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(A) NOTE:

- (1) TE Standards are intended to describe the equipment, material, and construction requirements for the Lump Sum Bid Item; Electric Lighting System and High Mast Light Tower.
- (2) PRE-QUALIFICATION. All construction items and materials shall be on the Roadway Lighting Systems and Equipment Prequalified List (PQL 24.2). The PQL is available on the KDOT website: www.ksdot.org, under "Doing Business as" - "Highway Contractors" - "Pre-Qualified Materials". A manufacturer or supplier intending to supply lighting materials under these specifications shall submit an original copy of any catalog cuts, drawings, and/or data sheets for the material(s). A manufacturer or fabricator shall submit shop drawings with supporting calculations meeting AASHTO and KDOT Standards. This information shall be submitted to the Bureau of Traffic Engineering for review and approval.
- (B) CONSTRUCTION:
- (1) See Standard Specifications, Latest Edition, Sections 738 (HIGH MAST TOWERS), 814 (ELECTRIC LIGHTING SYSTEMS AND TRAFFIC SIGNALS), & 1703 (ELECTRIC LIGHTING SYSTEMS AND TRAFFIC SIGNALS EQUIPMENT). Locate all existing utilities prior to beginning work. Staking for controllers, poles, and junction boxes shall be done by the contractor, and approved by the engineer in charge.
- (C) TOWERS:
- (1) DESIGN. Design shall be in accordance with 2015 AASHTO LRFD Specifications for Structural Supports for the Highway Signs, Luminaries and Traffic Signals, including Interims, and KDOT Special Provision 744 (STRUCTURAL METALS FABRICATION). Tower design and shop drawings shall be sealed and signed by a professional engineer registered in the State of Kansas. Shop drawings shall reference the actual pole material to be used in the fabrication of poles for a specific Kansas Department of Transportation project. Shop drawings shall include weld details, referencing approved weld procedures and their given procedure numbers. Weld procedures shall be approved by KDOT prior to use Use 1700-Year MRI Basic Wind Speed of 120 mph for Extreme I Load Combination Limit State, Fatigue Category I with Limit State Pressure of 7.2 psf, and do not include ice loading. System loading EPA shall be 12.28 sq. ft. and weight of 961 lbs.
- (2) MATERIAL and FABRICATION. Shall be high strength steel meeting the requirements of ASTM A-595 Grade A; ASTM A-572 Grade 50 or 55; ASTM A1011 HSLAS Grade 50 or 55 Class 2; ASTM A-1018 HSLAS Grade 50 or 55 Class 2 and comply with the Kansas Department of Transportation Standard Specifications, Latest Edition. Towers shall comply with the 2015 AASHTO LRFD Specifications for Structural Supports for the Highway Signs, Luminaries and Traffic Signals, including Interims. The tower shall be galvanized in accordance with the requirements of ASTM A-123, and shall be assembled by telescoping on the job site. The bottom section of the pole shall be 1/2 inch in thickness. The base plate shall be made of steel plate with a minimum thickness of 3 inches, meet the requirements of above or ASTM A-36 and shall be designed to withstand the full bending moment of the shaft. All hand holes and weld backing rings shall have complete joint penetration (CJP), unless made from a solid. Field welds will not be allowed. The opening below the base plate shall be secured with a stainless steel or galvanized steel rodent screen.
- (3) CERTIFICATION. The manufacturer shall prepare certifications covering the composite fabricated structures, including certifications for all materials incorporated into the final product. These certifications shall include, but are not limited to, raw material, welding electrodes, approved welder test reports, approved weld procedures, and the required non-destructive test reports. A weld inspection shall be done before galvanizing.
- (4) INSPECTION. A weld inspection shall be done by a representative of the Kansas Department of Transportation Regional Materials Lab before galvanizing and alltowers will be visually inspected by a representative of the Kansas Department of Transportation Regional Materials Lab and a test report completed prior to assembly.
- (D) LOWERING DEVICE:
- (1) HEAD FRAME ASSEMBLY. The plate shall be fabricated from one quarter inch weldable structure steel with 11-gauge sheave supports. The head frame assembly shall be hot dipped galvanized in accordance with ASTM A-123, and no drilling or cutting will be allowed after galvanizing. The entire top of the head frame assembly shall be enclosed with an aluminum domed shaped cover. All hardware shall be stainless steel. Where two different materials meet, nylon washers shall be used. The main support assembly shall have six (6) cast aluminum hoisting sheaves. The sheaves shall be oil impregnated, sinter bronze bushings over stainless steel shaft, or permanently sealed ball bearings with inner fixed races, and have keeper bars/pins over the sheave to ensure the cable stays in track. The cable that operates over the sheaves shall be properly sized 7X19 stainless steel, meet the Federal Specification RR-W-410e. A power cord roller assembly consisting of multiple rollers minimizing bending radius shall be used with keeper bars/pins to ensure the cord stays in track. Minimum 8 inch tapered cast aluminum guide cylinders shall be bolted to the bottom of the head frame.
- (2) LUMINAIRE RING. Shall be fabricated of #7 gauge steel and shall include approved mounting plates/brackets necessary to support the specified number of luminaires. The luminaire ring shall be hot dipped galvanized in accordance with ASTM A-123, and no drilling or cutting will be allowed after galvanizing. A NEMA 3R pre-wired 600v terminal block enclosure with a weatherproof twist lock receptacle to allow testing of luminaires while in the lowered position shall be mounted on the ring. Three stainless steel pins/tubes shall be mounted on top of the ring to mate up with the tapered guide cylinders (at full depth) on the head frame when fully raised. The hoisting cables shall pass through the pins and have a compression spring mounted under the ring. The ring shall have a minimum of 10 non marking impact resistant bumper rollers mounted to the inside to allow contact with the pole during raising and lowering without damage to the pole or the ring. The bumper rollers shall have a stainless shaft. The ring shall have three high visibility flags visible from the ground that signal the operator when the luminaire ring has properly engaged with the head frame.
- (3) HOISTING ASSEMBLY. The internal winch assembly shall include a 30:1 worm gear reduction and an internal brake to prevent "free spooling". The winch drum shall be factory pre-spooled with the appropriate sized diameter 7X19 stainless steel aircraft cable, and shall be manufactured to the Federal Specification RR-W-410e. Shall be capable of raising and lowering minimum of six (6) luminaires on the ring assembly at an approximate rate of 10 feet per minute. The winch assembly shall accept a portable power unit compatible with the lowering device. The unit shall have a mechanical latching system that has the capability of taking the weight from the cables when at fully raised height.

