all information in human readable text.
2. The screen shall be rear illuminated and shall be dimmable.
3. During system start up the screen shall show the progress of the motors diagnostics self-tests. Upon completion of the startup sequence the screen shall indicate that the system is “OK” or shall provide specific information should a fault be detected. Fault conditions shall be reported in human readable text. Systems that report fault conditions in a series of blinking lights shall not be acceptable for this installation.
4. When a motor is selected the LCD screen shall readout the motor name or number, its current position above the floor, the amount of weight suspended from the batten, the preset position that is recorded, as well as a bar graph scale that shows the current position of the motor, top and bottom limits and the current weight suspended from the motor.

D. Motor Selection/Operation Buttons
1. There shall be rear illuminated motor selection buttons. Buttons shall remain illuminated until deselected.
2. Up to four motors may be selected to move at one time. When the up or down button is pushed and held, each motor shall move to its next stop location. If the stop location is the adjustable preset, the motor can be made to continue to travel in the selected direction by releasing and re-pressing the up or down hold-to-operate button until the next stop for the motor(s) is reached.
3. A maximum of four motors may move at one time and only in one direction at a time.
4. Although four motors moving at one time is the factory default, it shall be possible to increase to eight or reduce to one the quantity of simultaneously moving motors.
5. As a backup, there shall be dedicated hardware to detect and disable the system when the user attempts to move more than the configured maximum quantity of motors.
6. All buttons shall fit neatly within each of the cover panel cutouts on the controller.

E. Key Switches
1. A key switch shall control power to the control system. The key must be in the lock and the key turned to the on position for the motoring system to operate.
2. A separate key is required to turn on the load profiling system. That key must be in the lock and turned to the “ON” position for load profiling to function.
3. When load profiling is turned on the motor shall know the amount of weight that is supposed to be supported by the batten at any location in the path of travel. Should the weight exceed or be reduced below the profiled weight by a preset value, the motor shall stop operation until the fault is cleared.

F. Slack Line Detector
1. The slack line detector is located in the Powerhead. When a slack line condition occurs, it shall cease motor movement and result in a fault message on the LCD screen on the controller. Movement in the upward direction shall be possible to clear the fault.

G. E-Stop
1. The E-stop button on the QuickTouch controller shall be a mushroom button with a rear illuminated ring surrounding the button. During normal operation the E-stop button shall be in the out position. An E-stop can be activated via this button by firmly pressing the button in. The button shall latch and immediately cause a class zero stop of all motors in the system. The LCD screen shall report this as an E-stop fault. To continue system operation the E-stop button must be cleared by twisting the button to release the latch. Power to the control station must be cycled off/on to re-initiate the system. This action shall also initiate a self-test of the entire control system and contactors.
2. The illuminated ring around each E-stop button shall be dimmable. The status of the lighted ring shall provide additional information about the state of the system as follows:
   a. Ring at low intensity: no motor moving
   b. Ring at high intensity: motor(s) moving
c. Ring blinking: system in E-stop condition

3. Up to three remote E-stop stations may be connected to the system. Each additional E-stop station shall operate in the same way as the primary E-stop at the QuickTouch control panel.

H. System Diagnostics

1. Upon energization the control system shall perform an automatic series of diagnostic tests that assure that all system safety functions are working. Should an error in the safety functions be determined, the controller shall report back a fault condition in the LCD display window and shall identify the nature of the fault.

2. Monthly, the system automatically shall perform an additional series of diagnostic tests to determine if there are any problems with any portion of the motor control system safety features. In the event of a problem, the controller shall report back a fault condition in the LCD display window and shall identify the nature of the fault.

3. Eleven months after a system inspection has been performed, the system shall remind the user to schedule full system maintenance/inspection. The reminder shall remain in the system with a count-down calendar until it is turned off by the factory authorized and trained inspector.

4. The installing contractor shall be able to leave contact information within the system. This information shall be displayed at power up and in the event of severe fault conditions.

I. Remote Control Pendant

1. An optional remote control pendant with 30’ long attached cable and plug shall be provided for the system. The remote control must be plugged to the QuickTouch control panel. When the remote control is plugged in the E-stop on the remote is active. Systems requiring “shunt plugs” to bypass an unplugged remote control connector shall not be acceptable.

2. The remote control provides up/down control for those motors that have been preselected at the QuickTouch controller.

J. System Commissioning

1. It shall be possible to commission basic functionality of the system without a laptop computer or additional software.

2. A trained installer shall commission the full system via a laptop computer connected via the built-in USB port in the controller. USB connectivity shall not require special USB drivers.

3. Commissioning software shall feature an inspection report generator that allows a step by step inspection of the control system. Upon completion, the system shall generate an inspection report in PDF format.

INSTALLATION

3.1 GENERAL

A. Installation of this equipment shall only be performed by ETC approved and factory trained theatrical rigging installers. Installation shall be performed in a workmanlike manner and shall strictly adhere to the standards of these specifications and ETC’s installation requirements. Where necessary, the installer may make adjustments to accommodate unforeseen impediments to installation. The completed work must achieve all electrical, safety and appearance requirements as established in these specifications.

B. Work shall be performed in accordance with OSHA and local codes.
C. On site welding shall only be performed per AWS D1.1 standards and with advanced approval from the architect or Owner’s representative.

D. Division of responsibilities
   1. The rigging contractor shall be responsible for providing and installing:
      a. Powerhead
      b. Compression Tube, Compression Tube splices and Compression Tube beam clamps
      c. Supplementary steel and/or mounting adapters for the hoisting systems, if required
      d. Loft blocks
      e. Wire rope lift lines and terminations
      f. On electrics line sets: Cable Management system for distribution raceways, including low-voltage, ground and data wiring
      g. On electrics line sets: Factory prewired electrical termination boxes that are part of the cable management system.
      h. On electrics line sets: Factory prewired distribution raceway mounted at the bottom of the wire rope on the stage electrics sets
      i. Pipe batten attached to RACAs or Hanger Brackets
      j. Batten end caps
      k. Batten labels
      l. Attachment of the prewired twist-lock connector to the Power and Control Distribution outlet
      m. Attachment of the prewired circular pin connector data wire to the mating outlet on the Powerhead and on the Power and Control Distribution box
      n. Termination of the low voltage data wiring at the controller and at all power and control distribution boxes and at each E-stop station
      o. Face plates for all Control Stations, E-stop Stations and Power and Control Distribution Boxes
      p. Set limit switches
   2. The electrical contractor shall be responsible for providing and installing:
      a. All pipe, wiring and termination providing line voltage to all the Power and Control Distribution boxes
      b. All pipe and wiring connecting data lines between the first Power and Control Distribution Box and the Control station
      c. Pipe and wiring connecting data lines between Control Station and first E-Stop Station
      d. All pipe and wiring connecting data lines between all E-Stop Stations
      e. Back boxes for all Power and Control Distribution Boxes, the Control Stations and all E-Stop Stations
      f. All pipe and wiring and all terminations of line voltage of dimmed and non-dimmed circuits that terminate at the termination boxes mounted on/near the Compression Tube.

