

STATE	PROJECT NO.	YEAR	SHEET NO.	TOTAL SHEETS
KANSAS	87 N-0673-01	2017	92	99

3.2.11.1. SHAFT. The shaft shall be of Type 6061-T6, 6063-T6 or 6063-T832 aluminum alloy, and shall be a single piece of drawn seamless tubing having a nominal 4 ½ inch outside diameter and ¼ inch wall thickness. The shaft shall be threaded at one end for attaching the shaft to the base. The shaft shall have a uniform polished finish.

3.2.11.2. BASE. The pedestal base shall be AASHTO certified and be cast of Type 356.0-T6 aluminum alloy. It shall have a threaded collar with a set screw, and plastic or aluminum door.

3.2.11.3. ANCHOR BOLTS. Anchor bolts for traffic signal pedestals shall be of the dimensions detailed in the Plans and shall meet the requirements of the latest edition of ASTM A36. The threaded ends of the anchor bolts shall be zinc plated. Zinc plated nuts and washers shall be included with the anchor bolts. Anchor bolts for traffic signal pedestals will be visually accepted by the Engineer.

3.2.12. TERMINAL BLOCK. Terminal blocks in the poles shall be U.L. recognized barrier type or dead-front type terminal strips having terminals of sufficient size and number to connect the individual conductors run between the cabinet and the pole to the conductors run between the pole and the signal heads. They shall be rated for at least 30 amps current.

3.2.13. JUNCTION BOXES (IN-GROUND). The junction box 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 inches deep with a minimum physical opening of 130 square inches. In-ground junction boxes 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.

3.2.13.1. Enclosures, boxes and covers are required to conform to all test provisions of ANSI/SCTE 77 2007 "Specification for Underground Integrity" for Tier 15 applications.

3.2.13.2. The cover shall bear the logo "TRAFFIC SIGNAL" clearly and permanently molded or etched into the cover.

3.2.14. JUNCTION BOXES (ABOVE-GROUND). Above ground junction boxes shall have the nominal dimensions of 12 inches by 12 inches by 6 inches. The junction box shall be made of minimum 1/8 inch thick 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.

3.2.15. SERVICE BOXES. The service box shall have the nominal internal dimensions of 24 inches in diameter by 36 inches deep. Service boxes shall be provided with cable hooks as detailed in the Plans. The box may be constructed of one of the following methods: pre-cast concrete with a cast iron ring and cover; galvanized corrugated steel with a cast iron ring and cover; polymer concrete with a polymer concrete cover; fiberglass reinforced polymer body with a polymer concrete ring and cover. The ring shall be securely attached to the body.

3.2.15.1. Enclosures, boxes and covers are required to conform to all test provisions of ANSI/SCTE 77 2007 "Specification for Underground Integrity" for Tier 15 applications.

3.2.15.2. The cover shall bear the logo "TRAFFIC SIGNAL" clearly and permanently molded or etched into the cover.

3.2.16. LUMINAIRES. Luminaire's shall be High Pressure Sodium of 150 Watts or 250 Watts, as indicated in the Plans. The luminaire shall have a housing of a single piece aluminum alloy casting, with an integral slip-fitter for 2 Inch bracket mounting, an aluminum reflector, an auto-regulator type ballast set at 120 Volts, a medium semi-cutoff glass refractor with Type III light distribution, and a photocell receptacle.

3.2.17. LUMINAIRES LAMPS.

3.2.17.1. The 150 Watt lamp shall be High Pressure Sodium with a rated initial light output of 16,000 lumens, and a mean light output of 14,400 lumens.

3.2.17.2. The 250 Watt lamp shall be High Pressure Sodium with a rated initial light output of 30,000 lumens, and a mean light output of 27,000 lumens.

3.2.18. PHOTOCCELL. The photocell shall be solid state type, 1000 Watt/1800 Volt-amps maximum, single pole, single throw, twist lock mounting, 120 Volt operation. The operating levels shall be 1.5 footcandle ON and 0.33 footcandle OFF, with an allowable variation of 0.5 footcandle ON or OFF. The photocell shall have a minimum of a 30 second time delay OFF, and fail in the ON mode.

3.2.19. UN-FUSED STREET LIGHT CONNECTOR KIT. 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.

3.2.20. FUSED STREET LIGHT CONNECTOR KIT. Fused connector kits shall be sized to the conductors specified in the Plans and shall be supplied with molded rubber boots 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.

3.2.20.1. FUSE. The fuse shall be a minimum of 5 amp cartridge type as recommended by the connector manufacturer.

3.2.21. OVERHEAD STREET NAME SIGNS. Overhead street name signs shall bear the message indicated in the Plans. The legend shall be centered on the sign face. The border shall be ¾ of an inch wide.

