



**SPECIAL PROVISIONS  
FOR  
LIGHTING**

**Scott County  
IM-074-1(191)1--13-82**

**Effective Date  
March 15, 2011**

**THE STANDARD SPECIFICATIONS, SERIES 2009, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.**

Replace Article 2523.02 of the Standard Specifications with the language below.

**2523.02 MATERIALS.**

**A.** Install lighting materials that meet the requirements of Division 41, except as modified here.

**1. Aluminum Poles.**

- a.** Fabricated from ASTM B 221 6063-T6 or 6061-T6 aluminum alloy tube or ASTM B 209 5086-H34 aluminum sheet.
- b.** Minimum nominal wall thickness of 1/4 inch.
- c.** Shafts tapered approximately 0.14 inch per foot of length.
- d.** The pole shall have a finished as noted in the plans.
- e.** Castings of ASTM A 356/A 356M-T6 aluminum alloy meeting the requirements of Article 4187.01.
- f.** An internal Stockbridge vibration dampener device as recommended by the pole manufacturer and approved by the Engineer shall be included.
- g.** Blocked and paper or plastic wrapped prior to shipment.

**2. Mast arms, or Davit arms, and Accessories.**

- a. Mast arms.**
  - 1)** When indicated in the contract documents, furnish a single mast arm as luminaire support. The contract documents will state the horizontal span of the mast arm.
  - 2)** Furnish mast arms meeting the following requirements:
    - Aluminum tube to match the pole with smooth openings into the pole shaft to provide an electrical raceway.
    - Capable of accommodating a 2 inch slipfitter type luminaire.
    - Type A mast arms: no braces or truss members.
    - Type B mast arms: a single underbrace attached to the mast arm at no less than two locations.

**b. Davit Arms.**

- 1) When indicated in the contract documents, furnish a davit arm as a luminaire support.
- 2) Furnish davit arms meeting the following requirements.
  - Aluminum tube to match the pole with smooth openings into the pole shaft to provide an electrical raceway.
  - Each Davit arm shall have a wall thickness of not less than 0.188 inches. The bend shall be carefully made so that the arm is free of kinks, wrinkles or other defects.
  - The davit arm, shall be designed to slip fit over a 5 1/2 inch outside diameter pole shaft. The arm shall taper to a 3 1/2 inch outside diameter at the luminaire end.
  - The slip section shall not be less than 12 inches in length and the joint shall be held in place with two 5/8 inch diameter bolts 90 degrees apart with associated nuts, flat washers and lockwashers. Each bolt shall be threaded only at its end to minimize the potential for damage to the pole wire (no threads inside of pole). Submittal information shall include details of the slip joint.
  - The davit arm shall have a centerline bending radius of 10 feet. The bend shall produce a nominal up tilt of the arm not to exceed 5 degrees for an unloaded pole and 1.5 degrees for a loaded pole. The arm shall be coordinated with the luminaire furnished and produce a level mounting of the luminaire (up tilt not greater than 1.5 degrees) with the luminaire installed. Submittal information shall include confirmation of this requirement.

**3. Breakaway Couplings.**

**a. General.**

- 1) Breakaway couplings shall be manufactured of cast aluminum or galvanized steel. Certification shall be submitted from the supplier that the device used under the conditions of the particular design meets the AASHTO breakaway specification. Certification shall include test results performed by the manufacturer, supplier or others. If test results have been previously approved by a letter from the FHWA, a copy of the approval letter from FHWA should accompany the certification. The coupling shall not alter the bolt circle of the pole.
- 2) The breakaway device shall be vandal resistant and shall not adversely affect the light pole installation and maintenance or decrease the resistance of the light pole to non-collision type of design loading. The breakaway device shall be field attachable and detachable.

**b. Breakaway Coupling Cover.** The breakaway device shall have a cover enclosing the space between the bottom of the pole base plate and the foundation.

- 1) Aluminum Skirt. The cover shall be an aluminum skirt of a two piece design made of 3003 H14, or 5052 H32T aluminum alloy, 0.080 inches thick. The enclosure shall fit snugly around the breakaway devices between the bottom face of the pole base plate and top of the foundation. Vertical or horizontal movement of the enclosure will not be acceptable.
- 2) Stainless Steel Wire Cloth. The stainless steel wire cloth shall be installed to enclose the void between the pole base and the foundation.

