SECTION 265619 - LED EXTERIOR LIGHTING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

See "Sustainable Design Considerations" Article in the Evaluations for a discussion of sustainable design requirements that may impact the editing of this Section.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section Includes:

Luminaire-mounted photoelectric relays.

Luminaire types.

Materials.

Finishes.

Luminaire support components.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. CCT: Correlated color temperature.
				2. CRI: Color rendering index.
				3. Fixture: See "Luminaire."
				4. IP: International Protection or Ingress Protection Rating.
				5. Lumen: Measured output of lamp and luminaire, or both.
				6. Luminaire: Complete lighting unit, including lamp, reflector, and housing.
			1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of luminaire.

Arrange in order of luminaire designation.

Include data on features, accessories, and finishes.

Include physical description and dimensions of luminaire.

Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.

Retain any or all applicable testing procedure or standard options in first subparagraph below. The option of IES Lighting Measurements Testing and Calculation Guides establishes criteria for the application or activity. Retaining IES LM-79 or IES LM-80 establishes criteria for reporting of LED lamp. See "Applicable Standards" Article in the Evaluations for discussion of IES LM-79 and IES LM-80.

Photometric data and adjustment factors based on laboratory tests, complying with [**IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project**] [**IES LM-79**] [**IES LM-80**].

Retain either or both "Manufacturer Certified Data" and "Testing Data Certified Data" subparagraphs below to specify qualifications for laboratories providing photometric data. Retain first subparagraph for testing laboratories that are associated with a luminaire manufacturer's production facility. Retain second subparagraph for testing laboratories that are independent of a luminaire manufacturer's production facility.

Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.

Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

Wiring diagrams for power, control, and signal wiring.

Photoelectric relays.

Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

Retain "Shop Drawings" paragraph below for custom luminaires. Also, retain "Mockups" paragraph in "Quality Assurance" Article.

* + - * 1. Shop Drawings: For nonstandard or custom luminaires.

Include plans, elevations, sections, and mounting and attachment details.

Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Include diagrams for power, signal, and control wiring.

* + - * 1. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.
				2. Product Schedule: For luminaires and lamps.[**Use same designations indicated on Drawings.**]

Retain "Delegated-Design Submittal" paragraph below if design services, such as luminaire support, have been delegated to Contractor or manufacturer.

* + - * 1. Delegated-Design Submittal: For luminaire supports.

Include design calculations for luminaire supports[**and seismic restraints**].

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.

Retain "Coordination Drawings" paragraph below for situations where limited space necessitates maximum utilization for efficient installation of different components or if coordination is required for installation of products and materials by separate installers. Coordinate paragraph with other Sections specifying products listed below. Preparation of coordination drawings requires the participation of each trade involved in installations within the limited space.

* + - * 1. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

Luminaires.

Structural members to which [**equipment**] [**and**] luminaires will be attached.

Underground utilities and structures.

Existing underground utilities and structures.

Above-grade utilities and structures.

Existing above-grade utilities and structures.

Building features.

Vertical and horizontal information.

<**Insert feature**>.

Coordinate "Qualification Data" paragraph below and as may be supplemented in "Quality Assurance" Article.

* + - * 1. Qualification Data: For testing laboratory providing photometric data for luminaires.

Retain "Seismic Qualification Data" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 260548.16 "Seismic Controls for Electrical Systems." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Retain "Product Certificates" paragraph below to require submittal of product certificates from manufacturers.

* + - * 1. Product Certificates: For each type of the following:

Luminaire.

Photoelectric relay.

* + - * 1. Product Test Reports: For each luminaire, for tests performed by [**manufacturer and witnessed by a qualified testing agency**] [**a qualified testing agency**].
				2. Source quality-control reports.
				3. Sample warranty.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For luminaires [**and photoelectric relays**] to include in operation and maintenance manuals.

Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.

Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

* + - 1. MAINTENANCE MATERIAL SUBMITTALS
				1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Lamps: [**Ten for every 100**] <**Insert quantity**> of each type and rating installed. Furnish at least one of each type.

Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: [**One for every 100**] <**Insert quantity**> of each type and rating installed. Furnish at least one of each type.

