

**TEXAS DEPARTMENT OF TRANSPORTATION
SPECIAL SPECIFICATIONS
TO-7057-ITE
12 INCH (300 MM) LED TRAFFIC SIGNAL LAMP UNIT**

1.0 SCOPE

1.1 This specification describes the minimum acceptable design and performance requirements for 12 inch (300 mm) light emitting diode (LED) circular and arrow traffic signal lamp units for span wire and mast arm applications.

2.0 12 INCH (300 MM) LED TRAFFIC SIGNAL LAMP UNIT

2.1 General

- 2.1.1 All LED traffic signal lamp units shall conform to the latest versions of the Institute of Transportation Engineers (I.T.E.) Vehicle Traffic Control Signal Heads (VTCSHs) LED Vehicle Arrow Traffic Signal Supplement standard, the I.T.E. VTCSHs LED Circular Signal Supplement standard, and this specification. In the case of conflicts between standards and specifications, the latest Texas Department of Transportation (TxDOT) specifications shall govern.
- 2.1.2 The LED traffic signal lamp unit shall be designed as a retrofit replacement for existing signal lamps which will not require any special tools for installation. The 12 inch (300 mm) retrofit replacement LED traffic signal lamp unit shall fit into existing traffic signal housings without modifications.
- 2.1.3 Installation of a retrofit replacement LED traffic signal lamp unit into existing signal housing shall only require removal of the existing lens, reflector, and incandescent lamp, fitting of the new unit securely in the housing door, and connecting to existing electrical wiring or terminal block by means of simple connectors.
- 2.1.4 If proper orientation of the LED traffic signal lamp unit is required for optimum performance, prominent and permanent directional marking(s), that is an "UP arrow" or equivalent, for correct indexing and orientation shall exist on the unit.
- 2.1.5 The manufacturer's name, serial number, manufactured date (minimum week and year) and other necessary identification shall be permanently marked on the backside of the LED traffic signal lamp unit. A label shall be placed on the unit certifying compliance to the latest I.T.E. VTCSHs LED Vehicle Arrow Traffic Signal Supplement or latest I.T.E. VTCSHs LED Circular Signal Supplement standards, including standard title and date.
- 2.1.6 Any deviation to product design after testing and approval from TxDOT shall constitute a new model and must have a new model number. The new model must be submitted for acceptance. Failure to adhere to this requirement shall be grounds for automatic removal from the TxDOT PreQualified Products List (QPL) until an alternative solution has been approved by TxDOT. Random testing of average production LED traffic signal lamp units will be conducted to ensure compliance with this specification.

2.2 Physical and Mechanical Requirements

- 2.2.1 The LED traffic signal lamp unit shall be a single, self-contained device, not requiring on-site assembly for installation into existing traffic signal housing.
- 2.2.2 The assembly and manufacturing process for the LED traffic signal lamp unit shall be such as to ensure all internal LEDs and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.
- 2.2.3 Each LED traffic signal lamp unit shall be comprised of a UV stabilized polymeric outer shell, multiple LED light sources, and a regulated power supply. LEDs are to be mounted on a polycarbonate positioning plate or PC board.

2.3 Optical and Light Output Requirements

- 2.3.1 The LEDs shall be manufactured using Aluminum-Indium-Gallium-Phosphide (AlInGaP) technology or other LEDs with lower susceptibility to temperature degradation than Aluminum-Gallium-Arsenic (AlGaS). AlGaS LEDs will not be allowed.
- 2.3.2 Designs which require LEDs to be operated at currents greater than the LED manufacturer's recommended drive current will not be allowed.
- 2.3.3 The color of the LED traffic signal lamp units shall be specified in the solicitation.
- 2.3.4 Each LED traffic signal lamp unit shall meet minimum laboratory light intensity values and light output distribution as described in I.T.E. VTCSHs LED Supplements for a minimum period of 60 months, based on normal use in traffic signal operation over an operating temperature range of -40°F (-40°C) to +165°F (+74°C).
- 2.3.5 Measured chromaticity coordinates of LED traffic signal lamp units shall conform to the chromaticity requirements detailed in Section 4.3 Chromaticity of the I.T.E. VTCSHs LED Circular Signal Supplement or Section 4.3 Chromaticity of the I.T.E. VTCSHs LED Vehicle Arrow Traffic Signal Supplement for circular or arrow indications respectively for a minimum period of 60 months.
- 2.3.6 LED traffic signal lamp units tested or submitted for testing shall be representative of typical production units. Optical testing shall be performed with LED units mounted in standard traffic signal sections without visors or hoods attached to the signal sections.
- 2.3.7 A copy of the lab test report from an independent lab for each LED traffic signal lamp model shall include light intensity values at each ITE specific distribution test point (balls supplement table 1 or 2, for arrow supplement table 1 or 2). The lab report shall document current, voltage, total harmonic distortion (THD) for each test point. The power factor (PF) associated with each model shall be documented.