PART 4 – PRODUCTS

4.1 GENERAL

   A. Motorized rigging control (1) ETC QT4 – CONTROL MODULE STATION
SECTION 26 51 01 – DIMMING AND PRODUCTION LIGHTING SYSTEMS EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The intent of this specification is to provide a separate, complete and satisfactory lighting system as described in the following specifications. Provide new electronic components and fixtures for the rooms described below. Owner may modify the scope of work.

B. Re-install owner-furnished equipment as noted on technical system drawings, if applicable.

C. Organize and provide all components for safe use and ease of operation. Installation to be in accordance with applicable local, state and federal codes, regulations, statutes and laws.

D. Coordinate site installation schedule with project manager.

E. All testing and site commissioning will be provided by installing contractor.

1.2 EQUIPMENT SUPPLIER

A. Procure all lighting system equipment through authorized factory distributors.

B. All components and materials supplied are to be new, of the manufacturer’s latest model, and accompanied by full manufacturer’s warranty.

C. Single Source Responsibility: Provide material produced by a single manufacturer for each type of material or equipment.

1.3 INSURANCE

A. All equipment and materials shall be fully insured against loss or damage up until acceptance of the system by the Owner or until Owner relieves the Contractor in writing of this responsibility; whichever is earlier.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firm (material producer) with not less than three years of manufacturing and production experience, whose published literature clearly indicates general compliance of products with requirements of this section.

B. Installer’s Qualifications: Firm with three or more years of experience in installation of theatrical lighting systems similar to that required in this project.

C. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and the NEC.

D. Follow-up service compliance:
1. Respond to calls within 48 hours during or after warranty period.
2. Maintain a regularly staffed shop, including factory trained repair personnel and replacement parts.

1.5 SUBMITTALS

A. Bid Submittals
   1. Contractor shall examine all drawings and read all divisions of this specification in order to avoid omissions and duplications and to ensure a complete job. No allowances shall be made for failure to read and understand these documents. Discrepancies between drawings and specifications or obvious omissions shall be referred to Onpoint Designs for clarification before the bid date. Where discrepancies occur and pre-bid instructions have not been obtained, the contractor agrees to abide by Onpoint Designs decision.
   2. Bid proposals shall include all work and all equipment as specified, as well as any other equipment and materials to be used in assembling system.
   3. Requests for clarifications of specification intent shall be made, in writing, not later than ten (10) days prior to bid date.
   4. No portion of the work herein may be assigned or sub-contracted to others unless the following requirements have been satisfied:
      a. The names of any proposed sub-contractors has been disclosed in the bid proposal.
      b. A statement of qualifications for each sub-contractor has been included with the bid proposal.
      c. All terms of this contract, including bidding and qualification requirements, shall apply to the sub-contractor.
   5. The bid submittals shall include the following:
      a. Total contract price. (Less any State or Local Tax)

1.6 SUBMITTALS

A. Shall include the following items in the Lighting Systems submittal:
   1. Deviations: A complete list and description of all proposed deviations from this specification. All modifications of standard equipment must be fully described and accompanied by schematic diagrams.
   2. Descriptive Literature: Full manufacturer’s literature on all equipment items and materials compiled in the same order as given in this specification.

1.7 SUBSTITUTIONS

A. Subsequent to contract award, substitutions may be permitted with express written permission of Montana State University. The proposed substitutes must be equivalent to the specified products in quality, performance, construction, function and conformance to system objectives.

B. It is the responsibility of the Contractor to prove, to the satisfaction of Montana State University, that the proposed substitutions are equivalent to the specified product, as demonstrated by submission of the following:
   1. List of advantages to the Owner.
   2. Cost savings to the Owner.
   3. Printed specifications or laboratory test data for substituted product or products.
   4. Previous field experience with substituted product or products.
C. The contractor shall list the unit price of each item proposed for substitution and indicate which specified items are to be deleted.

D. If Onpoint Designs determines that the proposed product is not equal to the specified project, the Contractor shall supply the product specified in the contract documents.

E. Where substitute materials or methods are approved, the Contractor shall make all adjustments to contingent work necessary to accommodate the substituted equipment, without claim for additional payment.

F. In the event that one or more of the products specified herein is unavailable, the Contractor shall make recommendations to Montana State University as to what substitutions are available to meet the intent of the specification.

G. Montana State University reserves the right to substitute new products which become available subsequent to the issuance of the Contract Documents, provided that:
   1. The contractor has not yet purchased the originally specified equipment.
   2. The substitute equipment does not materially increase the Contractor’s costs.

PART 2 - PRODUCTS – REFER TO ETC MASTER QUOTE #130049414.01 (608) 831-4116

2.1 GENERAL
   A. No substitution without prior written approval shall be allowed.

2.2 DIMMING
   A. (1) ETC SR3-24 – DIMMER RACK AND DOOR
   B. (1) ETC CEM3 – CONTROL MODULE
   C. (17) ETC R20AF – DUAL 20A RELAY MODULE
   D. (7) ETC D20FB – SINGLE 20A 2-WIRE OR 4 WIRE FLUORESCENT MODULE
   E. (1) ETC SSSH24-48 – BLACK SENSOR SOUND SUPPRESSION HOOD

