

SCOPE OF WORK

1. INTENT

The intent of these specifications is to establish a requirements contract for the purchase of Traffic Signal Heads and additional components for the City of Arlington Public Works Department.

This specification governs and describes the minimum acceptable requirements for the materials, composition, quality, sampling, and testing of traffic control signal heads and lenses. Materials shall conform to all Institute of Transportation Engineers (ITE) specifications as related, TxDOT SPECIFICATION TO-7045 VEHICLE SIGNAL HEADS, PREQUALIFIED PRODUCTS LIST (QPL) OF TO-7045 VEHICLE SIGNAL HEADS. Only materials with approved product codes and/or designations from the TO-7045 pre-qualified products list (QPL) will be accepted for bid, if required and stated in the procurement or contract documents.

The Traffic Operations Division (TRF), Signal Operations Section of the Texas Department of Transportation (TxDOT) maintains the QPL. The TO-7045 QPL may be viewed at the following website: <http://www.dot.state.tx.us/gsd/purchasing/supps.htm> or may be reviewed as attachment within bid 21-0144.

2. SAMPLES

The awarded vendor must submit a sample 3-section signal head, including optical units, at time of bid submittal to the Department. Samples must be sent to *Julius White* to the following address:

Traffic Operations - 801 W Main Street Arlington TX, 76010

This is to ensure that the manufacturer has the technical and production capabilities to produce a material conforming to the requirements of this specification. A sample 5-section may be required upon written request.

In lieu of samples, vendors who have supplied 3 or 5 section signal heads to the City of Arlington within the past twelve months shall submit written documented proof of supply to include:

- Who ordered signal heads
- How many signal heads were purchased by the City of Arlington Public Works Department.

Purchases made by third parties on behalf of projects within the City of Arlington will not qualify in lieu of samples.

The City of Arlington reserves the right to accept or reject all or part of documentation provided.

Per spec TxDOT TO-7045, TRF tests samples for specification compliance and updates the QPL to include materials that meet specification requirements. In accordance with TRF, if materials fail to meet any of the specification requirements, the producer may not resubmit for prequalification until one year from original evaluation date. TRF may waive this time limit if provided with documentation from an independent testing facility stating that materials meet all requirements. TRF will enforce the one-year time limit if, after retesting, the material again fails any of the specification requirements.

3. PRODUCT SPECIFICATIONS

Traffic control signal heads shall be in accordance with the latest "Chapter 2: Vehicle Traffic Control Signal Heads" of Equipment and Material Standards of the Institute of Transportation Engineers except as noted herein.

Signal indications shall be in accordance with the latest revision to the Texas Manual on Uniform Traffic Control Devices.

The contract will specify the material type, either aluminum or polycarbonate, of the traffic signal heads to be provided.

The procurement or contract will specify if optical units, LED modules, or neither is to be provided.

- **Signal Section** – the assembly of a signal housing case, housing door, visor, and an optical unit or LED module.
- **Signal Face** – the front part of a signal head.
- **Signal Head** – one or more signal faces that when illuminated in a definite 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.

4. PHYSICAL MECHANICAL REQUIREMENTS

All material shall be accurately formed and free of defects affecting strength and appearance.

All materials furnished shall be new.

The complete unit, including optical unit and LED module, shall be designed to operate reliably throughout an ambient temperature range of -40 degrees F to 165 degrees F. This range corresponds to the environmental tests required by the National Electrical Manufacturers Association Standards Publication TS-2-1998 – Traffic Controller Assemblies with NTCIP Requirements. TxDOT may use the environmental testing required by TS-21998 while qualifying signal heads and their components.

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

Individual signal sections shall be rigidly joined to form a single “Signal Face.” Hardware used to join signal sections shall be stainless steel.

A three-section signal head rigidly supported at one end and extending horizontally shall:

- Deflect no more than 2-1/2 inches in any direction when subjected to a 10 pound load at the opposite end, and
- Deflect no more than 4 inches in any direction when subjected to a 25 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 backplate installed. The deflections above are measured at the point of loading.