**4. Roadway Luminaire.** The luminaire shall be Lumec Capella, Schröder Hestia, or approved equal, with the lighting distribution type as noted on the contract documents.

**a. Information Required.** Each bidder shall submit with his proposal the following information relative to the luminaire he proposes to furnish:

- 1) Outline drawing.
- 2) Complete description and weight.
- 3) Candlepower distribution curve showing the light distribution in the 70 degree cone and in a vertical plane through the maximum beam.
- 4) Isolux curves.
- 5) Utilization efficiency charts.
- 6) Luminaire efficiency.

- 7) Projected area in square feet.
  - 8) Manufacturer's name and catalogue designation of the luminaire.
  - 9) IES formatted photometric curve in electronic format.
- b.** Sample. One completely assembled luminaire of the manufacture intended to be furnished, shall be submitted upon request of the Engineer within 15 business days of such request.
- c.** Assembly. Each luminaire shall be delivered completely assembled, wired, and ready for installation (without the lamp). It shall consist of aluminum housing, aluminum reflector, glass refractor, refractor holder, lamp holder assembly, terminal board-fuse block, ballast-door panel, electronic ballast, fuses, gaskets, slip fitter, and all necessary hardware.
- d.** Finish. The luminaire shall have a baked-on enamel finish. Surface texture and paint quality shall be subject to inspection and approval by the Engineer. Color shall be gloss black as specified in the order. A paint chip shall be submitted as a sample upon request.
- e.** Photometric Requirements. The manufacturer shall demonstrate that the luminaires meets or exceeds the specified photometric requirements. The manufacturer shall provide photometric calculations using published luminaire data as part of the submitted package. The proposal shall contain luminaire photometric performance with results equal to or better than those listed as minimum requirements identified below in this Special Provision. Submittal information shall include computer-analysis based calculations, based on the controlling given conditions which demonstrate achievement of all listed performance requirements. Computer calculations shall be performed for roadway lighting and for sidewalk/parkway lighting. The submitted roadway lighting calculations shall be performed in accordance with the American National Standard Institute (ANSI)/ Illuminating Engineering Society of North American (IESNA) Practice for Roadway Lighting, ANSI/IESNA RP-8-2000, and shall include point-by-point illuminance, veiling luminance, and include a listings of all indicated averages and ratios. The submitted sidewalk/parkway calculations shall be performed in accordance with ANSI/IESNA RP-8-2000 requirements, and shall include point-by-point horizontal illuminance and vertical illuminance as well as listings of all indicated averages and ratios.
- 1) Minimum Performance Requirements (0.8 light loss factor):**
- Roadway Illuminance:
- Average Horizontal 0.9
  - Uniformity Ratio Av/Min 4:1
  - Max Veiling Luminance 0.3
- 2) The luminaires shall meet the performance requirements for the following physical conditions.**
- Curb-to-curb 72 Feet
  - Number of lanes: 3
  - Mounting height 45 Feet
  - Setback 3 Feet
  - Arm length 15 Feet
  - Spacing (staggered) 100 Feet
  - Pavement R3
- f.** Ballast. The electronic ballast shall be a low frequency square wave type. The electronic ballast must provide optimum starting and operation of a ceramic metal halide lamp. It must be designed to furnish proper electrical characteristics for starting and operating a 210 watt, ceramic metal halide lamp at temperatures as low as minus 20°F. The ballast must be multi-voltage able to operate within the voltage range of 200 to 277 volts.
- 1) Lamp Operation.** The electronic ballast must provide positive lamp ignition at an input voltage between 208 volts and 277 volts.
- 2) Rating.** The electronic ballast must have non-fading, color coded wire leads for rated input voltage of 240 volts at 60 cycles.

