SP-230211
(New)

SPECIAL PROVISIONS
FOR
ROADWAY LIGHTING

Polk County
IM-080-4(098)138--13-77

Effective Date
August 20, 2024

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

230211.01 DESCRIPTION.

A. Section Includes.

- Light Towers (including associated reinforced concrete footing)
- Tower Luminaires
- Light Poles
- Roadway Luminaires
- Underdeck Luminaires

B. References .

- 2023 NEC
- State and Local Electrical Code
- UL
- NEMA
- Illumination Engineering Society of North America (IESNA)
- ANSI
- AASHTO
- ASTM
- American Society of Mechanical Engineers (ASME)

C. Submittals.

1. Shop Drawings.

a. Submit drawings according to Article 1105.03 of the Standard Specifications.

b. Tower Lighting Equipment

1) Tower design data.

2) Internal wiring diagram and materials.

3) Additional drawings may be required on a project specific basis according to the

contract drawings.

4) Along with shop drawings, include a statement that methods and materials to be used in fabrication comply with the contract documents. Note and identify all materials or methods for which specific requirements have not been previously stipulated.
5) Provide the Engineer with an appropriate certification of compliance with all design requirements. Along with the certification, include copies of all calculations necessary for proper design of the tower shaft and component features of the tower assembly.
6) Have a Professional Engineer licensed in the State of Iowa perform the structural design. The Contractor's certification is to appear on the drawings. Provide the Engineer with the base shear, base moments, and vertical loads on the bottom of the base plate.
7) Obtain the Engineer's written concurrence for the various items involved prior to fabricating or assembling parts.

2. Additional Tower Submittals

a. Submit a copy of the certified mill analysis for each heat of steel used in the pole and pole assembly to the Iowa DOT Construction and Materials Bureau for review for compliance before these materials are shipped to the project.
b. Refer to Article 2522.03, D of the Standard Specifications for welding requirements.
c. Notify the Construction and Materials Bureau of the shop fabrication schedule.
d. Verify one copy of a mill certification accompanies each shipment to the project and two copies are sent to the Construction and Materials Bureau to:
  1) Identify materials included in each shipment, and
  2) Ensure that materials and fabricated materials may be used in the work promptly after delivery.
e. Final approval of all materials and fabricated materials will be based on:
  1) A certification that methods and materials used in fabrication comply with the contract documents.
  2) Satisfactory reports from random monitoring inspections performed during fabrication, and
  3) Verification of satisfactory compliance at the time of final inspection of the construction site.

3. Light Poles.

a. Refer to Section 2523 of the Standard Specifications for pole, mast arm, and base submittal requirements.
b. Light poles mounted on bridges or other location subject to vibration shall be equipped with vibration dampeners.

4. Luminaires.

a. Submittal requirements for tower, roadway and underdeck luminaires.
  1) Identify luminaires by designation on plans.
  2) Luminaire data sheet:
    a) Manufacturer Name.
    b) Complete catalog number including all provided options.
    c) Description of construction and optics.
    d) Input wattage.
    e) Luminous efficacy (lumens/watt).
    f) Photometric performance data.
    g) Dimensions.
    h) Weight,
    i) Effective projected area (EPA) for all pole and tower mounted luminaires.
    j) Voltage.
    k) Initial and IES L70 lumens.
    l) Correlated Color Temperature (CCT).
    m) Color Rendering Index (CRI).

n) Lamp life.
o) Driver manufacturer and model number.
p) Driver life.
q) Driver type (0-10V, constant voltage, constant current).
r) Dimming range and control device compatibility (as applicable).

3) For remote drivers, provide maximum wire length to luminaire.
4) Warranty information.

b. Alternate tower luminaires: if the luminaire is identified as 'Alternate' on the plans, submit a full photometric calculation showing illumination points on all project roadways, number of luminaires per tower, aiming of each individual tower luminaire, and a photometric summary for each ramp and mainline section listing Maximum, Minimum, Maximum, Max/Min, and Average/Min for each calculated zone.

c. Certifications: Solid-state Luminaire Useful Life Certificate.

d. Test Reports.
1) IESNA LM-79 Test Report for Solid State Luminaires
2) IESNA LM-80 Test Report for Solid-State Light Source.

D. Warranty for Conventional Roadway, Tower, and Underdeck Luminaires.

1. The luminaire manufacturer shall provide a written warranty on all products extending 10 years from the date of shipment. The warranty shall cover defect luminaires as described below. A significant change in LED color and/or failure of the paint finish shall be included as product defects.

