

TABLE OF CONTENTS

DIVISION 0 – PROCUREMENT AND CONTRACTING REQUIREMENTS

Section 00 01 01	Project Title Page
Section 00 01 10	Table of Contents
Section 00 74 00	Electronic Media Agreement Form

DIVISION 1 – GENERAL REQUIREMENTS

Section 01 10 00	Summary
Section 01 26 00	Contract Modification Procedures
Section 01 29 00	Payment Procedures
Section 01 31 00	Project Management and Coordination
Section 01 31 23	PM Database EBuilder
Section 01 33 00	Submittal Procedures
Section 01 35 53	Security Procedures
Section 01 41 00	Regulatory Requirements
Section 01 42 00	References
Section 01 45 00	Quality Control
Section 01 50 00	Temporary Facilities and Controls
Section 01 60 00	Product Requirements
Section 01 73 00	Execution
Section 01 73 29	Cutting and Patching
Section 01 74 19	Construction Waste Management and Disposal
Section 01 77 00	Closeout Procedures

DIVISION 2 – EXISTING CONDITIONS

Section 02 41 00	Demolition
------------------	------------

DIVISION 5 – METALS

Section 05 50 00	Metal Fabrications
------------------	--------------------

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

Section 06 10 00	Rough Carpentry
Section 06 20 00	Finish Carpentry
Section 06 40 00	Architectural Woodwork

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

Section 07 84 13	Penetration Firestopping
Section 07 92 00	Joint Sealants

TABLE OF CONTENTS

DIVISION 8 – OPENINGS

Section 08 11 14	Hollow Metal Doors and Frames
Section 08 31 00	Access Doors and Panels
Section 08 71 00	Door Hardware

DIVISION 9 – FINISHES

Section 09 21 16	Gypsum Board Assemblies
Section 09 51 00	Acoustical Ceilings
Section 09 65 00	Rubber Base
Section 09 68 00	Carpeting
Section 09 91 00	Painting

DIVISION 11 – EQUIPMENT

Section 11 61 34	Production Rigging
Section 11 61 83	Production Lighting Systems

DIVISION 26 – ELECTRICAL

Section 26 00 00	Electrical Basic Requirements
Section 26 05 09	Equipment Wiring
Section 26 05 19	Low-Voltage Electrical Power Conductors And Cables
Section 26 05 26	Grounding And Bonding For Electrical Systems
Section 26 05 29	Hangers And Supports For Electrical Systems And Equipment
Section 26 05 33	Raceways
Section 26 05 34	Boxes
Section 26 05 35	Production Systems Electrical Installation
Section 26 05 53	Identification For Electrical Systems
Section 26 05 73	Electrical Distribution System Studies
Section 26 24 16	Panelboards
Section 26 27 26	Wiring Devices
Section 26 28 00	Overcurrent Protective Devices
Section 26 28 16	Enclosed Switches And Circuit Breakers
Section 26 43 00	Surge Protection Devices
Section 26 51 00	Lighting

DIVISION 27 – COMMUNICATIONS

Section 27 00 00	Communications Basic Requirements
Section 27 05 28	Pathways For Communications Systems
Section 27 15 00	Communications Horizontal Cabling

TABLE OF CONTENTS

DIVISION 32 – EXTERIOR IMPROVEMENTS

Section 32 31 13 Chain Link Fences and Gates

END OF SECTION

DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish labor, material and equipment required for the demolition and removal of existing walls, ceilings, and other material as required preparatory to remodeling.
- B. Scope of demolition and removal work is shown on the Drawings.

1.2 PROJECT CONDITIONS

- A. Existing Conditions: Verify existing conditions at the site and include all work evident by site inspection whether or not shown on the Drawings. Include demolition that is implied or consequential to other trades to achieve the intended results.
- C. Notify the Architect in advance of cutting or alteration which may affect the structural safety of any portion of the project.
- D. All material and debris resulting from demolition Work shall become property of the Contractor and be removed from the site at Contractor's expense.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXAMINATION

- A. Inspect the work to determine condition of existing building and amount of existing materials and debris to be removed.

3.2 PREPARATION AND COORDINATION

- A. Utilities: Coordinate demolition work with affected electrical and mechanical crafts. Completely remove all existing utility services which are not a part of new work or designated to remain. Save and protect existing utilities shown to remain. Notify Architect at once if unknown utilities are found in the work.
- B. Laws and Ordinances: Comply with the applicable laws and ordinances governing the disposal of debris on or off the site, and commit no trespass on any public or private property in any operation due to or connected with demolition.

3.3 DEMOLITION PROTECTION

- A. Existing Facilities: Protect adjacent walkways, building entries, and other building facilities during demolition operations.

DEMOLITION

- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during demolition and cleaned and reinstalled in their original locations after demolition operations are complete.
- C. Salvaged Items for Reuse in the Work: ~~None required.~~ **Transport salvaged items to location as designated By Owner. Items that are to be salvaged to the Owner, include, but are not limited to:**
 - 1. **Leftover or excess electrical parts**
 - 2. **Coordinate with Owner prior to start of partial demolition**
- D. Existing Utilities: Maintain utility services indicated to remain and protect them against damage during demolition operations.
 - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner.
 - 2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner.
- E. Temporary Protection: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise from portions of the building that are outside the scope of this Project.

3.4 DEMOLITION, GENERAL

- A. General: Demolish indicated portions of existing building as detailed. Include demolition that is implied or consequential to other trades to achieve the intended results. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - 2. Maintain adequate ventilation when using cutting torches.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.

3.6 ASBESTOS REMOVAL

DEMOLITION

- A. The areas designated for demolition may contain hazardous materials that will be removed by other contractors outside the scope of this contract. Coordinate through the Owner the sequencing of hazardous material abatement and demolition so as not to delay the Project.

END OF SECTION

RUBBER BASE

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, material, equipment, and services required to install resilient floor covering and base. Prepare floors to receive new material.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM).

1.3 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures."
- B. Sample of each color and pattern of resilient flooring and welding rods. Do not start work until samples of material have been approved.
- C. Linoleum installer "Master Mechanic" certificate.

1.4 QUALITY ASSURANCE

- A. Conform to resilient flooring manufacturer's installation instructions.
- B. Linoleum Installer Qualifications: Engage an installer experienced in linoleum installation and is certified by the linoleum manufacturer as a "Master Mechanic."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver finish materials to job site only when satisfactory conditions for storage can be provided. Maintain in manufacturer's unbroken packages with original labels thereon.

1.6 PROJECT CONDITIONS

- A. Do not begin installation until the work of all other trades including painting has been completed and the temperature of the rooms maintained at 70°F at least 48 hours before work proceeds.
- B. The Owner will employ the services of an Independent Testing Laboratory (ITL) for testing the moisture content of concrete slabs. Cooperate with the Testing Laboratory by providing the required environmental conditions for moisture testing.

1.7 WARRANTY

- A. Provide manufacturer's standard warranty for each resilient flooring type.

1.8 MAINTENANCE

- A. Extra Materials: Furnish to Owner two boxes of same run of each pattern and color of tile. Save usable pieces of sheet vinyl floor covering and package in paper wrapped rolls, labeled on wrapping, securely tied.

RUBBER BASE

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Product manufacturers are listed below.
- B. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."
- C. RB-1, Rubber Base:
 - 1. ASTM F1861 Type TS, Group 1, thermoset vulcanized SBR rubber, continuous roll, 1/8-inch gauge, 4-inch top-set, coved toe at hard floor finishes, straight base at carpet, 6-inch base at toilet rooms.
 - 2. Manufacturers: Roppe, Flexco, Burke/Mercer, Johnsonite, and Nora.
 - 3. RB-1, Color: Refer to Finish and Material Legend.
- D. Adhesives: Refer to product manufacturer's recommendations for appropriate low VOC adhesive. Use only adhesives approved by resilient flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 - 1. Verify that finishes of substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

3.3 INSTALLATION

- A. Rubber Base:
 - 1. Install top-set base on floor covering with corners neatly fitted.
 - 2. Install straight base at carpets and coved base at hard floor finishes.

RUBBER BASE

3. Inside corners mitered and outside corners formed from continuous roll extending at least 12-inches beyond corner and installed with contact cement.
4. Where wall finish opening at floor is over 1/4-inch, do not install base until gap in substrate has been reduced to 1/4-inch or less with appropriate filler material.
5. Cut coved toe back at 45 degree angle at door frame terminations.

END OF SECTION

PRODUCTION LIGHTING SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Services as listed herein and related to the furnishing and commissioning of production lighting dimming and control system equipment.
2. Provide all low voltage terminations for the system, make all physical low voltage termination at all panels in the system per factory specification
3. Coordinate with architectural lighting designer and electrical engineer to provide all parts necessary for a functional emergency lighting system.

