ITEM 670.98000010- SOLAR POWERED 25W LIGHT EMITTING DIODE (LED) BUS SHELTER LUMINAIRE

DESCRIPTION

Under this item the Contractor shall furnish and install Solar Powered 25W LED Bus Shelter Luminaires in accordance with the Plans, specifications and as directed by the Engineer.

The luminaire Item shall be equipped with a LED type luminaire fixture at the designated wattage, controller, batteries, solar panels, cabinet, grounding and wiring harness for the wattage and operating time of eight (8) hours minimum per day. This item shall be provided with mechanical mounts to the shelter for the luminaire, solar panel, cabinet, for a complete installed working assembly and engineering shop drawings signed by a registered New York State engineer of the components and mounts.

DEFINITIONS OR TERMS

Within this specification the following definition or terms apply:

1. Luminaire shall be defined as the entire light assembly including but not limited to the slipfitter, painted metal housing, reflector, refractor, LEDs, LED module, lens, terminal block, driver circuitry, a twist-lock three prong receptacle for a photo-electric control for a complete outdoor weatherproof unit ready for mounting.

2. LED module or LED array is the modular replaceable cluster of LEDs assembled together on a circuit board or assembly and inserted in the luminaire. One or more LED modules shall provide the illumination of the luminaire.

3. LEDs are the individual diodes that produce the illumination.

MATERIALS

1. Luminaire

The components comprising the luminaire shall include but not be limited to the painted metal housing, reflector, refractor, LEDs, LED modules, lens, terminal block, driver circuitry, a twist-lock three prong receptacle for a photo-electric control for a complete outdoor weatherproof unit ready for mounting.

The luminaires shall be of the Light Emitting Diode (LED) type designed for outdoor use, modular in design with high-intensity white LEDs, and fully weatherproof.

The luminaires shall be modular and constructed so they provide a complete self contained insect resistant, shock resistant and vandal resistant unit.

The entire luminaire assembly shall be completely pre-wired, at the factory, requiring only the connection of the primary circuit wires to the electric power source for its operation.

All metallic component parts of the luminaire shall be made of a rust-resistant alloy or coated with an approved rust resistant finish. Weep holes shall be provided for drainage. Easy access to the LEDs and major electrical components shall be provided requiring no special tools to gain entrance for maintenance purposes.

The luminaire shall be provided with a means to prevent accidental exposure of the inner electrical components and accidental separation of the component parts.

The luminaire’s LED passive cooling system shall consist of a heat sink with no fans, pumps or liquids and shall resist debris buildup.
The luminaire casing shall be precision die-cast aluminum for the specified wattage and painted inside and out with a coat of baked on epoxy enamel, or polyester powder, virtually pinhole free, leaving no exposed metal. The luminaire color shall be as specified on the contract plans and details; a color chip shall be provided to the engineer for color approval.

The underside of the luminaire shall be marked with the standard NEMA decal, visible from the ground, indicating the type LED and wattage of the luminaire.

The luminaire shall contain a complete power assembly to which are mounted the necessary electrical components for DC operation, solid state starting, adjustable twistlock three prong receptacle for photo-electric control when specified, and a dead back terminal board with pressure type terminals.

The power assembly shall be capable of starting and operating the lamp at a temperature of minus twenty nine degrees Celsius to sixty degrees Celsius. The modular power assembly shall be readily removable as a single unit and utilize quick disconnect plugs.

The luminaire shall be designed for use on ceiling or wall mounted lamp and shall be fully waterproof. The luminaire shall operate on 12 volt DC power. The luminaire and batteries shall operate at similar voltages.

The luminaire shall provide Ingress Protection rating of IP-66 as detailed in IEC60529.

The luminaire shall have an IESNA light distribution as specified on the plans. The luminaire shall be available in a Type II, III or IV light distribution measured per the requirements of IESNA LM-79-08.

The luminaire shall be “Dark-Sky Friendly” compliant directing no illumination above horizontal.

LED module(s)/array(s) and the luminaire shall deliver at least 70% of initial lumens, when in use for a minimum of 50,000 hours as measured per the requirements of IESNA LM-80-08.

Luminaires shall have a minimum Color Rendering Index (CRI) of 65 as measured per the requirements of IESNA LM-79-08.

