

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Interior solid-state luminaires that use LED technology.
- 2. Emergency lighting units.
- 3. Exit signs.
- 4. Luminaire supports.

B. Related Sections:

- 1. Section 26 2726 "Wiring Devices" for occupancy sensors and manual wall box dimmers.
- 2. Section 26 0519 "Low Voltage Electrical Power Conductors and Cables" for wire and cabling.

1.3 SYSTEM DESCRIPTION

- A. Catalog numbers indicated in the Luminaire Schedule are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of light bar, driver, finish trim, ceiling type, mounting hardware or special requirements as specified or as required by the particular installations. Provide complete luminaire to correspond with the features, accessories, number of LED's, wattage and/or size specified in the text description of each luminaire type. Additional features, accessories and options specified shall be included.
- B. Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation. Recessed luminaires shall have frames that are compatible with the ceiling systems.
- C. Luminaire voltage shall match the voltage of the circuit serving same.

1.4 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. IP: International Protection or Ingress Protection Rating.

- D. LED: Light-emitting diode.
- E. LER: Luminaire efficacy rating.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting fixture, including lamp, reflector, and housing.

1.5 SUBMITTALS

- A. Product Data: For each type of luminaire, arranged in order of luminaire designation. Include data on features, accessories, finishes, and the following:
 - 1. Material and physical description of luminaire including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Energy-efficiency data.
 - 4. Life, output (lumens, CCT, and CRI), Kelvin temperature, and energy-efficiency data for LED light bars.
 - 5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each luminaire type. The adjustment factors shall be for light bars, drivers, and accessories identical to those indicated for the luminaire as applied in this Project.
 - a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer. LM-79 and LM-80 data for solid state lighting.
 - b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - 6. Photometric data, certified by a qualified independent testing agency, in IESNA format, based on certified results of laboratory tests of each luminaire type, outfitted with light bars, drivers and accessories identical to those indicated for the luminaire as applied in the Project.
 - 7. Low voltage transformers.
 - 8. LED power supplies.
 - 9. Types of LED's, including manufacturer, wattage, and Color Rendering Index (CRI) and color temperature in degrees Kelvin (K).
- B. Shop Drawings shall:
 - 1. Show detail of nonstandard or custom luminaires.
 - 2. Indicate dimensions, weights, method of field assembly, components, features and accessories.
 - 3. For custom luminaires, modified luminaires or linear luminaires mounted in continuous rows, submit scaled drawings prepared by the manufacturer showing all details of construction, lengths in runs, pendant or power feed locations, accessories, finishes and lists of materials.
 - 4. This Contractor shall provide the manufacturer with accurate field dimensions where required.
 - 5. Include wiring diagrams, power and control wiring.

- 6. Include plans of the locations of the light fixtures which are on the emergency lighting system.
 - C. Wiring diagrams shall detail wiring for luminaires and differentiate between manufacturer installed and field installed wiring.
 - D. Product Certificates shall be signed by manufacturers of luminaires certifying that products comply with requirements.
 - E. Dimming Driver Compatibility Certificates shall be signed by the manufacturer of driver certifying that drivers are compatible with dimming systems and equipment with which they are used. Product Certificates signed by product manufacturer shall be provided for each type of driver for dimmer controlled luminaires.
 - F. Maintenance Data shall be provided for luminaires and equipment to include in emergency, operation and maintenance manuals specified in specifications section describing Operations and Maintenance Data.
 - G. Field quality control test reports.
 - H. Special Warranties specified in the Section.
 - I. Review of luminaire submittals which indicate voltage, mounting condition, or quantities shall not be considered to be approval of said voltage, mounting condition or quantities. This Contractor shall field verify voltage and actual mounting condition and method.
 - J. Product samples complete with housing, trim, specified lumen package, and 8' cord with plug for 120 V shall be submitted if requested.
- 1.6 CUSTOM LUMINAIRES
- A. All custom luminaires require a prototype to be submitted prior to commencement of fabrication. The purpose of the prototype will be to review construction, LED placement within luminaire, LED type, optical assembly, finishes, etc. Modifications may be required as a result of prototype review. These modifications and others that do not materially affect the cost of the luminaire shall be incorporated at no additional cost to the University, Architect, Lighting Designer, or Engineer.
- 1.7 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For lighting equipment and luminaires to include in emergency, operation, and maintenance manuals.
 - 1. Provide a list of all arrays and drivers types used on Project; use ANSI and manufacturers' codes.
- 1.8 EXTRA MATERIALS
- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Glass, Plastic Diffusers and Lenses: 10% or one dozen (whichever is less) of each type and rating installed. Furnish at least one of each type.