1.2 RELATED SECTIONS

A. Coordinate with the following sections in carrying out this work:

1. Division 1 – General Conditions
2. Section 11 61 34 – Production Rigging Systems
3. Division 26 – Electrical
4. Section 26 05 35 – Production Systems Electrical Installation

1.3 REFERENCES

- A. Comply with all national, state and local regulations. In the event of conflict between these specifications and the applicable regulations, the more stringent shall govern.
- B. Equipment shall be provided per the related trade and regulatory guidelines including but not limited to UL, NEC, IEEE, and all manufacturer's recommendations and requirements. Contractor shall be responsible in the event that work under their control voids or jeopardizes manufacturers' warranties.
- C. Labor shall be provided per applicable labor regulations and practices.

1.4 DEFINITIONS

- A. Refer to Div. 1 for definitions.
- B. Owner's Representative: For the scope in this Section, authorized personnel representing The Beaverton School District and The Shalleck Collaborative, Inc., Theatre Consultants.

1.5 SYSTEM DESCRIPTION

- A. The production lighting control system shall be complete, and shall control the theatre lighting, and selected work lighting through interface with DMX controlled motorized breakers and dimmers.

PRODUCTION LIGHTING SYSTEM

- B. The system shall be comprised of control panels, control electronics, a data network, relays, and circuit wiring devices.
- C. Provide all low voltage terminations for the system, make all physical low voltage termination at all panels in the system per ETC factory specification.
- D. There shall be a fully functional emergency lighting system, designed by the electrical engineer.

1.6 CURRENT TECHNOLOGY

- A. Only the most current hardware and software shall be provided. In no case will discontinued or superseded products be acceptable. If the manufacturer has developed and successfully released products that meet or exceed the criteria within this specification, the Contractor shall notify the Owner's Representative and submit the new product for review. If accepted, the products will be provided at no additional cost to the Theatre. Software upgrades and authorized support services for its proper integration into the system shall be provided at no cost to the Theatre throughout the warranty period.
- B. In the event of known product defaults or recall, the Contractor shall immediately notify the Owner and Owner's Representative and make immediate arrangements for remedy.
- C. None of the stipulations herein shall be grounds for revision to the project schedule.
- D. See related procedures under Warranties in this Section.

1.7 SUBSTITUTIONS

- A. All requests for substitutions from the specified materials, assemblies or related services shall be submitted for review by the Owner's Representative prior to bid. Substitution requests made after bid shall be neither reviewed nor accepted. Requests shall be made in accordance with Division 1 of the specifications, and in a timely fashion so as to not affect the project schedule in either case of the substitution being accepted or rejected.
- B. Documentation for the substitution shall be submitted with supporting material and shall include the related information for the item as specified so that equivalence can be demonstrated. The burden of proof rests solely upon the Contractor. The Owner's Representative shall be the sole evaluator of the fitness of the substitution.
- C. All expenses related to the substitution including, but not limited to, all fees and expenses incurred in the evaluation of the substitution, and any effect on the costs and schedule of other trades whether or not the substitution is accepted, shall be borne by the Contractor.

1.8 WARRANTY

- A. Warranty shall provide coverage of material and product defects and assembly workmanship or installation for a period of two years following the date of acceptance by the Owner.
- B. Items under warranty shall be serviced to the satisfaction of the Owner within 14 days of notification to the Contractor. If warranty claims are not serviced to the satisfaction of the Theatre within the 14 day period, the Contractor shall bear all costs that arise as a result of

PRODUCTION LIGHTING SYSTEM

the delay, including, but not limited to, the use of temporary replacement components, additional Owner's staffing or overtime, shipping, cancelled uses or performances.

1.9 QUALITY ASSURANCE

- A. Equipment in this Section shall be provided by specialty subcontractors and manufacturers meeting the qualifications listed herein.
- B. Specialty subcontractor shall have been continuously engaged in the sales and integration of lighting control equipment similar to that specified herein for a minimum of ten years.
 - 1. Manufacturer shall have been continuously engaged in the manufacturing of lighting control equipment similar to that specified herein for a minimum of ten years.
- C. Specialty subcontractors shall have within their employ; manufacturer's factory authorized field services technicians within a four hour travel distance from the Project site.
- D. All equipment shall be UL listed and bear the appropriate labels.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Packing shall prevent damage to the equipment during transit. Costs to repair or replace all equipment damaged during the course of the contract services shall be borne by the Contractor.
- B. Do not deliver materials in this Section until building is ready for installation. Contractor is responsible to properly sequence the work and to protect from damage during delivery, handling, storage and installation.
- C. Contractor is responsible to coordinate and provide secure and protected storage as required for the execution of the Contract.
 - 1. Devices shall not be delivered to the project site until the project is suitably clean and all adjacent finish work that may be painted or produce dust has been completed. The contractor shall provide and maintain complete protection of all devices until the project has been made available for occupancy by the Owner. The Contractor shall thoroughly clean and remove any dirt or dust that infiltrates system components and be responsible for timely replacement of any damaged components.
 - 2. Device labels and connectors shall be delivered with temporary dust and paint protection installed.

1.11 PROJECT CONDITIONS

- A. Defects in the field which may impact the work in this Section shall be reported to the Owner's Representative and corrected in accordance with the requirements of the applicable Section of work prior to commencement of the work in this Section.

1.12 DEMOLITION

- A. Remove backboxes and wiring at existing production lighting receptacles. Remove conduit to production lighting receptacles or reuse if possible.

PRODUCTION LIGHTING SYSTEM

- B. Remove production lighting receptacles and wiring at old lighting desks in the booth.

1.13 MAINTENANCE

- A. Provide maintenance stock of User-serviceable components within the system. Maintenance stock shall be packaged in labeled long term storage packaging and turned over to the **school district maintenance department Theatre** at time of system commissioning.
- B. Maintenance stock shall include:
 - 1. Four fuses of each type in the system.
 - 2. Two control device receptacles and connectors of each type in the system.
 - 3. Four circuit distribution connectors of each type in the system.
 - 4. Four cable mount lighting fixture power connectors of each type in the inventory.
 - 5. Six spare keys of each type in the system.
 - 6. Components recommended by the Manufacturer.
 - 7. Any non-standard tools required for User service.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Dimming and control equipment in this Section shall be provided by specialty manufacturers providing products meeting the specifications herein.
- B. Dimming and control equipment in this Section shall be the products of the following pre-approved manufacturers:
 - 1. Electronic Theatre Controls
 - 2. or equal (no known equal)
- C. All other manufacturers must be approved by the Owner's Representative prior to bid.

2.2 MATERIALS

- A. All components supplied under this Section shall be new. Used or factory reconditioned components shall not be acceptable. Reuse of existing conduit, wiring and back boxes is acceptable if they meet conditions required herein.

2.3 PRODUCTION AND ARCHITECTURAL LIGHTING RELAY PANELS

- A. For production lighting relay panels, the wall mount relay panel shall be the Sensor IQ Relay Panel as manufactured by Electronic Theatre Controls, Inc.
- B. For architectural and work lighting relay panels, the wall mount relay panel shall be the

PRODUCTION LIGHTING SYSTEM

Sensor IQ Relay Panel as manufactured by Electronic Theatre Controls, Inc.

1. Provide main and branch breaker configurations to support connected fixture load types.

C. General

1. Panels shall be UL 508, UL924 and UL67 listed and so labeled.
2. The panels shall receive ESTA DMX512-A control protocol. Addressing shall be set via the user interface button keypad with any circuit patched to any DMX control address.
 - a. 2,500V of optical isolation shall be provided between the DMX512 inputs and the control electronics as well as between control and power components.
3. Panels shall be provided in 12, 24 or 48 circuits as shown on drawings.
 - a. Panel shall support dual and three pole circuits at decreased density where each pole constitutes one of the available single pole circuits
 - b. Single, Dual or three pole circuits shall be mixed as required for the circuiting shown on the drawings.

D. Electrical

1. Breakers and relays shall be rated to 100% electrical load.
2. Branch circuits shall be 20a unless noted otherwise.
3. Breaker output lugs shall accept 10-14 AWG dual conductor wire
4. Panel shall be fed by 120/208v Three phase, 4-wire plus ground input feeder.
5. Panels shall include a main breaker. See electrical documents for breaker sizing.

