

- (b) It shall attach to an 8-pin connector.
- (c) The cable shall be color coded for quick and easy wiring to terminal blocks and Click modules.
- (e) RS-485 conductor shall be 2 twisted pairs. The power conductor shall be a twisted pair.
- (f) The entire cable assembly shall be shielded with aluminum/polyester shield with drain wire.
- (g) The cable shall be RoHS compliant
- (h) The cable shall be environmentally sealed to ensure excellent immersion capability, and also be capable of withstanding extreme weather conditions.
- (i) The RS-485 conductors shall have nominal capacitance conductor to conductor of less than 40 pF/ft at 1 kHz.
- (j) The RS-485 conductors and the power conductors shall have nominal conductor DC resistance of less than 16.7 ohms/1000 ft and 11 ohms/1000 ft at 20°C respectively.
- (k) The cable shall have a diameter of 0.41 inch.
- (l) The cable jacket shall be made of gray PVC that is 0.053 inch thick.
- (m) The power wires and the communication wires shall be 20 AWG and 22 AWG respectively.
- (n) The cable shall be capable of operating at temperatures up to 221°F when dry and 167°F when wet.
- (o) The cable shall have an FT4 flammability rating.

(10) Connector Cable:

The cable end connector shall meet MIL-C-26482 specifications and shall be designed to interface with the appropriate MIL-C-26482 connector. The connector backshell shall be an environmentally sealed shell that offers excellent immersion capability. All conductors that interface with the connector shall be encased in a single jacket, and the outer diameter of the jacket shall be within the backshell's cable O.D. range to ensure proper sealing. The backshell shall have a strain relief with enough strength to support the cable slack under extreme weather conditions. Recommended connectors are Cannon's KPT series, and recommended backshells are Glenair Series 37 cable sealing backshells.

(11) Testing Requirements

The radar traffic detection system shall meet the following testing and certification requirements.

- (a) Tested under FCC CFR 47, part 15, section 15.249
- (b) FCC certification on product label.
- (c) FCC regulation compliant for life of the sensor.
- (d) Tested under IEC 6100-4-5 class 4
- (e) Tested under NEMA TS2-2003:
 - Shock pulses of 10 g, 11 ms half sine wave
 - Vibration of 0.5 g up to 30 Hz
 - 300 V positive/negative pulses
 - Stored at -49°F for 24 hours
 - Stored at +185°F for 24 hours
 - Operation at 10.8 VDC between -29.2°F and +165.2°F

All test results and certification shall be made available to the City.

E. Training, Warranty and Instructions:

For all traffic signal components and equipment including video detection and radar detection systems, the vendor shall provide adequate training, minimum warranty and detailed instructions as described below.

(1) Training:

A one-day training seminar will be provided by the vendor and shall provide instruction in the proper installation and programming of the radar detection system.

(2) Warranty:

All traffic signal equipment shall be warranted to be free of defects in material and workmanship for a period of minimum two years from the date of acceptance by the City. During the warranty period, the supplier shall repair with new or refurbished materials, or replace at no charge, any product containing a warranty defect. All materials returned for warranty repairs shall be made through the product distributor at no added charge to the City. Warranty repairs/replacement shall be completed within two weeks from the date of return to distributors.

During the warranty period, updates to all software shall be available from the supplier without charge.

(3) Instructions:

Wiring diagram of the system including detailed instructions and installation manual for all equipment and system shall be provided as necessary. Changes/substitutions in these requirements will not be accepted unless authorized in writing.

The company agrees, upon the request of the engineer, to deliver a sample of the equipment or system to be supplied in compliance with these specifications for test before acceptance. After completion of the test, the sample shall be returned.