Diffusers and Lenses: [**One for every 100**] <**Insert quantity**>of each type and rating installed. Furnish at least one of each type.

Globes and Guards: [**One for every 20**] <**Insert quantity**>of each type and rating installed. Furnish at least one of each type.

* + - 1. QUALITY ASSURANCE
				1. Luminaire Photometric Data Testing Laboratory Qualifications:

Retain one of two subparagraphs below to specify qualifications for laboratories providing photometric data to be submitted for luminaires. Retain first subparagraph for testing laboratories that are associated with a luminaire manufacturer's production facility. Retain second subparagraph for testing laboratories that are independent of a luminaire manufacturer's production facility.

Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

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, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

* + - * 1. Provide luminaires from a single manufacturer for each luminaire type.
				2. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
				3. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

Retain "Mockups" paragraph below for custom luminaires or to require approval of installation on the Project site.

* + - * 1. Mockups: For exterior luminaires, complete with power and control connections.

Obtain Architect's approval of luminaires in mockups before starting installations.

Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.

Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

* + - 1. DELIVERY, STORAGE, AND HANDLING
				1. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.
			2. FIELD CONDITIONS
				1. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
				2. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.
			3. WARRANTY

When warranties longer than one year are required and would exceed the "one-year period for correction of work," verify with Director’s Representative that warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

* + - * 1. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

Failures include, but are not limited to, the following:

Structural failures, including luminaire support components.

Faulty operation of luminaires and accessories.

Deterioration of metals, metal finishes, and other materials beyond normal weathering.

<**Insert failure modes**>.

Verify available warranties and warranty periods.

Warranty Period: [**2**] <**Insert number**> year(s) from date of Substantial Completion.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

Terminology used to describe products complies with NEMA LE 6 product classifications. These classifications were current at the time this Specification was written, but may not be inclusive of products required for the Project. For additional products, add new articles, describe characteristics not already included in the specification, and choose the appropriate manufacturer listing.

* + - 1. PERFORMANCE REQUIREMENTS
				1. Seismic Performance:

Retain one of two subparagraphs below with "Seismic Qualification Data" paragraph in "Informational Submittals" Article for projects requiring seismic design. Delete both subparagraphs if performance requirements are indicated on Drawings. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Coordinate requirements with structural engineer.

Luminaires shall withstand the effects of earthquake motions determined according to [**ASCE/SEI 7**] <**Insert requirement**>.

Luminaires and lamps shall be labeled vibration and shock resistant.

Retain subparagraph below to define the term "withstand" as it applies to this Project. Definition varies with type of building and occupancy and is critical to valid certification. Option is used for essential facilities where equipment must operate immediately after an earthquake.

The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified[**and the luminaire will be fully operational during and after the seismic event**]."

* + - 1. LUMINAIRE REQUIREMENTS

Product characteristics in this article apply to all luminaires in the Project.

* + - * 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
				2. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

Coordinate "FM Global Compliance" paragraph below with Drawings.

* + - * 1. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

Coordinate "UL Compliance" paragraph below with luminaire types listed in UL 1598. See discussion of UL 1598 in "Applicable Standards" Article in the Evaluations.

* + - * 1. UL Compliance: Comply with UL 1598[**and listed for wet location**].
				2. Lamp base complying with [**ANSI C81.61**] [**or**] [**IEC 60061-1**].
				3. Bulb shape complying with ANSI C79.1.

Retain CRI and CCT below for projects that require the same CRI and CCT across all product types. If different product types require different CRI or CCT values, remove CRI and CCT values from this article and insert under each product type used in the Project. Note that each product type may have a different minimum CRI or CCT requirement.

* + - * 1. CRI of [**minimum**] [**65**] [**70**] [**80**] <**Insert number**>. CCT of [**2700 K**] [**3000 K**] [**4100 K**] <**Insert value**>.
				2. L70 lamp life of [**35,000**] [**50,000**] <**Insert number**> hours.
				3. Lamps dimmable from 100 percent to 0 percent of maximum light output.
				4. Internal driver.
				5. Nominal Operating Voltage: [**120 V ac**] [**240 V ac**] [**277 V ac**] [**12 V dc**] [**24 V dc**].

