

## **SECTION 510 NAVIGATION LIGHTS FOR FIXED BRIDGES**

### **510-1 Description.**

Furnish and install navigation lighting systems, including all wiring, conduit, wiring devices, transformers, enclosures, grounding system, controls, protective devices, lights, etc., as shown in the Plans and in compliance with Code of Federal Regulations (CFR), Title 33, Part 118, which is further clarified in U.S. Coast Guard (USCG) Publication "A Guide to Bridge Lighting". Navigation lights must operate from sunset to sunrise and during periods of low visibility.

### **510-2 Coordination of Electrical Work.**

Use experienced personnel in the type of work required by the Contract Documents to provide a complete and satisfactory fitting and fully operational installation. Perform all electrical work either by, or under the immediate supervision of an electrical journeyman.

Schedule and arrange electrical work in a neat, well-organized manner without interference with the work scheduling of other trades.

### **510-3 Materials and Equipment.**

Meet the equipment and material requirements as shown in the Contract Documents.

Furnish and install only materials and equipment of new stock meeting ANSI, NEC, NEMA, and UL requirements, and approved by the Engineer, except where the Contract Documents allow or specify the use of other than new equipment.

Furnish and install marine type products manufactured of corrosion resistant materials.

Furnish and install only fasteners manufactured from ASTM 316 stainless steel with yield strength 35,000 psi or higher.

Furnish and install ASTM 300 series stainless steel conduit straps or hangers held at not less than two points.

Furnish and install framework for supporting boxes, switches, and other externally mounted electrical devices fabricated from ASTM A709 Grade 36 hot-dip galvanized structural steel.

### **510-4 Navigation Lights and Aids.**

**510-4.1 Navigation Lights:** Equip all navigation lights with a LED array with a minimum of 50,000 hour life and bright enough to meet the visibility requirements of CFR Title 33, Part 118. Mount LED arrays on an internal shock and vibration isolator. Provide, in the circuit, a lightning surge suppressor capable of absorbing multiple strikes without replacement. Provide special power supply to provide current limited DC voltage to the LED array.

Furnish and install fixtures with unpainted housings of heavy duty cast aluminum or bronze construction with a 1-1/2 to 2 inch threaded conduit opening on the bottom. Use only marine type mounting boxes with minimum 3/4 inch conduit opening. Furnish and install fixtures with lenses that are standard marine molded, single-piece fresnel type, rigid, heat resistant glass or U.V. resistant polycarbonate and inside diameter of 7 to 8 inch. Furnish all stainless steel closure bolts, lens tie rods, and attachment hardware for a complete and accepted installation.

Furnish and install pier/fender lights, center channel lights and channel margin lights with cast aluminum or bronze swivel assembly and mounting bracket, complete with stainless steel pivot, watertight "O" ring seal, bronze bearings, cable entrance fitting, and stainless steel service chain rated for a minimum 225 pounds load. Use a 1-1/2 or 2 inch galvanized pipe or stainless steel pipe as a hanger stem with automatic lock at service and operating positions. Furnish and install a 60% counterweight if stem exceeds 5 feet in length.

Ensure the pier/fender Light is equipped with a red 180 degree lens, the center channel light is equipped with a green 360 degree lens and the channel margin light is equipped with a red 180 degree lens.

**510-4.2 Clearance Gauge Lights:** Furnish and install one-piece die-cast aluminum fixture housing fitted with watertight gasket, stainless steel hinges and fasteners, and adjustable aiming capability, equipped with a 120 V<sub>AC</sub> 50 watt, high-pressure sodium lamp. Use a heavy cast aluminum connection box body and cover with stainless steel swing bolts, watertight gasket and provisions for mounting to a platform with four stainless steel lag bolts or screws.

### **510-5 Disconnect Switches.**

Furnish and install switches that are HP rated and meet Federal and NEMA Specifications with NEMA Type 4X (stainless steel) enclosures, and with metal factory nameplates that are front cover mounted and contain a permanent record of switch type, catalog number, and HP rating. Provide switch with visible blades, reinforced fuse clips, and non-teasible, positive, quick make-quick break mechanisms. Provide switch assembly plus operating handle as an integral part of the enclosure base.

Use switches with defeat able door interlocks that prevent the door from opening when the operating handle is in the ON position, and whose handle position is easily recognizable and is padlockable in the OFF position. Use heavy-duty switches with line terminal shields.

**510-5.1 Fusible Switch Assemblies:** Furnish and install NEMA KS 1 type; load interrupter enclosed knife switch. Provide fuse Clips that are designed to accommodate Class R fuses.

**510-5.2 Non-fusible Switch Assemblies:** Furnish and install NEMA KS 1; HD type, load interrupter enclosed knife switch.

**510-5.3 Enclosures:** Furnish and install NEMA KS 1 type enclosure as shown in the Contract Documents.

**510-5.4 Installation:** Install disconnect switches where indicated in the Contract Document or where required by the Engineer. Use separate conduits for line and load conductors. Install fuses in fusible disconnect switches.

### **510-6 Supporting and Mounting Devices.**

Ensure the sizes, and types of anchors, fasteners and supports used are adequate to carry the load of the equipment and conduit, including the wire in the conduit.

Space conduit supports to avoid conflicts with reinforcing steel at 5 feet maximum. For concrete mounting, use anchor bolts and all matching parts and tools recommended by and provided by the same manufacturer, as well as suitable for dynamic loading caused by vibration due to traffic. To mount conduit supports and pull boxes, use 1/4 inch diameter anchor system. To mount channel lights use minimum 1/2 inch diameter anchor system with 3-1/2 inch embedment and 8 inch edge distance.