E. Mechanical

1. The panels shall be set up for wall or flush mounting and supplied with cover.

F. Function

1. Panel shall be user programmable.
2. Circuits shall be individually addressable.

G. Provide with the following Breaker Panel Accessories

1. Ethernet Option shall provide advanced control of breakers over streaming ACN (sACN) and transmit status, control override, and measured energy usage per branch circuit to web browser based interface or central monitoring interface

PRODUCTION LIGHTING SYSTEM

2. A Contact Input Option shall allow 24 dry contact inputs to be linked for direct or group breaker control, to activate a preset, or to activate a sequence. Controller software shall allow for normally open maintained, normally closed maintained or momentary toggle.
 3. A RideThru Option shall provide short-term power backup of control electronics by automatically engaging when power is lost, and recharging when normal power is present
 4. A Tamperproof Hardware Kit shall include center reject Torx head screws to prevent access to panel interior by unqualified individuals
 5. Main Breaker options
- H. Panel shall be of the same manufacturer as the architectural control system.
- I. The wall mount relay panel shall be the Sensor IQ Relay Panel as manufactured by Electronic Theatre Controls, Inc.
- J. Provide the following options:
1. Ethernet Option
 2. 0-10V Dimming Option
 3. Contact Input Option
 4. RideThru Option

2.4 ARCHITECTURAL CONTROL ELECTRONICS

- A. Provide control electronics with memory capacity and performance as required to meet the functions within these specifications.
1. The system shall permit control of any dimmer on the system by the Control Console or any other DMX512 controller, or the Preset Panels as specified below on a last action basis.
 2. Racks shall be configured to normally exchange data via the Ethernet network, with all programming capabilities granted therein.
 3. Two optically isolated DMX512 inputs shall be provided, allowing overlapping or separation of any control level. 2,500V of optical isolation shall be provided between the DMX512 inputs and the control module.
 4. The system shall send control signal to low voltage relay panels as specified.
 5. Architectural control electronics may be housed external from dimmer racks.
 6. Provide options/modules as necessary to accept an RS-232 control connection from the AV control system.

PRODUCTION LIGHTING SYSTEM

7. Products shall be
 - a. ETC Paradigm

2.5 EMERGENCY SYSTEMS

- A. Provide equipment necessary for emergency lighting systems as shown on drawings
- B. Emergency Power Transfer Switch
 1. All Devices shall be UL1008 listed and labeled.
 2. Provide ELTS by Electronic theatre controls, if required by electrical engineer to support the emergency lighting system.
- C. Emergency signal devices
 1. All devices shall be UL 924 listed and so labeled.
 2. Provide Power loss detection kit
 - a. Provide ETC Emergency Bypass Detection Kit (EBDK)
 3. Provide DMX emergency signal dedication
 - a. Provide DMX Emergency Bypass Controller (DEBC)
 - b. Provide in quantities as required to serve each discrete DMX line as shown on the architectural drawings.

2.6 LIGHTING CONTROL ETHERNET NETWORK COMPONENTS

- A. Network general specifications:
 1. The lighting control system shall operate on an Ethernet TCP/IP based network, with all components and procedures meeting IEEE standard specification 802.3af-2003, for Power over Ethernet, 10/100BaseT and/or 10/100Base FL.
 2. The network shall support multiple consoles, computers, file servers, printers, and architectural processors with discrete command lines and control. The network shall support multiple venues/systems on the same network.
 3. Device configuration selection, manufacturing, installation shall be accomplished to assure a flexible and robust system for the prevention of data interruption and ease of User maintenance and diagnostics.
 4. ESTA ACN protocol shall be supported.
- B. Network Nodes
 1. DMX and other lighting control data shall be inserted and retrieved on the Ethernet network via protocol translation nodes.

PRODUCTION LIGHTING SYSTEM

2. Each DMX Node shall have LEDs for indication of power, network activity, and DMX port configuration. Those LEDs used for DMX port configuration indication shall also indicate the presence of valid DMX/EDMX signal.
3. Network configuration shall be via production lighting control manufacturer's configuration software. The software shall permit complete user flexibility allowing the system operator to patch DMX data over Ethernet DMX (EDMX), assign node labels for easy identification, assign RFUs to specific systems in multi-system networks, assign DMX offsets and provide DMX port prioritization. Each node shall have a specific IP address provided automatically by the software. The user may edit this IP address. Systems that do not support simple Windows configuration, or systems that do not allow complete reconfiguration of the above mentioned features over Ethernet shall not be acceptable.
4. All configuration data for each network device shall be held at the device and system operation shall not require continuous on line operation of the network configuration software.
5. Systems connected to the same network shall be capable of arbitrating control over EDMX data. The system shall be capable of alternating control of individual dimmer data between architectural and production lighting systems without intervention by the user. The user shall dictate the conditions under which system shall automatically take control and the network shall allow user override of the user selected defaults. Systems which require direct user intervention to allocate control of dimmers between architectural and production lighting systems shall not be allowed.
6. The network shall allow multiple DMX inputs assigned to the same EDMX range to be set at different priorities. This shall allow the user to assign high or low priority to each DMX input port in the network on a port by port basis. The network shall require a valid DMX signal present at the input to initiate prioritization. Systems that do not allow for prioritization shall not be allowed.
7. Each DMX Node shall control up to 2048 DMX addresses, within the confines of up to 64 DMX (32,767 EDMX address) "universes". The specific DMX data input or output by the Node shall be freely configurable by the user. Duplicate outputs of DMX lines (DMX splitter) and discrete outputs shall be fully supported. Multiple sources may be combined and a priority may be assigned to each source. Each DMX line may have its own start address and offset for ease of use. DMX ports shall be configurable for either input or output.
8. Maximum delay time from input to output shall not be greater than one packet time (approximately 30 mSec.). A minimum DMX update rate of 40Hz shall be sustained under all conditions.
9. Power for the nodes shall be provided over the Cat5 cable, as PoE as specified herein. The node electronics shall be electrically isolated from the power supplied over the Cat5 cable.
10. DMX inputs shall be fully opto-isolated from the node electronics and from each other. DMX outputs shall be earth-ground referenced. DMX Ports shall be capable of withstanding fault voltages of up to 250VAC without damage.

PRODUCTION LIGHTING SYSTEM

11. Provide 8 portable nodes at each school.

C. Control Equipment Rack (CER)

1. Rack general assembly:

- a. Provide industry standard 19" equipment rack for all necessary control equipment specified herein.
- b. Wall mounting with fixed back plane swing out front section for access. Hinges shall be placed on the side appropriate to the mounting condition. Verify in field.
- c. Mounting brackets shall be 14 gauge steel
- d. Engraved label riveted to the case front with the name of the rack. Rack label characters shall be ½" high.
- e. Bottom air vents and rear knockouts for conduit entry.
- f. All unused sections shall be covered with vent panels no taller than 2 rack units (R.U.).
- g. Rack to be configured and mounted with all controls within wheelchair chair reach as required by the ADA and local codes.
- h. Powder coat finish: Black
- i. Body and Back pan shall be 18 gauge Steel
- j. Rackrail shall be 11 gauge steel
- k. Rack shall be Middle Atlantic Products model DWR, or equal

D. Switches

- 1. Provide Power Over Ethernet (PoE) 48-port 1000Mbps Ethernet switches in quantities as required, configured appropriately.

E. Provide network patch panels for the termination of network taps. Label each point to match labels on drawings.

F. Provide patch cables as required for the inter connection of the system.

2.7 CONTROL RECEPTACLE PANELS

A. General

- 1. The control receptacle panels shall consist of the appropriate connectors required for the system in this Project.

B. Connectors

PRODUCTION LIGHTING SYSTEM

1. The control receptacle panels shall include for following connector types, per industry standard:
 - a. RJ-45 XLR type, Neutrik Ethercon Series Connectors for Cat5, configured to accept standard RJ-45 connectors.
 - b. 5-Pin male and female XLR connectors for DMX input/output per industry standard
 - c. Other receptacle types as appropriate per manufacturer's standard features. Match power receptacles to each school's existing receptacle type.

C. Physical

1. Faceplates shall be .080" aluminum, edges eased, finished in fine texture, scratch-resistant powder coat, with fasteners countersunk.
 - a. Panels specified as flush mounted shall overlap back box by 1/2". Surface mounted panels shall match back box size with no gaps or overlap.
 - b. Provide all back boxes and coordinate mounting with Div. 26.
2. Color shall be black unless otherwise noted.
3. Panels noted as custom color shall be factory powder coated a color selected by the Owner's Representative. Engraving shall be filled a contrasting color.
4. Engraved and filled labels 1/8" high characters minimum, filled shall be white unless otherwise noted.
 - a. Network taps and node gateways shall be labeled per the patch bay location and point number as shown on schedule.
5. Wall mounted panels shall mount into an industry standard back box, depending on size and quantity of connectors. A terminal block shall be supplied for terminations.
6. Rack mounted panels shall mount within industry standard equipment racks. Provide local breaker for integral AC power receptacle per Code.
7. Panels mounted in floor boxes shall include a clear flexible vinyl dirt guard. Guard shall cover receptacles but not labels.
8. Provide complete hardware for mounting on gridiron or catwalk hangers where required.

