SECTION 26 55 61

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
ARCHITECT OF RECORD/ENGINEER OF RECORD IS RESPONSIBLE FOR REVIEWING THIS SPECIFICATION SECTION IN DETAIL FOR COORDINATION WITH THE PROJECT SCOPE OF WORK.

ALL "PROJECT NOTE" TEXT IS TO BE REMOVED FOLLOWING REVIEW OF THE CONTENT OF EACH NOTE BY THE ARCHITECT OF RECORD/ENGINEER OF RECORD.

EDIT THE DOCUMENT FOOTER TO INCLUDE THE PROJECT NAME AND NUMBER.

EDIT THE DOCUMENT HEADER TO INDICATE THE ARCHITECT OF RECORD PROJECT ISSUE" DATE. THE "CPS CONTROL" DATE SHOULD NOT BE EDITED.

ANY MODIFICATIONS TO THE TECHNICAL STANDARDS IN THIS SECTION - INCLUDING THE REMOVAL OR ADDITION OF MANUFACTURERS - MUST BE APPROVED BY CPS.

REQUESTS FOR MODIFICATION ARE TO BE SUBMITTED TO THE DESIGN MANAGER DURING THE DESIGN PHASE FOR REVIEW AND APPROVAL.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~

THEATRICAL LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes equipment for stage lighting systems including fixtures, lamps, dimmers, controls, and distribution components.

1.02 REFERENCE STANDARDS

A. ANSI C78.379 - Classification of the Beam Patterns of Reflector Lamps; 2015.

B. City of Chicago Building Code - Municipal Code of Chicago for the Building Industry; 2017.

C. Chicago Electrical Code - Municipal Code of the City of Chicago, Building/Electrical Code Requirements; 2018.

D. IEEE C62.41.1 - IEEE Standard Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (Reaffirmed 2008).

E. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

G. NFPA 101 - Life Safety Code; 2017.

1.03 DEFINITIONS

A. Barn Doors: Rotatable attachment consisting of two or four metal flaps fixed to the front of Fresnel- or PAR-type fixtures to reduce beam spread in one or more directions.

B. Borderlight: Striplight with compartment for each lamp. Each compartment contains a reflector lamp or a lamp and a reflector, and a color frame. Compartments are aligned in-line and wired on two, three, or four alternate circuits, each circuit producing a different color.

C. Connector Strip: Adaptor for connecting many fixtures to one multiconductor cable; consists of multiple connecting stations, each with a plug connector and a short length of cable. The number of stations is related to the number of circuits in the cable.

D. Ellipsoidal Spotlight: Fixture with an elliptical reflector mounted in a fixed relationship to the lamp. The light is focused through a gate where the beam can be shaped by the use of shutters, a gobo, or an iris. The shaped beam is then focused by a system of lenses. Also known as a LEKO light.

E. Floor Pocket: Electrical socket mounted under a hinged cover in the stage floor.

F. Follow Spotlight: Narrow-beam, stand-mounted spotlight with its own dimmer, iris, color magazine, and shutters. Located in or above the auditorium; operator controlled so the light beam can be moved to follow an actor.

G. Fresnel Lens Spotlight: Fixture that produces an even, soft-edged beam of light through a glass lens with a series of stepped concentric circles on the front and a pebbled surface on the back.

H. Gridiron Junction Box: Transitions branch load circuits from conduits to flexible cables.

I. Plug-in Box: Small version of a connector strip.

J. Shutters: Metal blades that shape the edge of the beam. Shutters (normally four) are located in a gate at the center of the fixture. Similar in effect to barn doors.

K. Zoom Ellipsoidal Spotlight: A modification of an ellipsoidal spotlight; the distance between the reflector and lamp is adjustable.

1.04 SUBMITTALS

A. With Bid:
1. Contractor shall indicate any additional wire or conduit runs that are not shown on the drawings that will be required to install Manufacturer's system.
2. Contractor shall provide a schedule of quantities of dimmers, fixtures, color media, lamps, control equipment, and cables to be provided per schedules in drawings. If schedule of quantities is not provided with bid, the contractor will still be responsible for these quantities to make the space operational.

B. Product Data: For each type of product indicated.

C. Shop Drawings: Show fabrication and installation details for dimmer racks showing arrangements, characteristics, and circuit assignments of various modules. Include elevation views of front panels indicating devices and controls. Include illustrations and dimensioned outline drawings.
1. Wiring Diagrams: Power, signal, and control wiring. Show connections and circuit and channel assignments.
2. Equipment Legend: Show a unified system of designations for lighting instruments, panels, dimmers, circuits, and equipment.
3. Quantities of each component and sub-assembly

D. Samples: The manufacturer shall submit to the Architect/Engineer of Record for review prior to fabrication samples of any equipment component requested by the Theatre Consultant.

E. Qualification Data: For Installer and manufacturer.

F. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around dimming equipment where piping and ducts are prohibited. Show rack layout and relationships between components and adjacent structural and mechanical elements.

G. Operation and Maintenance Data: For fixtures, distribution components, software operating manuals, instructional videotapes, and controls to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 00 - Closeout Submittals, include the following:
   1. Control-Console Introduction:
      a. Descriptions of controls and features.
      b. Software instruction manuals.
      c. Setup requirements for unit and related equipment.
      d. Default settings.
      e. Maintenance procedures and schedules.
   2. Control-Console Operation:
      a. Elementary on-off operation.
      b. How to set cues manually.
      c. How to patch dimmer to channels electronically.
      d. How to operate two-scene presets manually.
      e. How to operate fundamental memory.
      f. How to set and record simple cues.
      g. How to recall, playback, and revise cues and scenes.
      h. How to use submasters, split cues, store and recall programs, set up special effects, and print out cues.
      i. How to set up and run system for a typical event or performance.
      j. How to get help.
   3. Dimmer Bank:
      a. Descriptions of features, functions, and safety and security precautions.
      b. Descriptions of dimmer module features, dipswitches, non-dim functions, and racking systems.
      c. How to check loads against dimmer capacity ratings.
      d. How to set basic power-in and power-out connections.
      e. Basic maintenance requirements including need for qualified electrician for internal maintenance; basic maintenance schedule; techniques for keeping terminals properly tightened, filter screens clean, and overheat sensors checked; and techniques for performing other required servicing.
      f. How to adjust control cards.
      g. How to get help.
      h. Description of warranty.
   4. System Troubleshooting: Procedures for common software, programming, control console, dimmer bank, and distribution system problems; include information on how to get help.
   5. Relamping instructions.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Dimming Equipment Manufacturer Qualifications: A qualified manufacturer. Maintain, within 30 miles of Project site, a service center capable of providing training, parts, and emergency

maintenance repair support within 24 hours' maximum response time. The manufacturer shall have at least ten years' experience in the fabrication of similar equipment. If requested, the Manufacturer shall submit a representative list of installations.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Chicago Electrical Code by UL, and marked for intended use.