Retain "In-line Fusing" paragraph below when an integral fuse is desired. Coordinate with the Exterior Luminaire Schedule on Drawings.

* + - * 1. In-line Fusing: [**On the primary for each luminaire**] [**Separate in-line fuse for each luminaire**].
				2. Lamp Rating: Lamp marked for [**outdoor use**] [**and**] [**in enclosed locations**].
				3. Source Limitations:

Retain one of two subparagraphs below. Retain first subparagraph if all luminaires are to be obtained from a single manufacturer or source. Retain second subparagraph if multiple luminaires may be obtained from multiple manufacturers or sources.

Obtain luminaires from single source from a single manufacturer.

For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

* + - 1. LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

Retain this article if photometric relay manufacturer differs from luminaire manufacturer.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=11882) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Intermatic, Inc](http://www.specagent.com/Lookup?uid=123457163904).

Lutron Electronics Co., Inc.

NSI Industries (Tork).

Or equal.

* + - * 1. Comply with UL 773 or UL 773A.
				2. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay.[**Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.**]

Relay with locking-type receptacle shall comply with ANSI C136.10.

Adjustable window slide for adjusting on-off set points.

* + - 1. LUMINAIRE TYPES

Retain "Area and Site" paragraph below for an outdoor luminaire used for general lighting of a large area, typically mounted on a pole with an arm or on top of a post. Typical uses include parking lots, walkways, and plazas.

* + - * 1. Area and Site:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=11872) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Kim Lighting; Hubbell Incorporated, Lighting](http://www.specagent.com/Lookup?uid=123457163920).

[Lithonia Lighting; Acuity Brands Lighting, Inc](http://www.specagent.com/Lookup?uid=123457163910).

[RAB Lighting](http://www.specagent.com/Lookup?uid=123457163915).

Or equal.

Luminaire Shape: [**Round**] [**Square**] [**Hexagonal**] <**Insert shape or feature**>.

Mounting: [**Pole**] [**Building**] <**Insert mounting type**> with [**extruded-aluminum**] [**stainless-steel**] <**Insert material**> [**rectangular**] [**round**] arm, [**11 inches**][**13 inches**]in length.

Luminaire-Mounting Height: <**Insert height of luminaire from finished grade**>.

Distribution: [**Type I**] [**Type II**] [**Type III**] [**Type IV**] [**Type V**].

Materials for "Diffusers and Globes" and "Housings" subparagraphs below may specific to each type of luminaire. General requirements for subparagraphs are specified in separate articles toward the end of Part 2.

Diffusers and Globes: [**Tempered Fresnel glass**] [**Prismatic glass**] [**Diffuse glass**] [**Clear glass**] [**Prismatic acrylic**] [**Clear, UV-stabilized acrylic**] [**Clear polycarbonate**] <**Insert material**>.

Housings:

[**Extruded-aluminum**] <**Insert material**> housing and heat sink.

[**Clear**] <**Insert color**> [**anodized**] [**powder-coat**] [**painted**] finish.

Retain "Bollard" paragraph below for an outdoor luminaire with a height lower than pedestrian level used to light an area in close proximity.

* + - * 1. Bollard:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=11874) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Kim Lighting; Hubbell Incorporated, Lighting](http://www.specagent.com/Lookup?uid=123457163880).

[Lithonia Lighting; Acuity Brands Lighting, Inc](http://www.specagent.com/Lookup?uid=123457163875).

[RAB Lighting](http://www.specagent.com/Lookup?uid=123457163877).

Or equal.

Shape: [**Round**] [**Square**] [**Hexagonal**] [**Fluted**] <**Insert shape or feature**>.

Height Above Finished Grade: [**24 inches**] [**30 inches**] <**Insert height**>.

Overall Height: [**30 inches**][**36 inches**] <**Insert height**>.

Diameter: [**6 inches**] <**Insert measurement**>.

Mounting: [**3 point cast aluminum base**] <**Insert mounting provisions**>.

Distribution: [**Type III**] [**Type V**].

Materials for "Diffusers and Globes" and "Housings" subparagraphs below may specific to each type of luminaire. General requirements for subparagraphs are specified in separate articles toward the end of Part 2.

