

**BLACK HILLS ENERGY  
SPECIFICATION 930 FOR  
LED LUMINAIRES  
100, 250, AND 400 WATT REPLACEMENT**

## 1. SCOPE

This specification covers the minimum requirements for 100 Watt, 250 Watt, and 400 Watt replacement High Pressure Sodium (HPS) Light Emitting Diode (LED) luminaires intended for use in street, roadway, and area lighting applications.

## 2. GENERAL REQUIREMENTS

- 2.1. LED luminaires purchased to this specification shall meet the following national standards listed in paragraph 2.2 of Black Hills Energy Specification 930, as applicable.
- 2.2. All standard specifications described in Paragraph 2.2 of BLACK HILLS ENERGY Specification 930 shall be strictly adhered to by the LED Luminaire manufacturer, except for the case where the modifications or additions in this BLACK HILLS ENERGY Specification 930 conflict with the national standards listed. In this case, the modifications or additions to BLACK HILLS ENERGY Specification 930 shall rule.

ANSI C136.2-2009: American National Standard for Roadway and Area Lighting Equipment-Luminaire Voltage Classification

ANSI C136.10-2010: American National Standard for Roadway Lighting Equipment-Locking-Type Photocontrol Devices and Mating Receptacle-Physical and Electrical Interchangeability and Testing

ANSI C136.15-2011: American National Standard for Roadway and Area Lighting Equipment-Luminaire Field Identification

ANSI C136.22-2009: American National Standard for Roadway and Area Lighting Equipment-Internal Labeling of Luminaires

ANSI C136.31-2010: American National Standard for Roadway and Area Lighting Equipment-Luminaire Vibration

ANSI C136.37-2011: American National Standard for Solid State Light Sources Used in Roadway and Area Lighting

ANSI C78.377-2011: Specifications for the Chromaticity of Solid State Lighting Products

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ANSI/IEEE C63.4-2014: American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

CFR Title 47 Parts 15/18 FCC-2012

IEC Standard 60529-2013: Degrees of Protection Provided by Enclosure

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

IESNA LM-79-2008: Electrical and Photometric Measurements of Solid-State Lighting Products.

IESNA LM-80-2008: Measuring Lumen Maintenance of LED Light Sources.

IESNA RP8-2014: Roadway Lighting

IESNA TM-15-2011: Luminaire Classification System for Outdoor Luminaires

IESNA TM-21-2011: Projecting Long Term Lumen Maintenance of LED Light Sources

UL 1012-2010: Power Units Other Than Class 2

UL 1310-2011: Class 2 Power Units

UL 1449-2014: Surge Protection Devices

UL 1598-2008: Standard for Luminaires

2.3. The Luminaires shall have a voltage classification of 600 volts in accordance with ANSI C136.2.

2.4. Luminaires shall be provided with LED drivers capable of operating at input voltages of 120 - 277 volts. LED drivers shall be suitable for operation at ambient temperatures of (-40 to 40°C) within the luminaire and have a minimum power factor of .90. The LED driver shall be designed to tolerate multiple short circuit operations without damage or degradation of performance and be rated for a minimum 100,000 hour life expectancy at rated operating temperatures within the luminaire.

2.5. LED luminaires purchased to this specification shall have an input frequency of 60Hz and output frequency greater than or equal to 120Hz.

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- 2.6. Luminaire shall provide means to protect LED driver and LED lighting array from electrical transients caused by electrical storms or capacitor switching by means of surge protection device.
  - 2.6.1. Surge Protection Device (SPD) shall be UL1449 recognized.
  - 2.6.2. SPD shall be 3 wire and provide both common and differential mode protection.
  - 2.6.3. SPD must have an inductive filter circuit that reduces the amount of energy passed thru to electronics during a surge event.
  - 2.6.4. Luminaire must pass Electrical Transient Immunity testing per ANSI C136.2. This includes Ring Wave, Enhanced Combination Wave rating (10kV/5kA), and Electrical Fast Transient (EFT) tests.
  - 2.6.5. Surge protection shall be thermally fused.
  - 2.6.6. Failure mode of surge protection is to turn luminaire off.