EMERGENCY ACCESSORIES
   A. (7) ETC ALCR-PP – AUTOMATIC LOAD CONTROL RELAY

2.4 CONTROL
   A. 1) ETC RACK AND DOOR
   B. (1) ETC ERN2-RM-120 – ENCLOSURE
C. (1) ETC P-ACP2 – PARADIGM ARCHITECTRUAL CONTROL PROCESSOR
D. (1) ETC P-SPM – PARADIGM STATION POWER MODULE
E. (1) ETC PATCH PANEL 24 – 1RU 19” RJ45 PATCH PANEL WITH 24 PATCH CABLES
F. (1) ETC MAP BR1 – 1RU 19” BRUSH GROMMET PANEL
G. (1) ETC CISCO SG300-28PP – 24 PORT NETWORK SWITCH W/POE+
H. (1) ETC RSN-LV – RESPONSE 0-10V GATEWAY
I. (1) ETC PS-DIN24 – 24V DC 2A DIN POWER SUPPLY
J. (1) ETC ION 6000 – ION LIGHTING CONTROL CONSOLE
K. (2) ETC M8306 – 24” WIDESCREEN LCD MONITOR
L. (2) ETC SGM1479 – DUST COVER FOR LCD MONITOR
M. (2) ETC 108A1002 – 25’ DMX CABLE
N. (2) ETC UH10002- _Z – STANDARD COLOR FACEPLATE
O. (2) ETC UH10002 – 1 GANG 2-BUTTON ARCHITECTURAL STATION
P. (1) ETC P-TS7-1 – 7” TOUCHSCREEN
Q. (1) ETC P-LCD-FBB – FLUSH MOUNT BOX FOR TOUCHSCREEN

2.5 DMX INTERFACE
A. (1) ETC N32G-2M – NET3 TWO PORT DMX/RDM INPUT GATEWAY
B. B.(8) ETC N31G-4F – NET3 ONE PORT OUTPUT GATEWAY
C. C.(8) ETC N31G-BB – SINGLE GANG SURFACE MOUNT BOX
D. D.(4) ETC ECPB PB-U – U-BOLT KIT FOR SURFACE BOX

2.6 CABLING
A. (LOT) SEE DRAWINGS FOR TYPES AND QUANITIES
B. (LOT) ALL REQUIRED DMX CABLES TO MAKE A FULLY FUNCTIONING SYSTEM

2.7 AUDITORIUM PRODUCTION LIGHTING FIXTURES (All with Twist-lock)
A. (24) ETC S4LED2LS-0-C – LED SOURCE FOUR 26 ELLIPSOIDAL FIXTURES WITH C-CLAMPS, DMX CABLES, AND SAFETY CABLE.
B. (24) ETC S4LEDSDTHDS-0-C - LED SOURCE FOUR 26 ELLIPSOIDAL FIXTURES WITH C-CLAMPS, DMX CABLES, AND SAFETY CABLE

2.8 DISTRIBUTION (All with Twist-lock) – INCLUDE DMX IN POWER STRIPS

A. (3) ETC 9140A – SURFACE MOUNT BOX FOR LIGHTING OUTLETS

B. (2) ETC CUSTOM CONNECTOR STRIPS FOR LIGHTING BARS IN SPEC FOR MOTORIZED RIGGING

PART 3 - EXECUTION

3.1 GENERAL

3.2 PERPARATION

A. Before installing the rack enclosure(s) in the workspace, the Contractor shall perform a physical inspection in order to confirm the placement and that the space is in workable condition.

3.3 ELECTRICAL POWER

A. Review and coordinate electrical power system installation, including grounding, with the electrical contractor to ensure proper operation of the lighting system.

3.4 SPLICES

A. Use absolutely no splices of any kind in any cable except at readily accessible terminal strips, junction boxes or at the equipment itself.

3.5 PRODUCTION LIGHTING INSTALLATION

A. Locate and orient lighting fixtures per the design and direction of Montana State University.

B. Terminate all remaining signal low voltage DMX cabling not covered by the Electrical Contractor.

C. Coordinate with Montana State University for lighting focus and commissioning.

3.6 VERIFICATION TESTING

A. Confirm that each individual wire and cable run (whether in a rack or in conduit) is identified with a unique number. These numbers are to be affixed to both ends of each cable and clearly visible. Provide a complete list of these numbers along with the termination location of each end of the wire run.

B. Confirm that all system outputs are free of spurious signals including oscillations and radio frequency signals.
C. For all cabling, confirm:
   1. Proper circuits appearing at each termination location.
   2. Continuity of all conductors.
   3. Proper polarity is maintained.
   4. Absence of short circuits between conductors within each circuit.
   5. Absence of short circuits between circuit conductors and conduit.

3.7 ACCEPTANCE TESTING

A. Montana State University shall perform Acceptance Testing during a period designated by the General Contractor. Contractor shall furnish a minimum of one (1) technician for the acceptance-testing period.

B. The minimum time required for Acceptance Testing is one (1) working day. Coordinate this time period so that free access, work lighting, and electrical power are available on the site.

C. Contractor shall bear any cost incurred for additional time and expenses due to failure to have the system functioning in accordance with specification requirements at the times scheduled for Montana State University Acceptance Testing.

D. Ensure that lighting areas are clean and orderly condition ready for Acceptance Testing.

E. At the time of Acceptance Testing, submit one (1) copy of the operation and maintenance manual to Montana State University.

F. Contractor shall be prepared to verify the performance of any portion of the system.

G. Contractor shall make additional mechanical and electrical adjustments within the scope of work and which are deemed necessary by Montana State University as a result of the acceptance tests. This may include re-hanging, changes in configurations, etc.

3.8 SYSTEM DOCUMENTATION

A. Within thirty (30) days of the Acceptance Testing, prepare and submit three (3) neatly bound copies of the operation and maintenance manuals to Montana State University.
   1. Operation and Maintenance Manual to include:
      a. Table of Contents
      b. Basic power on/off and operational procedure.
      c. All available manufacturer’s operation and service literature for each major system component.
      d. One line signal flow diagram with all cable runs and patch points identified by alphanumeric character.
      e. Copies of all shop drawings which have been updated to include any changes made during the installation process.
      f. A copy of the final settings as provided by Montana State University.

PART 4 – WARRANTY

4.1 GENERAL
A. Warranty shall cover, at no cost to Owner, any faulty materials and workmanship and pay for any damage to other work resulting therefrom.

B. Period of warranty shall be for a minimum warranty of one (1) year from Date of Acceptance of installation by Owner.

END OF SECTION 26 51 01
SECTION 27 51 17 - AV SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK

A. The intent of this specification is to provide a separate, complete and satisfactory audio/video systems as described in the following specifications and drawings. Provide and install all new electronic components and loudspeaker systems for the rooms described below. Owner reserves the right to modify the scope of work.

B. Re-install Owner-furnished equipment as noted on technical system drawings, if applicable.

C. Organize and install all components for safe use and ease of operation. Installation to be in accordance with applicable local, state and federal codes, regulations, statutes and laws.

D. Coordinate site installation schedule with General Contractor.

E. Drawings: Technical system drawings are generally diagrammatic. Complete details for the building, which affect the installation, may not be shown. For additional details, the Contractor is referred to the Architectural, Electrical, Structural and Mechanical Drawings as well as developing any required drawing to support the installation of AV equipment.

