

ITEM 689

TWELVE-INCH LED TRAFFIC SIGNAL LAMP UNIT

- 689.1 Description. This Specification describes the minimum acceptable design and performance requirements for a 12 in. (300 mm) light emitting diode (LED) traffic signal lamp unit for use in various Traffic Signal Head Assemblies.
- 689.2 Units of Measurements. The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.
- 689.3 Material Producer List. The Harris County Public Infrastructure Department maintains the Material Producer List (MPL) of all materials conforming to the requirements of this Specification. Materials appearing on the MPL, need no further sampling or testing unless deemed necessary by the Department.
- 689.4 Bidders' and Suppliers' Requirements. The Department will purchase or allow on projects only those products listed by manufacturer and product code or designation shown on the MPL.
- Use of pre-qualified product does not relieve the Bidder of the responsibility to provide product that meets this Specification. The Department may inspect or test material at any time and reject any material that does not meet the specifications.
- 689.5 Pre-Qualification Procedure.
- A. Pre-Qualification Request. Prospective producers interested in submitting their product for evaluation must submit a written request to:
- Harris County PID
6922 Katy Road, Houston, TX 77024
Attn: Traffic Signal Maintenance
- B. Pre-Qualification Samples. Ship two samples of each color indication and type from a normal production run of each LED traffic signal lamp unit model requesting acceptance to:
- Harris County PID
6922 Katy Road, Houston, TX 77024
Attn: Traffic Signal Maintenance

Provide additional samples when directed by the Department.

All products submitted for pre-qualification tests must be at no cost to the Department.

Provide the following with pre-qualification samples:

- Manufacturer name and contact information
 - Brand and model number of LED traffic signal lamp unit
 - LED Manufacturer's recommended drive current and degradation curves
 - One schematic diagram for each LED traffic signal lamp unit model being evaluated, along with any necessary installation instructions
 - Copy of the manufacturer's International Organization for Standardization ISO 9000 certification, or latest revision, (including date)
 - Copy of the manufacturer's quality assurance (QA) testing procedures
 - Letter from the manufacturer confirming compliance to this Specification
 - Testing procedures explaining compliance to this Specification, in addition to the I.T.E. tests
 - Letter confirming participation in a third party traffic signal certification program conducted by an independent Nationally Recognized Testing Laboratory (NRTL); including reports confirming each LED traffic signal lamp unit model's compliance with this Specification, including Section 689.7 as well as the latest pertinent I.T.E standards.
 - Completed checklist detailing the page and paragraph in the laboratory report where I.T.E. and Department compliance has been tested
 - 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
- C. Sampling and Testing. The Department will connect all samples submitted to the Department's ITS Traffic Signal Control Cabinet and will test to I.T.E. Vehicle Traffic Control Signal Heads (VTCSH) environmental standards. All LED units must be operational at the conclusion of the test and must not cause Conflict Monitor (MMU/CMU) trip conditions in the controller/cabinet during testing.

During the environmental testing, the Department may evaluate the samples for chromaticity and intensity after 8 hours of soaking at -40°F (-40°C) and 165°F (74°C), at low (80 VAC) and high (135 VAC) voltages.

The Department will conduct destructive testing to determine that the units are in conformance with the catastrophic LED failure clause.

- D. Evaluation. The Department will return to the submitting party a letter of

confirmation or rejection for each model submitted. For each rejected model, TSM will issue a test report along with the letter of rejection.

1. Qualification. If approved for use by the Department, the product will be included in the MPL.

Any deviation in product design after testing and approval from the Department constitutes a new model which must be resubmitted for acceptance.

If a manufacturer determines there is reason to remove a model from the MPL, they must submit a letter to the Department identifying the problem in writing. The Department will remove the model without prejudice. Once the problem has been resolved to the Department's satisfaction, the manufacturer may apply for re-qualification for the new model.

All submitted materials become the property of the Department.