- 3) **Lamp Current.** The electronic ballast must supply a nominal 2.2 amperes to a 210 watt lamp in accordance with the lamp manufacturer's recommendations, during operation and a maximum of 3.5 amperes at start-up.
  - 4) **Power Factor.** The power factor of the electronic ballast over the design range of input voltages specified above must not be less than 95%.
  - 5) **Line Current.** With nominal input voltage applied, the input current under starting, short circuit, or open circuit condition, must not exceed 1.7 amperes at 208 volts nominal, and 1.23 amperes at 277 volts nominal.
  - 6) **Lamp Wattage.** The electronic ballast must deliver 210 watts to a horizontal burning ceramic metal halide lamp when operating at the nominal input voltage. Wattage must not vary by more than  $\pm 5\%$ .
  - 7) The electronic ballast input current must have Total Harmonic Distortion (THD) of less than 15% when operated at nominal line voltage.
  - 8) The electronic ballast must have a lamp end-of-life detection and shutdown circuit.
  - 9) The electronic ballast must be thermally protected to shut off when operating temperatures reach unacceptable levels
  - 10) The electronic ballast must meet the requirements of the FCC rules and regulations, Title 47 CFR, part 18.
  - 11) The electronic ballast must be UL certified.
- g. **Testing.** All testing shall be done on a prototype of the actual luminaire to be provided under this Special Provision by an independent testing company. If recent test results are available, they may be considered as meeting the testing requirements of this Special Provision. The Engineer will have the final approval of which tests are adequate.

The manufacturer shall be responsible for all costs associated with the specified testing, incidental to this contract.

- 1) Photometric testing shall be in accordance with published IESNA lighting measurement testing and calculation guidelines. The photometric tests shall be conducted with a reference lamp and ballast. The tests, at a minimum, shall yield:
  - An isofootcandle chart with maximum candela and half maximum candela trace.
  - An isocandela diagram.
  - Maximum plane and maximum cone plots of candela.
  - A candlepower table (house and street side).
  - A coefficient of utilization chart.
  - A luminous flux distribution table.
- 2) Electrical testing shall conform to applicable NEMA and ANSI standards and, at a minimum, shall yield:
  - A ballast dielectric test.
  - Total ballast losses in watts and percent of input.
  - A lamp volt-watt trace.
  - Regulation data.
  - Power factor.
  - A table of ballast characteristics.
- 3) Initial testing (0 hour testing) using resonance ignition. OCV (open circuit voltage) shall meet latest ANSI lamp testing standards.
  - Ballast short circuit current (assuming the electronic ballast does not incorporate a circuit to turn off the output)
  - Any automatic shut off features
  - Any rectification protection features
  - Ballast losses (system efficiency)
  - Current waveform shape
  - Record initial waveform and characteristics at  $\pm 10\%$  and at nominal input voltage
  - Record OCV (open circuit voltage waveforms and operational frequencies, and OCV characteristics at  $\pm 10\%$  and at nominal input voltage

- 4) Test at 100 hour. Lamp has been operating for at least 100 hours:**
- Test lamps data sheet
  - Photometry data for test lamp operated with the test ballasts shall be recorded and compare data for the same lamps operated with ANSI reactors
  - Maximum lamp power voltage output deviation
  - Results for voltage and current waveforms for re-ignition voltage, crest factors, power factor
  - Record at room temperature and in the dark, lamp full-arc time (within ANSI time limit)
  - Record starting time under cold box condition (lamps at  $-30^{\circ}\text{F}$ ) at minus 10% nominal ballast input voltage
  - Hot restrike time
  - Record any acoustic resonance or arc instability under the full range of lamp operating position
  - Record any change of OCV (open circuit voltage) or ignition waveform
- 5) Lifetime testing. Life testing for a minimum of 20% of rated lamp life at nominal ballast input voltage, with a minimum of 6 test ballasts and 6 control ballasts.**
- Record photometry and electrical maintenance on lamps operating on control, and test ballasts
  - Record all end-of-life lamp characteristics and effects on ballasts
  - Record lamp X-rays life effects, electrode wear, and arc-tube deterioration
- h. Thermal testing in accordance with U.L. Standard 1572 or Standard 1598. The fixture shall be placed in a controlled  $25^{\circ}\text{C}$  environment and be energized for a minimum of 8 hours. At no time will any of the components exceed the manufacturer's recommended operating temperatures. At no time will any surface of the refractor exceed the manufacturer's recommended temperature limits.**
- i. Vibration testing in accordance with ANSI Standard C136.31. Upon completion of the test, all set screws, castings, and components shall be secure and undamaged. The luminaire will not be energized for this test, and will not include the lamp and fuse.**
- j. Warranty. The manufacturer shall warrant the performance and construction of these luminaires to meet the requirements of this special provision, and shall warrant all parts, components and appurtenances against defects due to design, workmanship or material developing within a period of 5 years after the date of manufacture as indicated on the luminaire. This will be interpreted particularly to mean compatible performance of ballast with lamps of various manufactures, failure of any component, loss of reflectivity of reflecting surface, and discolorations or fogging of the refractor impairing the transmission of light. Any luminaire or part thereof, not performing as required, or developing defects within this period shall be replaced by the manufacturer without expense to the State.**