2.8 ARCHITECTURAL CONTROL PANELS

- A. Architectural control panels shall be able to control any of the following:
1. Theatre theatrical lighting relays
 2. Theatre architectural lighting relays

PRODUCTION LIGHTING SYSTEM

3. Lighting circuits on relays
- B. Architectural control panel wiring shall be digital, low voltage wiring that shall be topology free. Panels shall be interactive with each other as described herein.
- C. Physical
 1. Faceplates shall be .080" aluminum, edges eased, finished in fine texture, scratch-resistant powder coat, with fasteners countersunk.
 - a. Panels specified as flush mounted shall overlap back box by 1/2". Surface mounted panels shall match back box size with no gaps or overlap.
 - b. Provide back box and coordinate mounting with Div. 26.
 2. Color shall be black unless otherwise noted.
 3. Panels noted as custom color shall be factory powder coated a color selected by the Owner's Representative. Engraving shall be filled a contrasting color.
 4. Engraved and filled labels 1/8" high characters minimum, filled shall be white unless otherwise noted.
 5. Wall mounted panels shall mount into an industry standard back box, depending on size and quantity of connectors. Back boxes shall not exceed 4" in recess depth. A terminal block shall be supplied for terminations.
 6. Rack mounted panels shall mount within industry standard equipment racks.
- D. LCD Touchscreen
 1. Rear illuminated LCD touch screen with all standard advertised features.
 - a. Acceptable devices:
 - b. ETC Unison Paradigm LCD touch screen
 2. Provided, immediately adjacent to LCD Panels.
 - a. One illuminated, momentary contact "ENTRY PANEL LOCKOUT" pushbutton. The pushbutton shall cause Theatre one-button panels to be inoperative when pressed once and all "LOCKOUT" pilot lights shall illuminate. The pushbutton shall remain lit so long as the "LOCKOUT" status is maintained. "LOCKOUT" status shall be activated or deactivated at any "LOCKOUT" pushbutton, regardless of the last action. Action on an illuminated pushbutton in "LOCKOUT" mode will release the preset panels for operation and the pilot light shall go out. Action on the lockout button shall not cause any change in level status. This button shall have no effect on the controls outside of the Theatre.
 - b. One on/off button to turn on general worklights and rehearsal lights to be programmed at time of commission.

PRODUCTION LIGHTING SYSTEM

E. LCD Panel Operations

1. The following should be used as a basis for the initial soft programming of the architectural control stations. The configuration shall be verified with the Owner's Representatives at time of commissioning.
2. LCD panels shall be programmed with soft pages for access to various areas and levels of control.
 - a. Virtual pushbuttons shall indicate state by a change in appearance. Controls shall be though various pages of controls.
 - b. Access shall be divided into two security levels minimum. The panels shall "home" to a first level of access which allows the User to play presets changing the levels of the areas shown on the display, without login. The first level of access shall not allow the programming of presets.
 - c. The program function shall become available as a "record" button on the same preset playback screens upon login to the second level with a four digit pass code on a virtual keypad. The pass code shall initially be set as "4100". The login screen shall be a back page visible as a first level page choice, and shall include a "logout" pushbutton which shall return the panel to the first level. "Logout" from the second level shall automatically occur after 30 minutes of inactivity.
 - d. The LCD shall be used to program the multi-button and one-button pushbutton preset panels.
 - e. The system shall allow the programming of presets and macros through a "snapshot" procedure. Levels shall be set by the control console, by soft sliders at the LCD panel or at the dimmer rack and then captured as a preset to be replayed at any one of the preset buttons.
 - f. The first page shall be called "House Presets" and shall contain the same number and function of preset buttons as the multi-button preset stations specified herein.
 - g. The second page shall be called "Work/Reh" and shall have buttons for the various areas of the theatre's technical areas and the rehearsal groups. The work light buttons shall include control of the low voltage relay circuits as well as production circuits selected as rehearsal lights. If the architectural control system does not receive status information back from the relay cabinet, then separate on and off buttons shall be shown, and the "off" button shall activate a macro that pulses the channel on then off, so the indicators on the panel match the channels' state.
 - h. The third page shall be called "Show Presets" and shall include ten buttons, named as directed by the Owner's Representative at time of programming.
 - i. The next page shall only be visible at the second security level and shall be used to program the one-button entry stations.

PRODUCTION LIGHTING SYSTEM

- j. The next pages shall include sliders for each architect control group as listed in the architectural lighting dimming schedule.

F. Multi-Button and One-Button Panels

- 1. Pushbutton stations shall include programmable buttons with integral LED indicators.
- 2. Multi button panels shall include a card holder with slide-in tags and clear cover for User labeling.

G. Preset Panel Operations

- 1. The system shall allow the programming of presets and macros through the LCD as described above.
- 2. Action on any one button shall cause all identical pushbutton indicators on other panels to mimic the preset state.

2.9 WIRING DEVICES

- A. Provide power distribution wiring devices in the quantities, types and configurations as shown on drawings. All back boxes shall be supplied by production lighting contractor and manufacturer.
- B. Devices shall be fabricated from 18 gauge cold rolled steel with 16 gauge covers, finished with flat black powder coat unless otherwise noted. Devices shall be UL listed and labeled for the use specified herein.
 - 1. Back box shall not exceed 6-1/2" high x 4" deep.
 - 2. Panels specified as flush mounted shall overlap back box by 1/2". Surface mounted panels shall match back box size with no gaps or overlap.
- C. Receptacles and connectors shall all be of the same manufacturer and be fully black.
 - 1. Connector type: Provide 20A L5-20 connectors throughout, except at orchestra shell drop boxes, Provide 20A L5-20 connectors at orchestra shell drop boxes.
 - a. Connectors shall be of the same manufacturer throughout the project to minimize maintenance stock.
- D. Receptacles and connectors shall be factory pre-wired to internal feed through terminal blocks and grounded. All wiring and terminals shall be factory numbered. Size all lugs as required based on wire size indicated on the Electrical documents. Provide for dedicated neutrals within each device and homerun. Terminals shall be clamp-type compression terminals appropriately listed.
 - 1. All parallel circuits, if applicable shall homerun to the dimmer rack, unless otherwise noted.
- E. Circuits shall be labeled with engraved lamicoid tags with 1/2" high characters securely riveted to the box and plainly visible. Label color shall be:

PRODUCTION LIGHTING SYSTEM

1. Production Lighting circuits - black tags with white core.
- F. Pigtails shall be of neoprene covered, black, heavy duty SO, SOW or better three-wire 12/3 cable. Internal wiring shall be sized to circuit ampacity and shall be rated at 125°C. Provide heavy duty strain relief at box entry. Visible leads shall not be acceptable.
1. In addition to box labels, pigtails shall be labeled with ½” high minimum black characters on white background sleeves, protected and securely affixed under clear heat shrink tubing. Pigtail label assembly shall be applied 6” above the connector.
- G. Provide with all necessary mounting hardware as required.
- H. All 6-circuit multipin receptacles shall be wired per USITT industry standard for 19 pin connectors.
- I. Multicable Plug Boxes:
1. Multicable plug boxes shall include female 6-circuit, heavy-duty, locking multipin receptacle(s) which will mate to multi-cables.
 2. Provide threaded couple/uncouple panel mount multi-pin connectors.
 3. Contacts shall be manufactured from copper alloy with hard silver or gold plating.
 4. Backshells shall provide minimum 1” of wiring space.
 5. Multipin receptacles to be Socapex compatible as manufactured by Veam, Pyle-National and as appropriate for the theatre industry's standards in the project's immediate region.
 6. Label shall include each circuit number preceded by an “A-” through “F-” designation.
 7. Provide pigtail and basket weave strain reliefs.
 8. Provide robust tie-off devices.
- J. Terminal Boxes, Type “ET” and “BT”
1. Provide terminal boxes factory wired with numbered terminal blocks for field connection by others, as indicated in the Drawings and schedules. Provide 6 spare terminals in each terminal box in addition to the circuits indicated in the Drawings. Provide with ground lugs bonded to the box.
 - a. Terminals and circuiting shall include relay circuits as well as integral constant AC power as indicated on drawings.
 2. Reinforce base of terminal boxes as required to take load from multicable.
 3. Terminal boxes for Drop Boxes, and Connector strips shall include multiconductor extension drops as specified below.

PRODUCTION LIGHTING SYSTEM

4. Terminal box to be clearly labeled with circuit numbers.

2.10 MULTICABLE EXTENSION DROPS

- A. Provide flexible multiconductor extension cables drops:
 1. Cables shall be of heavy duty SO, neoprene covered cable with the number of conductors in accordance with prevailing electrical codes. Provide 2 conductors for each circuit, plus grounds, rated for 20A, 125V.
 2. Provide min. two (2) spare conductors per batten.
 3. Provide for:
 - a. Receptacle Boxes on fixed electrics battens
- B. Coordinate lengths with Production Rigging Sub-Contractor, under Section 116134. Provide lengths sufficient to allow battens to travel to the floor.
- C. Strain relief:
 1. Provide "Hubbell Kellems Deluxe" cord type grips correctly sized to restrain multicable at connection to devices.
 2. Provide "Hubbell Kellems Heavy Duty, Single Eye, Closed Mesh Strain Relief" at cord connection point to loftblock beam.
 3. Provide 1 rated shackle for each eye.
- D. Coordinate installation with Production Rigging Sub-Contractor, under Section 116133 and with division 26.
- E. Provide with all necessary mounting hardware as required.