2. Failure. Products not qualified under this Specification may not be furnished on Department projects and must be corrected of all deficiencies before reconsideration for qualification.

If products fail to meet any of the specification requirements, the producer may not resubmit for pre-qualification until one year from original evaluation date. The Department may waive this time limit if provided with documentation from an independent testing facility stating the product meets all requirements. The Department will enforce the one year time limit if, after retesting, the product again fails any of the specification requirements.

Costs of sampling and testing are normally borne by the Department; however, the costs of sampling and testing products failing to conform to the requirements of this Specification are borne by the contractor or supplier. This cost will be assessed at the rate established by the Director of the Department and in effect at the time of testing for each recurring non-compliant submittal.

Amounts due to the Department will be deducted from monthly or final estimates on contracts or from partial or final payments on direct purchases by the Department.

- E. Disqualification. The following conditions are cause for immediate removal from the MPL:
 - A problem is found to exist with a LED traffic signal lamp unit (e.g. unsafe failure condition or excessive failure rate)
 - Excessive complaints about a manufacturer's compliance to Section 689.8

- Manufacturer deviates LED traffic signal lamp units from pre-qualified units without prior testing and approval from the Department

If the Department removes a model from the MPL for cause other than manufacturer's recommendation, the manufacturer may not resubmit for approval for a minimum of one year.

The Department may reinstate a model on the MPL under a different model number, if all problems identified have been corrected, and the new model no longer exhibits the same. The Department must approve of the new model as a successful replacement.

- F. Periodic Evaluation. The Department may perform random sample testing on shipments, to be completed within 30 days after delivery.

The Department will perform optical testing with the module mounted in a standard traffic signal section, but without a visor or hood attached to the section or housing. The quantity of each model in the shipment will determine the number of modules tested. The sample size will conform to ANSI/ASQC Z1.4. The Department will determine the sampling parameters used for the random sample testing. All parameters of the specification may be tested on the modules. Acceptance or rejection of the shipment will conform to ANSI/ASQC Z1.4 for randomly sampled shipments.

689.6. Material Requirements.

- A. General Requirements. All LED traffic signal lamp units must conform to the latest versions of the Institute of Transportation Engineers (I.T.E.) *Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Supplement* standard, the I.T.E. *Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Circular Signal Supplement* standard, and this Specification. In the case of conflicts between standards and specifications, the latest Department specifications will govern.

The LED traffic signal lamp unit must be designed as a retrofit replacement for existing signal lamps and will not require any special tools for installation. The 12 in. retrofit replacement LED traffic signal lamp unit must fit into existing traffic signal housings without modifications.

Installation of a retrofit replacement LED traffic signal lamp unit into existing signal housing must 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.

For proper orientation of the LED traffic signal circular lamp unit prominent and permanent directional marking(s), i.e. an "UP arrow" or equivalent, for correct indexing and orientation must exist on the unit.

LED traffic signal arrow lamp units when required shall be omnidirectional only with permanent markings, i.e. "Suitable for mounting in any direction" or equivalent.

Each LED traffic signal lamp unit shall have the manufacturer's name, trademark, model number, serial number, lot number, month and year of manufacture, and required operating characteristics, including rated voltage, power consumption, and volt-ampere, permanently marked on the back of the module. Serial Number schemes that clearly identify the date of manufacture will be considered.

Each LED traffic signal lamp unit shall have a symbol indicating module type and color. Symbol must be an inch in diameter. Color must be written out in 0.50 inch high letters next to the symbol.

Each LED traffic signal lamp unit shall have a label certifying compliance to the latest *I.T.E. Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Supplement* or latest *I.T.E. Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Circular Signal Supplement* standards, including standard title and date.

Each LED traffic signal lamp unit shall have a label from a Nationally Recognized Testing Laboratory (NRTL) indicating participation in a third party traffic signal certification program which provides ongoing verification of production to pertinent standards.

