

SECTION 715 HIGHWAY LIGHTING SYSTEM

715-1 Description.

Install a highway lighting system in accordance with the details shown in the plans. Include in the system the light poles, bases, luminaires, ballasts, pull boxes, cable, conduit, substations, expansion joints, protective devices, transformers and control devices; all as specified or required for the complete facility.

715-2 Shop Drawings and Working Drawings.

Submit shop drawings and working drawings with descriptive specifications and engineering data for panel board, transformer, primary oil switch, fused cutouts, light poles (including brackets), luminaires, ballast, photo-electric cell, and cable or any other item requested by the Engineer as specified in Section 5.

715-3 Materials and Equipment to be Installed.

715-3.1 General: Meet the materials and equipment requirements of Section 992. Provide products of established, reputable manufacturers of electrical equipment, meeting NEC requirements, the regulations of the National Board of Fire Underwriters, and the approval of the Engineer.

715-3.2 Criterion Designation of Materials and Equipment: Where a criterion specification is designated for any material or equipment to be installed, by the name or catalog number of a specific manufacturer, understand that such designation is intended only for the purpose of establishing the style, quality, performance characteristics, etc., and is not intended to limit the acceptability of competitive products. The Engineer will consider products of other manufacturers which are approved as similar and equal as equally acceptable.

715-4 Furnishing of Electrical Service.

Start the system with a weatherhead on a riser on a service pole and extend through the required metering equipment of the power company, and through the lighting system as shown.

The power company will provide service to the areas in the vicinities indicated. Consult and cooperate with the power company in locating its distribution transformer and service pole so that the lines will be as short and direct as possible. Bear any line-extension costs up to the first 2,000 feet [600 m]. Furnish or install only those parts of the metering equipment or connections that are customary and required by the power company in the locality involved.

715-5 Excavation and Backfilling.

715-5.1 General: For excavation and backfilling, meet the requirements of Section 125, except that when rock is encountered, carry the excavation 3 inches [75 mm] below the required level and re-fill with sand or with selected earth material, 100% of which passes the 1 inch [25 mm] sieve.

715-5.2 Trenches for Cable: Construct trenches for cable or conduit no less than 6 inches [150 mm] in width and deep enough to provide a minimum cover in accordance with the Design Standards.

715-5.3 Placing Backfill for Cable: For installation of the cable, place an initial layer of 6 inches [150 mm] thick, loose measurement, sand or selected earth material, 100% of which passes a 1 inch [25 mm] sieve. Place and compact the remaining material in accordance with 125-8.

715-6 Concrete Bases for Light Poles.

715-6.1 Bases: Provide bases for light poles of the sizes and shapes shown in the plans.

715-6.2 Setting Anchor Bolts: Set anchor bolts according to manufacturer's templates and adjust to a plumb line, check for elevation and location, and hold rigidly in position to prevent displacement while pouring concrete.

715-6.3 Installation: Install poured-in-place bases at least one week before installing the poles, and thoroughly tamp the earth around the base to prevent settling.

Do not erect high mast lighting poles before the concrete in the support footing has cured for at least seven days. The Engineer may allow pole installations prior to seven days provided the footing concrete strength is at least 2,500 psi [17 MPa]. Determine concrete strength from tests on a minimum of two test cylinders, tested in accordance with Section 346.

715-6.4 Alternate Foundation: The Contractor may use screw type foundations meeting the following requirements in lieu of precast or cast-in-place concrete foundations detailed on Design Standards, Index No. 17503.

715-6.4.1 Screw Type Foundations Located Above the Water Table:

(a) Design: For steel screw type foundations, meet the latest edition of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and the requirements herein. Provide steel equaling or exceeding the requirements of ASTM A 53, Type E, Grade B for the pipe and ASTM A 36 [ASTM A 36M] for the plates and bars. Design screw type foundations to be installed by auguring into the ground using a right hand turning movement with a working installation torque of up to 20,000 ft·lb [27 kN·m]. Provide a minimum base plate thickness of 1 3/8 inches [35 mm]. Provide base plates with holes to match the number and location of the light pole anchor bolts. Make the holes 1/16 inch [1.6 mm] larger in diameter than the light pole anchor bolts. Use base plates of sufficient size to provide the required bolt edge distances. Notch the base plates to indicate the orientation of the shaft cableways. Provide pipes for these screw type foundations having a minimum of 10.75 inches [273.0 mm] outside diameter and a minimum wall thickness of 0.365 inch [9.27 mm]. Provide an opening at the bottom of the pipe for drainage purposes. Hot-dip galvanize the whole foundation after fabrication in accordance to ASTM A 123 [ASTM A 123M]. Submit drawings to the Department for approval as specified in Section 5.

(b) Limits of Use: The Contractor may use screw type foundations only with roadway light poles whose maximum working load reactions at their base do not exceed the following:

moment = 30,600 ft·lb [41.5 kN·m]

shear = 1,020 lb [4.5 kN]

torsion = 3,000 ft·lb [4.0 kN·m]

axial = 400 lb [1.8 kN]

For soil properties for these installations, meet the following minimum requirements:

cohesionless:

friction angle = 30 degrees

unit weight = 100 lb/ft³ [1,600 kg/m³]

cohesive:

cohesion = 1,000 ft·lb [48 kPa]

(c) Installation: Prior to installation, submit pole reaction and soil property data to the Engineer for approval.

