



CITY OF SUNNYVALE

DEPARTMENT OF PUBLIC WORKS
Division of Transportation and Traffic

Requirements for Solid State Lighting LED Roadway Luminaires

Date Revised: August 28, 2017

Luminaires

- Luminaires heads shall be the slim, low-profile type, constructed from low copper die cast aluminum alloy (A360) components with 2.5mm desirable thickness; both door and housing assembly
- The luminaire shall be a single, self-contained device, not requiring on site assembly for installation.
- The transformer for the luminaire shall be integral to the unit. LED or other drivers shall be mounted internally, and be replaceable.
- Electric components shall be RoHS compliant, shall have a 20KVA surge protector, and 7 pin photocell receptacles.
- All components must be accessible without special or additional tools, and shall be suitable for wet listed operation (per UL 1508 requirements). The optical assembly of the luminaire shall be protected against dust and moisture intrusion per the requirements of Ingress Protection IP-66 minimum to protect all internal components. The electronics/power supply enclosure shall be protected per the requirements of IP-65 (minimum).
- Thermal management shall be passive by design.
- Units shall have a high performance aluminum heat-sink (minimum heat sink surface of 3.5 square inches per watt) with no fans, pumps, or liquids and shall be resistant to debris buildup.
- Fixture shall be designed for energy-efficient LED 'Roadway Light' applications.
- Finish shall be gray in color, shall include an exterior E-coat epoxy primer with an ultra-durable powder topcoat to provide resistance to corrosion, ultraviolet degradation and abrasion. IP ratings must be provided.
- The housing shall be designed to prevent the buildup of water or debris on the top of the housing. Exposed heat sink fins shall be oriented so that water can freely run off the luminaire, and carry dust and other accumulated debris away from the unit.
- Heat sink range preferably from -40 to +50 °C.
- Fixture door shall be of metallic construction.
- When the components are mounted on a down-opening door, the door shall be hinged and secured to the luminaire housing separately from the refractor or flat lens frame. The door shall be secured to the housing in a manner to prevent its accidental opening or disengagement.
- Preferably provide easy step adjustment in 2.5 degrees increments of +/- 5 degree tilt.
- All screws shall be stainless steel. Captive screws are needed on any component that requires maintenance after installation.
- No parts shall be constructed of polycarbonate unless it is UV stabilized. Lens discoloration will be considered a failure under warranty.
- Luminaire must be wireless control dimmable feature ready.
- Luminaires shall be Philips; vendor shall submit to the City of Sunnyvale's Transportation Engineer a cut sheet of LED to be supplied before installation for approval. All proposed

fixtures must be on the PG&E Qualified LED Products list. More information is available on the following web site:

<http://www.pge.com/en/mybusiness/save/rebates/lighting/led/index.page>

Fixture Luminous Efficacy and Lumen Output

Efficacy shall be determined as the total luminous flux emitted by the luminaire divided by the total power input to the luminaire, and is expressed in lumens per watt (lm/W). Luminaire shall allow for thermal and optical losses.

Minimum desirable values of total delivered lm/W and lumens output are as follows:

1. For residential streets:
 - a. 115 lm/W with maximum system wattage of not more than 35W including all the components. Minimum desirable output of fixture of 4000 lumens.
2. For arterials and collectors:
 - a. 103 lm/W with maximum system wattage of not more than 70W including all components. Minimum desirable output of fixture of 7000 lumens.
3. For Acorn style (Downtown Standards) – Retrofit Kit
 - a. 100 lm/W with maximum of 58W including all components. Minimum desirable output of fixture is 5800 lumens.
4. For Soffit/wall-pack
 - a. 100 lm/W with maximum system wattage of not more than 41W including all the components. Minimum desirable output of fixture of 4100 lumens.

Required values shall be verified by submitting an independent testing lab certification per IESNA LM-79-08 requirements.

If LED lumens/watt increases, between the time that the specifications are released and the time that the product is ordered, the additional benefit of more light for the same energy or the reduction in wattage usage to obtain the same delivered lumens shall not be a cause for a pricing increase or failure to deliver the required products.

Lumen Depreciation

LED's in the luminaire shall be rated for "life" in hours as defined by the Illuminating Engineering Society of North America (IESNA) standards (IESNA LM-80)

Minimum desirable value of required (based on LM-80 data from the LED chip manufacturer, in-situ junction temperature testing results need to be provided from the fixture manufacturer to determine L70 life):

1. Delivered lumens shall be 70% of initial delivered lumens after > 100,000 hours of operation at 25°C ambient.

Minimum desirable light loss factors (LLF) on all fixtures of 0.9 or higher.