Any deviation to product design after testing and approval from the Department will 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 will be grounds for automatic removal from the MPL until the Department approves an alternative solution. Random testing of average production LED traffic signal lamp units will be conducted to ensure compliance with this Specification.

- B. Physical and Mechanical Requirements. The LED traffic signal lamp unit must be a single, self-contained device, not requiring on-site assembly for installation into existing traffic signal housing.

The assembly and manufacturing process for the LED traffic signal lamp unit must ensure that all internal LEDs and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.

Each LED traffic signal lamp unit must be comprised of a UV stabilized polymeric outer shell, multiple LED light sources, and a regulated power supply. LEDs must be mounted on a printed circuit board/heat sink assembly.

- C. Optical and Light Output Requirements. The LEDs must be manufactured

using AlInGaP (Aluminum-Indium-Gallium-Phosphide) technology and/or InGaN (Indium-Gallium-Nitride) LEDs. The AlGaAs (Aluminum-Gallium-Arsenic) LEDs will not be allowed.

Designs that require the LEDs to be operated at currents greater than the LED manufacturer's published recommended drive current will not be allowed.

Each LED traffic signal lamp unit must meet minimum laboratory light intensity values and light output distribution as described in I.T.E. *Vehicle Traffic Control Signal Heads (VTCSH) - 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).

Measured chromaticity coordinates of LED traffic signal lamp units must conform to the chromaticity requirements detailed in the I.T.E. *VTCSH LED Circular Signal Supplement*, Section 4.2: Chromaticity, or in the I.T.E. *VTCSH LED Vehicle Arrow Traffic Signal Supplement*, Section 4.2: Chromaticity, for circular or arrow indications respectfully for a minimum period of 60 months.

Only LED lamp units with an incandescent appearance and meeting the criteria of this specification will be eligible for bid.

LED traffic signal lamp units tested or submitted for testing must be representative of typical production units. Perform optical testing with LED units mounted in standard traffic signal sections without visors or hoods attached to the signal sections.

A copy of the lab test report from an NRTL for each LED traffic signal lamp model must include light intensity values at each I.T.E. specific distribution test point (balls supplement Table 1 or 2, for arrow supplement Table 4). The lab report must document current, voltage, and total harmonic distortion (THD) for each test point. The power factor (PF) associated with each model must be documented.

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

LED traffic signal lamp units must be operationally compatible with TS1, TS2 cabinet designs, 170 cabinet designs and ITS cabinet designs (comply with TEES Chapters 3 and 6). Under normal operating

conditions, the LED lamp unit must operate without inhibiting any Conflict Monitor (MMU/CMU) monitoring features.

If a 20 mA alternating current or less is applied to the unit, the voltage read across the 2 leads must be 15 VAC or less.

Arrow and circular LED traffic signal lamp units must 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. *VTCSH Circular Signal Supplement*, Section 5.7. LED Arrow indications must trip the Conflict Monitor (MMU/CMU) after no more than 15% to 25% LED loss occurs. The LED unit must always be recognizable as an arrow indication for any loss less than this trip condition.

Two, captive, color coded, 600 V, 18 AWG minimum jacketed wires, 3 feet or 1 meter long, conforming to the National Electric Code, rated for service at 22°F (105°C), are to be provided for an electrical connection.

The LED traffic signal lamp units must have on-board circuitry including voltage surge protection, to withstand high-repetition noise transients and low-repetition high-energy transients as stated in NEMA Standard TS 2-2003, Section 2.1.8, except voltage must be 2000 V instead of 1000 V. The circuitry must also be able to withstand high-repetition low-energy transients as stated in NEMA Standard TS 2-2003, Section 2.1.6.

- E. Environmental Requirements. Environmental requirements must meet or exceed I.T.E. *VTCSH LED Standard Supplements*.

The LED traffic signal lamp units must be rated for use in the ambient operating temperature range of -40°F (-40°C) to 165°F (74°C).

The LED traffic signal lamp units must be dust and moisture tight to protect all internal LED and electrical components.