D. Comply with NECA 1.

E. Comply with NFPA 101.

F. Comply with City of Chicago Building Code.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be wrapped and sealed in polyethylene and substantially crated for shipment. Crates shall clearly indicate the equipment contained, nature of components, and theatre site allocation.

B. Dimmers shall be individually packaged.

C. Deliver equipment in fully enclosed vehicles after specified environmental conditions have been permanently established in spaces where equipment is to be placed.

D. Store equipment in spaces with environments controlled within manufacturer’s ambient temperature and humidity tolerances for non-operating equipment.

E. The contractor shall provide full insurance against loss or damage during shipment, storage, installation, and testing. Certification of such coverage shall be furnished to the Architect/Engineer of Record within thirty days of award of contract.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Dimmer Modules: One (1) of each type and rating installed.
2. Fuses: Three (3) of each kind.
3. Lamps: One (1) for every ten (10) of each type, and rating installed. Furnish at least one (1) of each type.
4. Glass Roundels: One (1) for every three (3) of each type and color installed. Furnish at least one (1) of each type.
5. Interchangeable Lenses: One (1) for every fifty (50) of each type installed. Furnish at least one (1) of each type.

1.08 WARRANTY

A. The manufacturer shall unconditionally warrant all equipment and systems provided under this Section to be free from defects in materials and workmanship for a period of at least twelve months from the date of final acceptance of all work of this Section. Lamps and normal wear and tear are exempted.

B. Appropriate additional equipment to replace any and all equipment removed for service shall be provided at the job site at no expense to the Board. Replacement control console(s) must be of the same model as those removed for service.

C. Warranty service shall be performed by personnel in the employment of the manufacturer and shall not be sub-contracted or assigned to another company, service, or individual unless the Board has approved such assignment in writing in which event the manufacturer shall nevertheless be responsible to the Board for such work.

D. For a period of two years following acceptance, the manufacturer shall provide and install at no cost to the Board all control console operating system upgrades. Thereafter the manufacturer shall notify the Board of all operating system upgrades for the life of the control console. Manufacturer shall keep the system user's name and address in a database for this purpose. All upgrades shall include a full written description so as to allow existing data to be accessed and upgraded.

E. For a period of five years following acceptance, the manufacturer shall maintain service capability by guaranteeing a factory-authorized representative available for onsite service calls within twenty-four hours of notification by Board of a need for service.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
1. Dimming and Control
   a. Colortran; www.knightsoundandlighting.com/tag/colortran.
   b. Electronic Theatre Controls (ETC); www.etcconnect.com.
   c. Strand Lighting; www.strandlighting.com.
2. Wiring Devices
   a. Electronic Theatre Controls (ETC); www.etcconnect.com.
   b. SECOA; www.secoatech.com.
   c. Strand Lighting; www.strandlighting.com.
3. Luminaires and Accessories
   a. Altman Lighting Co.; www.altmanlighting.com.
   b. Electronic Theatre Controls (ETC); www.etcconnect.com.
   c. Strand Lighting; www.strandlighting.com.
4. Lamps
   a. GE Lighting; www.gelighting.com.
   b. Osram Sylvania; www.sylvania.com.
   c. Philips Lighting; www.usa.lighting.philips.com.
5. Distribution Components
   a. Altman Lighting Co.; www.altmanlighting.com.
   b. SSRC; www.sscronline.com.
   c. Union Connector Co.; www.unionconnector.com.
6. Lighting Control System
   a. Colortran; www.knightsoundandlighting.com/tag/colortran.
   b. Strand; www.strandlighting.com.
   c. Electronic Theatre Controls (ETC); www.etcconnect.com.
7. Rigging Components
   a. Altman Lighting Co.; www.altmanlighting.com.
   b. Electronic Theatre Controls (ETC); www.etcconnect.com.
   c. Strand Lighting; www.strandlighting.com.
8. Color Media
   a. GAM; www.gamonline.com.
   b. Lee Filters; www.leefilters.com.
   c. Rosco; www.rosco.com.

B. Dealers: Subject to compliance with requirements, the equipment indicated herein shall be provided by one of the following dealers:
   1. Chicago Spotlight.
   2. Designlab Chicago.
   3. Grand Stage/Art Drapery Studios.
   4. Barbizon.

2.02 GENERAL

A. All components shall be new, in good condition, and under warranty.

B. All components shall bear UL labels and labels identifying the manufacturer, model number, and serial number. All such labels shall be permanently attached in a conspicuous location.

C. All control and receptacle faceplates not otherwise described elsewhere in this specification shall be black anodized aluminum or black painted steel, and all labels and legends shall be permanently engraved directly into the faceplate. Engravings shall be filled with white paint. Minimum text height if not specified elsewhere shall be 1/4 inch. All faceplates shall have beveled edges and rounded corners.

D. Control signal protocol and connector types shall comply with “DMX-512” as established and published by the U.S. Institute for Theatre Technology. Control consoles shall be interchangeable.

E. All control, signal and video connectors shall be of substantial construction and shall be of the locking or latching type. All plate-mounted connectors shall be bolted to faceplates - rivets shall not be acceptable.

F. All components requiring external electrical connections of more than eight conductors shall include barrier-type terminal strips properly sized and permanently labeled.

G. All keys for lockable devices in each theatre (i.e. control console, entry panels, dimmer racks, etc.) shall be keyed identically. Provide a total of two keys for each keyed device.