Luminaire Classification and Light Distribution

- Light Distribution and Luminaire Classification (LCS) shall be in accordance with IESNA for a Type III distribution for arterials and collectors, Type II distribution for residential streets and

Type V distribution for post-top/Acorn Downtown locations.

- Fixture should have Forward Very High (FVH) and Back Very High (BVH) values of equal to or less than 0.5%, and Up Low (UL), Up High (UH) of 0%.
- The LCS values are intended to replace previous “Full Cutoff” designation which is no longer printed on test reports per the Illuminating Engineering Society (IES) TM-15-07 standard.
- Luminaire should have independent photometric test reports and shall be Energy Star and Dark Sky compliant.

Correlated Color Temperature (CCT) and Color Rendering Index (CRI) Values

Luminaire shall have a minimum CRI and maximum CCT values per IESNA LM-79-08 as follows:

1. CRI: 70
2. CCT: 4,000 °K – 6000 °K

Safety, Installation and Other Requirements

- Luminaires shall comply with the most current codes, standards and requirement relating to the installation and usage of solid-state lighting products, such as but not limited to NFPA-NEC, FCC (Title 47 CFR Part 15), and UL Standards (8750, 1598, 1012, 1310, 2108).
- Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire
- Contractor shall verify that the existing in-line fuse is sized appropriately for LED fixture per manufacturer’s recommendations, or replace the in-line fuse with the appropriately sized item.

Factory Installed Options

At minimum, the following options shall be included:

1. IP66 Rating
2. Fuse
3. NEMA 7 pin photo control receptacle
4. Fixture must be Wireless control dimmable feature ready
5. Luminaire shall have an external label per ANSI C136.15
6. Luminaire shall have an internal label per ANSI C136.22.

Documentation to be Provided to City prior to installation

1. Manufacturer’s Literature
2. Detailed Manufacturer’s Specifications
3. Test Reports: LM79-08, LM80-08, ANSI C78.377.2008, and third party certification compliance. Additional documentation or test certifications may be required at City’s discretion.

Hazardous Material Disposal

Vendor shall remove, handle, transport, store, and dispose of all existing luminaires including light bulbs, and all other construction or installation related refuse in compliance with City’s current practice and all applicable laws and regulations in such a manner as to minimize potential adverse environmental impacts

on this project at no additional cost to the city. The City encourages recycling where possible. The majority of existing lamps are High Pressure Sodium vapor. However, other lamps such as Mercury Vapor or Metal Halide may be existing as well. Vendor shall dispose of removed heads and lamps and related parts regardless of the type.

Photoelectric controls requirements

Luminaires shall be provided with an intelligent networked wireless controller for remote monitoring and control to mount on a NEMA standard ANSI C136.41-2013 120-277V twist-lock connector. Unit shall be Echelon TOP900TLX-GRY Ordering # 100118.

Desirable features include:

Control Specifications

- Control profiles and interfaces
 - Power to fixture ON/OFF
 - Bi-level with OFF
 - 0-10V (sink) dimming control in .1V increments with 0V turning fixture power OFF
- Control events and schedules
 - Weekday and weekend schedules
 - Up to eight control events per day
 - Scheduled events based on time of day and/or astronomical time
 - Schedule use of motion sensors and photocell
 - Real-time commands and overrides
- Photocell daytime override
- Data logging
- Failure detection and reporting
- Photocell thresholds synchronization
- Direct motion detector interface
- Over the air flashing (program updates)

Electrical and Operational Specifications

- Operating voltage: 100–480 Vac 50/60 Hz
- Power switching: 1000W
- Power consumption: <2W @ 120/277; 3W @ 480
- Operating temperature: -40C to +70C
- 345J surge protection
- Zero crossing
- Failsafe: power ON, lamp level high
- Wireless standard:
 - IEEE 802.15.4
 - Operating frequency: 902-928 MHz
 - 10 channel DSSS (Direct Sequence Spread Spectrum)
 - RF power: adjustable to +24 dBm (250 mW)
 - Range: TOP900 to TOP900 1 mile+ line of sight
 - Range extender: TOP900 can be used as repeater
- IP66 certified
- FCC and IC approved

- UL 916/773 and Canadian C12.2 listed
- RoHS compliant
- 5-year limited warranty

Photoelectric control shall be installed in accordance with Section 86-1.02M and 87-1.03M of the State Standard Specifications

Warranties

A minimum of ten (10) year warranty that fully covers 100% the entire fixture; that is housing, driver, LEDs, electronic component, etc., shall apply to all LED luminaires supplied under this project.. Any lamp not meeting all criteria during its expected life shall be deemed failed and must be replaced. No pro-rata warranty will be accepted.