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

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

Aluminum:

- Cast aluminum parts shall have a minimum tensile strength of 17,000 psi.
- Cast aluminum components shall be accurately formed and free from pouring faults, sponginess, cracks, blow holes, or other defects affecting their strength and appearance.
- Sheet aluminum parts shall have a minimum tensile strength of 27,000 psi.
- Aluminum materials shall conform to the following:

TYPE	ASTM	ALLOY
Die Cast	B85	SG100B, SG100A, SC84B, SC84A, S12B, or SC12A
Permanent Mold Castings	B108	CS72A or S5A
Sheet	B209	M1A

Polycarbonate:

- Polycarbonate material shall be ultraviolet-stabilized.
- Polycarbonate components shall be of one-piece construction molded construction. Bonding (chemical, thermal, ultrasonic, etc.) of multiple pieces is not allowed.
- Polycarbonate housings shall be at least 0.090 inches thick and shall be ribbed so as to produce the strongest possible assembly consistent with light weight.
- Polycarbonate material shall meet the following physical property requirements:

TEST	REQUIRED	ASTM
Specific Gravity	≥ 1.17	D792
Vicat Softening Point	305 - 325 degrees F	D1525
Brittleness Point	< 200 degrees F	D746
Flammability	Self-Extinguishing	D635
Tensile Strength (Yield)	≥ 8500 psi	D638
Elongation at Yield	5.5 to 8.5 %	D638
Shear Strength (Yield)	≥ 5500 psi	D732
Izod Impact Strength (notched, 1/8 inch thick)	≥ 15 ft-lb/in	D256
Fatigue strength, (2.5 mm cycles)	≥ 900psi	D671

Hardware:

- Except where noted, all bolts, nuts, washers, lock washers, screws, and other assembly hardware shall be galvanized steel, stainless steel, or dichromate sealed aluminum.

MATERIALS	APPLICABLE SPECIFICATION
Stainless Steel	ASTM a320, 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
Brass	UNS C36000

- When used, dissimilar metals shall be so selected or insulated to prevent corrosion.
- All non-metallic hardware shall be fiberglass reinforced polycarbonate.

Gaskets:

- Gaskets used in the optical unit shall be closed-cell silicone or peroxide-cured EPDM and shall withstand temperatures up to 250 degrees F without permanent deformation or becoming brittle
- Other gaskets shall be closed-cell neoprene.

5. HOUSING, DOORS, AND VISORS

Design of door, housing, and visor shall be such that there is no light leakage (i.e. light is emitted only through the lens).

Housings when assembled, together with doors, lenses, and mounting attachments, shall comprise a dust and moisture proof housing for the optical units or LED modules, connecting wiring, and terminal block.

Housings:

- The housing shall be one piece and shall be either die cast aluminum alloy, permanent mold cast aluminum alloy, or molded polycarbonate.
- Housings shall be of the sectional adjustable expandable type.
- Portions of cases providing for attachment to supporting arms shall be molded with large bosses for the supporting arms.
- Both the top and the bottom of each traffic signal housing case shall 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 shall 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 shall 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 shall be provided on the rear of each signal section for mounting a back plate. They shall accommodate No. 8 x 1/2 inch self-threading screws. The holes shall not open to the inside of the housing.
- Each signal section shall be capable of being rotated 360 degrees about its mounting axis and shall be capable of being locked at 5 degree intervals. Locking shall be accomplished by the engagement of serrations in adjacent signal sections and in the mounting bracket assembly.
- Serrations shall be integral with the signal section and designed to insure flush alignment of the perimeters of the section.
- Polycarbonate sections shall have additional strengthening ribs integral with the mating sides.
- Individual units shall be so manufactured that all units are interchangeable except for terminal blocks.

Doors:

- Door shall be of the same material as the housing.
- Aluminum door shall 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 shall be securely gasketed to the traffic signal housing with a weatherproof gasket.
- Polycarbonate door shall be attached to the housing by means of two stainless steel hinge pins, or by polycarbonate hinge pins which are an integrally molded part of the housing door.
- Two thumb screws shall be installed on the side of the door to provide for opening and closing the door without the use of special tools.
- Thumb screws shall have a flat-bearing surface or flat washer to prevent gouging of the housing door by the screws.
- Thumb screws shall remain captive in housing door when the door is open.

Visors:

- Each signal section shall be provided with an easily detachable visor.
- The visor shall be rigidly attached to the door in a manner that will prevent the leakage of light and moisture throughout the periphery of attachment.
- Visor shall be standard tunnel type.
- Visor shall 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 inches.
- Polycarbonate visors shall have a minimum thickness of 0.100 inches.
- Heads may be shipped with visors detached. If heads are shipped with the visors attached, visors shall be easily removed and replaced without damage to visor or signal head.
- The visor on the front of each door shall:
 - be circular in section
 - have a downward tilt of 2 to 8 degrees relative to the perpendicular plane of the housing door
 - encompass approximately 300 degrees of the lens
 - extend outward from the face of the lens a minimum of 9-½ inches
 - 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.