2.03 PLUG CONNECTORS

A. Plug Connectors: 20-A, slip pin, 2 wire plus ground, with integral strain relief.

2.04 LIGHTING FIXTURES AND ACCESSORIES

A. General Lighting Fixture and Accessory Requirements:
   1. Listed under UL 1573.
   2. Fixtures: Equipped with pigtail, yoke with pipe clamp, safety cable for batten mounting, and filter holder.
   3. Metal Parts: Free of burrs, sharp corners, and edges.
   4. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
   5. Fixture Doors and Their Internal Access: Smooth operating, free of light leakage under operating conditions, and arranged to permit relamping without use of tools. Doors, lenses, diffusers, and other pieces arranged to prevent accidental falling during relamping and when secured in operating position.
   6. Pigtail: Factory wired, 36-inch long, 3-wire cord and plug connector assembly with cord encased in woven fiberglass or silicone tubing.
   7. Lamp Sockets: Relampable without disturbing alignment or focus adjustment.
   8. Fixture Ventilation Openings: Baffled against light leaks.

9. Fixture Operating Controls and Handles: Thermally insulated.
10. Lenses: Borosilicate glass in silicone mountings.
11. Framing Shutters: Stainless steel, four way; with each blade in a separate plane under adjustable tension mounting. Blades adjust plus or minus 30 degrees of rotation in gate, for 120-degree-minimum total angular rotation between adjacent blades.
12. Color Filter Frame Holder: Attached to front of fixture.
13. Fixture Yoke: Rigid metal, arranged for vertical aiming of unit and equipped with T-bolt or hand screw to lock alignment.
14.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
PROJECT SPECIFIC EQUIPMENT AND ITEMS TO BE INCLUDED FOR PROJECT SCOPE. COORDINATE ALL ITEMS AND EQUIPMENT TO BE INCLUDED WITH THEATRICAL LIGHTING SUPPLIER REQUIREMENTS FOR PROJECT.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~

B. Ellipsoidal Spotlights: Fixtures with an elliptical reflector mounted in a fixed relationship to the lamp. The light shall be projected through a gate where the beam is shaped by the use of shutters, a gobo, or an iris. The shaped beam shall then be focused by a system of lenses.
   1. Lamp Rating: 500 to 1000 W. Provide lamp as specified on drawings with fixture.
   2. Socket shall be mounted and shielded to withstand maximum lamp seal temperatures without substantial deterioration.
   3. Reflector: Molded borosilicate, ellipsoidal, double flatted. Dichroic coatings to produce 95% minimum reflectance of visible light and 90% minimum transmissions of infrared radiance.
   4. Shutters: Four stainless steel shutters, operating in two different planes. Shutter gate shall be rotating and locking, permitting flexible shutter cuts.
   5. Pattern slot: Accepts standard pattern template holders.
   6. Iris: In addition to shutters, when specified.
   7. Lenses: Aspheric, with anti-reflective coating to reduce light loss. Lenses shall be reasonably clear, with no perceptible discoloration or clouding.
   8. Lamp adjustment: Vertical, horizontal and axial adjustment.
   9. Wiring: Three 36-inch type SF-2 leads in fiberglass sleeve.
   10. Connector shall be factory installed prior to shipment to job site.
   11. Color frame: Free of burrs and sharp edges; painted or anodized flat black.
   12. Minimum cosine illumination performance ratings when operated with ANSI C78 Series FEL lamp:
      a. 171,000 beam candlepower at 20-degree field angle.
      b. 48,000 beam candlepower at 40-degree field angle.

C. Zoom Ellipsoidal Spotlights: Fixtures with an elliptical reflector mounted in an adjustable relationship to the lamp. The light shall be projected through a gate where the beam is shaped by the use of shutters, a gobo, or an iris. The shaped beam shall then be focused by a system of lenses.
   1. Lamp Rating: 500 to 1000 W. Provide lamp as specified on drawings with fixture.
   2. Socket shall be mounted and shielded to withstand maximum lamp seal temperatures without substantial deterioration.
   3. Reflector:
      a. Molded borosilicate, ellipsoidal, double flatted. Dichroic coatings to produce 95% minimum reflectance of visible light and 90% minimum transmission of infrared radiance, or:
      b. Specular Alzak, ellipsoidal, double flatted.
   4. Shutters: Four stainless steel shutters, operating in a minimum of two different planes.
   5. Pattern slot: Accepts standard pattern template holders.
   6. Iris: In addition to shutters, when specified.
   7. Lenses:

a. Aspheric, with anti-reflective coating to reduce light loss, or:
b. Pyrex, plano-convex
c. Lenses shall be reasonably clear, with no perceptible discoloration or clouding

8. Lamp adjustment: Vertical, horizontal and axial adjustment.
9. Wiring: Three 36-inch type SF-2 leads in fiberglass sleeve.
10. Connector shall be factory installed prior to shipment to job site.
11. Lens Adjustment: Lenses shall be "zoom" adjustable to produce a continuously variable field angle of between 30 degrees and 18 degrees. Modifying the beam spread shall not require disassembling the fixture. Each lens shall move independently on guides and shall lock into place with thermally insulated knobs.
12. Color frame: Free of burrs, and sharp edges; painted or anodized flat black.
13. Minimum cosine illumination performance rating when operated with ANSI C78 Series FEL lamp: 82,000 beam candlepower at 35-degree field angle.

D. Fresnel Lens Spotlights:
1. Die-cast extruded-aluminum housing, with hinged front for relamping.
2. Lamp Rating: 500 to 1000 W. Provide lamp as specified on drawings with fixture.
3. Socket: Medium 2-pin or medium prefocus.
4. Reflector: Specular Alzak, spherical.
5. Lens: Pyrex, fresnel, 6-inch diameter.
6. Adjustment: Lamp carriage continuously adjustable to provide a field angle from 20 degrees to 45 degrees.
7. Wiring: Three 36-inch type SF-2 leads in fiberglass sleeve.
8. Connector: 20A slip pin connector, 2 wire plus ground.
9. Color frame: Free of burrs and sharp edges; painted or anodized flat black
10. Illumination Performance Rating when Operated with ANSI C78 Series EGT Lamp:
a. 175,000 beam candlepower at 12.5-degree field angle in spot focus.
b. 12,000 beam candlepower at 74.6-degree field angle in flood focus.

