DMS - 11120
VEHICLE SIGNAL HEADS

EFFECTIVE DATE: APRIL 2008

11120.1. Description. This Specification governs for the products, composition, quality, sampling, and testing of traffic control signal heads.

11120.2. 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.

11120.3. Pre-Qualified Producer List. The Traffic Operations Division (TRF), Signal Operations Section maintains the Material Producer List (MPL) of all materials conforming to the requirements of this Specification. Materials appearing on the MPL, entitled "Traffic Signals," need no further sampling or testing unless deemed necessary by the Project Engineer or TRF.

11120.4. 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 contractor 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.

11120.5. Pre-Qualification Procedure.

A. Pre-Qualification Request. Submit a request for evaluation to the Texas Department of Transportation, Traffic Operations Division, Traffic Management Section (TRF-TM), 9500 North Lake Creek Parkway, Austin, Texas 78717.

B. Pre-Qualification Sample. Submit a sample three-section signal head including optical units with the pre-qualification request.

Provide additional samples when directed by the Department.

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

C. Sampling and Testing. TRF-TM tests samples for Specification compliance and updates the MPL to include products that meet specification requirements.

Specific tests are normally indicated in conjunction with specific Specification requirements; however, the Department reserves the right to conduct whatever tests are deemed necessary to identify component materials and verify results of specific tests indicated in conjunction with specification requirements.

D. Evaluation. TRF-TM will notify prospective bidders and suppliers after completion of material evaluation.

1. Qualification. If approved for use by the Department, TRF-TM will add the material to the MPL.

All approved 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 1 year from original evaluation date. TRF may waive this time limit if provided with documentation from an independent testing facility stating the product meets all requirements. TRF will enforce the 1-year time limit if, after retesting, the product again fails any of the specification requirements.

If requested within 6 months of testing, materials that fail the pre-qualification testing will be returned to the submitter at their expense. After 6 months, failed materials become Department property to be disposed of at the Department's discretion.

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. The Director of TRF will assess this cost at the time of testing.

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. Pre-qualified product provided on a project that does not match the pre-qualification sample will result in the removal of that product from the MPL for 1 year at the discretion of the Department.

Any deviation in product design after testing and approval from the Department constitutes a new model, which must be resubmitted for acceptance. Failure to notify the Department of the change and resubmit for approval is grounds for removal from the MPL for an undetermined time.

11120.6. Product Requirements.

A. General Requirements. Traffic control signal heads must be in accordance with the latest *Equipment and Material Standards of the Institute of Transportation Engineers,* Chapter 2, "Vehicle Traffic Control Signal Heads," except as noted herein.

Vehicle Signal Head Housing must be in accordance with all applicable provisions of the latest revision to the *Texas Manual on Uniform Traffic Control Devices*.

The procurement or contract will specify the material type (aluminum or polycarbonate) of the traffic signal heads to be provided.

B. Definitions.

- LED Module—an array of LEDs sealed in its own lens and housing that is capable of providing a traffic signal indication
- Signal Section—the assembly of a signal housing, lens, if any, and light source with necessary components to be used to display one signal indication
- Signal Face—an assembly of one or more signal sections that is provided for controlling traffic movements on one or more approaches
- Signal Head—one or more signal faces that, when illuminated in a defined sequence, indicate to traffic approaching the signal face the right of way at the intersection or give warning of existence of a hazardous condition. When designated as Two-Way, Three-Way, Four-Way, or Five-Way Signal Head, that number of faces are attached to pipe arm supports (e.g., a Three-Way Signal Head requires three signal faces). Unless otherwise specified, the pipe support arms radiate from their point of support at equal angles (i.e., 180°, 120°, 90°, and 72° angles of separation) for two-way, three-way, four-way, and five-way signal heads, respectively
- Signal Visor—the part of the signal section that directs the signal indication specifically to approaching traffic and reduces the effect of direct external light entering the signal lens

C. Physical and Mechanical Requirements. All material must be accurately formed and free of defects affecting strength and appearance.

All materials furnished must be new.

The complete unit must be designed to operate reliably throughout an ambient temperature range of -40°F to 165°F. This range corresponds to the environmental tests required by the National Electrical Manufactures Association Standards Publication TS-2—Traffic Controller Assemblies with NTCIP Requirements. The Department may use the environmental testing required by TS-2 while qualifying signal heads and their components.

Signal head housing components must be either aluminum or polycarbonate, as specified in the procurement or contract.

Join individual signal sections rigidly to form a single “Signal Face.” Hardware used to join signal sections must be stainless steel.