- (4) PORTABLE POWER UNIT. Shall be (1/2") heavy duty, reversible drill, UL approved, and equipped with a torque limiting safety clutch. The portable power unit shall be arranged for remote control operations. The portable power unit shall be capable of operating the lowering device.
- (5) STEP DOWN TRANSFORMER. Shall be 1.5 kVA, single phase with a primary voltage of 480 volts and a secondary voltage of 120/240 volts. Transformer shall be provided with a carrying case and the necessary service receptacles. A 5 foot section of tower cable shall be provided for each tower for testing luminaires while the luminaire ring is in the lowered position. Transformer shall be equipped with the appropriate receptacles.

- (6) TOWER POWER CABLE. Shall be 600 volt. #10 AWG three conductor, stranded, extra-flexible copper conductor type S.O. cord with chloro-sulfonated polyethylene jacket, or other approved.
- (7) CIRCUIT BREAKER FOR BASE OF TOWER. Shall be 15 amp, single throw, double pole, with 100 amp frame for 480 volt operation.
- (8) SERVICE RECEPTACLE. Shall be weatherproof, twist lock, 600 volt rated.

- (9) ACCEPTANCE. A factory representative or a certified installer of the lowering device shall be on site to approve installation and contractor shall demonstrate the lowering device is fully functional prior to final acceptance of the project.

(E) ELECTRICAL MATERIAL:

- (1) PHOTO CELL. Shall be solid state type, 1000 watts, 1800 VA ballast, single pole, single throw, twist lock mounting. ANSI C136.10, ROHS compliant, UL listed, surge rated in excess of ANSI C136.10 to 20kV/10kA. Shall be made by the same manufacturer as the luminaire, and fail in the on mode.
- (2) DISTRIBUTION WIRE. Shall be Type USE-2, stranded, annealed copper meeting the requirements of ASTM B-8 and ASTM B-33, and be the size specified in the plans.
- (a) SECONDARY SERVICE CABLE IN CONDUIT (CIC). Shall be stranded copper single conductor cable for operation at 600 volts maximum. Material shall meet the applicable requirement of ICEA Standard S-105-692 and listed by UL as Type USE-2 for direct burial. Make splices in the secondary service cable inside of tower bases, pole bases, and junction boxes only. Contact the Bureau of Traffic Engineering for approval of other splice locations. The duct shall be polyethylene with minimum tensile strength of 3100 psi, sized to provide the correct fill based on NEC requirements, and shall meet ASTM D-3485 (Latest Revision).
- (3) LED LUMINAIRES
Shall have a housing of aluminum alloy casting, capable of mounting to a 2" (inch) luminaire arm, and in compliance with ANSI C136-37. Shall be IP-66 rated for optical assembly and IP-65 rated for electrical components, and shall have the following: three-hole terminal blocks for incoming #10 AWG AC lines, minimum 20kV/10kA surge protection, a 7-pin photo control receptacle with electronic photocontrol or shorting cap, and an electronic dimmable driver (power supply, rated for 100,000 hours). Shall be fully tested in accordance with IESNA Standard LM-79, pre-wired for installation, and shall maintain 70% of initial lumen output after 100,000 hours of operation. LED luminaire criteria: (lumen output, luminaire wattage, lumens per watt, input voltage, bug rating, CCT (4000k +/- 300k), CRI (70), photometric requirements, and distribution), and the photometric performance criteria: (maintained horizontal illumination, avg/min and max/min uniformity ratios) shall be determined by the project designer. Designers shall conform to the IESNA Standard RP-8-18 and/or AASHTO Standard GL-7-2018 for required illumination, show the BASIS FOR DESIGN (ADDITIONAL CRITERIA) on the TE209, and submit a photometric report to the Bureau of Traffic Engineering for approval.

- (4) CONTROLLER:
The controller cabinet shall be constructed of 5052 alloy aluminum 0.125" (inch) thick, and shall be of clean cut design having no sharp edges, corners or projections. The circuiting shall be serviceable by means of a full length hinged door with padlock provisions. The controller shall have 600 volt rated molded case main and secondary breakers, twist-lock photocell socket, and electrically held contactors. The equipment within the controller shall be wired prior to delivery. The controller shall have a meter view window and a glass to allow light to the photocell that faces NORTH. All conductors coming in to the controller shall be identified with a permanent label.

- (a) The main and secondary breakers shall have a mounting dimension of 1" (inch) wide by 4" (inch) high mounting holes shall be positioned to accommodate a breaker 2" (inch) wide side by side. See CONTROLLER DETAIL SHEET TE202.

- (b) The contractor shall contact the power company prior to acquiring the lighting controller. An exposed ringless meter design and cover, 200 amp, 5 terminal meter socket with horn bypass, is an approved option for remote access if required by the power company.

- (5) FUSED/UN-FUSED CONNECTORS:
Fused connectors shall be sized to the conductors specified in the plans and shall have molded rubber boot for waterproofing. The connector shall be capable of withstanding multiple disconnects without damage to the watertight seals or terminals. Each connector shall include all parts and materials necessary to complete its installation, such as fuses, lubricating compound, and assembly devices. Un-fused connector kits shall be of the set-screw type, sized to the conductors specified in the plans. They shall be furnished with waterproof rubber boots.

- (a) Fuses for inline connectors shall be Class CC and sized in accordance with ampacity of the conductors in the pole.

(F) GENERAL MATERIALS AND NOTES:

- (1) MISCELLANEOUS HARDWARE. Hardware that requires galvanizing or electroplating shall conform to the Standard Kansas Department of Transportation Standard Specifications, Latest Edition, Section 1703.2 (c) (ELECTRIC LIGHTING SYSTEMS AND TRAFFIC SIGNALS EQUIPMENT).
- (2) CONDUIT INSTALLATION. Conduit shall be installed per Section 814.3 (ELECTRIC LIGHTING SYSTEMS AND TRAFFIC SIGNALS) of the Standard Specifications and as noted. All electrical conduit above ground shall be metallic. Conduit attached to the bridge shall have expansion fittings installed at the ends of the bridge and at each expansion joint. All attachments to bridges shall have a Highway Right of Way Permit (DOT304), and Utility Attachment Permit (DOT 310) approved before work begins, in accordance with the current Kansas Department of Transportation Utility Accommodation Policy. When pulling wires through conduit, a pulling sock or other similar device shall be used to equalize pulling strain on the conductors.
- (3) METALLIC CONDUIT. See Standard Specification 1703.2 (ELECTRIC LIGHTING SYSTEMS AND TRAFFIC SIGNALS EQUIPMENT). Shall be rigid steel conduit meeting the requirements of American Standard Specification C-80.1. Shall be zinc coated and shall meet the requirements of NEMA FB-1.
- (4) NON-METALLIC CONDUIT. See Standard Specification 1703.2 (ELECTRIC LIGHTING SYSTEMS AND TRAFFIC SIGNALS EQUIPMENT).
- (a) RIGID POLYVINYL CHLORIDE (PVC). Shall meet the requirements of NEMA TC-2, Federal Specifications No. WC 1094A and UL 651. Each length shall bear the Underwriters, Inc. Label. Non-metallic conduit fittings shall be fabricated from polyvinyl chloride meeting the requirements of NEMA TC-3, Federal Specifications No. WC 1094A and UL 514. Each shall bear the Underwriters, Inc. Label. The joints shall be made in accordance with the manufacturers recommendations.
- (b) HIGH DENSITY POLYETHYLENE (HDPE). Shall meet the requirements of ASTM F 2160, ASTM F 2176, and NEMA Standard TC-7. Shall be coilable, smooth wall, Schedule 40 or Schedule 80. A letter of certification (LOC) will be required from the conduit producer and/or resin producer. The conduit will need to be marked with ASTM F 2160 designation on the print line. Shall be continuous from outlet to outlet, with no splices allowed. Bend radii shall not exceed the manufacturer's recommendations. Cable fills should not exceed the values set by the NEC.
- (5) GROUND. Ground all metal parts including poles, controllers, junction boxes, and conduit used above ground with a No. 6 bare wire. Ground wire shall be a #6 AWG solid bare copper wire and arrangement shall be as noted on plans. Ground rods shall be copper clad 3/4" (inch) diameter by 20' (feet) long, or two ground rods at 10' (feet) each.
- (6) ANCHOR BOLTS. Shall conform to the Standard Specification Section 1600 (FERROUS AND NON-FERROUS METALS) (Grade 55) with the following exception: Do not use cut threads, use rolled threads.
- (7) JUNCTION BOXES (IN-GROUND). Shall be of sufficient size to facilitate the conduit and wiring as indicated in the plans. Junction boxes shall have the minimum nominal dimensions of 12" (inch) deep with a minimum physical opening of 130 square inches. May be constructed of one of the following methods: Pre-cast concrete with a cast iron cover; Polymer concrete with a polymer concrete cover; Fiberglass reinforced polymer body with a polymer concrete ring and cover; High density polyethylene body with polymer concrete ring and cover. The ring shall be securely attached to the body. All conductors coming in to the junction box shall be identified with a permanent label.
- (a) Enclosures, boxes and covers are required to conform to all test provisions of ANSI/SCTE 77 2017 "Specification for Underground Integrity" for Tier 15 applications.
- (b) The cover shall bear the logo "LIGHTING" clearly and permanently molded or etched into the cover.
- (8) JUNCTION BOXES (ABOVE-GROUND):
Shall have the nominal dimensions of 12" (inch) x 12" (inch) x 6" (inch). Shall be made of 14 gauge sheet metal (steel) with welded seams, knockouts and weather proof screw cover. Boxes shall be hot dipped galvanized in accordance with ASTM A-123 after fabrication. All conductors coming in to the junction box shall be identified with a permanent label.
- (9) WEDGE TYPE STUD BOLT ANCHORS:
The contractor shall install two 3/8" (inch) x 3" (inch) wedge type anchors for conduit clamps. The anchors shall be wedge type made from carbon steel meeting AISI 12L14 steel. The minimum embedded depth shall be 1 3/4" (inch).
- (10) CONDUIT CLAMPS WITH CLAMP BACKS:
The contractor shall install 2" (inch) conduit clamps with a compatible clamp back. Clamps shall be heavy duty steel to secure the 2" (inch) rigid conduit to structure. Conduit clamps are to be spaced at 6' (feet) intervals.

STATE	PROJECT NO.	YEAR	SHEET NO.	TOTAL SHEETS
KANSAS	0	0	0	0

03	05-23-23	Fuse detail/removed metallic jacking	J.A.P.	S.M.P.
02	05-05-21	POL/AASHTO GL-7-2018/grounding rod/details	J.A.P.	S.M.P.
01	04-28-20	AASHTO LRFD/lowering dev/surge/CJP welds	J.A.P.	C.P.A.
NO.	DATE	REVISIONS	BY	APPD
KANSAS DEPARTMENT OF TRANSPORTATION				
CONSTRUCTION AND MATERIAL REQUIREMENTS FOR HIGHWAY LIGHTING (TOWERS)				
TE206				
FHWA APPROVAL		07-07-23	APPD.	Sara M. Peters
DESIGNED	J.A.P.	DETAILED	J.A.P.	QUANTITIES
DESIGN CK.	S.M.P.	DETAIL CK.	S.M.P.	QUAN.CK.
		TRACED		TRACED