2. Replacement part(s) or complete luminaire shall be shipped at manufacturer's expense to the project location. The DOT will remove the unit in the field and ship it to the manufacturer. Return shipping cost is the responsibility of the manufacturer.

3. Replacement parts or complete replacements shall meet all requirements of the original specification.

4. If more than 10% of a luminaires individual LEDs fail during the warranty period, the luminaire is considered defective.

5. Luminaire lens discoloration and paint finish deterioration such as blistering, cracking, peeling, or corrosion shall be considered a failure under the warranty.

230211.02 MATERIALS.

A. Manufacturers.

1. Luminaires.
See plans for list of acceptable manufactures and model numbers.

2. Light Poles and Towers.
Luminaire manufacturer's standard

B. Luminaires.

1. General.
a. The luminaire optical assembly shall be protected against dust and moisture intrusion with a minimum Ingress Protection rating of IP66 in accordance with ANSI Standard C136.25.
b. LED luminaire and all its components shall be lead free and ROHS compliant.
c. Each LED luminaire shall be listed with Underwriters Laboratory, Inc. or the Canadian Standards Association as being in compliance with UL-1598 and suitable for use in wet locations.

d. Each luminaire shall be equipped with a barrier type terminal block secured to its housing. The terminal screws shall be captive to the terminal block and able to accommodate conductors of 14 AWG to 10 AWG wire size. Each terminal shall be clearly identified.
e. Unless noted otherwise on the plans, luminaires shall have a nominal Correlated Color Temperature of 4,000 ±300 degrees Kelvin and a Color Rendering Index (CRI) of 70 or greater.
f. LED luminaires shall comply with the Class "A" electronic noise emission limits as outlined in Title 47, Subpart B, Section 15 of the FCC regulations.
g. Management of heat generated by the LED light source shall be by heat sink elements (fins) protruding from the luminaire housing, Heat sink elements must be self-cleaning. Fans, pumps, or other devices to dissipate heat are not acceptable.
h. LED luminaires shall be capable of operating on a single phase, 60 Hz, 120-277V AC source (unless shown otherwise on the plans) and shall be unaffected by voltage fluctuations of ±10%.
i. Each luminaire shall be provided with a UL labeled surge protection device (SPD) that provides a minimum of 10 KV/5KA protection according to the current edition of ANSI C136.2. The SPD shall be field replaceable; shall conform to the requirements of UL Standard 1449 and shall be electrically connected in series to fail to an open circuit.
j. The total harmonic distortion (current and voltage) induced into an AC power line by the LED luminaire under full load shall not exceed 20% and its LED circuitry shall prevent visible flicker to the unshielded eye over the voltage range of the luminaire.
k. Luminaires shall be fully operational in an ambient temperature range of -40°F to 104°F.
l. All LED luminaires shall maintain a minimum of 70% of their initial lumen (L70) after 100,000 hours of operation (27 years at 10 hours/day) at 77°F. The projection of lumen maintenance shall be based on recommendations provided by IESNA technical memorandum TM-21 and test data collected according to the latest issue of IESNA STANDARD LM-80.
m. Luminaires shall have a minimum luminaire efficacy of 100 lumens per watt when tested in accordance with IESNA standard LM-79.

2. Roadway Luminaire Additional Requirements.

a. All LED Roadway luminaires shall be provided with an ANSI C136.41 compliant seven pin dimming receptacle (three twist-lock power contacts and four dimming contacts) for future use when needed. The receptacle on the luminaire whose circuit is controlled via contactor at the lighting control cabinet shall be provided with a rain tight shorting cap.
b. Electronic photocontrols used with LED Roadway luminaires shall be of solid state, long life, locking style construction. Photocontrols shall be ANSI C 136.61 compliant and shall possess the necessary electronics to withstand the high inrush current of LED luminaires. Shall be warranted for a minimum of 6 years.
c. Capable of slip-fitter mounting to a 2 3/8 inch O.D. steel pipe mast arm with plus or minus five degree leveling adjustment at 2.5 degree increments.

C. Light Poles.

See Section 2523 of the Standard Specifications.

D. Towers.

1. General Requirements.

Each tower lighting installation consists of:
a. A reinforced concrete foundation.
b. A tubular steel tower of circular or other approved cross-section of the length indicated in the contract documents.
c. Approved luminaires of the proper number, luminaires shall be either remote driver or integral driver type.
d. Fixed cross-arm assemblies or ring at top of tower with wiring routed internally (lowering devices are <u>not</u> acceptable). The luminaires and associated mount shall withstand 150

mph winds and maintain original aiming and/or orientation.

e. Where luminaires with remote drivers are supplied, an enclosure shall be mounted on pole at approximately 10 feet above grade to house remote drivers and supporting electrical equipment.

f. Manufacturer wiring harness.

g. Handhole with cover at base of pole,

h. All components shall be designed and manufactured as a system.