2.11 CONTROL CONSOLE

- A. Provide the following control consoles:
 1. ETC Ion 1000 with 2x20 fader wing

2.12 CONSOLE ACCESSORIES – ETC ION

- A. Provide the following accessories:
 1. One (1) Apple ipad mini with IRFR application installed and configured.
 2. Provide industrial water and fall protection case and cover for ipad mini.
 3. Two (2) POE wireless access points
 - a. Mount/install access point on steel plate and attached to PCR on stage and back of third catwalk at main theatre. Plug into network port at top of the rack and

PRODUCTION LIGHTING SYSTEM

back of catwalk, provide required network cable.

- b. Standards 802.11 a/b/g/n/ac
 - c. Dual band 2.4 and 5 GHz
 - d. Wireless data rates up to 300Mbps
 - e. POE – power over ethernet
 - f. Setup to work with IRFR ipad
 - g. Black in color.
 - h. Any lights shall be shut off if in view of audience.
4. Control Room Monitors & Keyboards
- a. Provide two monitors for the console.
 - b. Monitors shall be 22” minimum diagonal color (if supported by console) flat panel display monitors. Provide Dell S2240T Touch Screen Monitor or equal.
 - c. Monitors shall include vertical and tilt adjustment stand.
 - d. Provide one keyboard & mouse for each console
5. Tech table equipment
- a. In addition to Control Room Monitors, provide two 22” minimum diagonal color flat panel display monitors for use at a tech table position. Standard desk-top mount with vertical and tilt adjustment stand. Provide Dell S2240T Touch Screen Monitor or equal.
 - b. Provide ETC Nomad Puck 256 for use at tech table position.
 - c. Provide plug strip and 25 foot power and data cables.
 - d. Two dimmable table top or integrated “Littlelite” worklights.
 - e. Road case with 1” foam padded, hard sided industry standard pre-manufactured case with lifting handles and casters. Provide with individual slots for tech table monitors and Nomad Puck RVI. Provide slot for plug strips and all cables and little lights. Attach lamicoid labels to the short end and top of the road case “Tech Table Production Lighting”
6. Two dimmable table top or integrated “Littlelite” worklights.
7. Power supply and surge protector/UPS capable of maintaining the console and monitor for 15 minutes after power is suspended.
8. Console power and all control cables shall be 25’ long.

PRODUCTION LIGHTING SYSTEM

- a. Exception: provide standard length monitor data cables.
- 9. Dust covers for console and all monitors.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Advise Div. 26 for the proper installation of the dimming and control equipment specified herein.
- B. For the commissioning services as listed herein only, coordinate scheduling and access with the Contractor and Owner and provide personnel lifts or ladders as required for access to the lighting equipment.
- C. For the commissioning services as listed herein only, remove all packing materials from the jobsite. Insert operations and maintenance information into the project record documents as specified above in Submittals.
- D. Provide all low voltage terminations for the system, make all physical low voltage termination at all panels in the system per factory specification.

3.2 COMMISSIONING AND DEMONSTRATION

- A. Coordinate with Division 26.
- B. Factory trained and authorized personnel shall review, test, program and otherwise complete the system, providing that the system and all components are fully functional per the Documents and fully covered under the Manufacturer's warranty.
 - 1. It shall be under the work in this section to provide turnkey proper and logical programming of the lighting control systems.
 - 2. It shall be under the work in this section to coordinate the proper and logical programming of the low voltage relay panel supplied under Division 26.
 - a. The low voltage panel shall be programmed so the control groups of branch circuits match the control and indication on the architectural control panels provided and programmed under this section.
- C. Upon completion of the commissioning, the factory trained and authorized personnel shall demonstrate operation and maintenance of the system to the Owner's representatives. Coordinate with the Owner's Representative's schedules two weeks in advance minimum.
- D. Training shall include, but not be limited to:
 - 1. Safety precautions.
 - 2. Identification of all elements provided under this section.
 - 3. Maintenance, diagnostics and trouble shooting.

PRODUCTION LIGHTING SYSTEM

4. Control operation training of the console, dimming and control electronics.
 5. Operations and maintenance manual orientation.
- E. Provide 6 hours of training, minimum over 2 days.

END OF SECTION

ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work included in 26 00 00, Electrical Basic Requirements applies to Division 26, Electrical work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electrical systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
 - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

- A. Contents of Section applies to Division 26, Electrical Contract Documents.
- B. Related Work:
 - 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
 - b. Drawings

ELECTRICAL BASIC REQUIREMENTS

- c. Addenda
- d. Owner/Architect Agreement
- e. Owner/Contractor Agreement
- f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

- A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 26, Electrical Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. State of Oregon:
 - a. OAR - Oregon Administrative Rules
 - b. OESC - Oregon Electrical Specialty Code
 - c. OFC - Oregon Fire Code
 - d. OMSC - Oregon Mechanical Specialty Code
 - e. OPSC - Oregon Plumbing Specialty Code
 - f. OSSC - Oregon Structural Specialty Code
 - g. OEESC - Oregon Energy Efficiency Specialty Code
 - h. Oregon Elevator Specialty Code
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 - 1. ABA - Architectural Barriers Act
 - 2. ADA - Americans with Disabilities Act
 - 3. ANSI - American National Standards Institute
 - 4. APWA - American Public Works Association
 - 5. ASCE - American Society of Civil Engineers
 - 6. ASHRAE Guideline 0, the Commissioning Process

ELECTRICAL BASIC REQUIREMENTS

7. ASTM - ASTM International
 8. CFR - Code of Federal Regulations
 9. EPA - Environmental Protection Agency
 10. ETL - Electrical Testing Laboratories
 11. FCC - Federal Communications Commission
 12. FM - FM Global
 13. IBC - International Building Code
 14. IEC - International Electrotechnical Commission
 15. IEEE - Institute of Electrical and Electronics Engineers
 16. IES - Illuminating Engineering Society
 17. ISO - International Organization for Standardization
 18. MSS - Manufacturers Standardization Society
 19. NEC - National Electric Code
 20. NECA - National Electrical Contractors Association
 21. NEMA - National Electrical Manufacturers Association
 22. NETA - National Electrical Testing Association
 23. NFPA - National Fire Protection Association
 24. OSHA - Occupational Safety and Health Administration
 25. UL - Underwriters Laboratories Inc.
- D. See Division 26, Electrical individual Sections for additional references.
- E. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- F. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

ELECTRICAL BASIC REQUIREMENTS

1.4 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures as well as individual Division 26, Electrical Sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
 - 1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
 - 2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one zip file per specification division containing a separate file for each Specification Section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.
 - 3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 26, Electrical Sections.
 - 4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.
 - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
 - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 26, Electrical specification Sections for specific items required in product data submittal outside of these requirements.
 - c. See Division 26, Electrical individual Sections for additional submittal requirements outside of these requirements.

ELECTRICAL BASIC REQUIREMENTS

5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.
7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 26, Electrical Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
10. Substitutions and Variation from Basis of Design:
 - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

ELECTRICAL BASIC REQUIREMENTS

11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 26, Electrical specification Sections for additional requirements for shop drawings outside of these requirements.
 - a. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
12. Samples: Provide samples when requested by individual Sections.
13. Resubmission Requirements:
 - a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
 - b. Resubmit for review until review indicates no exception taken or "make corrections as noted".
14. Operation and Maintenance Manuals, Owner's Instructions:
 - a. Submit, at one time, electronic files (PDF format) on CD/DVD of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - (1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - (2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment.
 - (3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
 - (4) Include product certificates of warranties and guarantees.

ELECTRICAL BASIC REQUIREMENTS

- (5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
 - (6) Include commissioning reports.
 - (7) Include copy of startup and test reports specific to each piece of equipment.
 - (8) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
- b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 26 00 00, Electrical Basic Requirements, Demonstration.
 - c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:

- a. Maintain at site at least one set of drawings for recording "As-constructed" conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed electrical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
- b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
- c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
- d. See Division 26, Electrical individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations.

ELECTRICAL BASIC REQUIREMENTS

- B. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e. distribution equipment, duct banks, light fixtures, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- D. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- E. Provide products that are UL listed.

1.6 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

- A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable tray and electrical services with architectural and structural requirements, and other trades (including ceiling suspension and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
- B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- C. Verify in field exact size, location, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

ELECTRICAL BASIC REQUIREMENTS

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide like items from one manufacturer.