F. Discrepancies: Where discrepancies occur between plans and specifications, Onpoint Designs working through the Architect and Electrical Engineer will determine which takes precedence. The AV Contractor shall then perform the selected requirement without additional cost.

G. Excavating and Backfill: Do excavating and backfill as necessary. Backfill shall conform to Architectural section of the specifications. Remove all surplus earth from site.

H. General Workmanship:

1. Floor Boxes

   i. It shall be the responsibility of the Electrical Contractor and AV Contractor to study the General, Electrical, Technical System, and Mechanical drawings and specifications and confer with the various trades involved to the end that there is no conflict between the technical system floor boxes, and any work of other trades. All boxes must be installed plumb and level with final finish floor, not rough grade. All floor boxes must be cleaned, sealed, and covered after conduit termination to prevent contamination.

   ii. The specific boxes provided by AV contractor, supplied with a rough-in box cover, must be kept free of dirt, water, and associated construction site contaminates; keep box cover attached with supplied screws at all times, unless raceway or associated work is in progress. The following must be checked before installing any work:

      a. The exact floor box location

      b. Location of door swings and aisles; (coordinate exact box location to avoid ingress and
c. The location of structural footings; (coordinate exact box location when box is near footing, to avoid complications with raceway routing, before mounting box).

d. Box cover finish; (coordinate exact box finish level to grade, to match level of finish floor)

e. All base millwork and details

f. The exact location of all Owner furnished fixtures and equipment.

iii. Outlet Boxes: It shall be the responsibility of the Electrical Contractor and AV Contractor to study the General, Electrical, Technical System, And Mechanical drawings and specifications and confer with the various trades involved to the end that there is no conflict between the technical system outlets and any work of other trades. All boxes must be installed plumb and level with finish wall, and ceiling assemblies. The following must be checked before installing any work:

a. The exact outlet location

b. The location of furred ceilings and walls

c. All door swings

d. All millwork and millwork details

e. All windows and other openings

f. The exact location of all Owner furnished fixtures and equipment.

iv. Locations: Outlet and floor box locations shown are approximate unless dimensioned or specified. The Contractor shall verify exact location before installation. The Owner reserves the right to make reasonable changes in outlet location without additional expense.

1.3 AV EQUIPMENT SUPPLIER

A. Procure all AV equipment through authorized factory distributors.

B. All components and materials supplied are to be new, of the manufacturer’s latest model, and accompanied by full manufacturer’s warranty.

C. Single Source Responsibility: Provide material produced by a single manufacturer for each type of material or equipment.

D. Provide all system programing for user touch panels. Coordinate all programing and user touch panel layouts and functions with MSU AV Staff.

E. Coordinate and provide all AV network interfaces with MSU IT Staff.

F. AV carts to be supplied by General Contractor. Coordinate all required equipment to be installed in AV carts.

1.4 INSURANCE

A. All equipment and materials shall be fully insured against loss or damage up until acceptance of the system by the Owner or until Owner relieves the Contractor in writing of this responsibility; whichever
QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firm (material producer) with not less than three years of manufacturing and production experience, whose published literature clearly indicates general compliance of products with requirements of this section.

B. Installer’s Qualifications: Firm with three or more years of experience in installation of sound and/or video systems similar to that required in this project.

C. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and the NEC.

D. EIA Compliance: comply with the following Electronic Industries Association Standards:
   2. EIA Standard SE-103: Speakers for Sound Equipment.

E. Follow-up service compliance:
   1. Respond to calls within 48 hours during or after warranty period.
   2. Maintain a regularly staffed shop, including factory trained repair personnel and replacement parts.

ACCEPTANCE

A. Acceptance testing will include operation of each major system and any other components deemed necessary. AV contractor will conduct this testing and provide the test equipment specified herein.

B. AV contractor is responsible for delivering a complete and fully functional system that fulfills both the letter and intent of this specification, as well as the expectations of the owner (MSU). Final acceptance of the system is contingent on the quality and completeness of the systems, regardless of any errors, omissions, or other shortcomings of this specification.

TESTS, CALIBRATIONS AND COMPLETION

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. Verify 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. Temporarily lift the technical ground from the main electrical ground, and measure the DC resistance between them. Resistance should be at least 1 Mega-ohm.
   3. Identify and correct any problems if within the audiovisual system scope of work; notify the Electrical Contractor if problem is in a related area of work.

C. Perform the following procedures on the System:
   1. Adjust, balance, and align all equipment for optimum performance and to meet all
manufacturer's published specifications. Settings to be reviewed include gain, delay times, and nominal settings. Establish and mark normal settings for all level controls, and record these settings in the System Reference Manual.

2. Check all control functions for proper operation, from all controlling devices to all controlled devices.

3. Video Signal: From all source inputs (for cameras, character generators, video tape units, etc.) through all VDAs, processors, switchers, etc., to all signal destinations. Verification of correct signal timing for each source via each path will be made using standard test patterns. Each processing device will be checked; the signal shall pass through the device in that no processing mode such that unity luminance, chrominance, and signal timing and phasing conditions are achieved.

4. Any other test on any piece of equipment or system the Owner deems appropriate.

CONT.
D. Audio System Tests: Perform the following tests and adjustments, supplying all test equipment required. Make all corrections necessary to bring system(s) into compliance with the specifications. Actual performance may deviate slightly due to component variations, field conditions or limitations and building interaction. Design parameters are: system frequency response shall be +/- 3dB 100 Hz - 18 kHz. Evenness of coverage shall be +/- 3dB maximum at 2 kHz throughout listening area. Nominal sound pressure level shall be 85 dBA SPL at any seat in the area with a maximum continuous SPL capability of 95 dBA.

1. Measure and record the impedance of each speaker line circuit terminating at the equipment rack, with speakers connected employing frequencies of 500, 1000 Hz, and 4000 Hz and others as appropriate to the driver (use all for full range systems).
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 typ) for this test.
4. Measure and record electrical distortion of each input through amplifiers, switching, and power amplifier for each system installed; distortion should be less than 0.5% for the overall system in each test. Observe the output waveform on an oscilloscope for freedom from clipping, parasitics, oscillation, or RF components which could indicate unacceptable system operation.
5. Measure and record system electrical frequency response for each input channel through power amplifier output. Deviation shall not exceed +1 dB within the range 105 to 18 kHz.
6. Check system to assure freedom from oscillation or stray RF pickup. Check all inputs without signal and with 1000 Hz sine wave driving system to full 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.
7. Measure and record the output impedance of each active device operating as a source to a passive device or network. Measure and record the input impedance of each active device used to terminate passive devices.
8. Check polarity of all loudspeakers with an electronic polarity checker and by applying music program or pink noise signal to 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 speaker to the next.
9. Apply sine wave sweep signal to each loudspeaker system, sweeping from 100 to 5000 Hz at a level 10 dB below full amplifier output, and listen for rattles or objectionable noise.