Diffusers and Globes: [**Tempered Fresnel glass**] [**Prismatic glass**] [**Diffuse glass**] [**Clear glass**] [**Prismatic acrylic**] [**Clear, UV-stabilized acrylic**] [**Clear polycarbonate**] <**Insert material**>.

Housings:

[**Extruded-aluminum**] <**Insert material**> housing and heat sink.

[**Clear**] <**Insert color**> [**anodized**] [**powder-coat**] [**painted**] finish.

Retain "Border" paragraph below for an outdoor luminaire used to light an area in close proximity and ranges in height from less than 20 inches down, with lower rim flush with the ground/concrete and the light-emitting opening above grade. Typical uses include sidewalks, promenades, drive-over applications, and landscaped areas.

* + - * 1. Border:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=11875) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Kim Lighting; Hubbell Incorporated, Lighting](http://www.specagent.com/Lookup?uid=123457163933).

[Lithonia Lighting; Acuity Brands Lighting, Inc](http://www.specagent.com/Lookup?uid=123457163927).

[RAB Lighting](http://www.specagent.com/Lookup?uid=123457163929).

Or equal.

Shape: [**Round**] [**Square**] <**Insert shape**>.

Dimensions: [**12 inches**] [**square**] [**in diameter**].

[**Flush**] <**Insert dimension**> with grade.

Materials for "Diffusers and Globes" and "Housings" subparagraphs below may specific to each type of luminaire. General requirements for subparagraphs are specified in separate articles toward the end of Part 2.

Diffusers and Globes: [**Tempered Fresnel glass**] [**Prismatic glass**] [**Diffuse glass**] [**Clear glass**] [**Prismatic acrylic**] [**Clear, UV-stabilized acrylic**] [**Clear polycarbonate**] <**Insert material**>.

Housings:

[**Extruded-aluminum**] <**Insert material**> housing and heat sink.

[**Clear**] <**Insert color**> [**anodized**] [**powder-coat**] [**painted**] finish.

Retain "Canopy" paragraph below for a surface or recessed luminaire installed under a canopy or overhang. Typical uses are drive-through windows, building entrances, and gas stations.

* + - * 1. Canopy:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=11876) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Kim Lighting; Hubbell Incorporated, Lighting](http://www.specagent.com/Lookup?uid=123457163945).

[Lithonia Lighting; Acuity Brands Lighting, Inc](http://www.specagent.com/Lookup?uid=123457163941).

[RAB Lighting](http://www.specagent.com/Lookup?uid=123457163943).

Or equal.

Shape: [**Round**] [**Square**] <**Insert shape**>.

Dimensions: [**12 inches**] [**square**] [**in diameter**].

Materials for "Diffusers and Globes" and "Housings" subparagraphs below may specific to each type of luminaire. General requirements for subparagraphs are specified in separate articles toward the end of Part 2.

Diffusers and Globes: [**Tempered Fresnel glass**] [**Prismatic glass**] [**Diffuse glass**] [**Clear glass**] [**Prismatic acrylic**] [**Clear, UV-stabilized acrylic**] [**Clear polycarbonate**] <**Insert material**>.

Housings:

[**Extruded-aluminum**] <**Insert material**> housing and heat sink.

[**Clear**] <**Insert color**> [**anodized**] [**powder-coat**] [**painted**] finish.

Retain "Decorative Post Top" paragraph below for an outdoor luminaire designed for daytime and nighttime aesthetics. Typical uses include walkways, plazas, streetscapes, and building entrances.

* + - * 1. Decorative Post Top:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=11877) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Kim Lighting; Hubbell Incorporated, Lighting](http://www.specagent.com/Lookup?uid=123457163957).

[Lithonia Lighting; Acuity Brands Lighting, Inc](http://www.specagent.com/Lookup?uid=123457163952).

[RAB Lighting](http://www.specagent.com/Lookup?uid=123457163954).

Or equal.

Luminaire-Mounting Height: <**Insert height of luminaire from finished grade**>.

Mounting Type: [**Arm**] [**Tenon**] [**Ring**].