Install by auguring into the ground. Use only a small amount of downward pressure, sufficient to ensure engagement of the augers. The Engineer will not allow installation into pre-excavated hole. Ensure that the pole manufacturer provides bolts for connecting the pole to the foundation, and install bolts complete with nuts and lockwashers. Do not allow the top of the installed base plate to protrude more than 2 inches [50 mm] above the ground surface.

715-6.4.2 Screw type foundations when the water table is encountered: When the water table is encountered within the depth of the screw type foundations permitted in 715-6.4.1 above, the Contractor may propose a project-specific screw type foundation design. In this event, submit to the

Engineer, for approval, design calculations and drawings which account for the presence of the water table. When making the calculations, take into account the variability of the soil strata above and below the water table which may result in deeper foundations, larger diameter pipe, or both.

Provide screw type foundation material in accordance with 715-6.4.1(a), and use the in-situ soil properties, determined from the on-site soil boring investigation conducted in accordance with 715-6.4.1(c), in the proposed foundation design.

715-7 Laying Cables.

Place the direct-burial cables by moving the cable reel along the trench so that the cables are placed directly in their final position in the trench, with a minimum of handling and dragging. Space the cables at least 3 inches [75 mm] apart, both vertically and horizontally, and separate them with clean sand. Place the bottom cables on a 3 inches [75 mm] bed of sand and cover the top cables with 3 inches [75 mm] of sand prior to backfilling. Leave at least 3 feet [0.9 m] of slack cable where the cable enters and leaves ducts, and after looping into light poles. Leave adequate slack in light poles and bracket cables and other conductors. Protect cables pulled into conduit or ducts against abrasion, kinking, and twisting. Locate pull boxes so that the cable is not subjected to excessive pulling stresses.

715-8 Splicing.

Make all conductor splices in the bases of the light poles, or in pull boxes designed for the purpose. Do not make underground splices unless specifically authorized by the Engineer, and then only as directed by him.

Make all necessary splices or connections with solderless connectors or compression sleeves. Do not use twist-on connectors if any of the conductors involved is larger than No. 10.

715-9 Conduit and Ducts.

715-9.1 General: Install conduit and ducts at the locations shown in the plans, or as required for a satisfactory installation. Provide conduit or ducts for all crossings under roads and streets.

715-9.2 Conduit in Structures: Use conduit of either rigid steel or PVC for embedding in structural concrete. Install an expansion joint at every structural expansion joint through which the conduit passes. Provide exposed runs of conduit with adequate expansion joints as shown in the plans or approved by the Engineer. Obtain the Engineer's approval of the design of the expansion joints.

715-9.3 Pre-wired Direct-burial Duct: Where specifically specified in the plans or directed by the Engineer, install a pre-wired, flexible polyethylene plastic pipe containing the conductors for the lighting circuits. Provide conductors and polyethylene pipe as described in the plans.

715-10 Erecting Light Poles.

715-10.1 General: Install the light poles at the locations and in accordance with the details shown in the plans. Unless otherwise specifically approved by the Engineer, fasten ratchet arms to the shaft prior to erection. Adjust the poles to a plumb line after erection and use metal shims or leveling nuts if necessary to obtain precise alignment. Use a thin cement grout where necessary to eliminate unevenness or irregularities in the top of the base.

715-10.2 Adjusting Anchor Bolts: Where poles are to be placed on existing foundations or bases with anchor bolts in place, furnish poles with a base which fits the anchor bolt spacing. Include the cost of any necessary extension of existing anchor bolts in the price bid for the lighting system.

715-10.3 Installation of Luminaire: Install the luminaire on the bracket in accordance with the manufacturer's instructions, and place it so that the light pattern is evenly distributed along the roadway.

715-10.4 Electrical Connections: Make primary ballast connections in accordance with manufacturer's instructions. Install sufficient cable to allow all connections to be made outside the light pole base. Connect the ground conductor to the ground stud provided.

715-10.5 Identification Plates: If required by the Contract Documents, stamp the identification plate on the pole with an identifying number or legend. Number the poles consecutively, beginning with number 1. Stamp each light pole number with 3/4 inch [19 mm] figures and stamp each circuit number with 1/2 inch [13 mm] figures.

715-11 Grounding.

Ground in strict accordance with the National Electrical Code (NEC), local ordinances, applicable codes, and the requirements of the local utility company. For grounding, meet the following minimum requirements:

Solidly interconnect and connect to ground the grounding terminal of each lightning arrester, the tank of the transformer, and the neutral. Use one or more approved rods, 5/8 inch [15.87 mm] in diameter and 10 feet [3.0 m] long, as ground rod. Provide connectors at the ground rod as shown in the plans or approved by the Engineer. Protect grounding conductors on the wooden poles by cedar or cypress wood molding, extending at least 8 feet [2.4 m] above grade.