E. Report: Upon completion of initial tests and adjustments, submit written report of tests to Owner along with all documents, diagrams, and record drawings required herein. Report shall include 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.

F. In the event the need for further adjustment or work becomes evident during acceptance testing, the AV Contractor will continue his work 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 AV Contractor is subject to Delay Damages.

G. Test Equipment
1. Harris Videotek Gen-Star HD-SDI and SD-SDI generator with Audio and Gen Lock
2. Extron VTG 400D Programmable Video and Audio Test Generator with HD SDI out.
3. NTI Montest - HDMI Video Test Pattern Generator.
5. Spectra Cal - Color Calibration system
6. Tools including screwdrivers, pliers, cutters, wire strippers, nut drivers, crimpers, heat shrink blower, controlled temperature soldering unit, ladders, flashlight, measuring tape, electric drill, etc.

7. Sine Wave Generator. Output: +4 dBu, 5 Hz to 50,000 Hz with less than 0.05% THD into any load. Acceptable: Audio Precision, Hewlett Packard, Sound Technology, or Tektronix.

8. Pink Noise Source. Equal energy per octave bandwidth 20 - 20,000 Hz, +1 dB (long-term average) @ 0 dBu output. Stability: +2 dB per day. Acceptable: Ivie IE-20.

9. Impedance Meter. Capable of testing audio lines at three frequencies, minimum, between 250 Hz and 4000 Hz. Measurement Range: 1 ohm to 100,000 ohms. Acceptable: Gold-Line ZM1.

10. Multi-meter. Measurement range, DC to 20,000 Hz, 100 mV to 300 V, 10ma to 10A. Acceptable: Fluke 77.


12. Sound Level meter meeting ANSI SL.4 1971 Type 2. Acceptable: GenRad 1933 or B&K.

13. Dual-trace oscilloscope: 100 MHz bandwidth, 1 mV/cm sensitivity. Acceptable: Tektronix 2445.

14. TEF and Smaart Analysis are preferred methods of testing of frequency response in addition to those methods listed above.

1.8 INSTRUCTION OF OWNER PERSONNEL

A. Provide four (4) separate periods of four (4) hour instruction sessions to the Owner's designated personnel on the use and operation of each of the systems. The instructor must be fully knowledgeable of all system functions and all equipment features. The System Reference Manuals shall be complete and on-site at the time of instruction. The AV Contractor shall be present at the first two formal uses of the system.

1.9 AS BUILT DRAWINGS:

A. Provide the Architect with as-built drawings, which are new and reproducible, showing the measured location of all concerned portions of the work and all changes the Contractor has made. Show all pull boxes installed that are required per this specification but not specifically called out. Drawings must show all addendum items, change orders and deviations to the plans. Keep a record set of drawings on site to be marked daily. This information should be transferred to the reproducibles at the close of the job.

1.10 COORDINATION OF WORK

A. AV SYSTEMS IS GENERALLY DEFINED AS follows:

1. Sound Reinforcement / Recording System: Including, but not limited to, public address equipment; sound system loudspeakers, amplifiers, signal processing, microphones, and related equipment; recorders and related equipment; production intercom equipment and related accessories; background music/paging system equipment; and, hearing assistance systems and related equipment.

2. Audio-Visual System: Including, but not limited to, audio visual system screens, both electric and manual; low voltage control system; push button control wall plates; film and slide projectors and related equipment; multi-media control computers and related equipment; and, hearing assistance system equipment.

3. Visual Presentation System: Including, but not limited to, video cameras; monitors and receivers, signal processing, recorders, video projection equipment, switchers and patching
systems and related accessories.

1.11 WORK PERFORMED BY ELECTRICAL CONTRACTOR FOR AV SYSTEMS

A. Include all labor, material, equipment, transportation and services to provide the complete electrical service and raceway systems required for the operation of the various technical systems in use on this project including, but not limited to the following:

1. Electrical Service Systems
   i. Technical System Dedicated, Shielded, Electrical Service, with Isolated Ground, as specified.
   ii. Provide conduit, power wire (electric screens, as shown on drawings), lugs, grounding, trenching, backfill and all incidental equipment required to complete the service.
   iii. Provide branch-circuit panels for power as specified.
   iv. Complete branch-circuit wiring system, receptacles, junction boxes, lighting (for control rooms, equipment racks and technical spaces), etc.
   v. Provide all shielded isolation transformers, isolated ground systems, and other specialty items as called out in this specification or shown on drawings.

PART 2 Bid Instructions

1.1 Submittals:

A. BID SUBMITTALS:

1. Contractor shall examine all drawings and read all divisions of this specification in order to avoid omissions and duplications and to ensure a complete job. No allowances shall be made for failure to read and understand these documents. Discrepancies between drawings and specifications or obvious omissions shall be referred to Onpoint Designs for clarification before the bid date. Where discrepancies occur and pre-bid instructions have not been obtained, the contractor agrees to abide by Onpoint Designs decision.

2. Bid proposals shall include all work and all equipment as specified, as well as any other equipment and materials to be used in assembling system.

3. Requests for clarifications of specification intent shall be made, in writing, not later than ten (10) day prior to bid date.

4. No portion of the work herein may be assigned or sub-contracted to others unless the following requirements have been satisfied:
   i. The names of any proposed sub-contractors has been disclosed in the bid proposal.
   ii. A statement of qualifications for each sub-contractor has been included with the bid proposal.
   iii. All terms of this contract, including bidding and qualification requirements, shall apply to the sub-contractor.

5. The bid submittals shall include the following:
i. Total contract price per section. (Less any State or Local Tax)

1.2 Work Quality and Warranty

A. Complete all work to the satisfaction of the Owner. Guarantee all systems for a period of one (1) year from Date of Substantial Completion against defective materials, components and poor workmanship. Replace any defective component or material at no expense to the Owner during the guarantee period, provided it does not show abuse.

1.3 Substitutions:

A. Subsequent to contract award, substitutions may be permitted with express written permission of Montana State University. The proposed substitutes must be equivalent to the specified products in quality, performance, construction, function and conformance to system objectives.