2. Electrical Component Enclosure (for towers with remote driver luminaires).

a. One enclosure minimum per tower, mounted at approximately 10 feet above grade for access by ladder required. Additional enclosures if required.

b. Access to wiring within pole with no exposed wiring or conduit.

c. Nominal minimum size: Width: 14.0 inches, Height: 52.0 inches, Depth: 8.0 inches.

d. Construction

1) 0.08 inch, power-coated aluminum.

2) Rating: NEMA 3R, IP54.

3) Full-length stainless-steel hinge.

4) Door with oil-resistant gasket.

5) Door clamps and hasp/staple for padlocking.

6) All stainless-steel fasteners passivated and coated.

e. An aluminum enclosure housing all the remote drivers and electrical equipment shall be supplied as one U.L. listed system.

f. The enclosure shall be touch-safe and include drivers and fusing with indicator lights to notify when a fuse is to be replaced for each luminaire (remote driver luminaires).

g. A disconnect will be provide for each tower circuit (remote driver luminaires)'.

h. Handhole access shall be provide behind the enclosure for routing wiring within the shaft into the enclosure.

3. Handhole.

a. The pole shall provide an opening of nominal size 10 inch by 30 inch to permit pulling and connections of wiring.

b. Install a neoprene gasket to make the handhole weatherproof. Obtain the Engineer's acceptance the gasket prior to installation. Foam adhesive-back rubber gaskets are unacceptable.

c. Ensure handhole cover is fabricated from the same type of steel as the pole. Use 1/8 inch minimum for handhole cover. Ensure the securing hardware is stainless steel and provisions have been made to allow the door to be bolted shut.

4. Wiring Harness: Provide internal wiring harness with an abrasion protective sleeve, stain relief, and plug-in connections for fast, trouble-free installation.

5. Lightning grounding shall be provided as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.

6. Surge protection shall be provided at the tower equal to or greater than 40kA for each line to ground (Common Mode) as recommended by IEE C62.41.2_2002.

7. Poles with Telescoped Lap Joints Bevel the lower section of the joint.

8. Poles with Welded Transverse Splices Bevel all backing plates for transverse welds

9. Longitudinal Seam Welds.

a. Inspection.

1) Visually inspect all welds

2) Radiographically inspect the full length of all full-penetration sections of longitudinal seam welds on all tower poles, and

3) Use the magnetic particle method to inspect a random 25% of all tower poles, inspecting 4 inches in every 4 feet of weld length, starting from the connection end. If there are fewer than four tower pole, at least one pole shall be randomly selected.

b. Minimum 60% penetration, except for the following areas where complete penetration welds are required:

1) Within 6 inches of circumferential welds which are complete penetration butt welds.

2) For a distance of the nominal splice length plus 6 inches on both sections of telescopic (slip type) field splices of high level lighting (pole type) supports.

10. Pole Base.

a. Use a solid plate. Keep the hole cut out in the base plate for utility lines to a maximum diameter of 12 inches as shown in the contract documents.

b. Design the pole base and anchor bolt system to resist both tension and compression resulting from bending moments and direct loads.

11. Pole Base Plate.

a. Prior to welding, ultrasonically test the pole base plate using a Straight Beam Search Unit, meeting the requirements of the current AWS D1.1, Structural Welding Code, to determine the extent of laminar type discontinuities in the plate.

b. After welding the pole to the base plate, use the same ultrasonic testing described above to ensure there are no laminar tears in the base plate.

12. Shaft, Base Plate, and Integral Shaft.

Ensure the shaft and integral shaft components are fabricated with steel meeting the requirements of ASTM A 709 Grade 50W or ASTM A 871 Grade 65. Ensure base plate is fabricated with steel meeting requirements of ASTM A 709 Grade 50W. Steel used for shaft, base plate, and integral shaft components shall meet impact requirements specified in Article 4152.02 of the Standard Specifications.

13. Poles.

a. The poles may be furnished in a single welded units or in telescoping sections.

1) Fabricating the tower by welding two or more shaft sections together is permitted. If the pole sections are welded together, buff weld all transverse pole splices with full penetrating welds.

2) Use a method for connecting the sections that results in a smooth joint with no projections on the exterior of the shaft.

3) Unless specifically authorized otherwise, all welded connections of shaft sections are to be made in the fabricator's shop.

4) If hauling length restrictions do not allow the tower shaft to be shop fabricated in one piece, furnish a telescope pole.

b. Telescoping Sections.