**5. Low Mounting Height Luminaire.**

- a. Furnish complete low mounting height luminaires consisting of the following:**
- 1) An optical train which includes a single piece, prismatic refractor mounted in an aluminum door assembly.**
  - 2) An asymmetric, specular processed aluminum reflector.**
  - 3) An anodized aluminum visor.**
  - 4) Attached or integral ballast housing.**
- b. Furnish a door assembly equipped with noncorrosive metal pressure latches, hinges, and safety chain.**
- c. Furnish a luminaire housing complete with:**
- 1) Captive neoprene and felt double gaskets.**
  - 2) A rear access hole with an aluminum cover plate with gasket.**
  - 3) Tapped conduit entries as shown in contract documents.**

- d. Furnish a refractor that meets the following:
  - 1) Fabricated from molded, high-transmission-factor, thermal shock resisting, and crystal glass.
  - 2) Is of adequate size to properly house the specified lamp and to produce the required light distribution.
  - 3) Inner and outer surface are covered with an array of reflecting and refracting prisms and diffusing flutes which are designed to provide an asymmetric light distribution.
- e. With a ceramic metal halide lamp, furnish an electronic ballast. The electronic ballast shall be a low frequency square wave type. The electronic ballast must provide optimum starting and operation of a ceramic metal halide lamp. It must be designed to furnish proper electrical characteristics for starting and operating a 140 watt ceramic metal halide lamp at temperatures as low as minus 20°F. The ballast must be able to operate within the voltage range of 200 to 277 volts. Ballast shall maintain lamp wattage within  $\pm 5\%$  variation with a voltage regulation of  $\pm 10\%$ , with no less than a 95% power factor.

**6. Lamp.**

- a. Physical Requirements. All lamps must be tube shaped with a single end. Bases must be ANSI PGZ12 for the 60 and 140 watt lamps and ANSI PGZ18 for the 210 watt lamp. Bases must be polarized with twist and lock pins. Bulb material must be clear quartz crystal or lead borosilicate glass. The 140 watt lamps must have a diameter of 1 1/8 inches (T9) and the 210 watt lamps must have a diameter of 1 1/2 inches (T12). The light center length (LCL) for the 140 watt lamps must be 2.5 inches and the overall length (MOL) must not be greater than 5.5 inches. The light center length (LCL) for the 210 watt lamps must be 3.5 inches and the overall length (MOL) must not be greater than 7.5 inches.
- b. Electrical Requirements. The lamp shall conform to the applicable electrical characteristics of ANSI Standard C78.43 for single ended metal halide lamps. The lamps shall also conform to the requirements of IEC (International Electrotechnical Commission) Standards 60068-2-6, 60068-2-29, 60068-2-14-NA, and 60068-2-14-NB.
- c. Light Output. The color temperature of the lamps shall be between 2600 and 2850°Kelvin for the 140 watt lamp and 3000 and 4200°Kelvin for the 210 watt lamps. At half the average rated lamp life, the mean output lumens shall not be less than 90% of the initial lumen output. The color rendering index for the 140 watt lamps shall meet 65. The color rendering index for the 210 watt lamps shall meet or exceed 90.
- d. Testing. All lamps shall be tested according to the applicable requirements in ANSI Standard C78.43 and shall operate at a low temperature of -20°F.
- e. Individual Lamp Characteristics. Lamps shall be ceramic discharge metal halide lamps and meet the following:

Wattage	Rated Life (hours)	Initial Lumens
140	12,000	16,500
210	20,000	23,100

- f. Warranty. The manufacturer will be required to deliver to the Iowa Department of Transportation, new rated life lamps, without cost to the State, to replace any lamps failing to operate satisfactorily for a period of one year after installation.
- g. Packaging. All lamps shall have the date of manufacture, actual or coded, embossed on the lamp base or another suitable location. All lamps shall be individually packaged and packed in properly labeled cartons so as to prevent damage in shipping or storage.

**B. Use cast-in-place concrete that meets the requirements of Section 2403.**