2.4 Electrical

- 2.4.1 Each LED traffic signal lamp unit shall incorporate a regulated power supply engineered to electrically protect the LEDs and maintain a safe and reliable operation. The power supply shall provide capacitor filtered DC regulated current to the LEDs per the LED manufacturer specification. Design of the power supply shall be such that the failure of an individual component or any combination of components cannot cause the signal to be illuminated after AC power is removed.

- 2.4.2 LED traffic signal lamp units shall be operationally compatible with TS1, TS2 cabinet designs, and 170 cabinet designs. Under normal operating conditions, the LED lamp unit shall operate without inhibiting any Conflict Monitor/MMU monitoring features.
- 2.4.3 LED lamp units with the incandescent look and meeting the criteria of this specification will be eligible for bid.
- 2.4.4 Circular and arrow LED traffic signal lamp units shall be designed to sense a loss of light output due to catastrophic LED failure and react in compliance with the failed state impedance provision of the I.T.E. VTCSHs Circular Signal Supplement (Section 5.7).
- 2.4.5 Two, captive, color coded, 600V, 18 AWG minimum jacketed wires, 3 feet (1 m) long, conforming to the National Electric Code, rated for service at 221°F (105°C), are to be provided for an electrical connection.
- 2.4.6 The LED traffic signal lamp units shall have on-board circuitry including voltage surge protection, to withstand high-repetition noise transients and low-repetition high-energy transients as stated in Section 2.1.8, NEMA Standard TS 2-2003, except voltage shall be 2000V instead of 1000V The circuitry shall also be able to withstand high-repetition low-energy transients as stated in Section 2.1.6, NEMA Standard TS 2-2003.

2.5 Environmental Requirements

- 2.5.1 Environmental requirements shall meet or exceed I.T.E. VTCSHs LED Standard Supplements.
- 2.5.2 The LED traffic signal lamp units shall be rated for use in the ambient operating temperature range of 40°F (-40°C) to +165°F (+74°C).
- 2.5.3 The LED traffic signal lamp units shall be dust and moisture tight to protect all internal LED and electrical components.
- 2.5.4 The LED traffic signal lamp units shall consist of a housing that is a sealed watertight enclosure that eliminates dirt contamination and allows for safe handling and operation in all weather conditions. Moisture resistance testing shall be performed on LED signal modules in conformance with the requirements in the I.T.E. VTCSHs LED Standard Supplements. Evidence of internal moisture after testing shall be cause for rejection.

2.6 Production Testing Requirements

- 2.6.1 A quality assurance (QA) program must be in place at the manufacturer's facility to ensure product reliability. All lamps shall be certified in a LED Traffic Signal Module Certification Program by Intertek ETL or a Third-Party Lab with "Nationally Recognized Testing Laboratory (NRTL)" status.
- 2.6.2 All lamps manufactured shall be affixed with an Intertek ETL Verified label or from a Third-Party NRTL to demonstrate compliance to Section 6.3 (Production Tests & Inspections), latest revision of I.T.E. VTCSH Full Ball Specification for LED Ball modules and latest revision of I.T.E. VTCSH Arrow Specification for LED Arrow modules.