The Off-state Power Consumption power draw of the luminaire (including PE or remote control devices) shall be minimal, under 2 watts, when in the off state.

The light source will be of white LED type. Multiple LEDs can be used. The color temperature of white LEDs used in the system should be in the Correlated Color Temperature (CCT) range of 5000 degrees K – 6000 degrees K as measured per the requirements of IESNA LM-79-08. Use of LEDs which emit ultraviolet light is not permitted.

The light output from the white LED light source should be constant throughout the duty cycle.

The LEDs should be mounted in a LED module or array that is suitable for outdoor use. The LED modules shall be mounted in the luminaire housing suitable for outdoor use.

Access to the LEDs shall be by a cast aluminum door. The door assembly shall be hinged to the unit and protected by a safety chain. The door shall be equipped with stainless steel pressure latches and weatherproof, bug resistant gaskets. The latches shall secure the lamp access door and hold it firmly.
against the gaskets. The latches and door assembly shall be designed so that tools are not required to gain entrance to the luminaire for re-lamping purposes.

The luminaire shall be equipped with an adjustment to simplify beam angle setting.

The luminaire wattage (25 Watt) as indicated in the Item Description is a nominal, minimal value. The luminaire description of the proper size and type shall be submitted for approval by the engineer prior to being furnished.

The luminous performance of luminaire used should not be less than 50 lumen/watt delivered, where the total light output is divided by the total power input.

2. Controller

The controller shall monitor the luminaire light output, battery usage, charging and power consumption and provide a timer for time of day on-off operation. The controller clock shall provide time of day operation for powering the luminaire on at dusk and off at a specified time after continuous operation for a number of hours, adjusted for seasonal and daylight savings time operation. It shall also be controlled by the optional Photo-Electric Cell if called for on the plans.

The controller timer shall be a multi-purpose digital single channel timer design specifically for lighting applications. It shall be programmable in AM/PM and 365 day format with a separate schedule for each day for the week. It shall have daylight saving or standard time, automatic leap year correction and astronomic 1-99 minute, plus or minus offset from sunrise to sunset. It shall have a manual ON/ OFF override and a 30-day back up using a replaceable 9V lithium Battery.

The total electronic efficiency should be at least 80%.

Electronics should operate at 12 VDC and should have temperature compensation for proper charging of the battery through out the year. The operating voltage shall match the luminaire voltage.

The controller shall manage the light output that should remain constant with variations in the battery voltages.

Necessary lengths of wires / cables, switches suitable for DC use and fuses should be provided.

The controller should have protection against battery overcharge and deep discharge conditions. The numerical values of the cut off limits must be specified, while submitting the samples for the testing purposes.

Fuses should be provided to protect against short circuit conditions.

A blocking diode should be provided as part of the electronics, to prevent reverse flow of current through the Photovoltaic (PV) module(s), in case such a diode is not provided with the PV module.

Full protection against open circuit, accidental short circuit and reverse polarity should be provided.
3. Battery

The batteries shall be sized to power the luminaire for a minimum of three (3) days of eight (8) continuous hours of use. The batteries shall have an additional 30% excess storage capacity beyond the three (3) day requirement.

The batteries shall be self contained gel type, maintenance free and provide power at 12 voltsDC.

The batteries shall be wired to provide 12 VDC power. The solar panel and batteries shall be provided with similar operating voltages maximizing the panel capacity to charge the batteries. The luminaire and batteries shall be provided with similar operating voltages.

Each battery shall not exceed 77 lbs.

The batteries shall be housed with the controller in the cabinet.

4. Cabinet

The cabinet shall be sized to house the controller, batteries and miscellaneous power equipment. It shall be constructed of 1/8in. thick aluminum alloy type 5052-H32 to provide a strong rigid construction and weatherproof with a NEMA 3R rating. All welds shall be neatly formed and free of cracks, blowholes and other irregularities, and all inside and outside edges of the cabinet shall be free of burrs.

The cabinet shall be constructed to accommodate the weight of the components enclosed, reinforced and heliarc welded for rigidity and mounting.