6. EXTERIOR FINISH

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

Aluminum:

- All exposed metal surfaces except for the inside of the visors of the assembled traffic signal head shall be electrostatically applied powder-coat paint or given two separately baked-on coats of high-grade enamel.
- The inside of the visors shall be provided with two coats of high grade flat black finish paint.

Polycarbonate:

- The federal yellow colorant shall be completely impregnated in the polycarbonate material.
- The inside of the visors shall be provided with two coats of high grade flat black finish paint.

7. ELECTRICAL

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

Receptacle:

- Each lamp receptacle assembly shall be provided with two flexible insulated color coded leads a minimum of 3 feet in length and no smaller than No. 18 American Wire Gauge.
- Receptacle leads are to be securely fastened to the lamp socket and connected to the terminal block mounted in the signal section housing at the receptacle/optical unit by means of solderless wire connector or binding screws and spade lugs.

Terminal Blocks:

- Terminal blocks shall be double-row and contain a minimum of six sections.
- All terminal blocks shall be securely mounted in an accessible position and shall be of weatherproof molded construction.
- The terminal block body shall be of one-piece molded construction using phenolic materials.
- The block shall 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 shall be rated for a minimum of 20 ampere, 250 volt service and section to section breakdown voltage shall be a minimum of 1600 volts AC RMS.
- All metal parts with the exception of screws shall be nickel plated brass.
- Binding screws shall be nickel-plated brass or stainless steel.
- Section Terminal Block - The terminal block shall either be securely mounted on or integrally molded into the interior of the housing.
 - Each multiple section signal face assembly shall be provided with a double- row, six-section terminal strip in the top section of the assembly. The section terminals shall be wired to the top-mounted common terminal, ready for field installation. Binding screws for solderless connectors shall be provided for the interior wires.
 - The terminal block shall be securely mounted to the housing case in an internally accessible position in the signal section.

Wiring:

- Each lead shall 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 wiring shall be so arranged that any one optical unit can be individually illuminated through connections to terminals in the terminal compartment.
- Separate terminals shall be provided for the interior wires and the field wires. In addition to the interior wires required in Section H.3.i.(1), 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 shall be covered in the procurement contract or documents

8. MOUNTING REQUIREMENTS

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

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

Each housing case shall be so attached to its supporting arm that it will be adjustable by rotation about its vertical 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 degrees apart and may be rigidly clamped in any position throughout the range of adjustment.

Provision shall be made for carrying the traffic signal leads enclosed in the mounting attachment. Any opening in an assembled signal head shall be plugged with an aesthetically pleasing plug.

Mounting attachments shall 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.

Span-Wire Mounting:

- The span-wire mounting attachment shall 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 shall 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 shall be adjustable by rotation about its vertical axis in a horizontal plane and the mounting attachment shall be so constructed that the head may be firmly clamped in any position throughout the range of adjustment.
- The mounting shall provide a suitable outlet for wiring from the signal head tilted downward and so constructed as 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 shall be provided with a suitable compensating device to insure that the signal head will assume a normally-vertical position.

Mast-Arm Mounting:

The mast-arm and signal-head mounting shall be as shown in the procurement or contract documents.

Side-of-Pole Mounting:

- Supports for side-of-pole mounting of the signal head in a vertical position shall be 1-1/2 inch (nominal diameter) standard pipe bracket arms, attached to the top and bottom of the signal head.
- The signal head shall be adjustable, by rotation of the various signal faces about their vertical axis, throughout a radial angle of 360 degrees and shall be capable of being rigidly clamped in any position throughout the range of adjustment.
- The mounting assembly shall 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 shall have running threads at least 1-1/4 inches long at the pole connection end.
- Provision shall be made for carrying the wire from the signal head enclosed in the bottom support and an outlet tilted downward for the wiring shall be provided, adjacent to the pole connection end, tapped and plugged for 1-1/4 inch conduit.

Top-of-Post Mounting:

- Supports for top-of-post mounting of the signal head in a vertical position shall 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 shall consist of a slipfitter connection, as either 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 each 3/8 inch nominal major diameter stainless steel set screws with 20 threads per inch in pairs with a 120 degree spacing shall be provided for attaching the slipfitter to the pole.
- The signal head assembly shall be adjustable, by rotation about its vertical axis in a horizontal plane, throughout a radial angle of 360 degrees and the mounting attachment shall be so constructed that the head may be firmly clamped in any position throughout the range of adjustment.
- The slipfitter connection shall 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.