3.0 DOCUMENTATION REQUIREMENTS

- 3.1 Each LED traffic signal lamp unit shall be provided with the following documentation:
- A. Complete and accurate installation wiring guide.
 - B. Contact name, address, telephone number and email address or webpage for the representative, manufacturer, or distributor for warranty repair.
 - C. If requested by the purchaser, the respondents shall supply schematics for all electronics.
- 3.2 Respondents shall be required to submit a copy of a test report, certified by an independent laboratory, stating that the LED traffic signal lamp model submitted meets or exceeds the latest I.T.E. VTCSHs LED Supplemental Standards. The laboratory report shall include documentation of tests and verification of compliance to the additional provisions of this standard. Tests performed by the independent lab shall follow all the instructions documented in the latest I.T.E. VTCSHs circular signal supplement or latest I.T.E. VTCSHs arrow supplement as it pertains to the product being tested. Criteria in Section 2.3.7 above shall be documented in the test report.
- 3.3 Proof of "Nationally Recognized Testing Laboratory (NRTL)" status, as required in Section 2.6.1, must be documented and submitted with each model of LED traffic signal lamp unit. TxDOT shall be notified in writing prior to changing testing labs.
- 3.4 Manufacturers shall be International Organization for Standardization (ISO) 9000 certified or latest revision.
- 3.5 Compliance letter specified in Section 4.2, Warranty.
- 3.6 Certification document specified in Section 4.7, Warranty.

4.0 WARRANTY

- 4.1 Manufacturer must comply with all requirements of the following warranty. Failure to comply with the requirements of this warranty is cause for the manufacturer/supplier to be removed from the QPL.
- 4.2 The manufacturer/supplier shall submit a letter of compliance indicating understanding and willingness to abide by the provisions of this specification. The manufacturer/supplier shall provide name and telephone number of the person to contact regarding potential claims under the provisions of this warranty. The compliance letter shall be addressed to:
- Texas Department of Transportation
Attn: TRF-TM Signal & Radio Operations Branch Manager
125 E. 11th Street
Austin, Texas 78701-2483
- 4.3 The LED traffic signal lamp units shall be warranted against any failure due to design, workmanship, material defects or intensity within the first 60 months of field operation. LED traffic signal lamp units shall meet or exceed minimum requirements of this specification for a period of no less than 60 months of field operation.
- 4.4 Repair or full replacement will be required if a LED traffic signal lamp unit fails to operate as specified under normal operating conditions. Repaired or replaced LED traffic signal lamp units will be provided at no cost to TxDOT. The replaced or repaired LED traffic signal lamp units will inherit the remainder of the failed LED traffic signal lamp unit's warranty.

- 4.5 LED traffic signal lamp units shall be repaired or replaced within 5 business days after receipt of failed LED traffic signal lamp units at no cost to TxDOT, except the cost of shipping the failed LED traffic signal lamp units to the responsible vendor. The cost of shipping the LED traffic signal lamp units back to TxDOT will be borne by the vendor or manufacturer.
- 4.6 If a LED traffic signal lamp unit fails with no visible damage to electronic/electrical components, (not including fuses or components designed to act as a fuse) or wiring, then the LED traffic signal unit is considered to have failed under normal operating conditions; A blown fuse, or a component acting as a fuse, without any other permanent failure to electrical/electronic components shall be considered to have failed under normal operating conditions. Acts-of-god will not be accepted as excusable unit failures without visible damage.
- 4.7 The manufacturer/provider shall submit a certification document with each lot or shipment stating that the LED traffic signal lamp units provided meets all the requirements of this specification. The certification document shall show individual lot numbers and manufacturer dates.

5.0 QUALITY ASSURANCE

- 5.1 TxDOT may perform random sample testing on shipments. Random sample testing will be completed within 30 days after delivery.
- 5.2 Optical testing shall be performed with the module mounted in a standard traffic signal section, but without a visor or hood attached to the section or housing. The number of modules tested shall be determined by the quantity of each model in the shipment. The sample size shall conform to ANSI/ASQC Z1.4. TxDOT Traffic Operations Division, Traffic Signals Branch shall determine the sampling parameters to be used for the random sample testing. All parameters of the specification may be tested on the modules. Acceptance or rejection of the shipment shall conform to ANSI/ASQC Z1.4 for random sampled shipments.
- 5.3 TxDOT reserves the right to select a sample from the field during the warranty period and perform tests to determine extended compliance and/or deterioration of the LED traffic signal lamp units.