Doors and Door Hardware. The cabinet door openings shall be double flanged on all four edges to increase strength around the openings and keep dirt and liquids from entering the enclosure when the doors are open. The front and rear doors shall be constructed of 1/8 in thick type 5052-H32 aluminum alloy to provide a strong rigid construction. All welds shall be neatly formed and free of cracks, blowholes and other irregularities, and all inside and outside edges of the cabinet shall be free of burrs.

The door hinges shall be minimum 3/32 in. thick aluminum and shall have a ¼ in diameter stainless steel hinge pin, and no hinge leaves shall be exposed externally when the door is closed. The hinge pin shall be capped top and bottom by weld to render it tamper proof.

A door restraint shall be provided to prevent door movement in windy conditions. The doors shall be furnished with a gasket that satisfies the physical properties as found in UL508 table 21. 1 and shall be a weather tight seal between the cabinet and door.

Door Latching Mechanism. The door latching mechanism shall be a three-point draw roller type. Pushrods will be turned edgewise at the outward supports and shall be ¼ in. x ¾ in aluminum, minimum. Rollers shall have a minimum diameter of 7/8 in. and shall be made of nylon.

Door Handles. Each door shall include one (1) stainless steel handle with a ¾ in. diameter shank, a Corbin #1548-1 keyed deadbolt type lock or equivalent, and shall have provisions for a padlock when the handle is in the closed position. Two (2) keys shall be furnished with each lock.

Sun Shields. A sun shield shall be provided on the top, the two sides and the doors of the Cabinet to reduce the cabinet internal ambient temperature. The shield shall be in the form of 1/8 in aluminum sheets installed on 1 in. spacers, mounted with tamper-proof hardware to the cabinets. The areas described above...
shall be covered, except for the handle and the padlock locations, and the top sun shield shall be crowned in a similar manner to the cabinet top.

Ventilation. The cabinet shall be provided with a passive ventilation system. Louvers shall satisfy the NEMA rod entry test for 3R ventilated enclosures. Exhaust air will be vented out between the top of the cabinet and door. The exhaust area shall be screened with a material having a minimum hole diameter of 1/8 in.

Cabinet Finish. The cabinet exterior including sun shields shall be finished as indicated in the plans. The Contractor shall submit a sample and description of the finish application process for approval by the Engineer. The cabinet shall be painted powder coated to a color as specified on the contract plans and details, a color chip shall be provided to the engineer for color approval.

Cabinet Grounding. A solid copper ground bus bar shall be permanently affixed to the inside surface of a cabinet wall. When installed, the cabinets shall be grounded in accordance with Sub-section 680-3.12 of the New York State Standard Specifications. The grounding shall consist of a conduit through the foundation, # 6 AWG ground wire from the cabinet ground lug to the ground rod and 5/8 in by 10 ft minimum, copper clad ground rod.

5. Solar Panels

One or two solar panels shall supply the power to the batteries. This solar panel array shall be properly sized for the total luminaire wattage for the daily operating time, geographic location area sunlight intensity (insolation) associated losses and with 30% excess capacity. The solar panel and batteries shall be provided with similar operating voltages maximizing the panel capacity to charge the batteries. The associated power calculations for the solar array and battery size and quantity shall be submitted for approval by the engineer prior to being furnished.

The solar panel array shall be mounted atop the shelter, facing south at a 45 degree angle with the horizon. The solar panel mount shall be adjustable horizontally and vertically to adjust toward the sun.

Metallic frame structure (with corrosion resistance paint) to be fixed on the roof of the Bus shelter to hold the Solar panel module. The frame structure should have provision to adjust its angle of inclination to the horizontal between 0 and 45, so that it can be installed at the specified tilt angle. The frame structure shall also have provisions to adjust for a 360 degree horizontal orientation, so that it can be installed at the specified orientation toward the sun.

The solar panel array mount and frame shall meet the latest requirements of AASHTO’s Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

The panel shall be made of monocrystalline or polycrystalline solar cells.

Ingress Protection rating of IP-65 as detailed in IEC60529.

BASIS OF ACCEPTANCE.

Acceptance of the luminaire will be based on manufacturer's certification of compliance and independent laboratory test results with these specification requirements and on inspection by the Engineer that no damage or defects are evident.