Ground each metal light pole not on a bridge structure with an approved rod, 10 feet [3.0 m] in length and at least 5/8 inch [15.87 mm] in diameter. Drive the rod vertically until the top of the rod is approximately 6 inches [150 mm] below the ground. Attach a No. 6 bare conductor to the rod with an approved clamp, and to the light pole through the grounding lug.

For poles on bridge structures, bring the grounding conductors out to a pull box at each end of the structure and connect them to driven ground rods, 20 feet [6 m] in length and at least 5/8 inch [15.87 mm] in diameter.

715-12 Labeling.

Stencil labels on the cases of oil switch, transformer, panel board, and photo-electric cell with white oil paint, as designated by the Engineer. Also, mark the correct circuit designations in accordance with the wiring diagram on the terminal marking strips of each terminal block and on the card holder in the panel board.

715-13 Markers.

Construct duct, cable, and splice markers as shown in the plans, and place them over the ends of underground ducts and at each change in direction of cable or conduit run. Place markers flat on the ground with 1 inch [25 mm] projecting above finished grade.

715-14 Tests of Installation.

Upon completion of the work, test the installation to ensure that the installation is entirely free of ground faults, short circuits, and open circuits and that it is in satisfactory working condition. Furnish all labor, materials, and apparatus necessary for making the required tests. Remove and replace any defective material or workmanship discovered as a result of these tests at no expense to the Department, and make subsequent re-tests to the satisfaction of the Engineer.

Make all arrangements with the power supplier for power. Pay all costs, excluding energy charges, required for the test period.

Not less than 48 hours prior to the beginning of the test period, give the power supplier the schedule for such test.

Test the installation under normal operating conditions during the seven day test period specified in 715-15, rather than as a continuous burn test period.

If the work is not open to traffic at the end of the seven day test period, de-energize the lighting system until the work is opened.

715-15 Acceptance of Highway Lighting.

The Engineer may make partial acceptance of the highway lighting based on satisfactory performance of all highway lighting for seven consecutive days. The seven day evaluation period may commence upon written authorization by the Engineer that highway lighting is considered ready for acceptance evaluation. Contract Time will be charged during the entire highway lighting evaluation period. Correct any defects in materials or workmanship which might appear during the evaluation period at no expense to the Department. Transfer to the Department any guarantees on equipment or materials furnished by the manufacturer and ensure that the manufacturer includes with such guarantees the provision that they are subject to such transfer, and proper validation of such fact. The Department's written acceptance of highway lighting and the transfer to the Department of all manufacturer guarantees will be conditions precedent to final acceptance of all work under the Contract in accordance with 5-11.

715-16 Method of Measurement.

The quantities to be paid for will be as follows, completed and accepted:

(a) Conduit: The length, in feet [meters], including elbows, sweeps, connecting hardware, trenching and backfill as indicated in the plans and the Design Standards, and the cost of restoring cut pavement, sidewalks, sod, and etc., to its original condition.

(b) Luminaire and Bracket Arm: The Contract unit price will include the bracket arm, luminaire with lamp, and all necessary mounting hardware as indicated in the plans and the Design Standards.

(c) Load Center: The Contract unit price will include the service pole, insulators, weatherheads, transformers, enclosures, panel boards, breakers, safety switches, H.O.A. switches, lighting protectors, fuses, photo electric assembly, meter base, and all external and internal conduit and conductors for the service as indicated in the plans and the Design Standards.

(d) Light Pole Foundation: The Contract unit price will include the foundation and anchor bolts with lock nuts and washers as indicated in the plans and the Design Standards.

(e) Luminaire: The Contract unit price will include the luminaire with lamp and necessary mounting hardware as indicated in the plans and the Design Standards.

(f) Pull Box: The Contract unit price will include the pull box and cover as indicated in the plans and the Design Standards.

(g) High Mast Parts: The Contract unit price will include the part specified with all mounting hardware as indicated in the Contract Documents and the Design Standards.

(h) Frangible Base for Light Pole: The Contract unit price will include the frangible base, attachments, bolts, and washers as indicated in the plans and the Design Standards.

(i) Photo Electric Control Assembly: The Contract unit price will include the photo electric control, transformers, conduit, and conductors as indicated in the plans and the Design Standards.

(j) Pre-Fab Pilaster: The Contract unit price will include the pilaster and all mounting hardware as indicated in the plans.

(k) High Mast Lighting Pole Complete: The Contract unit price will include the pole, luminaires with lamps, lowering system, breakers and anchor bolts with lock nuts and washers as indicated in the plans and the Design Standards.

(l) Conductor: The length, in feet [meters], as indicated in the plans and the Design Standards.

(m) Lighting Pole Complete: The Contract unit price will include the pole, bracket arm, luminaire with lamp, anchor bolts with lock nuts and washers, frangible base and foundation.

(n) Pole Cable Distribution System: The Contract Unit price will include the surge protector, fuse holders with fuses, waterproof connectors and the waterproof wiring connection to the luminaries.

715-17 Basis of Payment.

Prices and payments will be full compensation for all work specified in this Section, including all materials, equipment and tests.