6.0 QUALIFICATION TESTING

- 6.1 TxDOT Traffic Operations Division, Traffic Signals Branch maintains a TxDOT PreQualified Products List (QPL) for LED traffic signal lamp units meeting or exceeding this standard. LED traffic signal lamp units found on this list have been deemed acceptable for purchase by TxDOT.
- 6.2 If a problem is found to exist with a LED traffic signal lamp unit (i.e. unsafe failure condition or excessive failure rate) on this list, it will be immediately removed from the QPL. If there are excessive complaints about a manufacturer's compliance to warranty (Section 4.0), they will be immediately removed from the QPL.
- 6.3 It shall be grounds for automatic removal from the TxDOT QPL if any manufacturer deviates LED traffic signal lamp units from approved LED traffic signal lamp units without prior testing and approval from TxDOT.
- 6.4 TxDOT reserves the right to select a sample from the field during the warranty period and perform evaluation tests to determine extended compliance and/or deterioration of the LED traffic signal lamp unit. Any model that shows deterioration of unit causing the unit to no longer pass the evaluation tests during the warranty period shall be automatically removed from the TxDOT QPL, and the submitting party may be held legally responsible for all damages.

- 6.5 If a manufacturer determines there is a reason to remove a model from the QPL, they must submit a letter to TxDOT Traffic Operations Division, Traffic Signals Branch identifying the problem in writing and the model will be removed without prejudice. Once the problem has been resolved to TxDOT Traffic Operations Division, Traffic Signals Branch's satisfaction, a new model may be applied for re-qualification.
- 6.6 TxDOT Traffic Operations Division, Traffic Signals Branch shall return the submitting party a letter of confirmation or rejection for each model submitted. For each rejected model, a test report will be issued along with the letter of rejection.
- 6.7 If a model is removed from the QPL for cause other than previously stated, the manufacturer may not resubmit for approval for a minimum of one year.

7.0 PROCEDURES FOR PREQUALIFICATION

- 7.1 Contact TxDOT Traffic Operations Division, Traffic Signals Branch for shipping instructions and testing procedures at (512) 506-5100.
- 7.2 The manufacturer shall submit a copy of their ISO 9000 certification, or latest revision, including date.
- 7.3 Submit a copy of the manufacturer's quality assurance (QA) testing procedures.
- 7.4 Submit a letter from the manufacturer confirming compliance to this specification.
- 7.5 Submit the manufacturer's written warranty against defects in materials, design and workmanship for LED traffic signal lamp units for a period of 60 months after installation.
- 7.6 Submit independent laboratory reports confirming each LED traffic signal lamp unit model's compliance with this specification including the Documentation section of this specification.
- 7.7 Submit testing procedures explaining compliance to this specification, in addition to the I.T.E. tests.
- 7.8 Submit a completed checklist detailing the page and paragraph in the laboratory report where I.T.E. and TxDOT compliance has been tested.
- 7.9 Submit 2 samples of each color indication and type (samples are non-returnable) from a normal production run of each LED traffic signal lamp unit model requesting acceptance to TxDOT Traffic Management Signals branch for evaluation.
- 7.10 Submit one schematic diagram for each LED traffic signal lamp unit model being evaluated, along with any necessary installation instructions.
- 7.11 For each LED traffic signal lamp unit model submitted, the manufacturer name and contact information, brand and model number of LEDs used shall be provided, along with the LED manufacturer's recommended drive current and degradation curves.
- 7.12 All samples submitted will be connected to a TxDOT TS-2 Traffic Signal Control Cabinet and environmentally tested to NEMA TS-2 2003 standards. All LED's shall be operational at the conclusion of the test and shall not cause MMU trip conditions in the controller/cabinet during testing.

- 7.13 During the environmental testing, the samples may be evaluated for chromaticity and intensity after 8 hours of soaking at the extreme temperatures of 40°F (-40°C) and +165°F (+74°C), at low (80V AC) and high (135V AC) voltages.
- 7.14 Destructive testing will be conducted to determine that the units are in conformance with the catastrophic LED failure clause.
- 7.15 TxDOT reserves the right to charge \$250 per unit for each recurring non-compliant submittal.
- 7.16 A model may be reinstated on the QPL under a different model number provided that all problem(s) identified have been corrected and the new model no longer exhibits the same. TxDOT Traffic Operations Division, Traffic Signals Branch must approve of the new model as a successful replacement.