

Section 657 Poles, Arms, Standards, and Bases

657.1 Description

- (1) This section describes providing poles, arms, standards, and bases for lighting and traffic signals. This section also describes installing department-furnished components for lighting and traffic signals.

657.2 Materials

657.2.1 Department-Furnished Materials

Revise 657.2.1 to require contractor-provided bolt/nut/washer assemblies and DTI washers for steel luminaire arms. Standard details now specify a friction connection using A325 high-strength bolts.

- (1) The department will furnish the following as specified in the contract special provisions:
 - Type 9, 10, 12, and 13 poles and associated mounting hardware, hand hole covers, and pole caps.
 - Monotube arms.
 - Steel luminaire arms.

657.2.2 Contractor-Furnished Materials

657.2.2.1 Poles

657.2.2.1.1 General

- (1) Furnish shop drawings as specified in [506.3.2](#), except submit 5 copies with the materials list. Ensure the drawings contain sufficient detail to allow satisfactory review and show the outside diameters of the pole at the butt, top, and splice locations the plans show. Show the width, depth, length, and thickness of all material, and list pertinent ASTM specification designations and metal alloy designations together with the tensile strength of metallic members. Provide tightening procedures for arm-to-pole connections on the shop drawings.
- (2) Furnish poles from a department-approved manufacturer. Submit a materials list and accompanying certificate of compliance certifying that the poles incorporated into the work conform to the specified design criteria and other contract requirements. Also send a copy of the certificate and a copy of the pole shop drawings to the department electrical engineer.
- (3) Include hand holes with a bolt-on access cover as the plans show. Provide a grounding L-clip welded directly opposite the hand hole on the inside wall of the pole.
- (4) Weld base plates to the pole shaft. Identify the pole type and wall thickness using 1/2-inch lettering stamped under the hand-hole before galvanizing steel poles.
- (5) Complete welding before galvanizing steel poles. Clean exterior surfaces of steel poles after welding to ensure they are free of loose rust and mill scale, dirt, oil or grease, and other contaminants before zinc coating. Zinc coat as specified in [641.2.8](#). Ensure that the coating is tight, free from rough areas or slag, and presents a uniform appearance. Clean after manufacturing is complete to remove loose and foreign material.
- (6) Furnish aluminum or galvanized steel shims matching the pole material.
- (7) Furnish identification plaques as the plans show.

657.2.2.1.2 Type 2 and 3 Poles

- (1) For Types 2 and 3 poles, design support structures conforming to the AASHTO standard specification for structural supports for highway signs, luminaires, and traffic signals as published in the 1994, third edition. Design for the following:
 - A wind speed of 80 mph with a 1.3 gust factor.
 - Dead and live load related to a 25-foot trombone mast arm with 5-section signal head and a pair of twin 15-foot luminaire arms mounted on the pole as the plans show.

657.2.2.1.3 Other Pole Types

Revise 657.2.2.1.2(1) to specify 6th edition AASHTO design standards until new LRFD specifications are implemented.

- (1) Except for type 2 and 3 poles, design support structures, consisting of poles and arms, conforming to the minimum wall thickness the plan details show and to AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 6th Edition, and Interim Revisions. Use a design life of 50 years. Design to withstand a 3 second gust wind speed of 90 mph. Do not use the alternative method for wind pressures described in appendix C of those AASHTO standard specifications. No fatigue analysis is required.
- (2) Construct poles of materials having sufficient rigidity that, with material installed as the plans show, the centerline of the shaft is vertical. Ensure that lighting poles nominally 40 feet or less in length are made of one piece and round in cross-section.

- (3) Incorporate vibration dampeners as the plans show, internally mounted by the pole manufacturer, in type 5, 6, and 17 poles.

657.2.2.2 Trombone Arms

- (1) Design aluminum trombone arms as specified in [657.2.2.1.2](#) based on the completed maximum loading configuration the plans show. Furnish shop drawings conforming to [657.2.2.1.1](#) that show the width, depth, length, and thickness of all members. Also list the ASTM alloy designation and strength of each aluminum member on the shop drawings.
- (2) Submit a materials list and accompanying certificate of compliance certifying that the trombone arms incorporated into the work conform to the specified design criteria and other contract requirements. Also send a copy of the certificate of compliance and a copy of the shop drawings to the department's electrical engineer for informational review.
- (3) Ensure that the design incorporates all of the following:
 1. Round or oval upper and lower aluminum members welded to one or more tubular vertical struts.
 2. A mounting clamp welded to the pole end of the trombone arm for attachment to a round pole.
 3. Gussets at the joints between the main arm tubes and the arm clamps designed to resist side loads.
 4. A horizontally adjustable strut to allow mounting five 12-inch signal faces with backplates.
 5. A clean, uniform, natural aluminum finish. Do not paint or apply other anti-corrosion coatings.
 6. A wiring raceway entrance through the upper mounting bracket.
 7. Vertically adjustable through plus or minus 10 degrees as the plans show.