Measurement/Performance/Safety Standards:
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3. IESNA LM-80-08 IESNA Approved Method for Measuring Lumen Maintenance of LED Lighting Sources.
6. IEC 60529 Ingress Protection rating.

Acceptance testing of the Solar Powered 25W LED Bus Shelter Luminaire system occurs after installation and final inspection and acceptance of the unit and shall last for a period of two (2) weeks. Any failure of the unit shall be repaired and defective components replaced by the contractor during this period at no expense to the State and the acceptance test shall restart for another two (2) week period.

CONSTRUCTION DETAILS

The Solar Powered LED Bus Shelter Luminaire of the type and wattage specified, complete with luminaire, controller, cabinet, batteries, and solar panel arrays shall be installed and made operational as shown on the Plans.

Each solar panel, cabinet, luminaire unit shall meet the latest requirements of AASHTO’s Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and NFPA 70 NEC requirements.

The mechanical mounts to the bus shelter for the luminaire, solar panel, cabinet, etc. shall not affect the structural integrity of the bus shelter and shall meet AASHTO requirements. The Contractor shall provide shop drawings of the solar panel mounting to the bus shelter roof design signed by a licensed Professional Engineer registered in the State of New York for approval by the Engineer-In-Charge.

QUALITY AND WARRANTY

The original manufacturer of the white LED based solar lighting system are required to provide to the engineer a detailed report on the tests performance by independent laboratory and the actually measured values of Solar Panel (photovoltaic) module, electronics, LEDs, luminaire and battery and other related parameters, as per Measurement/Performance/Safety Standards.

TRAINING

The contractor shall conduct an (8) eight-hour maintenance training class demonstrating operation, inspection, general maintenance, diagnostics, and repair of all system components. The Training shall occur at a location within NYSDOT Region 10 at the engineer’s direction and after the installation of a unit and prior to final inspection and acceptance. The contractor shall provide 2 week notice prior to the start of the training.

DOCUMENTATION

Complete cut-sheets and shop drawing of all components, mounting procedures and calculations signed by a registered New York State engineer shall be submitted to the engineer for approval prior to installation.
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Shop drawings showing structural compliance with these specifications of the shelter, luminaire, solar panel array, cabinet and foundations and signed by a registered New York State engineer shall be furnished to the Engineer for approval.

Shop drawings showing compliance with these specifications of the power system and load calculations shall be furnished to the Engineer for approval.

Shop drawings shall have luminaire documentation in the form of independent laboratory testing showing compliance ANSI C78.377.2008, IESNA LM-80-08, IESNA LM-79-08 and IEC 60529.

An Operation, Instruction and Maintenance Manual, in English should be provided with the solar street lighting system. The following minimum details must be provided in the Manual:
1. White LED solar street lighting system - its components and expected performance
2. Photovoltaics (PV). The manufacturer, make, model number, country of origin and technical characteristics.
3. PV module
4. Clear instructions about mounting of PV module.
5. White LED Lights. The manufacturer, make, model number, country of origin, full binning number and technical characteristics of LEDs should be stated in the product data sheet and furnished with IESNA test results.
6. Battery and electronics used
7. Charging and significance of indicators.
8. Clear instructions on controller operation, settings and trouble shooting.
9. Clear instructions on operation, regular maintenance and trouble shooting of solar street lighting system.
10. Name and address of the person or service center to be contacted in case of failure or complaint.

METHOD OF MEASUREMENT

The Solar Powered 25W LED Bus Shelter Luminaire shall be measured by the number of each unit of the type specified, complete in place, in accordance with the Plans, specifications, or as directed by the Engineer.

BASIS OF PAYMENT

The unit price bid for each Solar Powered 25W LED Bus Shelter Luminaire shall include the cost of the luminaire of the type at the designated wattage, luminaire, controller, batteries, solar panels, cabinet, grounding, wiring harness and any and all hardware, mounting design and mounting hardware, fittings, expansion fittings, straps, clamps, labor and other material necessary to complete the work.

Payment schedule shall be as follows:
1. 75% of the bid price after installation and successful inspection by the Engineer.
2. 15% of the bid price after receipt of all documentation (manuals) and completion of the training.
3. 10% of the bid price after successful completion of acceptance testing.