1) If the pole sections are telescoped together, ensure the overlapped splices:

a) Are equal in strength and rigidity to that of welded splices and

b) Do not exceed four sections for poles up to and including 120 feet in length and do not exceed five sections for poles between 120 feet and 160 feet in length.

2) Ensure the telescoping sections overlap a length which is the larger of the following, and the overlap has he full contact between faying surfaces:

a) 2 feet or

b) 1.5 times the nominal diameter of the shaft at the slice level.

3) Ensure pole sections to be telescoped together are factory test fit to verify straightness of the pole and accuracy of the mating surfaces. Ensure the sections are match marked for accurate field assembly. In the field, mechanically fit the telescoping sections using factory supplied equipment. Submit assembly procedures for the Engineer's review and concurrence.

14. Ensure the structural design of the tower and its appurtenances meet the requirements of

AASHTO 2013 Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, with the following clarifications:

a. Wind Speed: Use a 90 mph basic wind speed (3 second gust) with a 50 year mean recurrence interval for strength design. Use HMLT Category I with a yearly mean wind velocity of 11 mph for fatigue design.

b. Total Wind Force: Calculate the total wind force on luminaires based on the sum of projected areas for each individual luminaire. Base the projected area of the individual luminaires on the manufacturer's recommendation.

c. Steel Tubular Shape: Use a compact section.

d. Anchor Bolts, Nuts, and Washers: Furnish each anchor bolt with one leveling nut, one anchoring nut, and one jam nut on the exposed end and one of the following on the embedded end: nut, nut and plate, or nut and anchor bolt assembly ring plate. Use anchor bolts, nuts, and washers that Materials I.M. 453.08. Meet the following requirements:

1) Anchor Bolts.

a) Use full-length galvanized bolts.

b) Comply with ASTM F 1554, Grade 105, S4 (-20 °F).

c) Threads are to comply with ANSI/ASME B1.1 for UNC thread series, Class 2A tolerance.

d) The end of each anchor bolt intended to project from the concrete is to be color coded to identify the grade.

e) Do not bend or weld anchor bolts.

2) Nuts.

a) Comply with ASTM A 563, Grade DH or ASTM A 194, Grade 2H.

b) Use heavy hex.

c) Use ANSI/ASME B1.1 for UNC thread series, Class 2B tolerance.

d) Nuts may be over-tapped according to the allowance requirements of ASTM A 563.

e) Refer to Articles 2522.03, H, 2, b through h of the Standard Specifications for tightening procedure and requirements.

3) Washers.

Comply with ASTM F 436 Type 1.

4) Galvanizing.

Galvanize entire anchor bolt assembly consisting of anchor bolts, nuts, and washers (and plates or anchor bolt assembly ring plate, if used) according to the requirements of ASTM B 695, Class 55 Type 1 or ASTM F 2329 with zinc bath temperature limited to 850 °F. Galvanize entire assembly by the same zinc-coating process, with no mixed processed in a lot of fastener assemblies.

5) Welding.

a) Galvanize entire Weld and fabricate steel structures according to Article 2408.03, B of the Standard Specifications except that gas, metal arc, and flux cored arc welding processes will be permitted.

b) Filler metal shall comply with the requirements of the AWS D1.1, Structural Welding Code.

c) Examine all fillet welds assessable for inspection using magnetic particle inspection using magnetic particle inspection according to ASTM E 709 (at no additional cost to the Contracting Authority).

d) Use ultrasonic inspection, according to the requirements of the Article 2408.03, B of the Standard Specifications, to perform a 100% examination of all transverse butt welds and all specified 100% penetration longitudinal butt welds on the pole. Perform a 100% visual inspection of all longitudinal butt welds. Supplement the visual inspection with magnetic particle inspection on all areas of questionable visual results. If defects are found in the area tested, perform additional inspection for a minimum of 5 feet on each side of the defect at no additional cost to the Contracting Authority. The cost of these inspections is incidental to other items in the contract.

230211.03 CONSTRUCTION.

A. Installation.

1. Tower Footings.

a. Construct footings as required in the contract documents at the specified locations. Unless specifically stated otherwise, construct footings using methods and materials complying with the current specifications.

b. Place anchor bolts according to Article 2405.03, H,3 of the Standard Specifications. Place conduit and all other appurtenant or optional features of the footing as shown in the contract documents.

2. Lighting Towers.

a. Transporting.

1) When transporting towers, comply with all applicable laws, rules, and regulations governing such movements.

2) Limit the overall length of the hauling unit and tower to 120 feet or less.

b. Erection.