B. It is the responsibility of the Contractor to prove, to the satisfaction of Montana State University, that the proposed substitutions are equivalent to the specified product, as demonstrated by submission of the following:
   1. List of advantages to the Owner.
   2. Cost savings to the Owner.
   3. Printed specifications or laboratory test data for substituted product or products.
   4. Previous field experience with substituted product or products.

C. The contractor shall list the unit price of each item proposed for substitution and indicate which specified items are to be deleted.

D. If Montana State University determines that the proposed product is not equal to the specified project, the Contractor shall supply the product specified in the contract documents.

E. Where substitute materials or methods are approved, the Contractor shall make all adjustments to contingent work necessary to accommodate the substituted equipment, without claim for additional payment.

F. In the event that one or more of the products specified herein is unavailable, the Contractor shall make recommendations to Montana State University as to what substitutions are available to meet the intent of the specification.

G. Montana State University reserves the right to substitute new products which become available subsequent to the issuance of the Contract Documents, provided that:
   1. The contractor has not yet purchased the originally specified equipment.
   2. The substitute equipment does not materially increase the Contractor’s costs.
### PART 3 PRODUCTS

#### 1.12 GENERAL

A. No substitution without prior written approval shall be allowed.

#### 1.12 Inspiration Hall

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# VIDEO SYSTEM

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### 1.12 Large Amphitheatre Classroom

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### 1.12 Large Tiered Classroom

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### AUDIO SYSTEM

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- **Manufacturer**: QSC
- **Manufacturer Part #**: AC-C6T

**Amplification**
- **Qty**: 1
- **Manufacturer**: Extron
- **Manufacturer Part #**: XPA 2002

**Processing**
- **Qty**: 1
- **Manufacturer**: Listen
- **Manufacturer Part #**: LR-5200 system

### FOG Equipment

**Wall Plates & Pockets**
- **Qty**: 1
- **Manufacturer**: ACE Backstage
- **Manufacturer Part #**: 132SLBK
- **Description**: Custom Plates and harness

**Equipment Racks & Power**
- **Qty**: 1
- **Manufacturer**: Lowell
- **Manufacturer Part #**: UDE-214
- **Qty**: 1
- **Manufacturer**: Furman
- **Manufacturer Part #**: CN-1800S
- **Qty**: 1
- **Manufacturer**: Lowell
- **Manufacturer Part #**: LOT

**Wire & Connectors**
- **Qty**: 1
- **Manufacturer**: West Penn
- **Manufacturer Part #**: Mic & Network Cabling - Plenum
- **Qty**: 1
- **Manufacturer**: West Penn
- **Manufacturer Part #**: Speaker Wire - Plenum
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- **Manufacturer**: Neutrik
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### Projection / Switching

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### Cameras

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### 1.12 Flex Classroom

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**Cameras**

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**Signal Distribution**

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<tr>
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<tr>
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**Control**

<table>
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<tbody>
<tr>
<td>1</td>
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<td>TLP Pro 720T Blk</td>
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<tr>
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<td>TP-LINK</td>
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**Wire**

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### 1.12 Teal Classroom

**VIDEO SYSTEM**

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</thead>
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<td>LG</td>
<td>55SE3KB</td>
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<tr>
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<td>DTP-Crosspoint 108 4k IPCP MA70</td>
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**Cameras**

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**Signal Distribution**

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<td>DPH-101</td>
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**Control**

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<td>TLP Pro 720T Blk</td>
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<td>TL-POE150s</td>
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**Wire**

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### 1.12 Medium Classroom

**AUDIO SYSTEM**

**Speakers**
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**FOH Equipment**

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**Wall Plates & Pockets**

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<tbody>
<tr>
<td>1</td>
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**Equipment Racks & Power**

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**Wire & Connectors**

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<tr>
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<tr>
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<td>Speaker Wire - Plenum</td>
</tr>
<tr>
<td>1</td>
<td>Neutrik</td>
<td>LOT as required to complete install</td>
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</tbody>
</table>
### AV System

**Processing**
- **QSC K12 YOKE**
- **1 Listen LR-5200 system**

**FOH Equipment**
- **1 Shure QLXD124/85**

**Wall Plates & Pockets**
- **1 ACE Backstage Custom**

**Equipment Racks & Power**
- **1 Lowell LWR-2428**
- **1 Lowell UDE-215**
- **1 Furman CN-1800S**
- **2 Furman CN-20MP**
- **1 Lowell LOT**

**Wire & Connectors**
- **1 West Penn Mic & Network Cabling - Plenum**
- **1 West Penn Speaker Wire - Plenum**
- **1 Neutrik LOT as required to complete install**

### VIDEO System

**Projection / Switching**
- **1 Christie DWU850-GS**
- **1 Christie 140-107109-01**
- **1 Crimson JR3XL**
- **1 Extron IN 1608 MA70**

**Signal Distribution**
- **1 Extron DTP-HDMI 4k 230 Rx**
- **1 Extron DTP T DWP 4K 332 D**
- **1 Extron FOXBOX Rx HDMI**
- **1 Extron Sharelink 200 N**
- **1 Extron Cable Cubby 100**

**Control**
- **1 Exton TLP Pro 720C Blk**
- **1 TP-LINK TL-POE150s**

**Wire**
- **2 CAT6S Shielded CAT6S wire - Plenum**
- **1 Connectors LOT as required to complete install**

---

**Seminar Rooms 321, 325, 329, 331 (List is qty for each space)**

**VIDEO System**

**Display / Switching**
- **1 LG 55SE3KB**
- **1 Extron Sharelink 200 N**
## Boardroom 359

<table>
<thead>
<tr>
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<td>VIDEO SYSTEM</td>
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<td>Display / Switching</td>
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<td>LG</td>
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<td>DTP Crosspoint 84 4k IPCP MA70</td>
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<tr>
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### Single Display Systems

(For Rooms: Conf Room 115 qty 1, Digital Design 139 qty 4, Innovation Alley 198 qty 2, Conf Room 237J qty 1, Conf Room 267E qty 1, Conf Room 294CM qty 1, Conf Room 295CM qty 1, Conf Room 296CM qty 1, Conf Room 297CM qty 1, Conf Room 393CM qty 1, Conf Room 394CM qty 1, Conf Room 395CM qty 1, Conf Room 396CM qty 1)
## 1.12 Single Projector System

(For Rooms: Manufacturing Process 176 qty 1, Capstone Small 191 qty 1, Design 220 qty 1, Capstone Light Build 226 qty 1, Controls Electronics Robotics 230 qty 1, EMEC/ETME Design Space 256 qty 1, EMEC/ETME Design Space 264 qty 1)

<table>
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<th>Manufacturer Part #</th>
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<tr>
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<td>LG</td>
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<tr>
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<td>Wire</td>
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<tr>
<td>1</td>
<td>Connectors</td>
<td>LOT as required to complete install</td>
</tr>
</tbody>
</table>

END OF SECTION 27 51 17
1/4" PLATE STEEL ADHERED TO TOP OF WALL WITH SILICONE, PAINTED TO MATCH WALL

ALUM. J REGLET

SCHEDULED WALL

VERIFY DIMENSIONS TO FIT SCREEN HOUSING

SCREW AT 9" O.C.