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2. Globes and Guards: 5% of each type and rating installed. Furnish at least one of each type.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver luminaires individually wrapped in factory fabricated fiberboard type containers.
- B. Handle luminaires carefully to prevent breakage, denting and scouring of the luminaire finish.
- C. Store product in a clean, dry space, protected from weather.

1.10 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authorities Having Jurisdiction, and marked for intended use.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Comply with most current edition of the Northwestern University Design Standards.
- E. Comply with NFPA 70.
- F. Designated manufacturers are listed to define the requirements for quality and function of the specified product.
- G. Mockups: Provide interior luminaires for room or module mockups complete with power and control connections.
 1. Obtain Lighting Designer's and Architect's approval of luminaires for mockups prior to starting installations.
 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 3. Remove mockups when directed. Luminaires may be reinstalled in the Work with approval from the University.
 4. Install luminaires for mockups with power and control connections.
 5. Mockups evaluated on the Project site may become part of the complete Work with the approval of the University, Lighting Designer and Architect if the mockup is undisturbed at the time of substantial completion.

1.11 COORDINATION

- A. Coordinate layout and installation of luminaires with ceiling system and other construction that penetrates ceilings or is supported by them including mechanical system, fire suppression, and technology and partition assemblies.

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- B. Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation.
- C. Recessed luminaires shall have frames that are compatible with the ceiling system indicated on the Architectural Drawings.
- D. Coordination Meetings: This Contractor shall meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate each luminaire mounting condition with ceiling type. During second meeting, coordinate luminaire layout in each area. This Contractor shall meet at least twice with the mechanical systems installer prior to fabrication and installation of ductwork. Coordinate depth and location of all luminaires with ductwork, fire suppression, and technology in all areas.

1.12 WARRANTY

- A. Comply with Division 1 requirements.
- B. General Warranty: Special warranty specified in this Section shall not deprive the University of other Rights the University may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by this Contractor under requirements of the Contract Documents.
- C. Special Warranty for LEDs' and Drivers: Manufacturers standard form in which manufacturer of LED's and drivers agrees to replace components that fails in materials or workmanship within specified warranty period.
 - 1. LED arrays: 10 years from date of Beneficial Occupancy.
 - 2. Drivers: 10 years from date of Beneficial Occupancy.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products as listed in the Lighting Fixture Schedule or comparable products approved in writing by the University.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES AND COMPONENTS

- A. Recessed Luminaires: Comply with NEMA LE 4 for ceiling compatibility for recessed luminaires.
 - 1. Chicago campus: Where applicable, City of Chicago environmental air marking (CCEA) for plenum installations.
- B. Luminaires: Comply with UL 1598.
- C. Metal Parts: Free of burrs, sharp corners and edges. Metal work shall be free of tool marks and dents and shall have accurate angles bent as sharply as compatible with the gauges of the required metal. Intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. All miters shall be in accurate alignment with abutting intersection members.

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- D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging. Luminaires to be painted after fabrication. Finish ferrous mounting hardware and accessories to prevent corrosion and discoloration to adjacent materials.
- E. Luminaire hardware to comply with the following material standards: For steel and aluminum luminaires, all screws, bolts, nuts and other fastening and latching hardware shall be cadmium or equivalent plated. For stainless steel luminaires, all hardware shall be stainless steel.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Safety devices shall be detachable if necessary and shall not interfere with luminaire performance, maintenance or the seating of any luminaire element. Safety device shall not be visible during normal luminaire operation and from normal viewing angles.
- G. Luminaires provided shall have means for disconnection from power source during service, as required in NEC Article 410.
- H. Reflecting Surfaces: Minimum reflectance as follows, unless indicated otherwise:
 - 1. White Surfaces: 85%
 - 2. Specular Surfaces: 90%
 - 3. Diffusing Specular Surfaces: 75%
- I. Reflector cones shall adhere to the following:
 - 1. Cones shall provide a minimum of 50 degree cutoff to source and source image.
 - 2. Plastic material shall not be used for reflector cones.
 - 3. Cones shall not be permanently fastened to the housing and shall be removable without tools. Retention devices shall not deform the cone or be visible from normal viewing angles.
 - 4. Trim shall be flush to ceiling without gaps or light leaks. Where the flange trim is separate from the cone, it shall have the same finish as the reflector cone.
 - 5. Reflector cones shall be uniform gauge, not less than 0.032" thick, high purity aluminum Alcoa 3002 alloy. Cones shall be free from spin marks or other defects.
 - 6. Manufacture cones using the Alzak® process. Refer to Luminaire Schedule for cone color and finish, i.e., specular or diffuse requirements.
- J. Lenses, Covers, Diffusers and Globes:
 - 1. Acrylic Lighting Diffusers: 100% virgin acrylic plastic. UV stabilized high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
 - b. Lenses shall have uniform brightness throughout the entire visible area without LED pixelation.
 - 2. Glass Globes: Annealed crystal glass unless otherwise indicated.
- K. Adjustable luminaires shall have positive locking devices to fix aiming angle. Luminaires shall be capable of being relamped without adjusting aiming angle.