E. Follow Spotlights:
1. Adjustable lenses in metal housing.
2. Lamp: HTI 400/24, with an approximate color temperature of 5600 degrees K., and an average rated life of 250 hours. Provide lamp with fixture.
3. Adjustable underslung base stand mounted on 3-inch, locking-type, rubber-tired, ball-bearing casters.
4. Adjustable lamp-holder and socket assembly with precision tuning adjustment; relampable without tools.
5. Three-leaf, full-range mechanical dimmer.
6. Adjustable iris and framing shutters.
7. Automatic color boom (minimum of 6 colors).
8. Removable 25-foot power cable.
9. Connector: 20A, 2 wire plus ground, locking with nylon body and integral cable clamp.
10. Optical train: Beam field diameter variable from 15'-0" (spot) to 40'-0" (flood) with the iris open full, and at a throw distance of 100-feet.
11. Optical performance: Shall produce 200 foot candles (spot) at a throw distance of 100-feet

F. PAR Spotlights:
1. Lamp Rating: 575 W. Provide lamp with fixture.
2. Lamp Holders: Steel or aluminum housing with porcelain-plated shell socket to suit lamp type indicated. Socket shall be mounted and shielded to withstand maximum lamp seal temperatures without substantial deterioration.
3. Reflector: Integral die-cast aluminum, faceted.
4. Lenses: Removable, rotating lenses fitting into fixture without the use of tools. Lenses shall be reasonably clear, with no perceptible discoloration or clouding. Each fixture shall

be provided with four lenses: Wide Flood, Medium Flood, Narrow Spot, and Very Narrow Spot
5. Lamp adjustment: Vertical, horizontal and axial adjustment.
6. Wiring: Three 36-inch type SF-2 leads in fiberglass sleeve.
7. Connector shall be factory installed prior to shipment to job site.
8. Color frame: Free of burrs and sharp edges; painted or anodized flat black.

G. Borderlight Units: Compartmented 3-circuit striplight with nine 150-W PAR 38/FL lamps in porcelain sockets and steel sheet housing, 90-inches long. Compartments shall be in line and wired on two, three, or four alternate circuits, each producing a different color.
1. Front Door: Spring loaded, designed to hold either filter frames or color roundels.
2. Color Roundels: One for each lamp; alternating red, blue, and clear.
a. Additional Roundels: Amber and green.
3. Hanger: Adjustable, steel-strap type equipped at each end with pipe clamp and safety cable for suspension from a batten.

H. Cyclorama Lights:
1. Each unit shall consist of four individual compartments, each containing a lamp, reflector, and color frame holder and wire separately.
2. Lamp Rating: 1000 or 15000 W per compartment, clear lamp. Provide lamp specified on drawings with fixture.
3. Sockets: Double ended, recessed single contact.
4. Reflectors: Anodized aluminum.
5. Wiring: Four 36-inch type SF-2 leads in fiberglass sleeve, for each compartment.
6. Connectors: One per compartment, free of burrs and sharp edges; painted or anodized flat black.
7. Color Frame: One per compartment, free of burrs, and sharp edges; painted or anodized flat black.
8. Mounting hardware: One complete set of handling irons per unit

I. Scoops:
1. Lamp Rating: 1000W. Provide lamp with fixture.
2. Socket: Medium prefocus, axially mounted.
3. Reflector: Matte aluminum, ellipsoidal, 14 or 16 inch diameter.
4. Adjustment: Lamp carriage continuously adjustable to provide a field angle from 60 degrees to 90 degrees.
5. Wiring: Three 36-inch type SF-2 leads in fiberglass sleeve.
6. Connector shall be factory installed prior to shipment to job site.
7. Color frame: Free of burrs and sharp edges; painted or anodized flat black.

2.05 LAMPS

A. Comply with the standard of the ANSI C78.379 Series that is applicable to each type of lamp. Where lamps of designated type, characteristics, and wattage are not indicated, provide lamps recommended by manufacturer of fixture in highest wattage for which fixture is listed.

2.06 DISTRIBUTION COMPONENTS

A. Connector Strip: UL-listed, factory-wired wireway and receptacle assembly.
1. Wireway: Steel or extruded aluminum; with removable cover and nominal cross-section dimensions of 3 by 4-1/2 inches.
2. Accessories: Cable clamps, support cradles, and cable strain relief grips for each cable.
3. Receptacles: Pigtail mounted, 18-inches long, with strain relief at wireway wall penetration.
4. Receptacle Wiring: For connecting to terminal blocks; with 125 deg C, cross-linked, polyethylene-insulated, identification-labeled wire.

5. Terminal Blocks: Molded-barrier type, with screw lugs to suit supply conductors.
6. Mounting Hardware: Furnished with each unit; permits surface, single-pipe-bracket, or double-pipe-bracket mounting.
7. Finish: Flat black baked enamel or black anodized aluminum.

B. Plug-in Boxes: UL-listed, factory-wired wireway and receptacle assembly, 24 inches long, unless otherwise indicated; and with the following features:
1. Wireway: Steel or extruded aluminum, with removable cover; nominal cross-section dimensions of 3 by 4-1/2 inches.
2. Accessories: Cable clamps, support cradles, and cable strain relief grips for each cable.
3. Receptacles: Pigtail mounted, 18-inches long, with strain relief at wireway wall penetration.
4. Receptacle Wiring: For connecting to terminal blocks; with 125 deg C, cross-linked, polyethylene-insulated, identification-labeled wire.
5. Terminal Blocks: Molded-barrier type, with screw lugs to suit supply conductors.
6. Surface or Grid Mounting: With accessories for surface mounting or with pipe-mounting accessory bracket.
7. Recessed Mounting: With flanged cover suitable for recessed mounting in wall.
8. Finish: Flat black enamel or black anodized aluminum.

C. Gridiron Junction Boxes: UL listed and factory wired with terminal strips and concentric knockouts on all sides.
1. Terminal Blocks: Molded-barrier type, with screw lugs to suit supply conductors.
2. Accessories: Cable clamps, support cradles, and cable strain relief grips for each cable, and brackets for surface or with pipe mounting.
3. Finish: Semigloss or matte black.