The LED traffic signal lamp units must consist of a housing that is a sealed, watertight enclosure to eliminate dirt contamination and allow for safe handling in all weather conditions. Perform moisture resistance testing on LED signal modules in conformance with the requirements in the I.T.E. *VTCSH LED Standard Supplements*. Evidence of internal moisture after testing will be cause for rejection.

- F. Production Testing Requirements. A quality assurance (QA) program must be in place at the manufacturer's facility to ensure product reliability.

Each new LED traffic signal lamp unit must be energized at the manufacturer's facility for a minimum of 24 hours at nominal operating voltage (120 VAC RMS) at room temperature in order to ensure electronic component reliability prior to shipment.

- 689.7. Documentation Requirements. Provide each LED traffic signal lamp unit with, as a minimum, the following documentation:
- Complete and accurate installation wiring guide
 - Contact name, address, telephone number and email address or webpage for the representative, manufacturer, or distributor for warranty repair
 - If requested by the purchaser, the bidders must supply schematics for all electronics
 - LED Manufacturer's recommended drive current and degradation curves
 - Compliance letter specified in Section 689.8
 - Certification document specified in Section 689.8
 - List containing all LED signal module serial numbers anticipated for use
 - Bidders must submit a copy of a test report, certified by an NRTL, stating that the LED traffic signal lamp model submitted meets or exceeds the latest I.T.E. *VTSCH LED Supplemental Standards*. The NRTL report must include documentation of tests and verification of compliance to the additional provisions of this standard. Tests performed by the independent lab must follow all the instructions documented in the latest I.T.E. *VTCSH* circular signal supplement or latest I.T.E. *VTCSH* arrow supplement as it pertains to the product being tested. The I.T.E. criteria in Section 6 Quality Assurance must be documented in the submitted test report.

Manufacturers must be certified to International Organization for Standardization ISO 9000, or latest revision.

- 689.8 Warranty Requirements. 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 MPL.

The manufacturer/provider must submit a letter of compliance indicating understanding and willingness to abide by the provisions of this Specification. The manufacturer/provider must provide name and telephone number of the person to contact regarding potential claims under the provisions of this warranty. Address the compliance letter to:

Harris County PID

6922 Katy Road, Houston, TX 77024

Attn: Traffic Signal Maintenance

The LED traffic signal lamp units must be warranted against any failure due to design, workmanship, material defects, and loss of intensity for 60 months of field operation. Units must meet or exceed minimum requirements of this Specification for a minimum of 60 months of field operation.

Repair or full replacement will be required if a LED traffic signal lamp unit fails to

operate as specified under normal operating conditions. Provide repaired or replaced units at no cost to the Department. Repaired units will inherit the remainder of the failed unit's warranty. Replaced units will be warranted for 60 months of field operation.

Should a lamp unit fail with no visible damage to electronic/electrical components, (not including fuses or components designed to act as a fuse) or wiring, the 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 will be considered to have failed under normal operating conditions. Natural phenomena (e.g. lightning) are not acceptable as excusable unit failures without visible damage.

Repair or replace LED traffic signal lamp units within 15 business days after receipt of failed LED units. All shipping costs will be borne by the vendor or manufacturer.

The manufacturer/provider must submit a certification document with each lot or shipment stating that the LED lamp units provided meet all the requirements of this Specification.

The certification document must show individual lot numbers and manufacturer dates.

The Department 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 fail the evaluation tests during the warranty period will be automatically removed from the MPL, and the submitting party may be held legally responsible for all damages.

689.9 Measurement and Payment. LED traffic signal lamp units when supplied as part of a traffic signal head assembly, will not be paid for directly, but shall be incidental to assemblies defined by ITEM 690 - Traffic Signal Heads, any pertinent Special Provisions and Standard Drawings (if applicable).

LED traffic signal lamp units when supplied individually shall be paid for by each type and color required.

There are line code(s), description(s), and unit(s) for this item.

END OF ITEM 686