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- L. Each luminaire that has an array with a beam pattern or a spread lens that defines beam orientation shall contain locking devices to insure the orientation is not disturbed during array replacement or cleaning.
- M. All luminaires and drivers shall operate within the temperature limits of their design and as specified by UL in the applications and mounting conditions specified.
- N. Luminaires recessed in suspended ceilings where the space above the ceiling is either an air supply or return plenum shall conform to NEC Article 300-22.
- O. Provide plaster frame for recessed luminaires mounted in other than T-bar ceilings. Verify mounting with architectural reflected ceiling plan before ordering luminaires.
- P. Fixtures installed in "hard" ceilings shall have all connections accessible through the luminaire.
- Q. Provide wire guards on all open strip type luminaires in unfinished spaces.
- R. For weatherproof or vapor-tight installations, finishes of luminaires and accessories shall be a premium 5 stage TGIC polyester powder coat paint minimum 2.5 mils thick, applied to factory-assembled and -tested luminaires before shipping, so that the entire assembly is completely corrosion resistant for the service intended. Exterior finishes shall have an outdoor life expectancy of not less than 20 years without any visible rust or corrosion. Where aluminum parts come in contact with bronze or steel parts, apply a coating material to both surfaces to prevent corrosion.
- S. Luminaires for use outdoors or in areas designated as damp locations shall be suitable gasketed to prevent the entrance of moisture. Provide approved wire mesh screens for ventilation openings. Dissimilar metals shall be separated by non-conductive material to prevent galvanic action.
- T. Factory-Applied Labels: Comply with UL 1598. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when light bars are in place.
- U. Luminaires shall be free of light leaks while providing sufficient ventilation of LED's and drivers to provide the required photometric performance.
- V. Luminaires shall hold LED arrays securely against normal vibration and maintenance handling.

2.3 LUMINAIRES

- A. Housing shall be minimum code gauge steel construction painted after fabrication with high reflectance white paint unless otherwise indicated.
- B. Shielding shall adhere to the following criteria:
 - 1. Flat frosted diffuser shall be 100% virgin acrylic, pattern #12, and shall have matte finish on exterior side. Diffuser shall be of sufficient density to completely obscure LED image.
 - 2. Flat clear lenses shall be injection molded 100% virgin acrylic.
 - 3. Clear patterned lenses shall be injection molded 100% virgin acrylic, pattern #12.
 - 4. Clear patterned lenses shall be polycarbonate, pattern #12.
 - 5. Minimum thickness shall not be less than 0.125" with a minimum weight of 8 ounces per square foot.

- C. Doorframes shall be supplied with concealed hinges and latches. Provide mitered corners with no gaps or light leaks.

2.4 EMERGENCY BATTERY PACK FOR LUMINAIRES [Evanston]

- A. Manufacturers:
 - 1. Basis of Design Product: (Eaton) Sure-Lites.
- B. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within/top of luminaire body and compatible with driver. Comply with UL 924.
 - 1. Indicator light: Visible without opening luminaire or entering ceiling space. Indicator Light: LED indicates normal power on.
 - 2. Battery: Sealed, maintenance-free, nickel-cadmium type, sized for ninety (90) minutes of operation.
 - 3. Charger: Fully automatic, solid-state.
 - 4. Integral Self-Test: Factory-installed electronic device automatically initiates code required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
 - 5. Universal Voltage input.