D. Floor Pockets: UL-listed, flush-mounted, receptacle outlet assembly.
1. Box: 0.0598-inch steel sheet, 10 inches deep.
2. Cover Plate: Steel, cast iron, or cast aluminum with nonskid safety tread surface and self-closing, hinged door with cable notches.
3. Barrier for allowing installation of low-voltage control receptacle for console input or hand-held remotes.

E. Power Wire and Cable:
1. Building Wire in Raceways: Comply with Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
2. Portable Power Cable: UL listed; flexible stage and lighting power cable; Types SC, SCE, or SCT; 600 V; multiconductor; 60 deg C temperature rating.
3.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
MODIFY LIGHTING CONTROL SYSTEM ARTICLE FOR PROJECT SPECIFIC REQUIREMENTS. TYPICAL DIMMER BOARDS (RACKS) USED. INTELLIGENT RACEWAY AND DIMMER MODULES MAY BE USED IN LIEU OF DIMMER BOARDS. COORDINATE WITH PROJECT SPECIFIC REQUIREMENTS AND DESIGN.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~

2.07 LIGHTING CONTROL SYSTEM

A. Description: Microprocessor-based modular system consisting of dimmer and control modules operated from remote-control stations and a control console.
1. Comply with UL 508.
2. Comply with USITT DMX 512 for data transmission.

B. Dimmer Boards: Dead-front, UL-labeled, front-access, freestanding board for mounting modular dimmers; formed-steel or extruded-aluminum structural members, completely enclosed with steel or aluminum panels. Painted with manufacturer's standard corrosion-resistant primer and finish coats and the following features:
   1. Primary Circuit Breaker: Fault-current withstand rating of the board; not less than 50,000A, symmetrical.
   2. Hinged, locking front door, with openings to allow air intake across the face of all dimmer modules.
   3. Individual board sections shall not exceed 84-inches high by 25-inches deep by 30-inches wide.
   4. For each module position, provide support rails and control-pin configurations, constructed for precise alignment of dimmer modules into power and signal connector sockets.
   5. Forced-air cooling of each board for maintaining operating temperature at each dimmer, assuming full load, in ambient temperature not to exceed 40 deg C. Exhaust rates shall be variable using temperature sensors and fan-speed control electronics. Individual control of multiple fans is acceptable in lieu of fan-speed control. Fan(s) shall start and stop automatically. Fan noise at full load shall be less than 3.1 sones.
   6. Each board shall have an automatic air-temperature sensor to shut off all dimmers in the board should the internal temperature rise above maximum safe operating limits. In an overheat condition, the fan shall continue operating. When a safe operating temperature is restored, the system shall automatically reset allowing normal user control.

C. Intelligent Raceway: May be used instead of dimmer racks and connector strips but must be used in conjunction with intelligent raceway dimmer modules.
   1. General:
      a. The Intelligent Raceway shall be a linear dimming system based on IGBT technology.
      b. Each Intelligent Raceway shall be formed of cold-rolled steel sections. Exterior surfaces shall be finished in fine-textured, scratch-resistant powder coat paint. Interior surfaces shall have a corrosion-resistant finish.
      c. Intelligent Raceway sections shall be 8 feet long. Height of each section shall not exceed 6 inches. Width of each section shall not exceed 3-1/2 inches. Overall length of combined sections shall not exceed 96 feet long.
      d. Each Intelligent Raceway shall include local controls and displays mounted adjacent to each dimmer.
      e. Each Intelligent Raceway shall produce no mechanical noise.
      f. Each Intelligent Raceway dimming system shall meet or exceed FCC ‘Class A’ standards for RFI/EMI emissions.
      g. Each dimming system shall be listed by UL as Type 508 Industrial Control Equipment, and so labeled.
   2. Electronics:
      a. Intelligent Raceway head-end electronics shall be housed in a junction box at one end of the Raceway.
      b. The standard control interface shall be a 10 BASE-T Ethernet connection running a TCP/IP based protocol. The protocol transmits 1024 discrete levels to the dimmers. The Intelligent Raceway transmits status data from its full complement of dimmers to the controller. USITT DMX512/1990 protocol is also supported.
      c. Each Intelligent Raceway shall include one permanently mounted RJ-45 jack to which the contractor shall land the incoming Ethernet control cable.
      d. Each Intelligent Raceway will also accept one optically isolated DMX input.
      e. Configuration of the Intelligent Raceway shall be performed by a PC-based program.

D. Intelligent Raceway Dimmer Modules:

1. General: The dimmers shall use IGBTs (Insulated Gate Bipolar Transistors) to regulate and control load voltage. Dimmers using hard-switching semiconductor devices, such as SCRs or other thyristors, shall not be acceptable. The dimmers shall not use filter chokes to control the rate of rise in the load current waveform.
2. Electrical:
   a. Each dimmer module shall contain two dimmers, each capable of controlling a 2400 watt load. Total load capacity of each dimmer module shall be capped at 20 Amps. If the load capacity is exceeded, the module shall automatically turn-off the last load energized
   b. Dimmer electronics shall be completely solid state.
   c. The dimmers shall be immune from damage caused by output short-circuits between load and neutral or load and ground.
3. Performance:
   a. The insertion loss (voltage drop across the complete dimmer at full load current while producing a full output sine wave) shall be less than three volts RMS. Insertion loss at reduced dimmer loading shall not vary significantly from that produced with a full rated load. Dimmers with insertion loss greater than three volts RMS at full rated load shall not be acceptable.
   b. The dimmers shall regulate dimmer output to within +/- 0.5 volts RMS of the assigned setting. Regulating response shall occur in the same power line cycle as the disturbance when the dimmer is in Reverse Phase Control (RPC) mode.
   c. The Intelligent Raceway shall provide information to the control console. The following information shall be reported:
      1) Present power line voltage.
      2) Connected lamp wattage.
      3) Present output setting.
      4) Dimmer operating temperature.
      5) Dimming mode.
      6) Overload condition.
      7) No load condition.
      8) Focus mode.
   d. The dimmers shall hold the last received level for a pre-specified period, should the control signal be interrupted.
   e. Dimmer Modules shall automatically switch from Reverse Phase Control (RPC) mode to Forward Phase Control (FPC) mode when inductive loads are detected. In RPC mode the dimmer is on from the beginning of the half-cycle until the desired output voltage is reached. In FPC mode, the dimmer turns on within the half-cycle and stays on until the end of the half-cycle. Use of RPC mode, when load type and other conditions permit, reduces the level of lamp filament noise.
   f. Provide with a mode that shall reduce harmonic currents present on the feed neutral conductor by automatically switching the dimmers in the system to an optimum configuration of FPC and RPC operation. The reduction in neutral current shall be a minimum of 33 percent with a maximum of 100 percent, depending upon load sizes and their associated levels.
   g. When in RPC mode, dimmer output voltage transition time is measured as "fall time". The actual "fall time" generated shall not be affected by the size of the load present. Dimmers shall provide a minimum fall time of 800 µS under normal load current regardless of load.
   h. The dimmer transfer function shall comply with the industry standard Square Law dimming curve within a tolerance of +/- 0.5 Volts RMS for all incandescent loads.
   i. Each dimmer shall have an associated Focus push button that provides local ON/OFF/LEVEL control for focusing, maintenance and other purposes. If the level set for a dimmer is zero, tapping the Focus button shall set the dimmer output to full. Pressing and holding the Focus button ramps the dimmer output up to any intermediate level. When a non-zero level is received from the controller, the dimmer shall return to normal operation. Tapping the Focus button a second time