657.2.2.3 Aluminum Luminaire Arms

- (1) Design aluminum luminaire arms as specified in [657.2.2.1.2](#) to withstand in-service field loadings including loads imposed by components attached to the arms. Furnish shop drawings conforming to [657.2.2.1.1](#). Include the dimensions of all members, list the ASTM alloy designation of aluminum members, and show weld details.
- (2) Submit a materials list and accompanying certificate of compliance certifying that the luminaire arms incorporated into the work conform to the specified design criteria and other contract requirements. Also send a copy of the certificate of compliance and a copy of the shop drawings to the department's electrical engineer.
- (3) Make luminaire arms out of extruded aluminum. Ensure that the arms are clean with a uniform natural aluminum finish. Do not paint or apply other anti-corrosion coatings.
- (4) Furnish an extruded aluminum fixture welded to the pole end of the luminaire arm that allows the arm to be clamped to a round pole dimensioned as the plans show. Furnish mounting clamps with stainless steel bolts, nuts, and washers conforming to [ASTM A320](#).

657.2.2.4 Traffic Signal Standards

- (1) Furnish standards consisting of extruded seamless aluminum alloy 6061-T6 manufactured conforming to [ASTM B241](#), or porthole extruded aluminum alloy 6061-T6 manufactured conforming to [ASTM B429](#). Also conform to the following:
 1. Threaded on one end, tapered, and conforming to national pipe threading dimensions and normal practice.
 2. Outside dimension of 4 1/2 inches.
 3. Schedule 80 aluminum pipe.
- (2) Ensure that the manufacturer has indent printed the ASTM and alloy designations 2 inches above the threading on the outside of each standard using 1/4-inch dies.

657.2.2.5 Bases

- (1) Furnish cast aluminum alloy pedestal and transformer bases from the department's approved products list and meeting the design criteria specified in [657.2.2.1.2](#). Ensure that castings are true to pattern in form and dimensions and free from defects affecting strength or service life.
- (2) Submit a materials list and accompanying certificate of compliance certifying that the bases incorporated into the work conform to the specified design criteria and other contract requirements.

- (3) If the engineer requests, provide one randomly selected sample pedestal base per traffic signal location. The department will base acceptance of all pedestal bases at that traffic signal location on destructive tests of that sample base.
- (4) Thread casting collars for pedestal bases to mate with the traffic signal standards furnished under the contract.
- (5) Use mounting washers for transformer bases conforming to the manufacturer's instructions.

657.2.2.6 High-Strength Bolts

- (1) Furnish zinc-coated type 1 bolt/nut/washer assemblies conforming to [506.2.5](#) and as follows:
 - Furnish 2 flat washers with each bolt/nut/washer assembly. Use the size, number, type, and configuration of hardened flat washers the DTI manufacturer recommends for bolt diameters greater than 1 1/8 inches.
 - Ensure that all bolt/nut/washer assemblies of a given size come from the same rotational-capacity lot, are shipped in sealed and labeled containers, and are accompanied by a certified report of test or analysis giving the results of the supplier's rotational-capacity testing. No field rotational-capacity testing is required.
 - Furnish 3 or more additional bolt/nut/washer assemblies of each size for pre-installation testing.
 - Submit 2 or more additional bolts and 3 or more additional nuts and washers of each size for department mechanical testing. The contractor need not submit components from a lot and heat the department previously approved.
- (2) Furnish zinc-coated direct tension indicating (DTI) washers conforming to [ASTM F959](#) type 325. Ensure that DTIs have identifying marks applied by the manufacturer. Provide the engineer with 2 copies of the DTI manufacturer's instructions showing acceptable installation configurations. Provide 3 or more additional DTIs as required for pre-installation testing. Also provide the engineer with at least two 0.005-inch metal feeler gauges.

657.3 Construction

657.3.1 General

657.3.1.1 Installation

- (1) Under the contractor-provided bid items numbered from 657.0100 - 0999 provide everything required to complete the installation as the plans show.
- (2) Under the install bid items numbered from 657.1000 - 1999 install the department-furnished components indicated in the bid item names. Also provide high-strength bolts and DTIs, fittings, either aluminum or galvanized steel shims, hardware, and other components the department does not furnish but that are required to complete the installation as the plans show.
- (3) Install a grounding lug either inside the base or pole as required to connect equipment grounding conductors.

657.3.1.2 Welding

- (1) Perform shop welding as the plans show and conforming to the following:
 - For steel poles and arms: AWS D 1.1, Structural Welding Code - Steel.
 - For aluminum poles and arms: AWS D 1.2, Structural Welding Code - Aluminum.
- (2) Do not weld in the field without the engineer's written approval. The engineer will only allow field welding for repairs in noncritical locations and when a department-approved individual competent to perform inspections is present during the welding. Perform field welding using personnel qualified under AWS D 1.5, Bridge Welding Code for steel or AWS D 1.2, Structural Welding Code - Aluminum for aluminum.

