MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
F0R
SOLAR POWER FLASHING BEACON, SINGLE OR DUAL

SIG:EMS 1 of 4 APPR:HLO:NJB:05-05-20
FHWA:APPR:05-06-20

a. Description. This work consists of completing one or more of the following work types at locations shown on the plans:

1. Furnishing and installing a single solar power flashing beacon assembly.

2. Removing and disposing of an existing single solar power flashing beacon assembly.

3. Furnishing and installing a dual solar power flashing beacon assembly.

4. Removing and disposing of an existing dual solar power flashing beacon assembly.

As applicable, this work includes removal or installation of the solar engine, solar panel, solar power light emitting diode (LED) flashing beacon signal modules with housing, mounting hardware, and all associated material required to ensure a complete removal or installation, as specified for a location. Storage and disposal of materials, when required, is also included in this item.

b. Material. Provide materials in accordance with sections 918 and 921 of the Standard Specifications of Construction and the following:

1. Solar Engine Assembly. The solar engine must meet all of the following requirements:

A. Fabricated from powder coated aluminum, with nominal dimensions of:

(1) 6 inches by 17 inches by 30 inches for a 20-watt panel.

(2) 6 inches by 17 inches by 21 inches or 6 inches by 20 inches by 21 inches for a 50-watt panel.

(3) 6 inches by 20 inches by 31 inches for a 80-watt panel.

B. Include an UL approved, integrated 20-watt, 50-watt, or 80-watt solar charger (solar panel) and battery system with mounting hardware.

C. Operate on 12 volts direct current (VDC).

D. Battery bracket enclosing the battery in a manner which restricts thermal expansion of the battery; must not require an external control or battery cabinet.

E. All batteries and electronics mounted with aluminum flashing.

F. House one, field-replaceable, sealed lead acid battery of:

(1) 33 Ampere-hour (Ah) for the 20-watt panel;

(2) 75Ah for the 50-watt panel; or

(3) 100Ah for the 80-watt panel.

G. Vented to provide cooling of the battery and electronic system. Ensure the venting is covered with wire mesh to prevent insect intrusion.

H. Ensure weight, including mounting hardware, does not exceed 81 pounds.

I. Accommodate mounting third party device(s) such as wireless contact closure type radios or sensing equipment and an auxiliary 12VDC power output to provide power to the device(s).

J. Provide sufficient empty space, 2¾ inch by 7 inch by 10 inch space (maximum), to house a third party device.

K. Capable of operating single or dual solar power LED flashing beacons (sign opticals). For the dual type operation where flashing beacons are located on either side of the roadway, provide a simultaneous type of flashing operation facing approaching traffic.

L. Ensure the solar panel meets the design qualification and type approval of photovoltaic modules in accordance with *IEC 61215*. This specification includes radiation testing, thermal testing, and mechanical testing for environmental conditions such as ultraviolet (UV)-exposure and thermal cycling, as well as degradation of maximum power output.

M. Can be tilted and oriented south without additional mounting hardware.

2. Solar Beacon. Ensure the solar beacon system meets all of the following requirements:

A. Operate on 12VDC.

B. Operate continuously (24 hour operation) when the battery is connected. The solar beacon must have the option to be activated by a third party switch or third party device with compatible wireless contact closure type radio output.

C. Conform to *MMUTCD* standards for flashing beacons.

D. Flash rate of not less than 50 or more than 60 per minute.

E. Illuminated period of each flash not less than one-half and not more than two-thirds of the total cycle.

F. Nighttime dimming feature.

G. Minimum operating autonomy of 30 days.

H. Automatically reduce light output when battery is low to reduce the risk the beacon will fail entirely in poor solar conditions.

I. Painted with a semi-gloss yellow enamel. The color must match the central color within the limits shown on FHWA Highway Yellow Tolerance Chart, except the color must not be darker than the central color.

3. LED Signal Module/Housing. The LED signal module must conform to the mandatory specifications of *ITE Vehicle Traffic Control Signal Heads (VTCSH)*, *Light Emitting Diode (LED) Circular Signal Supplement* as required by the *MMUTCD*. The LED signal housing must meet the equipment standard of the *ITE Vehicle Traffic Control Signal Heads (VTCSH) Chapter 2*.

4. Environmental Requirements. Ensure the system is able to operate in a temperature range of -40 degrees Fahrenheit (F) to +122 degrees F.

Ensure the system is designed and constructed to withstand 110 mile per hour (mph) wind loads in accordance with the requirements of the *AASHTO publication*, *Standard Specifications for Structural Supports of Highway Signs, Luminaires and Traffic Signals*.

Design and test the electronic circuit board housing, wire harnessing, and connectors in accordance to *International Electrotechnical Commission (IEC) Standard 60529, Ingress Protection IP67* requiring the enclosure be dust tight and remain completely sealed when immersed in water to a depth of 3 feet for 1 hour.

The LED module must meet the following environmental tests as specified in the *ITE Vehicle Traffic Control Signal Heads, Light Emitting Diode (LED) Circular Signal Supplement*:

A. Mechanical vibration. *MIL-STD-883*.

B. Temperature cycling. *MIL-STD-883*.

C. Moisture resistance. *MIL-STD-810F*.

5. Quality/Warranty. Ensure the system is *Federal Communications Commission (FCC)* certified to comply with all *47 CFR FCC Part 15 Subpart B Emission* requirements.

Provide a manufacturer's warranty, transferable to the MDOT, that the supplied materials are free from all defects in materials and workmanship. Furnish the warranty and other applicable documents from the manufacturer, and a copy of the invoice showing date of shipment, to the Engineer prior to acceptance

c. Construction. Furnish, install, or remove the single or dual solar power flashing beacon as shown on the plans or directed by the Engineer. Complete this work in accordance with sections 819 and 820 of the Standard Specifications for Construction, per the contract, and this special provision. Remove and dispose of the material, as directed by the Engineer, in accordance with section 204 of the Standard Specifications for Construction.

Deliver the entire system as a complete unit ready to install, requiring no assembly. Mount the solar engine assembly as shown on the plans. Provide the assembly and bracket for mounting as shown on the plans. Mount each 12 inch solar power LED flashing beacon (12VDC) separately, at each sign location, including required brackets, hardware, fittings, connectors, and other associated material necessary to complete the work.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

Pay Item	**Pay Unit**
Flsh Beacon, Solar Power	Each
Flsh Beacon, Solar Power, Rem	Each
Flsh Beacon, Solar Power, Dual	Each
Flsh Beacon, Solar Power, Dual, Rem	Each