2.2 MATERIALS

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by state, county, and city authorities. Equipment/fixture supplier is responsible for obtaining State, County, and City acceptance on equipment/fixtures that are not UL approved or are not listed for installation.
- B. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.
- C. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- D. Hazardous Materials:
 - 1. Comply with local, State of Oregon, and Federal regulations relating to hazardous materials.
 - 2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
 - 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Install equipment requiring access (i.e., junction boxes, light fixtures, power supplies, motors, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in passageways, doorways, scuttles or crawlspaces which would impede or block the intended usage.

ELECTRICAL BASIC REQUIREMENTS

- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.
- D. Earthwork:
 - 1. Confirm Earthwork requirements in Contract Documents. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- E. Firestopping:
 - 1. Confirm requirements in Division 07, Thermal and Moisture Protection. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- F. Plenums:
 - 1. In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.
- G. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- H. Provide miscellaneous supports/metals required for installation of equipment and conduit.

ELECTRICAL BASIC REQUIREMENTS

3.2 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 26 Electrical Sections.
- B. General:
 - 1. Earthquake resistant designs for Electrical (Division 26) equipment and distribution, i.e. power distribution equipment, generators, UPS, etc. to conform to regulations of jurisdiction having authority.
 - 2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
 - 3. Provide stamped shop drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for conduit and equipment. Submit shop drawings along with equipment submittals.
 - 4. Provide stamped shop drawings from licensed Structural Engineer of seismic flexible joints for conduit crossing building expansion or seismic joints. Submit shop drawings along with seismic bracing details.
 - 5. Provide means to prohibit excessive motion of electrical equipment during earthquake.

3.3 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
 - 1. Underground conduit installation prior to backfilling.
 - 2. Prior to covering walls.
 - 3. Prior to ceiling cover/installation.
 - 4. When main systems, or portions of, are being tested and ready for inspection by AHJ.
- C. Final Punch:

ELECTRICAL BASIC REQUIREMENTS

1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Electrical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the electrical systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:
 1. During remodeling or addition to existing structure, while existing structure is occupied, present services to remain intact until new construction, facilities or equipment is installed.
 2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring, and wiring to point of connection.
 3. Coordinate transfer time to new service with Owner. If required, perform transfer during off-peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
 - a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
 4. No interruption of services to any part of existing facilities will be permitted without express permission in each instance from Owner. Requests for outages must state specific dates, hours and maximum durations, with outages kept to these specific dates, hours and maximum durations. Obtain written permission from Owner for any interruption of power, lighting or signal circuits and systems.
 - a. Organize work to minimize duration of power interruption.
 - b. Coordinate utility service outages with utility company.

3.5 CUTTING AND PATCHING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:
 1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of

ELECTRICAL BASIC REQUIREMENTS

proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).

2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and/or walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage and handling to be replaced before installation.
 2. Protect equipment to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
 3. Protect bus duct and similar items until in service.

ELECTRICAL BASIC REQUIREMENTS

3.8 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 26, Electrical Sections.
- B. Upon completion of work and adjustment of equipment, test systems and demonstrate to Owner's Authorized Representative, Architect, and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

- A. Confirm Cleaning requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Upon completion of installation, thoroughly clean electrical equipment, removing dirt, debris, dust, temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- D. Provide miscellaneous supports/metals required for installation of equipment.

3.11 PAINTING

- A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

ELECTRICAL BASIC REQUIREMENTS

1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces (i.e., hangers, hanger rods, equipment stands, etc.) with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
2. In Electrical Room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
3. See individual equipment Specifications for other painting.
4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
5. Conduit: Clean, primer coat and paint interior/exterior conduit exposed in public areas with two coats paint suitable for metallic surfaces. Color selected by Architect.
6. Covers: Covers such as manholes, vaults and the like will be furnished with finishes which resist corrosion and rust.

3.12 DEMOLITION

- A. Confirm requirements in Division 01, General Requirements and Division 02, Existing Conditions. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 1. It is the intent of these documents to provide necessary information and adjustments to electrical system required to meet code, and accommodate installation of new work.
 2. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas. Owner will cooperate to best of their ability to assist in coordinated schedule, but will remain final authority as to time of work permitted.
 3. Examination:
 - a. Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to locate and preserve utilities. Replace damaged items with new material to match existing.
 - b. Verify that abandoned wiring and equipment serve only abandoned facilities.
 - c. Demolition drawings are based on casual field observation and existing record documents.

ELECTRICAL BASIC REQUIREMENTS

- (1) Verify accuracy of information shown prior to bidding and provide such labor and material as is necessary to accomplish work.
 - (2) Verify location and number of electrical outlets, luminaires, panels, etc. in field.
- d. Report discrepancies to Architect before disturbing existing installation.
 - (1) Promptly notify Owner if utilities are found which are not shown on Drawings.
- 4. Execution:
 - a. Remove existing luminaires, switches, receptacles, and other electrical equipment and devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless shown as retained or relocated on Drawings.
 - b. Provide temporary wiring and connections to maintain electrical continuity of existing systems during construction. Remove or relocate electrical boxes, conduit, wiring, equipment, and luminaires, as encountered in removed or remodeled areas in existing construction affected by this work.
 - c. Remove and restore wiring which serves usable existing outlets clear of construction or demolition.
 - d. If existing junction boxes will be made inaccessible, or if abandoned outlets serve as feed through boxes for other existing electrical equipment which is being retained, provide new conduit and wire to bypass inaccessible junction boxes and abandoned outlets.
 - e. If existing conduits pass through partitions or ceiling which are being removed or remodeled, provide new conduit and wire to reroute clear of construction or demolition and maintain service to existing load.
 - f. Extend circuiting and devices in existing walls to be furred out.
 - g. Remove abandoned wiring to source of supply.
 - h. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
 - i. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

ELECTRICAL BASIC REQUIREMENTS

- j. Disconnect and remove abandoned panelboards and distribution equipment.
- k. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- l. Existing lighting which is to remain, leave luminaires in proper working order.
- m. Repair adjacent construction and finishes damaged during demolition work.
- n. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

3.13 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - 1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Cleaning
 - b. Operation and Maintenance Manuals
 - c. Training of Operating Personnel
 - d. Record Drawings
 - e. Warranty and Guaranty Certificates
 - f. Start-up/Test Document and Commissioning Reports

3.14 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Tests:
 - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.

ELECTRICAL BASIC REQUIREMENTS

2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.15 SALVAGED EQUIPMENT AND RECYCLED MATERIAL

- A. Salvage the following equipment not being reused ~~and return to Owner~~ **transport to location as designated by Owner:**
 1. Luminaires
 2. Panelboards
 3. Breakers
 4. **Coordinate with Owner prior to start of partial demolition.**
- B. Electrical equipment that cannot be salvaged for reuse, sell/give to recycling company. Recycle following excess, removed, or demolished electrical material:
 1. Copper or aluminum conductors, buses, and motor/transformer windings.
 2. Steel and aluminum from raceways, boxes, enclosures, and housings.
 3. Acrylic and glass from luminaire lenses/refractors.
- C. Provide separate on-site storage space for recycled and salvaged material. Clearly label space.
- D. Confirm additional salvaged equipment and recycled materials in the Contract Documents.

END OF SECTION

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Anchors, Threaded Rod and Fasteners
2. Support Channel, Hangers and Supports

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
 2. Support systems to be supplied by a single manufacturer.
 3. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, equipment hangers/supports, and seismic restraint by a qualified Structural Professional Engineer.
 - a. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

- A. General: Provide conduit and equipment hangers and supports in accordance with the following:
1. When supports, anchorages, and seismic restraints for equipment and supports, anchorages and seismic restraints for conduit, cable tray and equipment are not shown on the Drawings, the Contractor is responsible for their design.
 2. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems: The following support systems to be designed, detailed, and bear the seal of a professional engineer registered in the State of Oregon.
1. Support frames such as conduit racks or stanchions for conduit and equipment which provide support from below.
 2. Equipment and piping support frame anchorage to supporting slab or structure.
- C. Provide channel support systems, for conduits to support multiple conduits capable of supporting combined weight of support systems and system contents.
- D. Provide heavy-duty steel trapezes for piping to support multiple conduit capable of supporting combined weight of supported systems and system contents.
- E. Provide seismic restraint hangers and supports for conduit and equipment.
- F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Anchors, Threaded Rod and Fasteners:
1. Anchor It
 2. Epcon System
 3. Hilti-Hit System
 4. Power Fast System

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

5. Or approved equivalent.
- B. Support Channel, Hangers and Supports:
1. B-Line
 2. Kindorf
 3. Superstrut
 4. Unistrut
 5. Or approved equivalent.