A three-section signal head rigidly supported at one end and extending horizontally must deflect no more than 3 in. in any direction when subjected to a 2-pound load at the opposite end and must deflect no more than 5 in. in any direction when subjected to a 10-pound load at the opposite end.

The applied loads above are in addition to the dead weight of the assembled head without the visors or back plate installed. The deflections above are measured at the point of loading.

All components and mounting attachments must be of adequate strength for the purpose intended.

All signal head components and related mounting hardware must be of corrosion/rust resistant materials capable of withstanding constant exposure to sunlight and corrosive atmospheres, including salt air.

1. **Aluminum.** Cast aluminum parts must have a minimum tensile strength of 17,000 psi.

   Cast aluminum components must be accurately formed and free from pouring faults, sponginess, cracks, blowholes, or other defects affecting their strength and appearance.

   Sheet aluminum parts must have a minimum tensile strength of 27,000 psi.

   Aluminum materials must conform to the requirements listed in Table 1.

Table 1

Referenced Specifications for Aluminum

Type	ASTM	Alloy
Die Castings	B 85	SG100B, SG100A, SC84B, SC84A, S12B, or SC12A
Permanent Mold Castings	B 108	CS72A or S5A
Sheet	B 209	M1A

2. **Polycarbonate.** Polycarbonate material must be ultraviolet-stabilized.

   Polycarbonate components must be of one-piece construction molded construction. Bonding (chemical, thermal, ultrasonic, etc.) of multiple pieces is not allowed.

   Polycarbonate housings must be at least 0.090 inches thick and must be ribbed to produce the strongest possible assembly consistent with light weight.

   Polycarbonate material must meet the physical property requirements listed in Table 2.

Table 2

Requirements & Referenced Specifications for Polycarbonate

Test	Required	ASTM
Specific Gravity	≥ 1.17	D 792
Vicat Softening Point	305-325°F	D 1525
Brittleness Point	< 200°F	D 746
Flammability	Self-Extinguishing	D 635
Tensile Strength (Yield)	≥ 8500 psi	D 638
Elongation at Yield	5.5 to 8.5 %	D 638
Shear Strength (Yield)	≥ 5500 psi	D 732
Izod Impact Strength (notched, 1/8 inch thick)	≥ 15 ft-lb/in	D 256
Fatigue strength, (2.5 mm cycles)	≥ 900 psi	D 671

3. **Hardware.** Except were noted, all bolts, nuts, washers, lock washers, screws, and other assembly hardware must be galvanized steel, stainless steel, or dichromate sealed aluminum.

Table 3

Referenced Specifications for Hardware

Material	Applicable Specification
Stainless Steel	ASTM A 320, Grade B8F Annealed
Galvanized Steel	ASTM A 307, Galvanized to ASTM A 153, Class C or D, or ASTM B 695, Class 50
Aluminum	Alloy 2024-T4, Dichromate sealed finished according to Mil-A-8625A Type II

4. **Gaskets.** All gaskets must be closed-cell neoprene.

D. Housings, Doors, and Visors. Design of door, housing, and visor must be such that there is no light leakage.

Housings, when assembled together with doors and mounting attachments, must comprise a dust and moisture proof housing for LED modules, connecting wiring, and terminal block.

1. **Housings.** The housing must be one piece and must be either die cast aluminum alloy, permanent mold cast aluminum alloy, or molded polycarbonate.

   Housings must be of the sectional adjustable expandable type.

   Portions of cases providing for attachment to supporting arms must be molded with large bosses for the supporting arms.

   Both the top and the bottom of each traffic signal housing case must be provided with an opening of 2 inches in diameter to accommodate 1-1/2 inch pipe brackets.

   Both the top and the bottom of each traffic signal housing case must be provided with four openings of 0.2 inches in diameter to accommodate connection by No. 10 machine screws.

   Unused holes at the ends of assembled signal heads must be sealed with removable nylon plugs to prevent the entry of foreign material (e.g. dust, insects, and moisture) into the housing.

   A minimum of four holes must be provided on the rear of each signal section for mounting a back plate. They must accommodate No. 8 x ½ inch self-threading screws. The holes must not open to the inside of the housing.

   Each signal section must be capable of being rotated 360° about its mounting axis and shall be capable of locking at 5° intervals. Locking must be accomplished by the engagement of serrations in adjacent signal sections and in the mounting bracket assembly.

   Serrations must be integral with the signal section and designed to insure flush alignment of the perimeters of the section.