IV. Traffic Signal Heads:

A. General:

(1) Signal Head Mounting

(a) Installation - Signal Heads shall not be installed at any intersection until all other signal equipment, including the controller, are in place and ready for operation at that intersection, except that the signal heads may be mounted if the faces are not directed toward traffic or if the faces are completely covered. In no case, shall the heads be installed more than 10 days prior to the signal turn-on. The Engineer shall direct the final positioning of the signal heads for optimum visibility. Vertical bracket and pedestal mounted traffic signal heads shall be installed at a height of 10 feet from the base of the pole to the bottom of the signal head unless otherwise specified in the Plans. Mast arm mounted signal heads shall be installed at a height of 15 to 19 feet from the pavement to the bottom of the signal head.

(b) Bracket Mounting - Bracket-mounted signal heads, as shown on the Plan, shall be supported by mounting brackets consisting of watertight assemblies of 1.5 inch durable Polycarbonate. Mounting brackets shall be yellow. The dimensions of the mounting brackets shall be as required to provide proper signal head alignment. Each bracket shall have 72 tooth serrations to assure a positive lock with the signal head and allow positioning of the traffic signal heads in increments of 5 degrees. All members shall be plumb or level, symmetrically arranged and securely assembled. Mounting brackets shall be attached to the pole with a stainless steel banding. Construction shall be such that all conductors are concealed within the assembly.

(c) Mast Arm Mounting - Mast Arm Signal Head Assemblies shall be rigid mounted. The assembly shall consist of both top and bottom brackets and be easily and completely adjustable in both horizontal and vertical planes. The top and bottom brackets shall have 72 tooth serrations cast into the arm to assure a positive lock with the signal housing. The mast arm signal bracket shall be constructed of high strength aluminum. It shall have a minimum of 1.5 inch opening to completely enclose the signal wiring. The bracket shall accommodate the number and size of signal heads as shown on the Plan. It shall be attached to the size and shape of the mast arm supplied by means of stainless steel bands.

(2) Back Plates - where shown on the Plan, 5 inch back plates shall be furnished and attached to the signal faces to provide a dark background for signal indications. Back plates shall be constructed of durable plastic capable of withstanding a 100 miles per hour wind.

B. Vehicle Traffic Signal Heads:

(1) General - all 2 and 3 section Signal Heads shall have "1-5/c #4 AWG" pulled to each from the base. All 4 section Signal Heads shall have "1-7/c #14 AWG" pulled to each from the base. All Push Buttons shall have "1-2/c #14 AWG" pulled to each from the base.

(2) Assembly - each Signal Head shall be a watertight assembly of 3 or more signal faces of the expandable, adjustable, LED type, together with all brackets and fittings necessary for proper mounting with the type of signal support designated on the Plan. Each signal face shall consist of 3 or more signal sections, rigidly and securely fastened together, positively positioned to control the movement of one direction of traffic. Each signal section shall be self-contained assembly consisting of an optical unit with housing, housing door, and visor. The rods shall not be used to fasten signal section together to form a signal face. All Signal Heads on a project shall be the product of one manufacturer, except for programmed heads. Terminal blocks of suitable size shall be placed in the middle section of the Signal Head.

(3) Housing - the housing for each signal section shall be made of durable polycarbonate. It shall be clean, smooth and free from flaws, cracks, blowholes and other imperfections. The housing shall be yellow with black doors. It shall be designed as a self-contained unit for separate mounting or inclusion in a signal face containing 3 or more signal sections rigidly and securely fastened together. It shall be equipped with round openings in the top and bottom and shall have 72 tooth serrations to assure a positive lock between signal heads and brackets and allow positioning of the traffic signal heads in increments of 5 degrees. The doors shall be suitably hinged and held securely to the body of the housing by simple stainless steel locking devices. All other door parts such as hinge pins, lens clips, screws etc. shall also be of stainless steel. A neoprene or silicone gasket shall be used between the lens and the reflectors to exclude dust and moisture.

(4) Visors - the visors for each signal section shall be a durable polycarbonate not less than 0.05 inch (No. 18 US Gauge) in thickness. It shall be designed to fit tightly against the door by means of 4 fastening screws and shall not permit any perceptible filtration of light between it and the housing door. Visors shall be at least 9.5 inches long for 12 inch diameter signals, shall angle slightly downward and shall be of the tunnel type. The optical unit and visor shall be designed as a whole as to eliminate outside rays from entering the unit from above the horizontal. All visors shall be black.