1) After testing has been accomplished to the satisfaction of the Engineer, the tower may be erected on the foundation.

2) Precise aligning and erecting of all components of the tower lighting system is essential. Plumb towers during full cloud cover, prior to sunrise or after sunset, as approved by the Engineer, to prevent thermal expansion effects on the steel tower due to heat from sunshine. Verify in at least two directions, 90 degrees apart, with a transit. Plumb all towers within a tolerance of 50% of the pole top diameter. Tighten anchor bolt nuts, after the tower is plumbed, using the following procedure:

a) Perform this work only on days with winds less than 15 mph. Tighten all the nuts in the presence of the inspector. Once the tightening procedure is started, it shall be completed on all base plate nuts.

b) Use properly sized wrenched or sockets, or both, designed for tightening nuts or bolts, or both, to avoid rounding or other damage to the nuts. Do not use adjustable end or pipe wrench.

c) Ensure base plates, anchor rods, and nuts are free of all dirt and debris.

d) Apply stick wax or bees wax to the threads and bearing surfaces of the anchor bolts, nuts, and washers.

e) Tighten top nuts so they fully contact the base plate. Tighten leveling nuts to snug tight condition. Snug tight is defined as the full effort of one person on the wrench with a length equal to 14 times the bolt diameter but not less than 18 inches. Apply full effort as close to the end of the wrench as possible. Perform tightening by leaning back and using entire body weight to pull firmly on the end of the wrench until the nut stops rotating. Perform two passes of tightening. Sequence tightening in each pass so that the nut on the opposite side, to the extent possible, is sequentially tightened until all the nuts in the pass have been tightened.

f) Tighten top nuts to snug tight as described for the leveling nuts.

g) Match-mark the top nuts and base plate using paint, crayon, or other approved means to provide to provide a reference for determining the relative rotation of the nut and base plate during tightening. Further tighten the top nuts tightened in two passes, as listed in the table below using a striking or hydraulic wrench. Follow a sequence of tightening in each pass so that the nut on the opposite side, to the extent possible, is sequentially tightened until all nuts in that pass have been turned. Do not allow the leveling nut to rotate during the top nut tightening.

Anchor Bolt Size	First Pass	Second Pass	Total Rotation
Less than or equal to 1 ½ inch diameter	1/6 turn	1/6 turn	1/6 turn
Greater than 1 ½ inch diameter	1/12 turn	1/12 turn	1/6 turn

h) Lubricate the jam nuts, place, and tighten to snug fit.
i) Cover the void between the base plate and top of the foundation as shown in the contract documents.

3. Luminaires.
a. Install luminaires so that water cannot enter or accumulate in the wiring compartment.
b. Ground all luminaires.
c. Confirm proper orientation and/or tilt of non-symmetrical luminaires.

B. Painting.

1. Repair all damage to lighting equipment metal surfaces or areas damaged during construction using factory approved methods.

2. Match original paint type and color.

230211.04 METHOD OF MEASUREMENT.

A. Towers.

1. Measure as individual units.

2. Lengths as specified on the plans.

B. Footings.

1. As outline in the following sections
a. Piling (see Section 2501 of the Standard Specifications)
b. Structural Concrete (see Section 2403 of the Standard Specifications)
c. Reinforcement (see Section 2404 of the Standard Specifications)
d. Excavation (see Section 2402 of the Standard Specifications)
e. Tower Luminaires.

2. Measure as individual units

C. Light Poles.
Measured as individual units.

D. Underdeck Luminaires.
Measure as individual units.

230211.05 BASIS OF PAYMENT.

A. Towers.

1. Payment shall be at the contract price for each of the specific lengths shown on the plans.

2. Payment for towers is full compensation for furnishing all materials, equipment, tools, and labor for construction of towers complete, including anchor bolt assembly and responsibility during

the testing period.

B. Footings.

1. As outline in the following sections:
- **a.** Piling (see Section 2501 of the Standard Specifications)
- **b.** Structural Concrete (see Section 2403 of the Standard Specifications)
- **c.** Reinforcement (see Section 2404 of the Standard Specifications)
- **d.** Excavation (see Section 2402 of the Standard Specifications)
- **e.** Tower Luminaires

2. Payment shall be at the contract price for each luminaire.

C. Light Pole.

1. Payment shall be at the contract price for each light pole.

2. Payment is full compensation for materials, equipment, excavation, and installation of the pole, luminaire, mast arm, foundation, base, ground rod, wiring within the pole, according to the contract documents.

D. Underdeck Luminaire.
Payment shall be at the contract price for each luminaire.