CAP ENDS

1 PT. HT. WALL AT PROJ. SCRNL.

: ASK-013 3" = 1'-0"

PROJECTOR SCREEN HOUSING

NORM ASBJORNSON HALL

MSU - CPD&C / STATE OF MONTANA
Memo

To: Bill DuBeau, A&E
From: Terry Jiracek
Date: 3-10-2017
Re: Electrical changes/ support for A/V drawing package – Norm Asbjornson Hall

A.C.E. Job # 15BL4300

Bill,

Please issue the summary verbiage below and revised drawings noted below to the contractor for electrical support of the A/V package adjustments.

Sheet EPS1-12

1. Revise key note #6 on sheet to read as follows: FOR CEILING MOUNTED PROJECTOR POWER CONNECTION AND MOTORIZED PROJECTOR LIFT, WHEN LIFT PRESENT. LIFT SHALL BE POWERED VIA THE CIRCUIT, NOT NECESSARILY THE RECEPTACLE. VERIFY EXACT LOCATION WITH A/V PLANS PRIOR TO ROUGH-IN.

2. See Large Classroom Amphitheater Style 0165: EC to rework circuitry serving ceiling mounted projectors, key note #6 on the plans such that each device is connected to a dedicated 20A/1p breaker in panel 1LAV. Utilize spare breakers within panel connect loads upon, as a total of (2) new spare breakers are used with this change. See revised sheet EPS1-12 and verify with AV plans for additional details prior to rough-in.

Sheet EPS1-13

3. See the Sitting Stair 0106: EC shall mount the receptacle located in the west face of the stair that is noted as "Center vertically in face of stair riser, mount device horizontally provide stainless steel cover plate" within the new custom cabinet that is designed by Architect as noted on revised TA1-13 sheet.

4. See Large Classroom Tiered 0137: EC to add power connections for 2)- motorized projection screens that are located on the south wall of space. Connect to the existing power circuit in room that serves projectors. See revised sheet EPS1-13 and verify with AV plans for additional details prior to rough-in.

5. See Café 0111: EC to add (2) GFCI receptacles located @ 8’-6” to center for powering of wall mounted menu boards. Connect devices to spare 20A/1p breakers in panel 1LAV2. One device will be located on north side of space and other on south. See power locations on EPS1-13 and verify with AV plans for additional details prior to rough-in.

Sheet EPS1-22

1. Revise key note #2 on sheet to read as follows: FOR CEILING MOUNTED PROJECTOR POWER CONNECTION AND MOTORIZED PROJECTOR LIFT, WHEN LIFT PRESENT. LIFT SHALL BE POWERED VIA THE CIRCUIT, NOT NECESSARILY THE RECEPTACLE. VERIFY EXACT LOCATION WITH A/V PLANS PRIOR TO ROUGH-IN.

Sheet EPS1-23

1. Revise key note #4 on sheet to read as follows: FOR CEILING MOUNTED PROJECTOR POWER CONNECTION AND MOTORIZED PROJECTOR LIFT, WHEN LIFT PRESENT. LIFT SHALL BE POWERED VIA THE CIRCUIT, NOT NECESSARILY THE RECEPTACLE. VERIFY EXACT LOCATION WITH A/V PLANS PRIOR TO ROUGH-IN.

Sheet EPS1-32

1. See Boardroom 0359: EC shall add an additional receptacle located in the AV cabinet area of the east casework in room. Connect receptacle to a dedicated 20A/1p spare breaker located in panel 3LAV1. EC to coordinate exact location of AV cabinet with Architectural and AV plans prior to rough-in. See revised sheet EPS1-32.

2. See Medium Classroom 0337: EC to add power connection for the new motorized projection screen that is located on the south wall of space. Connect to the existing power circuit in room that serves projectors. See revised sheet, EPS1-32 and verify with AV plans for additional details prior to rough-in.

3. Revise key note #3 on sheet to read as follows: FOR CEILING MOUNTED PROJECTOR POWER CONNECTION AND MOTORIZED PROJECTOR LIFT, WHEN LIFT PRESENT. LIFT SHALL BE POWERED VIA THE CIRCUIT, NOT NECESSARILY THE RECEPTACLE. VERIFY EXACT LOCATION WITH A/V PLANS PRIOR TO ROUGH-IN. See revised sheet EP1-32.

Sheet EPS1-33

1. Revise key note #3 on sheet to read as follows: FOR CEILING MOUNTED PROJECTOR POWER CONNECTION AND MOTORIZED PROJECTOR LIFT, WHEN LIFT PRESENT. LIFT SHALL BE POWERED VIA THE CIRCUIT, NOT NECESSARILY THE RECEPTACLE. VERIFY EXACT LOCATION WITH A/V PLANS PRIOR TO ROUGH-IN.
**ELECTRICAL POWER GENERAL NOTES**

1. All power supply(s) provided and installed by TC, 120V power wired complete by EC. Verify exact location shown in plans.

2. Power supply(s) shown are approximate.

3. For ceiling mounted projector power connection and motorized projector lift, when lift present, coordinate with A/V contractor.

4. For details, see electrical power general notes.

5. All wiring shall be contained within conduit, except where noted.

6. For ceiling mounted projector power connection and motorized projector lift, when lift present, coordinate with A/V contractor.

7. A/V contractor shall provide through-out entire circuit consisting of 4#10, 1#10 ground in 1/2" conduit.

8. Head end shade controller by EC. Coordinate with shade installer for additional details.

9. Head end shade controller by EC. Coordinate with shade installer for additional details.

10. Head end shade controller by EC. Coordinate with shade installer for additional details.

11. Head end shade controller by EC. Coordinate with shade installer for additional details.

12. Head end shade controller by EC. Coordinate with shade installer for additional details.

13. Head end shade controller by EC. Coordinate with shade installer for additional details.

14. Head end shade controller by EC. Coordinate with shade installer for additional details.

15. Head end shade controller by EC. Coordinate with shade installer for additional details.

16. Head end shade controller by EC. Coordinate with shade installer for additional details.

17. Head end shade controller by EC. Coordinate with shade installer for additional details.

18. Head end shade controller by EC. Coordinate with shade installer for additional details.

19. Head end shade controller by EC. Coordinate with shade installer for additional details.

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22. Head end shade controller by EC. Coordinate with shade installer for additional details.