(5) Wiring - wiring for each lamp receptacle shall be provided by color coded No. 18 Gauge lead wires with polyvinyl chloride insulation and a nylon jacket. Wires shall be of sufficient length to extend to the terminal block with the door fully open without splicing.

C. One Section Pedestrian Traffic Signal Head with Countdown Display:

(1) It shall meet or exceed current ITE standards and the 2009 MUTCD.

(2) The housing shall be polycarbonate and shall be a "clamshell type" housing. The housing shall be yellow in color. two equally spaced mounting lugs shall be internally cast into the top and bottom, permitting it to be hinged from either direction. the housing shall have a 72 tooth serrated bushing for use with standard signal hardware. each base shall have reinforcing ribs projecting the load bearing stress to the mounting point.

(3) The door shall be cast from aluminum alloy. The door shall be polycarbonate black.

(4) The visor shall be a one piece injection molded from ultraviolet stabilized, flame retardant, permanently colored, black polycarbonate.

(5) The pedestrian signal head shall be capable of displaying, brightly and uniformly, the alternate message symbol full "hand" in portland orange and the full "person" in white while being subject to strong ambient light conditions; the message shall "blankout" when not energized.

(6) The hand and person shall be nine (9) inches high.

(7) The overall dimensions of the signal head shall be approximately 18-inches wide, 19-inches high, and 9-inches deep, including hinges, and all components shall be readily accessible from the front.

(8) The countdown timer shall countdown the don't walk phase only; the walk phase countdown timer (if present) shall be disabled at the factory.

(9) The light source for each indication of the pedestrian head shall be a light emitting diode array meeting etl certification. the light output shall be comparable to that of a standard pedestrian signal illuminated by a 90-watt incandescent lamp. The module shall operate over a voltage range of 89 to 135 volts AC and consume less than 12 watts of power. the module shall have an operating temperature range of at least -34° C to +74° C.

(10) The manufacture shall warrant the pedestrian assembly against defects in workmanship and material for a period of 15 years. the manufacture shall warrant the pedestrian signal assembly (except the led lamps) against defects in material and workmanship for a period of 5 years. all warranties shall be assigned to the City of Topeka.

D. LED Signal Lamps:

(1) The red, green and yellow indication lamps shall almost perfectly approximate, to the motorist, the appearance of an incandescent Traffic Signal.

(2) The lens shall be made of UV stabilized plastic. The rear cover shall be of non-flammable material, and the entire unit shall be totally sealed to preclude the entrance of water, dust or other contaminants.

(3) The self-contained, regulated power supply shall allow the unit to operate over an input voltage range between 89 and 135 volts AC, and shall be configured in

at east 3 parallel circuits for reliability. Light output shall be comparable to that provided by a standard, 12 inch Traffic Signal lens illuminated by a 150 watt incandescent lamp. The red wave length shall be 630 to 660 NM.

(4) The manufacturer shall warrant the unit against defects in workmanship and materials for a period of at least 15 years after the date of shipment. This warranty shall be assigned to the City of Topeka.

E. Programmed Visibility Traffic Signal Heads:

(1) General - programmed visibility traffic signal heads and the installation thereof shall conform to the provisions above, except the provisions on optical units and visors shall not apply. the programmed visibility traffic signal heads shall be constructed of die cast aluminum.

(2) Visibility - the visibility of the signal indication shall be adjustable within the signal head to fit the lane or lanes in which traffic is to be controlled. During daylight, the signal indications shall be visible only in those areas or lanes designated. During dusk or darkness, a faint glow visible to the side will be permissible. External illumination shall not cause a signal indication, nor shall a signal indication in one signal section cause a signal indication in another signal section. Each section of a signal face shall provide a nominal 12 diameter round indication or arrow indication meeting the Institute of Transportation Engineers' dimensions as required.

(3) Visor - each section shall be provided with a sheet aluminum Sun visor.