2.5 MESSAGE SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance and lettering size. Comply with Authorities Having Jurisdiction, State and Local Codes.
- B. Coordinate with Division 28 requirements.
- C. Electrical: Internally mounted, universal 120/277V transformer.
- D. Internally Lighted Signs:
 - 1. Light bars for AC operation: LED, 70,000 hours minimum rated life.
- E. Heavy gauge steel housing and stenciled faceplate with glass or thermoplastic color shield.
 - 1. Legend: See Luminaire Schedule.

2.6 LED LUMINAIRES AND DRIVERS

- A. All Luminaires
 - 1. Comply with IES LM-79-08 Approved Method for measuring lumen maintenance of LED light sources.
 - 2. Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.
 - 3. Comply with In-Situ testing for more reliable results.
 - 4. LED's shall be Restriction of Hazardous Substances Directive (RoHS) compliant.
 - 5. LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours. (L70)
 - 6. LED luminaires shall deliver a minimum of 80 lumens per watt.

- a. LED's shall be "Bin No. 1" quality.
 - 7. Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.
 - 8. The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.
 - 9. LED color temperatures: **[3000/3500/4000/other (requires approval)]** as noted, +/- 275K.
 - 10. Luminaires shall have internal thermal protection.
 - 11. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.
 - 12. Color spatial uniformity shall be within .004 of CIE 1976 diagram.
 - 13. Color maintenance over rated life shall be within .007 of CIE 1976.
 - 14. Indoor luminaires shall have a minimum CRI of 85.
 - 15. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management
 - 16. LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver a minimum 70% of initial lumens, when installed in-situ, for a minimum of 50,000 hours.
 - 17. Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.
- B. Power Supplies and Drivers
- 1. Power Factor: 0.90 or higher
 - 2. Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
 - 3. Output operating frequency: 60Hz.
 - 4. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
 - 5. Total Harmonic Distortion Rating: 20% Maximum.
 - 6. Meet electrical and thermal conditions as described in LM-80 Section 5.0.
 - 7. Fully dimmable, 0 – 10 VDC standard.
 - 8. Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
 - 9. Compatibility of dimming switches: Certified by manufacturer for use with individually specified luminaire and individually specified control components.

2.7 LED ARRAYS

- A. All LED's of the same type are to be provided by the same manufacturer.
- B. Equip each luminaire with the proper LED array of the type shown or specified in the Luminaire Schedule

2.8 WIRING

- A. No internal wiring shall be visible at normal viewing angles.

2.9 LUMINAIRE SUPPORT COMPONENTS

- A. Single-Stem Hangers shall be 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish shall be the same as the luminaire.

- B. Twin-Stem Hangers shall be two, 1/2-inch steel tubes with single canopy arranged to mount a single fixture. Finish shall be the same as the luminaire.
- C. Rod Hangers shall be 3/16-inch minimum diameter, cadmium-plated threaded steel rod.
- D. Wires shall be ASTM A 641/A 641M, Class 3, soft temper, zinc coated steel, 12 gauge.
- E. Wires for humid spaces shall be ASTM A 580/A 580M, composition 302 or 304, annealed stainless steel, 12 gauge.
- F. Aircraft Cable Support shall use cable, anchorages, and intermediate supports recommended by luminaire manufacturer.
- G. Hangers for pendant industrial luminaires shall be heavy duty No. 8 jack chain with hangers, "S" hooks, mounting straps, and all required accessories for complete installation.

2.10 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with Authorities Having Jurisdiction.
 - 1. Comply with City of Chicago Building Code requirements for Chicago campus.
- B. **[Evanston only: Eco-Smart brand LED exit sign.**
 - 1. **AC only or battery backup as scheduled.**
 - 2. **Universal mount canopy.**
 - 3. **Green Letters on white or black, mirror or brushed nickel field as scheduled.**
 - 4. **Directional chevrons as indicated, field configurable.**
 - 5. **LED panel, 0.25 W.**
 - 6. **Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack with nickel metal hydride battery with self diagnostics.]**
- C. Internally Lighted Signs:
 - 1. Products: Provide products as listed in the Lighting Fixture Schedule.
 - 2. Steel Housing, 20 gauge (Chicago campus), white finish.
 - 3. Glass or plastic faceplate.
 - 4. Red Letters on white field.
 - 5. Directional chevrons as indicated.
 - 6. *Field selectable full size arrow designations (Chicago campus).*
 - 7. Light bars: LED, 70,000 hours minimum rated lamp life.
 - a. Individual LED modules shall not be visible.
 - 8. *Maximum power consumption: 5 watts.*
 - 9. AC powered signs shall be 120/277V input.
 - 10. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. LED, 70,000 hours minimum rated lamp life.
 - b. Battery: Two hour capacity sealed, maintenance-free, Ni Cad type, five year manufacturer warranty.
 - c. Charger: Fully automatic, solid-state type with sealed transfer relay.