Use ASTM 300 series stainless steel conduit straps or hangers held at not less than two points.

Do not use powder-actuated anchors. Do not drill or weld structural steel members. Do not use bolts smaller than 1/4 inch in diameter except as may be necessary to fit the mounting holes in small and light devices. Install surface-mounted boxes with minimum of three anchors.

## **510-7 Conduit.**

**510-7.1 General:** Furnish and install conduit in the quantities and sizes required to complete the work as shown in the Plans and as required by NEC. Use products listed and classified by UL as suitable for purpose specified and shown. Do not use non-metallic flexible conduit, aluminum, or electrical metallic tubing (EMT).

**510-7.2 Liquid-Tight Flexible Metal Conduit:** Furnish and install, liquid-tight flexible metal conduit of interlocked steel construction with PVC jacket, and fittings meeting the requirements of ANSI/NEMA FB 1.

**510-7.3 PVC Conduit:** Furnish and install, schedule 80 PVC 3/4 inch minimum diameter conduit meeting the requirements of ASTM D1785 and NEMA TC 2 and fittings and conduit bodies meeting the requirements of ASTM D2467 and NEMA TC 3.

**510-7.4 Fiberglass Reinforced Epoxy Conduit:** Furnish and install rigid non-metallic fiberglass reinforced epoxy conduit and fittings manufactured in accordance with the applicable standards of ANSI and NEMA TC-14B.

Ensure the conduit has a bell and spigot type coupling and the coupling seal is made rigid by using an adhesive that will provide a water and vapor tight joint with a tensile strength equal to that listed for the conduit. An alternative type assembly may be used by applying a triple seal ribbed gasket of water resistant rubber material. Ensure the gasket is held firmly in place with a compatible adhesive.

Ensure that all fittings, adapters, and bends are manufactured from the same materials as the conduit and conform to the dimensional requirements of NEMA TC-14.

Use only fiberglass reinforced epoxy conduit and fittings made by the same manufacturer to insure proper fit and assembly, listed on the UL approved list and labeled for Type I service sizes 2 to 6 inches.

Ensure that each piece of conduit and fitting is clearly marked with durable contrasting ink, stenciled with the following:

1. Nominal size,
2. Bends to show the degree and radius of curvature,
3. Type: SW or HW,
4. Manufacturers' name or trademark.

**510-7.5 Installation:** Install conduit in accordance with National Electrical Contractors Association (NECA) "Standard of Installation" and manufacturer's instructions.

Arrange supports to prevent misalignment during wiring installation. Support conduit using straps, lay-in adjustable hangers, clevis hangers, and split hangers. Do not support conduit with wire or perforated pipe straps, plastic straps, or plastic hangers. Ensure that all wire used for temporary supports is removed upon completion of installation.

Install an expansion fitting for specified PVC conduit at all structure expansion joints or where movement between adjacent sections of conduit is expected. Submit certification to the Engineer from the manufacture that the expansion fitting meets the following minimum

requirements: compatibility with the connected conduits, water proof, UV protected, and allows longitudinal movement equal to that of the expansion joint or movement expected.

Route exposed conduit parallel and perpendicular to walls or route conduit in the railings. Install conduits to be continuous and watertight between boxes or equipment. Protect conduits at all times from the entrance of water and other foreign matter by being capped or well plugged overnight and when the work is temporarily suspended.

Cut conduit square using saw or pipe cutter; de-burr cut ends. Bring conduit to shoulder of fittings; fasten securely. Use conduit hubs to fasten conduit to metal boxes. Do not install more than the equivalent of three 90 degree bends (total 270 degrees) between boxes. Use conduit bodies to make sharp changes in direction such as around diaphragms.

Join PVC conduit using cement recommended by manufacturer. Wipe PVC conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for a minimum of 20 minutes before pulling conductors.

Do not use flexible conduit extensions greater than 24 inches in length. Ensure that all flexible conduit extensions are equipped with bonding jumpers.

Do not allow moisture traps; provide pull box with drain fitting at low points in exposed conduit system.

#### **510-8 Wiring.**

**510-8.1 General:** Do not use aluminum conductors. Use only SE or RHW on incoming service and use single conductor with XHHW insulation, unless otherwise noted in the Plans.

Do not use wire smaller than No. 12 AWG.

Furnish insulated conductors of seven or nineteen strand copper with a minimum 98% conductivity and connector accessories for copper in sufficient quantities for a complete installation.

**510-8.2 Installation:** Use pull boxes wherever necessary to facilitate the installation of the conductors. Do not use condulets for pulling more than ten conductors or for branching conductors.

Splice only in accessible boxes. Make lug connections with high pressure indent connector tools as recommended by the lug manufacturer. Make splices and taps to carry full ampacity of conductors without perceptible temperature rise. Tighten all connections to manufacturer's recommendations. Tape uninsulated conductors and connectors with electrical tape to 150% of the insulation value of conductor. Ensure all splices are waterproof.

Use solderless pressure connectors with insulating covers for No. 8 AWG and smaller wire splices and taps. Use split bolt connectors for No. 6 AWG and larger wire splices and taps.

Pull all conductors into a raceway at the same time. Use soap base wire pulling lubricant for pulling No. 4 AWG and larger wire.

**510-8.3 Testing:** Test each circuit for continuity and short-circuits for its complete length before being connected to its load.

Inspect wire and cable for physical damage and proper connection.

#### **510-8 Method of Measurement.**

The quantity to be paid for will be at the Contract lump sum price, completed and accepted.

**510-9 Basis of Payment.**

Price and payment will be full compensation for all work specified in this Section.

Payment will be made under:

Item No. 510- 1- Navigation Lights - lump sum.