Distribution: [**Type I**] [**Type II**] [**Type III**] [**Type IV**] [**Type V**].

Materials for "Diffusers and Globes" and "Housings" subparagraphs below may specific to each type of luminaire. General requirements for subparagraphs are specified in separate articles toward the end of Part 2.

Diffusers and Globes: [**Tempered Fresnel glass**] [**Prismatic glass**] [**Diffuse glass**] [**Clear glass**] [**Prismatic acrylic**] [**Clear, UV-stabilized acrylic**] [**Clear polycarbonate**] <**Insert material**>.

Housings:

[**Extruded-aluminum**] <**Insert material**> housing and heat sink.

[**Clear**] <**Insert color**> [**anodized**] [**powder-coat**] [**painted**] finish.

Retain "Roadway" paragraph below for an outdoor luminaire used to light streets or roadways, typically mounted on a pole with an arm. Typical uses include streets and roadways.

* + - * 1. Roadway:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=11878) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Crouse-Hinds Co.

[Current Lighting Solutions, LLC (Current, powered by GE)](http://www.specagent.com/Lookup?uid=123457163885).

ITT Outdoor Lighting.

Or equal.

Luminaire-Mounting Height: <**Insert height of luminaire from finished grade**>.

Mounting Type: [**Arm**] [**Tenon**] [**Ring**].

Distribution: [**Type I**] [**Type II**] [**Type III**] [**Type IV**] [**Type V**].

Materials for "Diffusers and Globes" and "Housings" subparagraphs below may specific to each type of luminaire. General requirements for subparagraphs are specified in separate articles toward the end of Part 2.

Diffusers and Globes: [**Tempered Fresnel glass**] [**Prismatic glass**] [**Diffuse glass**] [**Clear glass**] [**Prismatic acrylic**] [**Clear, UV-stabilized acrylic**] [**Clear polycarbonate**] <**Insert material**>.

Housings:

[**Extruded-aluminum**] <**Insert material**> housing and heat sink.

[**Clear**] <**Insert color**> [**anodized**] [**powder-coat**] [**painted**] finish.

* + - 1. MATERIALS
				1. Metal Parts: Free of burrs and sharp corners and edges.
				2. Sheet Metal Components: [**Corrosion-resistant aluminum**] [**Stainless steel**] [**Epoxy-coated steel**] <**Insert material**>. Form and support to prevent warping and sagging.
				3. 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. Doors shall be removable for cleaning or replacing lenses.
				4. Diffusers and Globes:

Retain "Acrylic Diffusers" subparagraph below if an acrylic option in the product description was retained.

Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

Retain "Glass" subparagraph below if a glass option in the product description was retained.

Glass: Annealed crystal glass unless otherwise indicated.

Retain "Lens Thickness" subparagraph below for all diffuser and globe types.

Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

* + - * 1. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
				2. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

White Surfaces: 85 percent.

Specular Surfaces: 83 percent.

Diffusing Specular Surfaces: 75 percent.

* + - * 1. Housings:

Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.

Provide filter/breather for enclosed luminaires.

* + - * 1. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

Label shall include the following lamp characteristics:

"USE ONLY" and include specific lamp type.

Lamp diameter, shape, size, wattage and coating.

CCT and CRI for all luminaires.

* + - 1. FINISHES

Retain "Variations in Finishes" paragraph below if finish is prone to variation; an example is color-anodized aluminum.

* + - * 1. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

Revise "Luminaire Finish" paragraph below to include custom colors. Coordinate custom-color requirements for luminaires with those for poles and other luminaire support requirements.

* + - * 1. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

Retain "Factory-Applied Finish for Aluminum Luminaires" paragraph below when luminaire material is aluminum that is not to be field painted and is not required to match finish of pole or support materials.

* + - * 1. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

Retain "Natural Satin Finish," "Class I, Clear-Anodic Finish," or "Class I, Color-Anodic Finish" subparagraph below or revise to suit Project.

Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.

Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

Color: [**Light bronze**] [**Medium bronze**] [**Dark bronze**] [**Black**] <**Insert color**>.

Retain "Factory-Applied Finish for Steel Luminaires" paragraph below when luminaire material is steel that is not to be field painted and is not required to match finish of pole or support materials.