3.2.21.1. BLANK.The aluminum sign blank shall be of a minimum of 0.100 inch thick. Material to be in accordance with Section 1627 of the Standard Specifications. All corners on the sign blank shall be rounded.

3.2.21.2. SHEETING. All sign faces shall have a green background with white legend and shall be covered with Type IV High Intensity Retroreflective sheeting. Fabrication of sign faces shall be per Section 812 of the Standard Specifications.

3.2.21.3. LETTERING. Copy size for the legends shall be as follows: 9 inch Series C upper case for street designation (i.e. SW, ST, AV); 12 inch upper case with 9 inch lower case Series C for names (i.e. Main, 5th).

3.2.21.4. ACCEPTANCE. Before final fabrication and shipment, the manufacturer or supplier shall provide, for the Engineer's approval, a layout of each sign showing the exact street name lettering to be placed on the sign. The signs shall be visually accepted by the Engineer.

3.2.22. REGULATORY SIGNS. The design details (color, letter height and letter series) for all regulatory signs shall be as shown in the latest edition of the FHWA Standard Highway Signs and Pavement Markings Book. Special signs not covered by the Standard Highway Signs Manual shall be as shown in the Plans. Sign blanks shall be a minimum of 0.080 inch thick aluminum alloy. The sign face shall be of Type IV High Intensity Retro reflective sheeting meeting the requirements of Section 2201 of the Standard Specifications.

3.2.22.1. ACCEPTANCE. Regulatory signs included in the Traffic Signal bid item will be accepted in accordance with Section 3.3 of these specifications, with additional certification stating that the Type IV High Intensity Retroreflective sheeting used to manufacture the signs was pre-qualified under Section 2201 of the Standard Specifications.

3.2.23. BLANK OUT SIGNS. The blank out sign legend shall be as indicated in the Plans. When energized, the sign message shall be clearly legible under any lighting conditions. It shall completely blank out when not energized. No phantom legend shall be seen under any ambient light condition. The housing shall be durable and weatherproof. The sign face shall consist of fiber-optic glass bundles arranged to define the legend. The fiber-optic modules and associated components shall be assembled directly to the sign face and shall have an inside back cover to provide protection for the module. The fiber-optic bundles shall be ground smooth and optically polished at the input and output ends for maximum light transmission. The sign shall be lit by 42 Watt lamps operating at 10.8 Volts AC. The lamps shall sustain an average 8,000 hour life. Transformers shall be used to reduce the incoming 120 Volts AC to 10.8 Volts AC. The transformers shall contain Class A insulation and weatherproofing, and shall be rated at 48.5 Volt-amps. The sign shall be capable of continuous operation over a range in temperatures from -37 degrees to +74 degrees Celsius.

3.2.24. ENTRANCE HEAD. The entrance head shall be of cast aluminum and shall be of the clamp-on type for use with rigid conduit of the specified in the Plans. It shall be U.L. listed.

3.2.25. SERVICE ENCLOSURE. The service enclosure shall be watertight, and be of sufficient size and load rating to provide the number of circuits indicated in the Plans. The enclosure shall be provided with a hasp for a padlock. Padlocks will be provided by others.

3.2.26. CIRCUIT BREAKERS. The circuit breakers shall be standard plug-in, single pole, molded case, of the trip rating as shown in the Plans.

3.2.27. GROUND ROD. The ground rod shall be ¾ inch diameter by 10 feet long copper bonded steel rod and bear the U.L. label.

3.2.28. GROUND ROD CLAMP. The ground rod clamp shall be a ¾ inch clamp cast of high strength copper alloy and be U.L. listed for direct burial.

3.2.29. SERVICE WIRE. The service wire shall be Type USE-2 stranded, annealed, copper wire meeting the requirements of ASTM B-8, and be of the size specified in the Plans.

3.2.30. LIGHTING DISTRIBUTION WIRE. The lighting distribution wire shall be Type USE-2 stranded, annealed, copper wire meeting the requirements of ASTM B-8, and be of the size specified in the Plans.

3.2.31. POLE & BRACKET WIRE. The pole and bracket wire shall be Type USE-2 stranded, annealed, copper wire meeting the requirements of ASTM B-8, and be of the size specified in the Plans.

3.2.32. GROUND WIRE. The ground wire shall be No. 6 AWG solid bare copper wire meeting the requirements of ASTM B-3.

3.2.33. MULTICONDUCTOR CABLE. The multiconductor cable shall meet the requirements of IMSA 19-1 or IMSA 20-1. Conductors shall be stranded No. 14 AWG. The number of conductors shall be as indicated in the Plans.