2.2 ANCHORS, THREADED ROD AND FASTENERS

- A. Anchors, Threaded Rod and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Concrete Inserts: Cast in concrete for support fasteners for loads up to 800 lbs.
- C. Anchors and Fasteners:
1. Do not use powder-actuated anchors.
 2. Concrete Structural Elements: Use precast inserts.
 3. Steel Structural Elements: Use beam clamps.
 4. Concrete Surfaces: Use self-drilling anchors.
 5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
 6. Solid Masonry Walls: Use expansion anchors.
 7. Sheet Metal: Use sheet metal screws.
 8. Wood Elements: Use wood screws.
- D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.
- E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.
- F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

2.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS

- A. Hangers and Supports - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
 - 1. Channel Material: Carbon steel.
 - 2. Coating: Hot dip galvanized.
- B. Pipe Straps: Two-hole galvanized or malleable iron.
- C. Luminaire Chain: 90 lb. test with steel hooks.
- D. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings that are necessary for completion of the project. The Contractor is responsible for their design.
 - 1. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
- E. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.
- F. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.
- G. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Fabrication - Miscellaneous Metals
 - 1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.

2. Finishes:

- a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with one coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
- b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
- c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.2 ANCHORS, THREADED ROD AND FASTENERS INSTALLATION

- A. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.
- B. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- D. Do not use supports or fastening devices to support other than one particular item.
- E. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.
- F. Provide seismic bracing per OSSC requirements.
- G. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- H. Use spring lock washers under fastener nuts for strut.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

I. Cutting and Drilling

1. Do not drill or cut structural members without prior permission from Architect.

3.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS INSTALLATION

- A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
- B. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.
- C. Verify mounting height of luminaires prior to installation when heights are not detailed.
- D. Install vertical support members for equipment and luminaires, straight and parallel to building walls.
- E. Install horizontal support members straight and parallel to ceilings or finished floor unless otherwise noted.
- F. Provide independent supports to structural member for luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over suspended ceilings.
- G. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.
- H. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- I. Do not use supports or fastening devices to support other than one particular item.
- J. Support conduits within 18-inches of outlets, boxes, panels, cabinets and deflections unless more stringently required by OESC.
- K. Maximum distance between supports not to exceed ~~8~~ **5** foot spacing unless otherwise required by OESC.
- L. Support flexible conduits and metal clad cable within 12-inches of outlets, boxes, panels, cabinets and deflections unless otherwise required by OESC.
- M. Maximum distance between supports for flexible conduits and metal clad cable not to exceed 48-inches spacing unless otherwise required by OESC.
- N. Maximum distance between supports for rigid PVC conduits unless otherwise required by OESC is as follows:
 1. 1/2-inch or 3/4-inch and 1-inch conduit, 3-feet apart.
 2. 1-1/4-inch or 1-1/2-inch and 2-inch conduit, 4-feet apart.
 3. 2-1/2-inch and 3-inch conduit, 5-feet apart.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

4. 4-inch and 5-inch conduit, 6-feet apart.
 5. 6-inch conduit, 7-feet apart.
- O. Maximum distance between supports for auxiliary gutters and wireways unless otherwise required by OESC is as follows:
1. Sheet metal auxiliary gutters and wireways - 4-feet apart horizontally and 10-feet vertically.
 2. Non-metallic auxiliary gutters and wireways - 30-inches apart horizontally and 3-feet vertically.
- P. Install strut hangers as instructed by strut manufacturer. Suspend strut hangers as instructed by strut manufacturer for the load, with a maximum spacing of 8-feet on center and within 2-feet of outlet box, cabinet, junction box or other channel raceway termination unless otherwise required by OESC.
- Q. Coordinate routing of conduit racks with materials and equipment installed by other trades. Where conduit racks are exposed to view, coordinate location and installation with Architect for optimal appearance.
- R. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.
- S. Provide seismic bracing per OSSC requirements.
- T. Where service disconnects are mounted on building exterior, physically attach service disconnect to the building or structure served.
- U. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- V. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- W. Wet and Damp Locations:
1. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1-inch off wall.

END OF SECTION

PRODUCTION SYSTEMS ELECTRICAL INSTALLATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provision of services as listed within Div. 26 related to the installation of production systems and electrical infrastructure including:
 - a. Production lighting control systems

B. It shall be under the work in this section to provide electrical infrastructure, accommodations and connections to systems in other Sections.

1. It shall be under the work of a specialty sub contractor for Section 11 61 83 – Production Lighting Control to furnish equipment only to the jobsite. It is under the work in this Div. 26 Section to coordinate with, receive, install all equipment (line voltage and low voltage) and provide all power infrastructure, conduit, raceway, wire, connectors, hardware and other incidental items, terminations for both line voltage and low voltage and testing to provide a complete and working system. Reference PL Documents for other electrical requirements.

C. Coordination with all related sections doing adjacent or integrated work.

1.2 RELATED SECTIONS

A. Coordinate with the following sections in carrying out this work:

1. Division 1 General Conditions
2. Section 11 61 83 – Production Lighting Control
3. Other Division 26 Sections

1.3 REFERENCES

- A. Comply with all national, state and local regulations. In the event of conflict between these specifications and the applicable regulations, the more stringent shall govern.

1.4 DEFINITIONS

- A. Refer to Div. 1 for definitions.
- B. Owner's Representative: For the scope in this Section, authorized personnel representing The Beaverton School District and The Shalleck Collaborative, Inc., Theatre Consultants.

1.5 SYSTEM DESCRIPTION

A. Production Lighting Control System

1. The system shall be designed for the control of production lighting and shall consist of

PRODUCTION SYSTEMS ELECTRICAL INSTALLATION

factory pre-wired dimming, switching and processing rack enclosures containing relays, dimmers, power supplies, breakers, terminals and/or control electronics.

2. Switched circuits shall be connected to factory pre-wired wiring devices.
3. System shall work in conjunction with specified low-voltage control and receptacle stations.
4. All equipment is furnished as equipment only and must be installed and circuited by the electrical contractor.

1.6 DESIGN CRITERIA

A. Production Lighting System

1. Branch production lighting wiring and infrastructure shall provide 115VAC +/-3% at all wiring devices under a 575w lighting load.
2. Production circuits shall be rated for 100% continuous operation. Branch wire size and conduit/raceway shall be sized for the full rated loads of the dimmers and/or relays and 100% continuous operation of every circuit without deration on any part of the circuit or system, subject to the maximum overall feeder and protection devices as listed in Drawings. For 20A loads, assume 10AWG wire unless otherwise noted.
3. Control wiring shall be installed per the related trade and regulatory guidelines including but not limited to UL, NEC, IEEE, and all manufacturer's recommendations and requirements. Contractor shall be responsible in the event that work under their control voids or jeopardizes manufacturers' warranties.

1.7 SUBSTITUTIONS

- A. All requests for substitutions from the specified materials, assemblies or related services shall be submitted for review by the Owner's Representative prior to bid. Substitution requests made after bid shall be neither reviewed nor accepted. Requests shall be made in accordance with Division 1 of the specifications, and in a timely fashion so as to not affect the project schedule in either case of the substitution being accepted or rejected.
- B. Documentation for the substitution shall be submitted with supporting material and shall include the related information for the item as specified so that equivalence can be demonstrated. The burden of proof rests solely upon the Contractor. The Owner's Representative shall be the sole evaluator of the fitness of the substitution.
- C. All expenses related to the substitution including, but not limited to, all fees and expenses incurred in the evaluation of the substitution, and any effect on the costs and schedule of other trades whether or not the substitution is accepted, shall be borne by the Contractor.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Components and types per referenced specification sections except where manufacturer's recommendations and requirements vary.

PRODUCTION SYSTEMS ELECTRICAL INSTALLATION

1. Refer to final, approved production systems manufacturers or specialty sub contractor's shop drawings for final control wiring types, counts and routes, which shall govern over Drawings. Coordinate with manufacturer or specialty sub contractor for alternate routes and wire counts in case of field limitations.

2.2 PRODUCTION LIGHTING

- A. All power and control wiring shall be labeled at each end and connected per circuit assignments as shown on the PL drawings and approved shop drawings, as applicable.
- B. Provide excess tails at ends as recommended by the manufacturer.
- C. Control wiring shall be continuous with no splices per the applicable industry standards.
- D. Wiring device wiring:
 1. Branch load wiring shall include a dedicated neutral for each circuit, sized as a current carrying conductor. No common neutrals will be accepted.
 2. Provide one ground wire minimum per wiring device, homerun to and terminated at the Relay Panel, sized per applicable regulatory requirements.
 3. Coordinate circuit management for proper landing on device lugs. Coordination shall include, but not be limited to, verifying with the manufacturer, during the submittal process and prior to manufacturing, provision of the appropriate lug sizes within the devices.
 4. Branch circuit load wiring shall be continuous. No splices will be acceptable between relay lugs and wiring device terminal strip.
 5. Coordinate with manufacturer for the provision of properly sized terminals and lugs, as appropriate for compliant wiring. Wire size reductions or spliced leaders used for stepping down wire size to fit manufactures' terminals is not acceptable.
 6. All power and control wiring for production systems shall be pulled in metal raceway. This shall include empty raceway provided for future production systems wiring.
 - a. Raceway placed in grade or poured in concrete shall be epoxy covered, rigid metal conduit/raceway.
 7. Production lighting conduit shall be no smaller than 1" diameter, or the greater of what is required by either the applicable code, Drawings or the final, approved equipment shop drawings.
- E. Floor Pockets
 1. Install floor pockets at locations as shown on the drawings. Floor pockets will be provided by the PL contractor.
 - a. Install floor pockets to replace existing floor boxes. Enlarge area as required to receive new boxes. Repair floor damage after installation.