* + - * 1. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.

Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

Color:

Retain one of three subparagraphs below.

As selected from manufacturer's standard catalog of colors.

Match sample of [**manufacturer's standard**] [**custom**] color.

As selected by Architect from manufacturer's full range.

1. EXECUTION
	* + 1. EXAMINATION
				1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
				2. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
				3. Examine walls, roofs, [**and**] [**canopy ceilings**] [**and**] [**overhang ceilings**] for suitable conditions where luminaires will be installed.
				4. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. TEMPORARY LIGHTING
				1. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.
			3. GENERAL INSTALLATION REQUIREMENTS
				1. Comply with NECA 1.

Retain first paragraph below if seismic restraint is required by local code or authorities having jurisdiction. See the Evaluations.

* + - * 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
				2. Install lamps in each luminaire.
				3. Fasten luminaire to structural support.

NFPA 70 requires minimum support for luminaires. Retain "Supports" paragraph below for more specific support requirements and for requirements exceeding code minimums. For projects requiring seismic design, additional supports, and restraining devices beyond those specified here may be required. See the Evaluations.

* + - * 1. Supports:

Sized and rated for luminaire weight.

Able to maintain luminaire position after cleaning and relamping.

Support luminaires without causing deflection of finished surface.

Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

* + - * 1. Wall-Mounted Luminaire Support:

[**Attached to structural members in walls**] [**Attached to a minimum 1/8 inch backing plate attached to wall structural members**] [**Attached using through bolts and backing plates on either side of wall**] <**Insert means of attachment**>.

* + - * 1. Wiring Method: Install cables in raceways. Conceal raceways and cables.
				2. [**Install luminaires level, plumb, and square with finished grade unless otherwise indicated.**] [**Install luminaires at height and aiming angle as indicated on Drawings.**]
				3. Coordinate layout and installation of luminaires with other construction.
				4. Adjust luminaires that require field adjustment or aiming. [**Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.**]
			1. INSTALLATION OF BOLLARD LUMINAIRES

Coordinate this article with Drawings. Delete if installation is detailed on Drawings.

* + - * 1. Align units for optimum directional alignment of light distribution.

Retain subparagraph below if luminaires require protection from damage at base due to landscaping maintenance or snow removal operations. Coordinate with Drawings.

Install on concrete base with top [**4 inches**] <**Insert dimension**> above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth.

* + - 1. INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

Coordinate this article with Drawings. Delete if installation is detailed on Drawings.

* + - * 1. Aim as indicated on Drawings.
				2. Install on concrete base with top [**4 inches**] <**Insert dimension**> above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth.
			1. CORROSION PREVENTION
				1. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
			2. IDENTIFICATION
				1. Identify system components, wiring, cabling, and terminals.
			3. FIELD QUALITY CONTROL
				1. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

Retain "Perform the following tests and inspections" paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform the following tests and inspections[**with the assistance of a Company Service Advisor**]:

Coordinate "Operational Test" subparagraph below with requirements in Section 260923 "Lighting Control Devices."

Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

Retain "Photoelectric Control Operation" subparagraph below for luminaires controlled by photoelectric controls.

Verify operation of photoelectric controls.

Retain "Illumination Tests" paragraph below if specific illumination performance is indicated.

* + - * 1. Illumination Tests:

Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

Retain one or more of five subparagraphs below.

IES LM-5.

IES LM-50.

IES LM-52.

IES LM-64.

IES LM-72.

Coordinate "Operational Test" subparagraph below with requirements in Section 260923 "Lighting Control Devices."

Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

* + - * 1. Luminaire will be considered defective if it does not pass tests and inspections.
				2. 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.
			1. DEMONSTRATION
				1. [**Engage a Company Service Advisor to train**] [**Train**] Director’s Representative maintenance personnel to adjust, operate, and maintain luminaires[**and photocell relays**].
			2. ADJUSTING

Verify with Director’s Representative that adjusting service is required for Project.

* + - * 1. Occupancy Adjustments: When requested within [**12**] <**Insert number**> months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to [**two**] <**Insert number**> visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.

Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265619