3.2.34. SHIELDED DETECTOR LEAD-IN CABLE. Shielded detector lead-in cable shall meet the requirements of IMSA 50-2. Conductors shall be No. 14 AWG.

3.2.35. DETECTOR LOOP WIRE. The detector loop wire shall meet the requirements of IMSA 51-5. The conductor shall be No. 14 AWG, and the tube shall be of polyethylene.

3.2.36. LOOP SEALANT. The loop sealant shall be a one-part polyurethane, moisture curing, elastomeric compound requiring no mixing, measuring, or application of heat prior to or during application. It shall be specifically designed for sealing and protecting detector loop wires in both asphalt and concrete pavements. It shall not chemically attack or damage the pavement, yet shall sufficiently bond with the pavement to effectively seal the saw cut and prevent the infiltration of moisture into the slot. The cured loop sealant shall exhibit resistance to the normally encountered effects of weather, vehicular abrasion, motor oils, gasoline, antifreeze solution, brake fluid, deicing chemicals and salt in such manner that the performance of the detector loop is not adversely affected. The loop sealant shall provide compressive yield strength to withstand normal vehicular traffic and prevent the intrusion of rocks, glass, and other road debris into the slot. It shall remain sufficiently flexible at all normally encountered temperatures to withstand normal movement in asphalt and concrete pavements while protecting the loop wire from fracture and shear.

3.2.37. PRE-FORMED LOOPS. Pre-formed loops shall be factory assembled loops having the dimensions and number of turns of wire specified in the Plans. The loops shall be constructed of a minimum No. 16 AWG Type TFFN/THWN copper wire meeting the requirements of ASTM B-8, and encased in heavy duty tubing compatible with the paving material being used on the project. The tubing shall be completely filled with asphalt sealant material after the wire is installed. The loop tail shall be of flexible tubing of the length specified in the Plans and shall also be filled with asphalt sealant material. The detector wire within the loop tail shall be twisted a minimum of 3 turns per foot.

3.2.38. CONDUIT.

3.2.38.1. METALLIC CONDUIT AND FITTINGS. Metallic conduit shall be galvanized rigid steel conduit meeting the requirements of ANSI C80.1. Metallic conduit fittings shall be zinc coated and shall meet the requirements of ANSI C80.4.

3.2.38.2. PVC CONDUIT AND FITTINGS. PVC conduit shall be either Schedule 40 or Schedule 80 rigid polyvinyl chloride meeting the requirements of the latest edition of NEMA Standard TC-2. PVC conduit fittings shall meet the requirements of NEMA Standard TC-3 and shall be fabricated from polyvinyl chloride having the same chemical and physical properties as the conduit with which it is to be used. The conduit and fittings shall bear the U.L. label.

3.2.38.3. POLYETHYLENE CONDUIT. Polyethylene conduit shall be coilable, smooth wall, Schedule 40 or Schedule 80, high density polyethylene duct meeting the requirements of NEMA Standard TC-7.

3.2.38.4. FIBERGLASS CONDUIT. Conduit shall be fiberglass reinforced epoxy manufactured using the filament winding process. Conduit, elbows and fittings shall be manufactured from the same resin/hardener/glass systems manufactured by the same filament wound system. All conduit and fittings shall meet UL1684. All conduit shall be non-tapered. The joints shall have threaded bell and spigot ends. The conduit will be joined together using a two part epoxy adhesive creating a Tight Lock Joint. The conduit wall thickness will be .070 inch for ¾" to 4" diameter and .096 inch for 5" and 6" diameters. All conduits shall be manufactured to IPS pipe sizes.

3.2.39. EXPANSION FITTINGS. Expansion fittings shall be as detailed in the Plans.

3.3. BASIS OF ACCEPTANCE. Acceptance of materials furnished under these specifications will be based upon the following:

3.3.1. PRE-QUALIFICATION. The Bureau of Transportation Safety and Technology maintains a list of Pre-Qualified Traffic Signal Materials. Any product called for in the Bill of Materials in the Plans that is being furnished for the project must be on that list, or must be approved as noted in Section 3.3.2.1 of these specifications. A manufacturer or supplier intending to supply traffic signal materials under these specifications shall submit an original copy of any catalog cuts, shop drawings, drawings, and/or data sheets on the material, and certification from the manufacturer or fabricator certifying that the material meets the applicable specifications. This information shall be submitted to the Bureau of Transportation Safety and Technology, 700 SW Harrison, 6th Floor, Topeka, KS 66603-3754.