shall also return the dimmer to normal operation. If a dimmer already has a non-zero level from the control desk, the Focus button flashes the dimmer to full output. In all cases, activating the Focus button shall be reported to the system operator, at the console or system monitor.

j. Each dimmer shall have an LED display to facilitate local reporting of operating conditions.

k. Each dimmer will detect operating conditions and take active measures to protect itself (and the load). Protective measures shall include, but are not limited to the following:

1) At power-up, each dimmer will detect line voltages in excess of 180 VAC. When over-voltage is detected, the dimmer will not turn on its load. The dimmer will also notify the operator via IPS and flash its locally mounted LEDs. Dimmers shall withstand line voltages up to 230 VAC for an indefinite period and up to 280 VAC for fifteen minutes with no damage.

2) Each dimmer shall detect excessive heat sink operating temperatures and notify the console of the condition via IPS. The dimmer shall automatically reduce its own "fall time", which minimizes the production of heat. Dimmers will step from 800 µS to 250 µS. If heat continues to rise, the dimmer will shut down, notify the console via IPS and flash its locally mounted LEDs.

3) Each dimmer shall detect load current in excess of its own rating. An overload will cause a dimmer to shut down, notify the console and flash its locally mounted LEDs.

E. Dimmers: Modular solid-state units that operate smoothly over their operating ranges without audible lamp noise or radio-frequency interference at any setting. Modules shall be dead-front, draw-out type with floating line, load, and control sockets for smooth insertion and withdrawal; with load-side thermal-magnetic circuit breaker, speed-controlled cooling fan, and overtemperature sensor.

1. Non-Dim Units: On-off relay control only. Capable of serving inductive loads such as motors or high-intensity-discharge fixtures.
2. Surge Protection: Modules shall withstand power-line surges of 6000 V/3000 A according to IEEE C62.41.1 and IEEE C62.41.2.
3. Filter each dimmed circuit to provide a minimum 350-microsecond, current-rise time at a 90-degree conduction angle at 50 percent of rated dimmer capacity. At any load within rating, rate of current rise shall not exceed 30 mA/microsecond, measured from 10 to 90 percent of load current waveform.

F. Control System: 3-1/2-inch disc drive and microprocessor-based control system with a nonvolatile system memory to adjust dimmer channel settings for different scenes, to patch dimmers to channels, and to manually or automatically change dimmer settings from one preset scene to another. Provide (5) 3-1/2-inch computer discs for Board’s use with this system.

G. Control Console: Tabletop unit with manual and computer-based programming controls, memory units, indicating devices, and the following features:

1. Servicing access through hinged top panel.
2. Grand-master level control.
3. Blackout switch.
4. 24 submaster level controls with overlapping pile-on performance.
5. Bump buttons for momentary control of channels or submasters; one for each submaster level control.
6. Two cross-fade controls for split dipless fade between scenes, each with its own fade progress indicator.
7. The control console shall provide at least 250 control channels and at least 512 dimmers. In addition, the control console shall control an additional 512 dimmers for distribution through the DMX-512 network.
8. Multibutton keypad for programming in multiscene memory mode.

9. Fade time control for assigning fade time to cues, with individual cue adjustment from 1 to 300 seconds, minimum.
10. Liquid-crystal display with associated display controls, for displaying operating menus and memory readout.
11. Controls for setting levels into memory.
12. Cord and connector for connecting console to outlets for console power and control.
13. Key switch for power on and off.
14. Dimmer rack temperature warning light.
15. Internal battery backup power shall hold all memory information for up to 24 hours.
16. A UPS capable of sustaining operating voltage to control the console system for up to 10 minutes in the event of a loss of power. Capable of filtering spikes, surges and noise from power source. Conditioner shall provide continuity of earth ground from source to the console. Shall include a test switch to confirm battery charge. UPS shall be sized to provide rated power supply for control system.

H. System Operation: Console shall include off-line data storage using internal 3-1/2-inch disc drive unit. Operational capability includes the following:
1. Live and blind programming.
2. Special effects programmability for automatic operation of lights in pulsating, sequential dimming and brightening, and other special operating modes. Special effects menu displays operator guidance for programming and individual step levels.
3. Signal from fire-alarm control panel that automatically brings selected circuits to fully on or fully bright condition, overriding normal dimming and on-off controls.
4. Inserting cues between designated cues without renumbering.
5. Out-of-sequence playback of cues.
6. Controlling houselights and stage lights from console by assigning their dimmers or non-dim on-off controls to a channel.
7. Retaining programmed cues in memory for minimum of one year after power outage.
8. Automatic sequential execution of programmed cues.
9. The control board should have the capability to take control of the house lights away from the wall stations.
10. Printing cues using parallel or serial printer port, cable, and printer. Cable and printer are not included with this system.
11.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
CONSOLE POWER TO BE LOCATED ON DRAWINGS WHERE THEY WILL BE UTILIZED FOR EVENT LIGHTING. PROVIDE MULTIPLE OR ADDITIONAL OUTLETS AND POWER WHERE REQUIRED. COORDINATE LOCATIONS WITH ARCHITECTURAL ENGINEER, BOARD'S REPRESENTATIVE AND THEATRICAL LIGHTING REPRESENTATIVE.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~

I. Console Power and Control Outlets: Multiple receptacles matched to connector on console connector cord.

J. House Lighting Control Station: Architectural-type, multichannel, remote dimmer control station with the following features:
1. System controls designated houselights, stage lights, and other lights.
2. Stage lighting controls are compatible with dimming and control system.
3. Flush mounting.
4. Brushed-aluminum wall plate.
5. Six-channel slider potentiometer controls.
6. Master slider potentiometer controls lights on all channels proportionally from completely dimmed to degree of brightness that corresponds to individual slider positions.
7. Fully on switch that turns all channels on at full brightness regardless of slider position.