   Polycarbonate sections must have additional strengthening ribs integral with the mating sides.

Individual units must be manufactured so that all units are interchangeable except for terminal blocks.

The interior housing depth must be a nominal 7 in.

2. **Doors.** Door must be of the same material as the housing.

   Aluminum door must be provided with hinges and lugs for attachment to the main body casting, so spaced as to hold the door in perfect alignment when closed. The door must be securely gasketed to the traffic signal housing with a weatherproof gasket.

   Polycarbonate door must be attached to the housing by means of two stainless steel hinge pins or by polycarbonate hinge pins that are an integrally molded part of the housing door.

   Two thumbscrews must be installed on the side of the door to provide for opening and closing the door without the use of special tools.

   Thumbscrews must have a flat-bearing surface or flat washer to prevent gouging of the housing door by the screws.

   Thumbscrews must remain captive in housing door when the door is open.

   The circular opening in the door for the LED module must have a nominal size of 12 in.

3. **Visors.** Each signal section must be provided with an easily detachable visor.

   Unless stated otherwise in the procurement or contract, the signal face must be aligned horizontally.

   The visor must be attached rigidly to the door in a manner that will prevent the leakage of light and moisture throughout the periphery of attachment. The visor must be attached to the door so that the section is oriented horizontally with the door opening downwards.

   Visor must be standard tunnel type.

   Visor must be of the same material as the housing and door.

   Aluminum alloy visors may be of cast or sheet material with a minimum thickness of 0.050 in.

   Polycarbonate visors must have a minimum thickness of 0.100 in.

   Heads may be shipped with visors detached. If heads are shipped with the visors attached, visors must be easily removed and replaced without damage to visor or signal head.

   The visor on the front of each door must:

   - Be circular in section
   - Have a downward tilt of 2° to 8° relative to the perpendicular plane of the housing door
   - Encompass approximately 300° of the lens
   - Extend outward from the face of the lens a minimum of 9-1/2 in.

- Be of such design that the encircled portion of the lens will not be visible in the profile view of the traffic signal face
- Be open at the bottom so as to prevent the accumulation of snow and dirt

E. Exterior Finish. Unless stated otherwise in the procurement or contract, the color of the completed traffic signals must be Federal Yellow No. 13538 of Federal Standard 595, with the exception of the insides of the visors, which must be painted flat black.

1. **Aluminum.** All exposed metal surfaces except for the inside of the visors of the assembled traffic signal head must be electrostatically applied powder-coat paint or given two separately baked-on coats of high-grade enamel.

   The inside of the visors must be provided with two coats of high-grade flat black finish paint.

2. **Polycarbonate.** The federal yellow colorant must be completely impregnated in the polycarbonate material.

   The inside of the visors must be provided with two coats of high-grade flat black finish paint.

F. Electrical. The signal head must be designed to operate from a 120 volt, single-phase, 60-Hz alternate current power supply.

1. **Terminal Blocks.** Terminal blocks must be double-row and contain a minimum of six sections.

   All terminal blocks must be mounted securely in an accessible position and shall be of weatherproof molded construction.

   The terminal block body must be of one-piece molded construction using phenolic materials.

   The block must consist of permanently identified electrical sections, each section consisting of two 8/32 inch by 5/16 inch binding screws and a conducting metal strip between the screws.

   The block must be rated for a minimum of 20 ampere, 250 volt service and section to section breakdown voltage must be a minimum of 1600 volts AC RMS.

   All metal parts with the exception of screws must be nickel-plated brass.

   Binding screws must be nickel-plated brass or stainless steel.

   a. **Sectional Terminal Block.** The terminal block must either be securely mounted on or integrally molded into the interior of the housing.

   b. **Signal Face Assembly Terminal Block.** Each multiple section signal face assembly must be provided with a double- row, six-section terminal strip in the right or bottom section of the assembly. The section terminals must be wired to this common terminal, ready for field installation. Binding screws for solderless connectors must be provided for the interior wires.

The terminal block must be mounted securely to the housing case in an internally accessible position in the signal section.

2. **Wiring.** Each lead must be brought to a separate terminal in the terminal compartment, except the commons from one housing can all be brought to the same terminal in the terminal compartment.

   The color coding on leads from the individual LED modules must be maintained from the back of LED module to the individual terminals in the signal head terminal compartment, except that the commons from each housing shall be grouped and carried to one terminal. The color-coding must be as listed in Table 4.

