MICHIGAN

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

FOR

**SOLAR RECTANGULAR RAPID FLASHING BEACON**

SIG:HJK 1 of 4 APPR:EMS:DBP:08-28-24

**a. Description.** This work consists of furnishing and installing a solar powered, rectangular rapid flashing beacon (RRFB) (one way or two way as shown on plans).

As applicable, this work includes installation of the RRFB with housing, radio, antenna, battery(s), solar assembly, control box, mounting hardware, and all associated material required to complete the work.

**b. Materials.** Furnish materials in accordance with sections 918 and 921 of the Standard Specifications for Construction and the following requirements of this special provision:

1. Beacon. Furnish an RRFB meeting the following requirements:

A. A one-way RRFB consisting of two rectangular shaped amber indications, each with a high-intensity, LED-array pulsing class 1 light source in accordance with *SAE* *standard J595*.

B. Each amber indication must have minimum dimensions of 2 inches high by 5 inches wide, with the 5 inch dimension oriented horizontally and the 2 inch dimension oriented vertically.

C. Ensure a minimum of 5 inches measured horizontally between the inside edges of the amber indications.

D. Ensure a maximum of 36 inches measured horizontally between the outside edges of the amber indications.

E. Place the RRFB indications in a powder-coated (black or Federal yellow) aluminum housing.

F. A two-way RRFB consisting of four rectangular shaped amber indications (two facing in one direction, and two facing the opposite direction), each with a high-intensity amber LED-array pulsing class 1 light source in accordance with *SAE* *standard J595*, in addition to subsections b.1.B thru b.1.E of this special provision.

G. Use an RRFB that has an additional LED indication facing in the direction of pedestrian travel to furnish notice to the pedestrian when the RRFB is operating.

2. Beacon Flashing Requirements. Furnish a beacon meeting the following flashing requirements:

A. When activated, flash the two amber indications (facing the same direction in each RRFB) in a rapidly alternating "wig-wag (indication #1 on, then indication #2 on) and simultaneous flashing sequence as defined in *MUTCD, 11th Edition, Section 4L.03*.

B. To avoid frequencies that might cause seizures, do not use flash rates more than 5 flashes per second for each amber indication.

3. Beacon Operation. Furnish beacon operation meeting the following requirements:

A. The RRFB is dark until pedestrian actuation.

B. Initiate operation upon pedestrian actuation and cease operation at a predetermined time after actuation. Set this predetermined duration of operation as shown on the plans or as determined by the Engineer.

C. Simultaneously begin (upon actuation) and end (after the predetermined duration) the operation of all RRFB's associated with a given crosswalk.

D. Ability to synchronize all RRFBs associated with a given crosswalk using one of the following methods as shown on the plans:

(1) 900 megahertz (MHz) or 2.4 GHz radios that turn on within 120 milliseconds and remain synchronized throughout the duration of the flashing cycle; or

(2) Hardwire interconnect.

E. Capability of automatically dim during nighttime operation.

4. Control Box.

A. Ensure control box is *NEMA 3R* rated and *Ingress Protection-67* weatherproof.

B. Ensure any venting is covered with wire mesh to prevent insect intrusion.

C. Control box may be integrated with solar charger.

5. Control Circuit. Furnish a control circuit meeting the following requirements:

A. Independently flashes up to 2 separate LED light outputs.

B. Programmable light outputs and flash patterns.

C. Circuit connectors must conform to *Ingress Protection-67* rating, dust proof and protected from temporary immersion in water up to 3 feet deep for 30 minutes.

6. Radios. When RRFBs are not interconnected with hard wire, furnish radios meeting the following requirements:

A. Communications integrated with the RRFB control circuit to activate the system from a pushbutton input.

B. Radios synchronize all of the RRFBs at a crosswalk.

C. Radios capable of initiating operation of RRFBs within 120 milliseconds and maintaining synchronized operation throughout the duration of the flashing cycle.

D. Operates on a 900 MHz or 2.4 GHz radio frequency hopping spread spectrum network from 3.6 to 15 VDC.

7. Solar Engine Assembly. The solar assembly must meet all the following requirements:

A. Capable of operating single sided or back-to-back RRFB lights.

B. Operate on 12 VDC.

C. Furnish a minimum operating autonomy of 7 days.

D. Include a solar charger (solar panel), cabinet with battery system enclosure, and mounting hardware suitable for installation on 4 inch round poles.

E. Mount all batteries and electronics with aluminum or stainless steel.

F. Solar Charger Configuration:

(1) Furnish a solar charger and battery configuration that meets one of the following configurations:

(a) 15 Watt solar charger with 14Ah battery

(b) 30 Watt solar charger with 18Ah-44Ah battery

(c) 50 Watt solar charger with 18Ah-36Ah battery

(d) 65 Watt solar charger with 50Ah battery

(e) 80 Watt solar charger with 18Ah-55Ah battery

(2) Allow an adjustable angle and rotation to orient to maximum insolation exposure.

(3) Ensure solar panel is weatherproof with an *Ingress Protection-67* rating and constructed with UV-resistant material

(4) Meet a minimum operating temperature range of -40 °F to 140 °F.

(5) Assemblies with solar panel and control cabinet integrated together must be constructed to not exceed dimensions of:

28 inches (W) by 19 inches (H) by 6 inches (D).

(6) Ensure design weight of solar panel is less than 25 pounds. If solar panel and cabinet are incorporated together, the weight must not exceed 45 pounds.

(7) Withstand a minimum wind load rating of up to 120 mph as per AASHTO LTS-6 (*Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*).

(8) Ensure the solar panel meets the design qualification and type approval of photovoltaic modules in accordance with *IEC 61215*.

G. Battery:

(1) House a field-replaceable, sealed lead acid battery with a capacity of no less than 14 Ampere-hours (Ah).

(2) Fuse battery for short circuit protection.

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

**c. Construction.** Complete this work in accordance with sections 819, 820, and 919 of the Standard Specifications for Construction, per the plans, and this special provision.

1. Set the predetermined duration of operation of the RRFBs as shown on the plans or as determined by the Engineer.

2. Mount the RRFB system to the support as shown on the plans using *AISI 300* series stainless steel U-bolts and associated hardware.

3. Terminate wiring connections in the RRFB and in the control box.

4 Obtain shop drawing approval from the Engineer prior to installation of units.

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

**Pay Item** **Pay Unit**

Flsh Beacon, Rectangular Rapid, Solar Power Each