8. Take-control/off switch places station in control of channels and sets lighting to levels dictated by channel and master slider controls.
9. Legend on face of wall plate identifies items as "House Lighting Control Station" and identifies functions of each slider and switch position, with slider positions individually graduated from 0 to 10.
10. Illuminated push buttons for activating preset scenes of house lighting labeled Entry and Panic.
11. Flush wall mounted, unless otherwise indicated.

K. Entry Station: Push button activates or deactivates indicating light and presets scene of house lighting control system.
1. Light-emitting-diode indicating light illuminates when preset command is executed.
2. Labeled "Entry."
3. Flush wall mounted, unless otherwise indicated.

L. Key-Entry Station: Key-operated switch controls station to activate or deactivate indicating light and presets scene of lighting control system.
1. Light-emitting-diode indicating light illuminates when preset command is executed.
2. Labeled "Entry."
3. Flush wall mounted, unless otherwise indicated.

M. Emergency Lighting Control Station: Key-operated push button activates indicating light and brings selected dimmers to fully bright condition, i.e., the "panic" preset. Operating push button a second time returns dimmers to previous setting.
1. Indicating light on in emergency mode.
2. Labeled "Emergency Lights."
3. Flush wall mounted, unless otherwise indicated.

2.08 RIGGING COMPONENTS

A. Pipe Clamps: Malleable iron, suitable for clamping fixtures or items to pipe from 3/4 to 2 inches in OD. Arranged for horizontal rotation of yoke for aiming; equipped with T-bolt to lock alignment.

B. Safety Cables: Heavy-duty, flexible steel; 30-inch nominal length, with spring clip at one end and steel ring at other.

C. Cable Grips: Galvanized steel; basket-weave type for supporting stage cables.

2.09 ACCESSORIES

A. Sidearms: 24-inches long, 1-1/2 inch pipe with C-clamp and sliding tee.

B. Pipe booms: 50 lb., 24-inch diameter cast iron base threaded to accept 1-1/2 inch pipe, with 12’-0” long 1-1/2 inch pipe. Pipe threaded at both ends with coupling at top.

C. Rolling stands: Heavy duty double extension with heavy duty casters.

D. Pattern holders: Stainless steel with epoxy handle for holding standard size theatrical “gobo” patterns within the designated slot in the lighting instrument. Coordinate the pattern sizes with the type required by the fixtures supplied.

E. Drop-in iris assemblies: Provides rising of beam size from 100 percent to 10 percent of rated beam.

F. F-stop “donuts”: Fabricated of 20 gauge steel minimum, outside dimension to fit color frame holder of ellipsoidal spotlights, with diameter of circle to match the focal plane “gate” dimension for ellipsoidal spotlighting served. Paint flat black with high-temperature paint.

G. Four-way barndoors: Full 360 degree rotating barndoor with four leaves, each with individual tension adjustment. Separate slot for color frame. Painted or anodized flat black.

H. Top Hats: Square frame attached to cylinder. Cylinder length shall be equal to its diameter. Painted or anodized flat black.

I. Stage cable:
1. 20A cable shall be 12-3 type SO cord with male plug at one end and female connector at other end.
2. Cable lengths shall be identified by both the color of the connector cover plate, and a number permanently engraved and painted in a contrasting color on the connector cover plate.
3. Each cable shall have one Velcro tiewrap permanently attached to the insulation near the female connect.

J. Extension cords: 12-3 type SO cord with male plug at one end and female connector at other end. Connectors shall be NEMA 5-15 20A 125V.

K. Two-fers: Two-fers shall contain one male plug and two female connectors, wire in parallel with molded “Y” configuration. Cable shall be 12-3 type SO cord.

L. Adapters: Adapters shall be constructed of 12-3 type SO cord, 18 inches long, with a male plug at one end and a female connector at the other end.

M. Safety cables: Minimum 1/8 inch aircraft cable, with 2 inch diameter loops on each end, seized by swaged copper sleeves; one loop shall include an operable spring clip rated for 200 pounds breaking strength. Finished cable length shall be 36 inch.

N. Color Media: 20 inch x 24 inch sheets of theatrical color media.

O. Color Filter Storage Cabinet: To accept 20 inch x 24 inch color media sheets. Ten (10) shelves, with fifty (50) sheet capacity per shelf.

P.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
PROVIDE REQUIRED SCHEDULE OF QUANTITIES ON DRAWINGS COORDINATED WITH FULL THEATRICAL DESIGN AND BOARD.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~

2.10 SCHEDULE OF QUANTITIES

A. Provide quantities of dimmers, fixtures, color media, lamps, control equipment, and cables per schedules in drawings.

B. If schedule of quantities for dimmers, fixtures, color media, lamps, control equipment, and cables are not found on the drawings, contact the Architect/Engineer of Record prior to submission of bid.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set permanently mounted items level, plumb, and square with ceilings and walls.

B.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
COORDINATE ALL MOUNTING HEIGHTS ON DRAWINGS WITH BOARD AND PROJECT SCOPE REQUIREMENTS. VERIFY SUFFICIANT LIGHTING REQUIREMENTS WITH THEATRICAL LIGHTING REPRESENTATIVE.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~

C. Indicated mounting heights on drawings are to bottom of unit for suspended items and to center of unit for wall-mounted items.