Table 4

Wire Color Codes

Indication	Color Code
Red Ball and Red Arrow	RED
Yellow Ball	YELLOW
Green Ball	BROWN
Yellow Arrow	YELLOW with BLUE or WHITE tracer
Green Arrow	BROWN with BLUE or WHITE tracer
Neutral	WHITE

   The wiring must be arranged so that any one optical unit can be individually illuminated through connections to terminals in the terminal compartment.

   Separate terminals must be provided for the interior wires and the field wires. In addition to the interior wires required in Section F.1.b, the contractor or supplier is also required to furnish and install all other leads necessary to connect the terminal block of the multiple section face to the terminal block in the terminal compartment.

   Any variations from the above requirements must be covered in the procurement or contract documents.

G. Mounting Requirements. Complete signal faces must provide positive locked positioning when used with serrated brackets, mast arm, or span wire fittings.

Provision must be made for carrying the signal leads enclosed in the mounting attachment. The mounting attachment, together with supporting arms and assembled housings, must comprise a dust- and moisture-proof enclosure for LED modules and lead wiring.

Each housing case must be attached to its supporting arm so that it will be adjustable by rotation about its mounting axis in such a manner that any pair of adjacent cases may be adjusted individually to give indications in two directions as close as 15° apart and may be rigidly clamped in any position throughout the range of adjustment.

An aesthetically pleasing plug must plug any opening in an assembled signal head.

Mounting attachments must be one of the following types, as specified in the procurement or contract documents: None, Span-Wire, Mast-Arm, Side-of-Pole, or Top-of-Post.

1. **Span-Wire Mounting.** The span-wire mounting attachment must consist of a cable clamp to receive a suspension cable of 3/8 inch diameter together with a suitable connection to the head.

   The mounting must provide a balance adjuster between the signal head and the span wire capable of permitting freedom of movement with reference to the point of suspension.

   The signal head must be adjustable by rotation about its horizontal axis in a vertical plane, and the mounting attachment must be constructed so that the head may be firmly clamped in any position throughout the range of adjustment.

   The mounting must provide a suitable outlet for wiring from the signal head tilted downward and constructed to effectively seal the interior of the head from dust and moisture and prevent undue abrasion of the signal wiring.

   Mounting for signal-head units not balanced at the point of support must be provided with a suitable compensating device to ensure that the signal head will assume a normally horizontal position.

2. **Mast-Arm Mounting.** The mast-arm and signal-head mounting must be as shown in the procurement or contract documents.

3. **Side-of-Pole Mounting.** Supports for side-of-pole mounting of the signal head in a vertical position must be 1-1/2 inch (nominal diameter) standard pipe bracket arms, attached to the top and bottom of the signal head.

   The signal head must be adjustable, by rotation of the various signal faces about their vertical axis, throughout a radial angle of 360° and must be capable of being clamped rigidly in any position throughout the range of adjustment.

   The mounting assembly must consist of two standard pipe sections extending 12-3/4 inches from and at right angles to the axis of rotational adjustment of the signal head.

   Both supports must have running threads at least 1-1/4 inches long at the pole connection end.

   Provision must be made for carrying the wire from the signal head enclosed in the bottom support, and an outlet tilted downward for the wiring must be provided, adjacent to the pole connection end, tapped and plugged for 1-1/4 inch conduit.

   Any variation to this design must be as shown in the procurement or contract documents.

4. **Top-of-Post Mounting.** Supports for top-of-post mounting of the signal head in a vertical position must be 1-1/2 inch (nominal diameter) standard pipe bracket arms attached to the top and the bottom of the signal head.

   The mounting assembly must consist of a slip fitter connection, either as the hub or as part of the hub of the bottom pipe-arm assembly, for attachment around the top of a 4-1/2 inch outside diameter pipe.

Six 3/8-20 stainless steel setscrews in pairs with a 120° spacing must be provided for attaching the slip fitter to the pole.

The signal head assembly must be adjustable, by rotation about its vertical axis in a horizontal plane, throughout a radial angle of 360°, and the mounting attachment must be constructed so that the head may be clamped firmly in any position throughout the range of adjustment.

The slip fitter connection must be of pleasing appearance and of adequate strength, capable of holding the signal head rigidly in place and effectively sealing the interior of the pipe from moisture.

11120.7. Payment.

A. Procurement by the State. Payment for materials under this Specification will be in accordance with the conditions prescribed in the contract awarded by the State.

B. Contracts. Payment for materials governed by this Specification used in contract projects will not be measured or paid for directly, but will be subsidiary to bid items of the Contract.

11120.8. Archived Versions. Archived versions are available.