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24. Head end shade controller by EC. Coordinate with shade installer for additional details.

25. Head end shade controller by EC. Coordinate with shade installer for additional details.

26. Head end shade controller by EC. Coordinate with shade installer for additional details.

27. Head end shade controller by EC. Coordinate with shade installer for additional details.

28. Head end shade controller by EC. Coordinate with shade installer for additional details.

29. Head end shade controller by EC. Coordinate with shade installer for additional details.

30. Head end shade controller by EC. Coordinate with shade installer for additional details.
AV TECH STANDARDS

TA1-00 : TA1-00

SPECIFICATIONS

AUDIO CABLE

SPEAKER CABLE

OUTPUT

INPUT

DATA CABLE

OUTPUT

INPUT

ELECTRICAL NOTES

1. VERIFY SIZES, DIMENSIONS, AND LOCATIONS WITH ARCHITECTURAL DRAWINGS TO ENSURE COMPLETE OCCURRENCE. ARCHITECTURAL DRAWINGS TAKE PRIORITY.

2. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH NATIONAL, LOCAL, AND OTHER APPLICABLE CODES.

3. ALL AUDIO/VISUAL SYSTEMS SHALL BE FREE OF REFERENCE, OR DEEPLY PATTERNS, OR OTHER VISIBILITY ISSUES.

4. ALL BOXES COVERED; THESE WILL BE CONNECTED BY THE AV CONTRACTOR, OR ELECTRICAL CONTRACTOR, UNLESS OTHERWISE NOTED.

5. VERIFY SIZES, DIMENSIONS, AND LOCATIONS WITH ARCHITECTURAL DRAWINGS TO ENSURE COMPLETE OCCURRENCE. ARCHITECTURAL DRAWINGS TAKE PRIORITY.

6. VERIFY SIZES, DIMENSIONS, AND LOCATIONS WITH ARCHITECTURAL DRAWINGS TO ENSURE COMPLETE OCCURRENCE. ARCHITECTURAL DRAWINGS TAKE PRIORITY.

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Refer to electrical drawings for actual circuiting and panel schedule.
CONTRACTOR UNDER SEPARATE CONTRACT WITH MSU. ALL SUPPORTING POWER, CONDUIT AND BOXES TO BE SUPPLIED AND INSTALLED BY ELECTRICAL CONTRACTOR.
ALL POWER, CONDUIT AND BOXES REPRESENTED ON THIS PAGE, TO BE SUPPLIED AND INSTALLED BY ELECTRICAL CONTRACTOR. REFER TO ELECTRICAL DRAWINGS FOR ACTUAL CIRCUITING.
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AFF - TYP.  ELEV. - 5'-0"

POWER OUTLET, NETWORK DISPLAY, SIGNAL MOUNTED IN CHIEF PAC525 BACK BOX

FLOOR

MOUNT TWO FIRE-TREATED 2 x 6's ABOVE OUTLETS AND TWO BELOW

FLEX - 5/8" TAPE - 1 TP

TEAL / FLEX AND LAB DISPLAY HEIGHTS

CHIEF PAC525 BACK BOX

DISPLAY ELEV. - 5/8" TAPE - 1 TP

AVP 1 & POWER OUTLET

FLOOR

COLLABORATION AREAS DISPLAY MOUNTING SUPPORT DETAIL - TYPICAL

TA1-14 : TA1-14 1-1/2" = 1'

SECOND LEVEL AV INPUT PLATE DETAIL - TYPICAL

TA1-14 : TA1-14 1-1/2" = 1'

TA1-14 : TA1-14 1-1/2" = 1'

TA1-14 : TA1-14 1-1/2" = 1'

LAB SCREEN AND PROJECTOR HEIGHTS

VIDEO PROJECTOR

STANDARD 1995 TMCC MOUNT TYPICAL

LOCAL HDMI INPUT

PLUG STRIP

PLUG STRIP ELEV. - 3'-6"

MANUAL VIDEO SCREEN

LOCAL HDMI INPUT

VIDEO PROJECTOR POLE MOUNT TYPICAL

PLUG STRIP BY OTHERS

TAPE - 1 TP

5' - 9"

6'
ALL POWER, CONDUIT AND BOXES REPRESENTED ON THIS PAGE, TO BE SUPPLIED AND INSTALLED BY ELECTRICAL CONTRACTOR. REFER TO ELECTRICAL DRAWINGS FOR ACTUAL CIRCUITING.
MOUNT TWO FIRE-TREATED 2 x 6's ABOVE OUTLETS AND TWO BELOW.

POWER OUTLET, NETWORK DISPLAY, SIGNAL MOUNTED IN CHIEF PAC525 BACK BOX.

FLOOR

AFF - TYP.
ELEV. - 5'-0"

POWER OUTLET, NETWORK DISPLAY, SIGNAL MOUNTED IN CHIEF PAC525 BACK BOX.

FLOOR

AFF - TYP.
ELEV. - 5'-0"

AFF - TYP.
ELEV. - 2'-0"

AFF - TYP.
ELEV. - 1'-6"

AFF - TYP.
ELEV. - 2'-0"
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POWER SYSTEMS FOR LIGHTING SYSTEM SHOWN ON THIS SHEET FOR REFERENCE ONLY.
REFER TO ELECTRICAL DRAWINGS FOR ACTUAL CIRCUITING AND PANEL SCHEDULE.
3.7

RIGGING LEGEND

RIGGING LOAD POINTS

ETC PRODIGY P1500G

MAX LOAD AT THIS POINT/500LB.

RIGGING POINT BY GC.

RIGGING HARDWARE BY OTHERS.

TRUSS BY OTHERS.

TYPICAL RIGGING ATTACHMENT FOR 6 LOCATIONS

"TA9-32 : TA9-33"

5'-6" x 4'-6"

TA9-33R

LEVEL - 3

RIGGING EAST RCP

TA9-32 : TA9-33

1-1/2" = 1'-0"

TYPICAL RIGGING ATTACHMENT FOR 6 LOCATIONS

"TA9-32 : TA9-33"

5'-6" x 4'-6"

TA9-33R

LEVEL - 3

RIGGING EAST RCP

TA9-32 : TA9-33

1-1/2" = 1'-0"

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5'-6" x 4'-6"

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