Replacement under warranty shall be done within 7 business days from notification by the City excluding shipping time. City will pay shipping charges incurred in returning luminaires to manufacturer, vendor will pay all shipping charges incurred in returning luminaires back to the City once they're repaired or replaced.

References:

The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by their basic designation only. Versions listed shall be superseded by updated versions as they become available.

- A. American National Standards Institute (ANSI)
 1. C136.2-2004 (or latest), American National Standard for Roadway and Area Lighting Equipment—Luminaire Voltage Classification
 2. C136.10-2010 (or latest), American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacle Physical and Electrical Interchangeability and Testing
 3. C136.15-2011 (or latest), American National Standard for Roadway and Area Lighting Equipment – Luminaire Field Identification
 4. C136.22-2004 (R2009 or latest), American National Standard for Roadway and Area Lighting Equipment – Internal Labeling of Luminaires
 5. C136.25-2009 (or latest), American National Standard for Roadway and Area Lighting Equipment – Ingress Protection (Resistance to Dust, Solid Objects and Moisture) for Luminaire Enclosures
 6. C136.31-2010 (or latest), American National Standard for Roadway Lighting Equipment – Luminaire Vibration
 7. C136.37-2011 (or latest), American National Standard for Roadway and Area Lighting Equipment - Solid State Light Sources Used in Roadway and Area Lighting
- B. American Society for Testing and Materials International (ASTM)
 1. B117-09 (or latest), Standard Practice for Operating Salt Spray (Fog) Apparatus
 2. D1654-08 (or latest), Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
 3. D523-08 (or latest), Standard Test Method for Specular Gloss
 4. G154-06 (or latest), Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
- C. Council of the European Union (EC)

1. RoHS Directive 2002/95/EC, on the restriction of the use of certain hazardous substances in electrical and electronic equipment
- D. Federal Trade Commission (FTC)
1. Green Guides, 16 CFR Part 260, Guides for the Use of Environmental Marketing Claims
- E. Illuminating Engineering Society of North America (IESNA or IES)
1. DG-4-03 (or latest), Design Guide for Roadway Lighting Maintenance
 2. HB-10-11 (or latest), IES Lighting Handbook, 10th Edition
 3. LM-50-99 (or latest), IESNA Guide for Photometric Measurement of Roadway Lighting Installations
 4. LM-61-06 (or latest), IESNA Approved Guide for Identifying Operating Factors Influencing Measured Vs. Predicted Performance for Installed Outdoor High Intensity Discharge (HID) Luminaires
 5. LM-79-08 (or latest), IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products
 6. LM-80-08 (or latest), IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources
 7. RP-8-00 (or latest), ANSI / IESNA American National Standard Practice for Roadway Lighting
 8. RP-16-10 (or latest), ANSI/IES Nomenclature and Definitions for Illuminating Engineering
 9. TM-3-95 (or latest), A Discussion of Appendix E - "Classification of Luminaire Lighting Distribution," from ANSI/IESNA RP-8-83
 10. TM-15-11 (or latest), Luminaire Classification System for Outdoor Luminaires
 11. TM-21-11 (or latest), Projecting Long Term Lumen Maintenance of LED Light Sources
- F. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE C62.41.2-2002 (or latest), IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits
 2. ANSI/IEEE C62.45-2002 (or latest), IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
- G. National Electrical Manufacturers Association (NEMA)
1. ANSI/NEMA/ANSI C78.377-2008 (or latest), American National Standard for the Chromaticity of Solid State Lighting Products
- H. National Fire Protection Association (NFPA)
1. 70 – National Electrical Code (NEC)
- I. Underwriters Laboratories (UL)
1. 1449, Surge Protective Devices
 2. 1598, Luminaires
 3. 8750, Light Emitting Diode (LED) Equipment for Use in Lighting Products