657.3.2 Poles

- (1) Clean each pole before installation.
- (2) Secure type 9, 10, 12, and 13 structures to anchor assemblies conforming to the procedures enumerated in department form [DT2321](#). Complete department form [DT2321](#) for each structure. Indicate the parties responsible for the installation and submit the form to the engineer for inclusion in the permanent project record.
- (3) After completing erection using normal pole shaft raking techniques, ensure that the centerline of the shaft is vertical.
- (4) Install identification plaques as the plans show.

657.3.3 Arms

657.3.3.1 General

- (1) Install trombone, monotube, and luminaire arms to supporting structures at the height and alignment the plans show. Clamp luminaire arms to the pole and rake so the initial level of the luminaire tenon is plus 3 degrees.
- (2) Install traffic signal heads within 5 days after monotube arms are erected to control vibration. Contact the bureau of structures if signal heads cannot be installed within those 5 days.

657.3.3.2 High-Strength Bolts for Monotube Arms

657.3.3.2.1 Handling and Storage

- (1) Store bolts/nut/washer assemblies and DTIs in closed containers in a protected shelter to protect them from dirt and moisture until used. Maintain fastener system components as nearly as possible in the as-manufactured condition until installed. Remove from storage only as needed and promptly return unused components to storage.

657.3.3.2.2 Pre-installation Testing

- (1) Notify the engineer before performing the required field pre-installation testing.
- (2) Lubricate high-strength bolt threads with a wax-based lubricant before testing. Test bolt/nut/washer assemblies with DTIs in all the configurations used for installation.
- (3) Perform pre-installation testing in the field conforming to the procedures enumerated in department form [DT2322](#) for each bolt/nut/washer/DTI size and configuration installed. Provide the engineer with the test results by submitting 2 copies of department form [DT2322](#).

657.3.3.2.3 Bolt Installation

- (1) Do not begin bolt installation without the engineer's approval.
- (2) Lubricate high-strength bolt threads with a wax-based lubricant before installation.
- (3) Tension high-strength bolts using DTIs. Install the DTI on the bolt with the protrusions facing away from the connected materials. Install bolt/nut/washer assemblies with DTIs in the same configuration used for pre-installation testing.
- (4) Tighten conforming to department form [DT2322](#) to provide the correct installation tension. During the operation, ensure no rotation of the part not turned by the wrench. Snug systematically from the most rigid part of the connection to the free edges. Repeat until the full connection is in a snug condition and the faying surfaces are in firm contact. Systematically tighten the connection required number of refusals is achieved. If the gaps on the DTI are completely closed, discontinue tightening.
- (5) Perform QC testing as specified in [506.3.12.3.3.3](#) for tensioning with DTIs. The engineer may verify bolt installation by periodically testing with a feeler gauge.

657.3.4 Standards

- (1) Thread traffic signal standards into their pedestal bases without damaging the threads. Ensure that the base is level on its concrete foundation and the standard is vertical after all connections are tight.

657.3.5 Bases

- (1) Before installing, clean the mill scale, oil, and foreign material off transformer bases, traffic signal pedestal bases, and other aluminum bases.
- (2) Install transformer bases conforming to the manufacturer's instructions.

657.4 Measurement

- (1) The department will measure the bid items under this section as each individual unit acceptably completed.

657.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
657.0100	Pedestal Bases	EACH
657.0200 - 0299	Transformer Bases Breakaway (size)	EACH
657.0300 - 0399	Poles (type)	EACH
657.0400 - 0499	Traffic Signal Standards Aluminum (length)	EACH
657.0560 - 0599	Trombone Arms (length)	EACH
657.0600 - 0699	Luminaire Arms Single Member (clamp size) (length)	EACH
657.0700 - 0799	Luminaire Arms Truss (type) (clamp size) (length)	EACH

657.1300 - 1399	Install Poles (type)	EACH
657.1500 - 1599	Install Monotube Arms (length)	EACH
657.1800 - 1899	Install Luminaire Arms Steel (length)	EACH

- (2) Payment for Pedestal Bases and the Transformer Bases bid items is full compensation for providing the pedestal base including grounding lugs and related mounting hardware; for leveling shims; and for corrosion prevention. The department will pay for sample pedestal bases, provided under [657.2.2.5](#), at the contract unit price for Pedestal Bases.
- (3) Payment for the Poles bid items is full compensation for providing poles including grounding lugs and related mounting hardware; for hardware and fittings necessary to install the pole; for leveling shims; and for corrosion prevention.
- (4) Payment for the Traffic Signal Standards Aluminum bid items is full compensation for providing the standards.
- (5) Payment for the Trombone Arms and Luminaire Arms bid items is full compensation for providing arms including related mounting hardware and leveling shims.
- (6) Payment for the Install Poles bid items is full compensation for installing department-furnished poles and for providing grounding lugs, fittings, shims, hardware, and other required components the department does not furnish.
- (7) Payment for the Install Monotube Arms and Install Luminaire Arms Steel bid items is full compensation for installing department-furnished arms; for providing high-strength bolt/nut/washer assemblies and DTIs including those required for testing; and for providing related mounting hardware, leveling shims, and other required components the department does not furnish.
- (8) The department will pay separately for concrete foundations and provide or pay for anchor assemblies under [654](#).