D. Mount and connect fixtures, and install and connect distribution devices.
   1. If arrangement is not indicated, install so each fixture, dimmer, house lighting circuit, control channel, and outlet circuit can be operated and complete system demonstrated in all operating modes.
   2. Install safety cables secured to stage rigging or gridiron for all pipe-mounted electrical fixtures and equipment.

E. Install and anchor dimmer boards level on concrete bases, 4-inch nominal thickness. Concrete materials and installation requirements are specified in Division 03.
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
   2. For dimmer boards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to dimmer boards.

F. Consult and coordinate work with trades doing adjoining work.

G. Position all items accurately as indicated on the drawings, and true to plumb line and level. Maintain maximum headroom and clearance at all points.

H. Do not uncrate, unpack, unwrap, or install control console, video monitor(s), remote controls, or other auxiliary control components until construction is complete and environment is clean and dust-free

I. Install dimmer rack using resilient pads as specified herein. No portion of the dimmer rack shall contact any part of the building structure or walls except through resilient connections specifically approved by the theatre consultant. All load, feed, and control conduit connections to the dimmer racks shall be isolated through the use of deflection fittings, Type DF.

3.02 WIRING

A. Power Wiring:
   1. Install wiring as specified in Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables for hard-wired connections. Install wiring in raceways except cable and plug connections.

2. Install power wiring with a separate neutral for each output circuit from main dimmer and for each house and stage lighting circuit.
3. Install power and control wiring for the stage lighting system in raceways that are unique to only that system.

B. Signaling, Remote-Control, and Power-Limited Circuits:
1. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
2. Remote-control circuits associated with emergency lighting control shall be installed complying with Class 1 Circuit standards in the Chicago Electrical Code.
3. Install data-transmission cabling per manufacturer's recommendation.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

E. Remove wall plates and protect devices and assemblies during painting.

F. Support lighting fixtures, distribution components, and accessories per manufacturer's recommendation. Equip all pipe-mounted equipment with safety cables that are secured to supporting pipe.

G. Ground equipment according to Section 26 05 26 - Grounding and Bonding for Electrical Systems.

3.03 IDENTIFICATION

A. Identify components, power, and control wiring according to Section 26 05 53 - Identification for Electrical Systems.

B.

~~~ PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
COORDINATE ALL DESIGNATIONS AND NOMENCLATURE WITH PROJECT SCOPE. ALL NAMING AND LABLING TO BE APPROVED BY ENGINEER, ARCHITECT AND BOARD PRIOR TO INSTALLATION.

~~~ END OF PROJECT NOTE ~~~~~~~~~~~~~~~~~~~~~~~~~

C. Label each fixture, lighting outlet, distribution device, and dimmer module with unique designation. Make designations on elevated components readable from floor.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Schedule electrical tests and visual and mechanical inspections with at least seven days' advance notice.

C. Visual and Mechanical Tests and Inspections:
1. Inspect each fixture, outlet, module, control, and device for defects, finish failure, corrosion, physical damage, labeling by nationally recognized testing laboratory, and nameplate.

2. Exercise and perform operational tests on mechanical parts and operable devices according to manufacturer's written instructions.
3. Check tightness of electrical connections with torque wrench.
4. Verify proper protective device settings, fuse types, and ratings.
5. Record results of tests and inspections.

D. Electrical Tests: Perform tests according to manufacturer's written instructions.
1. Continuity tests of circuits.
2. Operational Tests: Connect each outlet to a fixture and a dimmer output circuit so each dimmer module, dimmer control and output circuit, outlet, and fixture in a typical operating mode will be sequentially tested. Set and operate controls to demonstrate fixtures, outlets, dimmers, and controls in a sequence that cues and reproduces actual operating functions for a typical system of the size and scope installed. Include operation and control of houselights and stage lights from each control location and station including optional plug-in control-console outlet locations. Record fixture and outlet assignments, control settings, operations, cues, and observations of performance.

E. Correct deficiencies disclosed by tests and inspections, and retest deficient items. Verify that specified requirements are met.

F. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible organization and person.

G. Reports: Prepare a schedule of lighting outlets by number; indicate circuits, dimmers, connected fixtures, and control-channel assignments. Prepare a schedule of control settings and circuit assignments for house control channels. Prepare written reports of tests and observations. Report defective materials, workmanship, and unsatisfactory test results. Include records of repairs and adjustments made.

3.05 ADJUSTING

A. Occupancy Adjustments: When requested within twelve (12) months of date of Preliminary Acceptance, provide on-site assistance in adjusting and programming system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

3.06 CLEANING

A. The contractor shall remove all paint spatters and other spots, dirt and debris from the equipment. Clean equipment and devices internally and externally using methods and materials recommended by the manufacturer.

3.07 CONTRACTOR STARTUP AND REPORTING

A. Contractor shall prepare and submit a complete set of record drawings, operation and maintenance data and certificates as outlined in this Section.

B. Contractor shall align all ellipsoidal spotlights for cosine (hot center) alignment at jobsite, prior to delivery to the Board. Such alignment to be supervised by an experienced representative of the theatrical dealer. Dealer shall train and supervise the electrical contractor’s workers in the alignment of ellipsoidal spotlights.

C. Upon completion of all installation work, the contractor shall certify in writing to the architect that the work is complete and ready for final inspection. Final inspection shall be scheduled by the

Board, Architect/Engineer of Record, and the theatre consultant within fourteen days following the contractor's notice of completion.

3.08 COMMISSIONING AND DEMONSTRATION

A. After system checkout and adjustment, the manufacturer's engineer shall operate the system for the review of the Board, Architect/Engineer of Record, and theatre consultant. Necessary adjustments or modifications shall be made as required by the Board, architect or theatre consultant.

B. A knowledgeable representative of the manufacturer shall instruct the Board's staff or representatives in the operation and maintenance of the system. This instruction session shall be scheduled to last a minimum of six hours. While it may be possible to schedule this instruction session to coincide with the system checkout, such coincidence shall not be assumed.

C. The manufacturer shall provide to the Board digital video instructions of the operation and maintenance of the system. Information contained in the video will cover all points of operation and maintenance covered in the instruction session with the Board's staff. A digital recording of the actual instruction session is acceptable. Provide two (2) copies of the digital media file on DVD or USB flash drive.

END OF SECTION 26 55 61