- d. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects light bars from battery, and battery is automatically recharged and floated on charger.
- e. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
- f. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
- g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.11 EMERGENCY LIGHTING UNITS

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
 - 1. City of Chicago Building Code approved for Chicago campus.
 - 2. Housing: 20 ga. Steel.
 - 3. Flexible cord and plug connections shall not be permitted.
 - 4. Battery: Sealed, maintenance-free, lead-acid type.
 - 5. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 6. Lamping: Tungsten Halogen (Chicago only) or LED (Evanston).
 - 7. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 8. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 9. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 10. Wire Guard: Heavy-chrome-plated wire guard to protect lamp heads or units in areas where subject to physical damage.
 - 11. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
 - 12. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
 - 13. Factory supplied molded plug and cord where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Luminaires:
 - 1. Set level, plumb, and square with ceilings and walls, and secure according to manufacturers written instructions and approved submittal materials, unless otherwise indicated.

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- B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, and reinstall.
- C. Remote Mounting of Drivers: Distance between the driver and fixture shall not exceed that recommended by manufacturer. Verify, with manufacturers, maximum distance between driver and luminaire.
- D. Mounting height indicated from finished floor to bottom of pendant luminaire or to the center of the outlet box for wall mounted luminaires unless otherwise noted. Verify mounting heights with Architect and Lighting Designer.
- E. Mounting height may also be indicated as the length of the pendant below finished ceiling.
- F. Lay-in Ceiling Luminaire Supports: Use grid as a support element.
 - 1. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees. In addition, provide slack earthquake safety wire hangers secured diagonally from opposite luminaire corners to structural members above suspended ceiling.
- G. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
 - 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
 - 5. All power feeds shall originate from the same location/end of each run.
 - 6. Where pendants or rods are longer than 48", brace to limit luminaire swinging.
- H. Provide all necessary hanging or mounting devices and accessories for all luminaires. Verify the types needed for various ceiling conditions. Plaster rings shall be provided where required.
- I. Verify weight and mounting method of all luminaires prior to ordering and provide suitable support. Coordinate with General Contractor for luminaires that require additional blocking or support. Luminaire mounting assemblies shall comply with all local seismic codes and regulations.
- J. Metal decking shall not be pierced for luminaire support.
- K. Refer to architectural reflected ceiling plans for coordination of luminaire locations with mechanical, fire protection, technology and fire safety equipment. Where conflicts occur, coordinate with Architect, Engineer and Lighting Designer prior to installing any of the Systems.
- L. In accessible suspended ceilings, luminaire wiring connections, including equipment grounding conductor, is to be through use of 72-inch (maximum) flexible conduit from a rigidly supported junction box.
- M. Wire per requirements of branch circuit installation. Properly ground each luminaire.

- N. Luminaires located in recessed ceilings with a fire resistive rating of 1 hour or more shall be enclosed in an approved fire resistive rated box equal to that of the ceiling. Acoustical ceiling tiles are not acceptable.
- O. Install luminaires with vent holes free of air blocking obstacles.
- P. Wire can type luminaires with at least 12" excess wire so drivers can be dropped through the cans for maintenance.
- Q. This Contractor shall be responsible for adjusting aperture flanges or rings on all recessed luminaires to be flush with the finished ceiling. Trim shall completely conceal ceiling opening.
- R. Brace suspended luminaires installed near ducts or other elements so that they do not swing into obstructions.
- S. Wall mounted luminaires shall be supported from four-square outlet box plaster ring and from wall at non-feed end with two 1/4-inch toggle bolts for gypsum board walls or 1/4-inch bolts to pre-set inserts for concrete wall.
- T. Luminaires shall not be secured to ductwork or other Systems.
- U. Adjust variable position lampholders for proper lamp position prior to luminaire installation.
- V. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 DOWNLIGHT LUMINAIRES

- A. Recessed Type in Accessible Ceilings: Mount in frames suitable for the ceiling with the recessed portion of the luminaire securely supported from the ceiling opening by use of a metal trim ring.
- B. Recessed Type in Non-accessible Ceilings: As Specified for mounting in accessible ceilings, except provide access to wiring and driver through the ceiling opening for the luminaire.