(4) Programming - the indication of each signal head, when not programmed, shall be visible from anywhere within 15 degrees of the optical axis. The signal head shall be able to be preset at angles between 10 degrees above and 10 degrees below the horizontal, and shall be preset at 4 degrees (post top) or 8 degrees (overhead) below the horizontal.

(5) Color Scheme - programmed signal heads shall have the stated color scheme.

(6) Candle Power - the signal section with the yellow indication, prior to programming, when directed downward 5 degrees from the horizontal, shall provide a minimum candlepower of 2500 candelas in the direction of the axis and a maximum candlepower of 100 candelas at 15 degrees horizontally in each direction from the axis. The signal head with yellow indication shall be programmed so that a minimum candle power of 2500 candelas can be directed along the optical axis and a candle power of less than 100 candelas directed at 1/2 degree horizontal from the axis and no measurable light is directed from 1 to 15 degrees horizontal from the axis. Under the same conditions, the candle power of the red indication shall be at least 19 percent of the yellow indication, and the candle power of the green indication shall be at least 38 percent of the yellow indication.

(7) Lamps - all traffic signal lamps shall meet the requirements of the latest edition of the equipment and materials standards of the Institute of Transportation Engineers (ITE) - traffic signal lamps. A nominal 130 watt, 120 volt, A21 clear traffic signal lamp shall be used in all 12 inch vehicle traffic signal indications.

(8) Dimming Devices - dimming devices shall be provided to gradually reduce the candle power as a function of the individual background illumination of each signal head for nighttime operation to approximately 15 percent of that for daytime operation.

V. Traffic Signal Poles, Pedestals and Conduits:

A. General:

(1) Load - all traffic signal poles shall conform to the 2013 Edition of the American Association of State Highway and Transportation Officials' "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" Handbook and all interims. The poles shall also accommodate wind loads which may cause deflections of the Mast Arm in the vertical. These deflections shall not be such that there is less than 15 feet clearance between the roadway and the lowest point of the signal assembly.

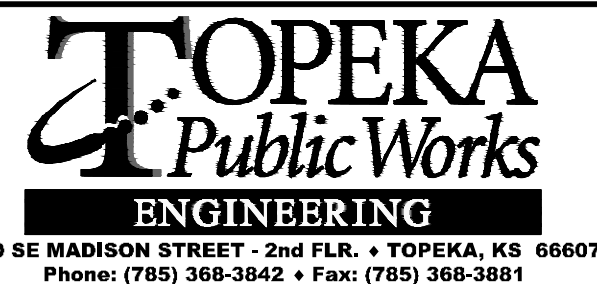
(2) Shop Drawings - all traffic signal poles shall be detailed on Shop Drawings by the manufacturer indicating pole and arm dimensions and attachment method along with signal weight, projected areas and type of mounting that is designed to accommodate. All new traffic signal poles or poles not previously approved will require submission of design calculations along with the Shop Drawings. Shop drawings and all design calculations shall be submitted to the Traffic Engineer for review and approval.

(3) Shaft - the shaft shall include high strength anchor bolts, washers and nuts, conforming to section 1615 of KDOT Standard Specifications. Also to be included are cover leaves, a hand-hole and cover, cast pole top, a J-hook, wire support and a suitable device for attaching the mast arm to the shaft. The shaft shall include 1 inch rubber grommets at all outlets for signal wiring. The Contractor shall provide type "B" certification for anchor bolts, in accordance to Section 2601 of KDOT Standard Specifications.

3	10/30/20	Major Revisions	SU	KRE	
2	01/22/18	Add Warranty Note under Sec. III - C	DHS	TLC	
1	9/1/17	Updated Standard	DHS	TLC	
NO.	DATE:	REVISION	BY:	APP'D	

EDITED BY: Shoeb Uddin

APP'D BY: Kristi Erickson



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**STANDARD DETAILS
DT - 109**

**TRAFFIC SIGNAL
SPECIFICATIONS**

DATE: _____

SHEET: _____

PROJ.: _____