### 3. CONSTRUCTION

- 3.1. Housing. Luminaire housing shall be constructed of die-cast aluminum or similar metal. Luminaire color shall be utility grey, powder coated and rust resistant. Any non-metallic parts shall be UV stabilized. At minimum the housing shall be IP65 rated per IEC 60529 to protect against moisture ingress.
  - 3.1.1. Bird Guard. The luminaire housing shall be designed to accept a 1-1/4 to 2-inch mast arm and prevent birds or other wildlife from entering the housing. The metallic provision shall be an integrated part of the housing, securely fastened, and removable to enlarge the hole from 1-1/4 to 2-inches. Plastic provisions will not be accepted.
- 3.2. LED Driver. LED Driver shall be provided with quick disconnects and be removable and field replaceable. It shall be potted or rated IP54 per IEC 60529. Driver current supplied to LED's shall be 700mA minimum for 100 Watt replacement HPS, and 1,000mA minimum for 250 Watt and 400 Watt replacement HPS.
- 3.3. Surge Protection Device. The surge protection device shall be removable and field replaceable.
- 3.4. Terminal Block. Luminaire shall be provided with a terminal block for power connection per ANSI C136.37-2011.
- 3.5. Slip fitter Mounting. At minimum, a universal two-bolt slip fitter shall be provided for clamping the luminaire securely to a 1-1/4 inch or 2-inch tenon and for leveling through no less than +/- 3 degrees from the axis of attachment. It shall be provided with a shoulder or stop to limit insertion of the tenon and allow the pitch of the LED optics assembly to be adjusted.
- 3.6. Photocontrol Mating Receptacle. The photocontrol mating receptacle shall be a 3 pin NEMA photocontrol receptacle and shall be in accordance with ANSI/NEMA C136.41. The receptacle shall be so designed and mounted that it can be turned

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through 350 degrees and securely positioned at any angular adjustment within +/- 15 degrees. The means for orientation shall be externally accessible and the receptacle or adjustment assembly shall be permanently marked with a North reference mark. The "required seat" shall be a smooth, flat, horizontal surface and shall be in accordance with ANSI/NEMA C136.41. The receptacle shall meet or exceed the electrical and environmental requirements specified in ANSI/NEMA C136.41.

- 3.7. Backlight Control. Luminaire shall be designed to optionally equip the housing with a backlight reduction mechanism.
- 3.8. Optical Assembly Enclosure. Optical enclosure must be IP66 rated per IEC 60529. Optical assembly shall be designed to provide a passive thermal management system.

#### 4. PERFORMANCE CRITERIA

- 4.1. IESNA Luminaire Classification (LCS). Luminaire shall be provided with an IESNA TM-15 B-U-G (Backlight, Uplight, Glare) rating, and there will be a maximum uplight rating of U0. Preference will be given to lower Backlight and Glare values, all other factors being equal.
- 4.2. IESNA Light Distribution Pattern. Luminaire distribution pattern shall be Type II, and Type V.
- 4.3. Correlated Color Temperature (CCT): Nominal CCT (Degrees Kelvin), 3000 +/- 275 K.
- 4.4. Color Rendering Index (CRI): Minimum CRI of 70
- 4.5. Lamp Lumen Depreciation (LLD). The luminaire LLD shall be greater than 85% at 40°C for 50,000 hours as projected per IESNA TM-21 calculations using IESNA LM-80 test data.
- 4.6. The luminaire Total Light Loss Factor shall be no less than 0.70 and at a minimum include Luminaire Dirt Depreciation of 0.90 and Lamp Lumen Depreciation (LLD) per section 4.5.
- 4.7. Lumen Requirements. Black Hills Energy will establish the following requirements for the intended replacement of 100W, 150W, 250W and 400W HPS Luminaires.
  - 4.7.1. An LED Luminaire with power demand not to exceed 70W, which shall have an output of 4250 lumens (+/- 20%).
  - 4.7.2. An LED Luminaire with power demand not to exceed 125W, which shall have an output of 12,000 lumens (+/- 20%).

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4.7.3. An LED Luminaire with power demand not to exceed 215W, which shall have an output of 16,000 lumens (+/- 20%).