3.3.2. TRAFFIC SIGNAL MATERIALS LIST. Items on the list shall include all items for which quantities are indicated in the Bill of Materials in the Plans. The list shall include the make, model and other descriptive data as may be required by the Engineer to identify the product. The Contractor shall sign the list certifying that the materials on the list, if approved, will be furnished for the project. The Engineer will compare the items on the Traffic Signal Materials List to the Pre-Qualified Traffic Signal Materials List. If all of the items match, the Engineer will sign the list attesting that the materials are approved for use on the project. A copy of the list shall then be forwarded to each of the following: Chief of Construction and Materials, State Traffic Engineer, and the Maintaining Agency's contact person indicated in the Plans.

3.3.2.1. In the event the Contractor wishes to furnish any item that is not on the pre-qualified list, the Contractor shall furnish the Engineer with the information for pre-qualification per Section 3.3.1 of these specifications. This information will be forwarded to the Bureau of Transportation Safety and Technology for review and approval, and the possible addition to the pre-qualified list.

3.3.3. VISUAL INSPECTION. Items will be visually inspected by the Engineer at the job site for condition and conformance with the requirements of these specifications.

3.3.4. ADDITIONAL REQUIREMENTS. There are additional requirements noted for specific items under Section 3.2. of these specifications.

3.4.1. BATTERY BACKUP SYSTEM (BBS)/UNINTERRUPTED POWER SYSTEM (UPS). The BBS/UPS shall be compatible with NEMA, Caltrans 332 or 336 Series, Model 170E/2070 Controllers. The BBS/UPS shall provide reliable power to the traffic signal (vehicle and pedestrian) in the event of a power interruption or power failure. Full operational working time shall be four (4) hours of full run-time operation for an "LED-only" intersection. Once the battery reaches 40% of remaining life, the traffic signals will switch to flash mode for a minimum of two (2) hours. The BBS/UPS shall include, but not be limited to the following: inverter/charger, power transfer relay, batteries, a separate manually operated non-electronic bypass switch and all necessary hardware, installation wiring kit and interconnect wiring. The BBS/UPS shall be capable of providing power for full run-time operation for an intersection (with green, yellow and red lights), including detection and flashing red light mode operation for an intersection not exceeding the full load capacity of the BBS/UPS. The BBS/UPS shall incorporate a Double Conversion (On-Line type) or Line Interactive (Buck/Boost) modes with a minimum input range of 90-150 VAC with built-in surge protector, noise filter and voltage regulator. The BPS/UPS shall meet NEMA, TEES, NEC standards.

3.4.1.1. BBS/UPS SYSTEM.The maximum transfer time from loss of power to switch over to BBS/UPS shall be 150 milliseconds. The BBS/UPS shall provide as a minimum 2-sets of normally open (NO) and normally closed (NC) single-pole double-throw (SPDT) relay contact closures, available on a panel-mounted terminal block, rated at a minimum 120 VAC +/- 3% at 60 Hz +/- 0.1% to the cabinet. The first set of NO and NC contact closures shall be energized whenever the unit switches to battery power (On Batt) and the second set of NO and NC contact closures shall be energized whenever the battery approaches approximately 40% of remaining useful capacity (Low Batt). Operating temperature for both the inverted/power transfer and manual bypass switch shall be -37° C to +74° C.

3.4.1.2. CABINET. The batteries shall be housed within an external battery cabinet provided with an inverted/charger, power transfer relay and manually operated bypass switch. The BBS with external battery cabinet shall come with all bolts, conduits and bushings, gaskets, shelves and hardware needed for mounting. The cabinet can be side mounted to the traffic signal cabinet (piggy back) or a free standing cabinet. The battery cabinet shall be ventilated per TEES Chapter 7 Section 2-Housings.

3.4.1.3 BATTERIES. Individual batteries shall be 12 Volt, or 24 Volt batteries, 100 amp-hour maximum, and shall be easily replaced and commercially available off the shelf. Batteries shall be deep cycle, sealed prismatic lead-calcium based Gel or Absorbed Glass Valve Regulated Lead Acid (AGM/VRLA). Batteries used for BBS shall consist of 4 to 8 batteries with a cumulative minimum rated capacity of 240 amp-hours. Batteries shall be certified by the manufacture to operate over a temperature range of -25° C to +74° C.

NO.	DATE	REVISIONS	BY	APP'D
3	4/7/15	Changes to pedestal door material & format	CPA	BDG
2	12/17/14	Added Battery Backup	CPA	BDG
1	3/13/13	Updated to overhead signing & terminology	CPA	BDG

KANSAS DEPARTMENT OF TRANSPORTATION

TRAFFIC SIGNAL
SPECIFICATIONS

TEI20D

FHWA APPROVAL	DESIGNED	DESIGN CK.	C.P.A. DETAILED	B.D.G. DETAIL CK.	12/31/2015	APP'D	QUANTITIES	QUAN. CK.	BY	APP'D
						Brian D. Gower, P.E.	TRACED	TRACE CK.		