3.3 LUMINAIRES

- A. Recessed Type: Support luminaires independent of the ceiling suspension system. Provide four integral tabs (one at each corner) which rotate into position and lock on ceiling tees after luminaire is lifted into the ceiling cavity or provide four clips similar to Caddy #535. Provide mounting frames suitable for the ceiling type. In addition, provide slack earthquake safety wire hangers secured diagonally from opposite luminaire corners to structural members above suspended ceiling.
- B. Wall Mounted Type: Support from four-square outlet box plaster ring and from wall at non-feed end with two 1/4 inch toggle bolts for gypsum board walls or 1/4 inch bolts to pre-set inserts for concrete wall.
- C. If clearance above T-bar system is too restricted to "tip-in" luminaire, coordinate with acoustic ceiling installer by leaving one cross T-bar off until the cross T-bar shall be secured into its proper place. Luminaires installed in hidden-spline-type ceilings shall have supporting channels installed by Ceiling Contractor to adequately support the luminaire without providing additional hangers from the structural ceiling above the suspended ceiling.

D. Surface Mounted Type:

1. Where mounted on accessible ceilings, support from structural members above ceiling by means of hanger rods through ceiling or as approved.
2. Continuous Runs of Luminaires: Laser sight to insure luminaires are straight and true when sighting from end to end, regardless of irregularities in the ceiling. Where luminaires are so installed, omit ornamental ends between sections. All seams/ joints shall be tightly fitted.

E. Pendant Mounted Type:

1. Provide strong back channel entire luminaire length unless luminaire is designed specifically to be self-supporting.
2. Where suspended below accessible ceiling, provide structural support at suspended ceiling level from structural members above ceiling. Do not run hanger rods through ceiling.
3. Continuous Runs of Luminaires: Laser sight to insure luminaires are straight and true when sighting from end to end, regardless of irregularities in the ceiling. Where luminaires are so installed, omit ornamental ends between sections. All seams/joints shall be tightly fitted.
4. All power feeds shall originate from the same location/end of each run.

F. Install luminaire diffusers only after construction work, painting and clean up are completed.

3.4 LED LUMINAIRES

- A. Adhere to manufacturers installation guidelines regarding proper thermal management.

3.5 LIGHTING CONTROL

- A. Provide branch circuiting in coordination with the requirements of Division 26 Wiring Device Section and as indicated.
- B. Where Quantum lighting control panels are used to sweep after hours in open areas or classrooms, provide all necessary interconnecting wiring and control modules, and local override switches for after hours operation. Verify correct operation in presence of NU Electric Shop.

3.6 CLEANING AND ADJUSTING

- A. Remove protective plastic covers from luminaires and luminaire diffusers only after construction work, painting and clean-up are completed. Remove, clean, and reinstall all dirty reflectors and diffusers.
- B. Clean luminaires internally and externally after installation. Use methods and materials recommended by manufacturer for cleaning Alzak reflectors and other surfaces.
- C. Make final adjustment of aimable luminaires and adjustable light settings under the direction of the Architect and/or Lighting Designer during a scheduled period of time prior to the completion of the Project, after normal business hours if required. Include all equipment and personnel expenses including overtime required for focusing.

- D. Luminaires, reflectors, louvers and accessories which are damaged, blemished, or impregnated with fingerprints shall be replaced at this Contractor's expense. All finishes shall be unmarred upon Project completion.

3.7 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."
- B. Identify each light fixture on emergency power with an identifying mark that can be easily viewed from the floor.

3.8 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting:
 - 1. Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery/generator and retransfer to normal.
 - 2. Walk test and verify foot-candle levels meet Code with meter.
 - 3. After installation, perform an on-site review of each emergency light fixture with the NU Electric Shop to confirm that
 - a. the emergency light is located per the Emergency Light Fixture Plans, and
 - b. the identification is readable.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.
- C. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- D. Replace all inoperable LED arrays at the end of construction prior to University beneficial occupancy.
- E. Advance Notice: Give dates and times for field tests.
- F. Provide instruments to make and record test results.
- G. Malfunctioning Luminaires and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.9 ADJUSTING

- A. Occupancy Adjustments: Within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this Work may be required after dark.
 - 1. Adjust aimable luminaires in the presence of Architect and University representative.

END OF SECTION 26 5100

NORTHWESTERN UNIVERSITY

PROJECT NAME _____

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FOR: _____
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