**5. WARRANTY.**

A full replacement warranty of the entire luminaire assembly must be provided due to any electrical or mechanical component failure for a period of 10 years. The warranty period shall begin 90 days after the date of manufacture as shown on luminaire labeling.

**6. MARKING**

Luminaires shall be provided with external labeling per ANSI C136.15 and internal labeling per ANSI C136.22.

6.1. Luminaire shall have a 3in x 3in Distribution Label indicating a Type 2 or Type 5 distribution with Black Letters on a White Background with respect to each luminaire. This Distribution Label shall be located on the luminaire. In addition, a Distribution Label shall be located on the outside of the luminaire box adjacent and below the luminaire catalog number.

6.2. The Distribution Label shall be as follows:

- 6.2.1. For 100W HPS replacement, type 2: 102 LED
- 6.2.2. For 100W HPS replacement, type 5: 105 LED
- 6.2.3. For 250W HPS replacement, type 2: 252 LED
- 6.2.4. For 250W HPS replacement, type 5: 255 LED
- 6.2.5. For 400W HPS replacement, type 2: 402 LED
- 6.2.6. For 400W HPS replacement, type 5: 405 LED

**7. INSPECTION AND TESTING**

LED luminaires will be subject to inspection and testing by a Black Hills Energy representative at the time of delivery to assure compliance with this specification. Material will not be accepted into stock and payment for material will not be issued until material has passed all inspection and testing.

**8. SHIPPING INSTRUCTIONS**

8.1. Packaging. Packaging of LED Luminaires shall be such as to afford reasonable and proper protection during normal shipping and handling. Each LED luminaire package shall contain a preprinted adhesive label that lists the luminaire serial number with the corresponding barcode. Each container shall be marked with the PO number, the number of luminaire contained therein, manufacturer’s name and catalog number, and a description of contents.

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- 8.2. Delivery Ticket. A delivery ticket shall be furnished with each delivery by the carrier. The delivery ticket shall show the PO number and the number of cartons or packages being delivered.
- 8.3. Packing List. A packing list shall be furnished with each delivery. The packing list shall include the PO number, a description of the contents, and the total number luminaire delivered.

**9. GENERAL INSTRUCTIONS**

9.1. Ordering Information. All requisitions, requests for quotation, and POs for luminaires covered by these requirements shall contain the following information:

- a. Catalog numbers of luminaires required
- b. Brief description of luminaires required
- c. Number of luminaires required
- d. Delivery date
- e. Delivery destination

9.2. Bid Evaluation Criteria. Black Hills Energy may evaluate bids based on one or more of the following: price and payment schedules, delivery time ARO, and/or warranties. Black Hills Energy reserves the right to add additional technical requirements and bid evaluation criteria at the time RFPs are requested. Black Hills Energy reserves the right to accept or reject any or all bid and/or proposals and will accept the bid that best suits the interests of Black Hills Energy. Manufacturer shall make available any product improvements, i.e. upgrades or new versions, during the term of contract for evaluation and approval for possible replacement of undelivered luminaires at a negotiated price and adjusted schedule. Approval and Furnishing of Product. Quotations will not be considered on a manufacturer's proposed product that is not approved by Black Hills Energy prior to solicitation of pricing. Black Hills Energy will approve products based on meeting the requirements of this specification and products shall be approved and furnished in accordance with Black Hills Energy requirements. Additional approval requirements are listed as follows: ease of conformance to these technical requirements, energy savings, customer support, maintenance turnaround time, ease of obtaining spare parts, number of proposed luminaires in service, length of time the manufacturer has been manufacturing luminaires, Black Hills Energy's experience with the proposed luminaire, Black Hills Energy's experience with the vendor/manufacturer's customer support, etc. Where conflicts may arise between this specification and Black Hills Energy Specification 930, this specification shall prevail.

9.2.1. Sample Requirements. Black Hills Energy may test and evaluate every luminaire proposed prior to approval to assure compliance with this specification. If requested, the manufacturer shall make available for a minimum of 30 working days, at the manufacturer's expense, a sample of the luminaire proposed for approval.

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9.3. Exceptions. Any and all exceptions to this specification must be listed individually and accompany the quotation. If there are no exceptions, the words "NO EXCEPTIONS" must be written on the quotation.

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