PRODUCTION SYSTEMS ELECTRICAL INSTALLATION

- b. At locations where pocket is to be located on grade, provide “pour pan” below floor pocket backbox. Pour pan will provide at least 1” of concrete between grade and backbox to prevent corrosion.
- c. Floor pocket backbox shall be placed in flooring material to yield a finished product that is flush with the finish floor, including floor box cover.

PART 3 EXECUTION

3.1 INSTALLATION

A. Production Lighting Control System

- 1. It is under the work in this Div. 26 Section to receive and store the necessary materials and equipment for installation of the system. It is the intent of these specifications and plans to include everything required for proper and complete installation and operation of the production lighting system, even though every item may not be specifically mentioned. The contractor shall deliver on a timely basis to other trades any equipment that must be installed during construction.
- 2. It is under the work in this Div. 26 Section to be responsible for field measurements and coordinating physical size of all equipment with the architectural requirements of the spaces into which they are to be installed.
- 3. It is under the work in this Div. 26 Section to install all lighting control and production lighting equipment in accordance with final, approved manufacturer’s approved shop drawings.

3.2 CONDUIT/RACEWAY INSTALLATION

A. Conduit/raceway shall not be placed where it obstructs production functions or the proper installation of other production systems.

- 1. No conduit/raceway is permitted on lighting pipes. Crossing pipes or grids used for lighting shall only be allowed where authorized by the Owner’s Representative. Vertical conduit/raceway shall be placed on vertical structural hangers or where otherwise permitted by the Owner’s Representative.
- 2. No conduit or raceway shall be in a rigging clear zone or shall obstruct the operations of the rigging systems or shall be within 6” of a moving rigging component, including lift lines.

3.3 COMMISSIONING

A. Production Lighting Control System

- 1. All branch load circuits shall be live tested before connecting the loads to the system load terminals.
- 2. All branch load circuits shall be live tested after termination for proper wiring, continuity and polarity. Irregularities shall be corrected before arrival of manufacturer’s factory-trained personnel and Owner’s Representative checkout.

PRODUCTION SYSTEMS ELECTRICAL INSTALLATION

3. Upon completion of the installation, including testing of load circuits, the contractor shall notify the dimming system manufacturer that the system is available for formal checkout.
4. Notification shall be provided in writing, two weeks prior to the time factory-trained personnel are needed on the job site.
5. No power is to be applied to the dimming system unless specifically authorized by written instructions from the manufacturer.

END OF SECTION

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provision of materials, installation and testing of:

1. Wall Switches
2. Receptacles
3. Finish Plates
4. Wall Dimmers
5. Surface Covers

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Wall switches and Dimmers
2. Receptacles
3. Wall Plates
4. In-Use Cover

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

WIRING DEVICES

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wall Switches:

1. Toggle Type Characteristics:
 - a. Cooper AH1201
 - b. Hubbell HBL1221
 - c. Leviton 1221
 - d. Legrand P&S PS20AC1
 - e. Or approved equivalent.

B. Receptacles:

1. Industrial Grade:
 - a. Cooper 5362
 - b. Hubbell HBL5362
 - c. Bryant BRY5362
 - d. Leviton 5362
 - e. Legrand P&S 5362A
 - f. Or approved equivalent.
2. Ground Fault Circuit Interrupter (GFCI) Receptacle - 20 Amp:
 - a. Cooper WRSGF20W
 - b. Hubbell GFR5362SGW
 - c. Legrand P&S 2097TRWR
 - d. Or approved equivalent.

WIRING DEVICES

C. Finish Plates:

1. Bryant
2. Cooper
3. Hubbell
4. Leviton
5. Legrand P&S
6. Or approved equivalent.

D. Wall Dimmers:

1. Lutron Maestro Series
2. Or approved equivalent.

E. Surface Covers:

1. Aluminum with Gasket, Blanks, Single Gang:
 - a. Bell 240-ALF
 - b. Carlon
 - c. Or approved equivalent.
2. 2-Gang:
 - a. Bell 236-ALF
 - b. Carlon
 - c. Or approved equivalent.

F. Provide lighting switches and receptacles of common manufacturer and appearance.

2.2 WALL SWITCHES

- A. Characteristics: Toggle type, quiet acting, 20 amp, 120/277 volt, UL listed for motor loads up to 80 percent of rated amperage, extra heavy duty.
- B. Finish: ~~Match Building Standard.~~ **Gray. Type 302 stainless steel, satin finish, beveled edge.**

WIRING DEVICES

2.3 RECEPTACLES

- A. Duplex Receptacles Characteristics: Straight parallel blade, 125 volt, 2 pole, 3 wire grounding.
 - 1. Industrial Grade: Back and side wired. Single piece, rivetless. Brass grounding strap and back-wired ground screw. 20 amp.
- B. Ground Fault Circuit Interrupter (GFCI) Receptacle: Feed through type, back-and-side wired, tamper-resistant, weather resistant self-testing, 20 amp, 125VAC.
- C. Surge Protector Receptacle: Feed-through type, back and side wired, 20 amp, 125VAC, LED monitor light, MOV protection in L-N, L-L, and N-G modes for up to 9000 amp surges. Minimum 170 joule rating.
- D. Special Purpose Receptacles: Reference Drawings for NEMA Standard Specification.
- E. Finish:
 - 1. ~~Same exposed finish as switches.~~ **Gray. Type 302 stainless steel, satin finish, beveled edge.**
 - 2. Receptacles connected to emergency circuits to have red finish.
 - 3. Receptacles installed in surface raceway to match raceway finish. See Section 26 05 33, Raceways.

2.4 FINISH PLATES

- A. Finish Plates: Type 302 stainless steel with smooth satin finish.
- B. Provide telephone/signal device plates; activated outlets to have coverplates to match modular jack.

2.5 WALL DIMMERS

- A. Provide wall dimmers compatible with type of load controlled (i.e. line voltage, low voltage, 2-wire, 3-wire, 0-10v). Finish to match wall switches. Size dimmers to accept connected load. Do not cut fins. Where dimmers are ganged together, provide a single multi gang coverplate.
- B. LED indicator dots show by what percentage controlled lighting is dimmed. Programmable settings for maximum and minimum trim settings, and rate of change in lighting levels.

2.6 SURFACE COVERS

- A. Material: Galvanized steel, drawn, 1/2-inch raised industrial type with openings appropriate for devices installed on surface receptacles.

WIRING DEVICES

- B. Cast Box and Extension Adaptors: Aluminum with gasket, blanks single gang or 2-gang.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. See Architectural elevations for location and mounting height of wiring devices. Review Architectural elevations prior to rough-in and contact Architect immediately if conflicts are found between Architectural and Electrical Drawings. Do not rough-in devices until conflicts are resolved.
- B. Install wiring devices and finish plates plumb with building lines, equipment cabinets and adjacent devices. Devices not plumb will be fixed at no additional cost to Owner.
- C. Orientation:
 - 1. Install wiring devices with long dimension oriented vertically at centerline height shown on drawings or as specified.
 - 2. Vertical Alignment: When more than one device is shown on drawings in close proximity to each other, but at different elevations, align devices on a common vertical center line for best appearance. Verify with Architect.
 - 3. Horizontal Alignment: When more than one device is shown on drawings in close proximity to each other with same elevation, align devices on a common horizontal center line for best appearance. Verify with Architect.
- D. Provide labeling per Section 26 05 53, Identification for Electrical Systems.
- E. Test wiring devices to ensure electrical continuity of grounding connections, and after energizing circuitry, to demonstrate compliance with requirements. Test receptacles for line to neutral, line to ground and neutral to ground faults. Correct any defective wiring.

3.2 WALL SWITCHES INSTALLATION

- A. At time of substantial completion, replace those items which have been damaged.

3.3 RECEPTACLES INSTALLATION

- A. Upon installation, adhere to proper and cautious use of convenience receptacles. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty receptacles or cord caps.
- B. GFCI Receptacles: One GFCI receptacle may not be used to provide GFCI protection to downstream duplex receptacles on the same branch circuit.

WIRING DEVICES

3.4 FINISH PLATES INSTALLATION

- A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

3.5 WALL DIMMERS INSTALLATION

- A. Install per manufacturer's recommendations and wiring diagrams.

3.6 SURFACE COVERS INSTALLATION

- A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

END OF SECTION