TRAILER MOUNTED SOLAR POWERED FLASHING ARROW PANEL MGS-06-06B

1.0 DESCRIPTION. All trailer mounted solar powered flashing arrow panels, hereinafter referred to as a FAP, shall be designed and manufactured in accordance with this specification.

2.0 MATERIALS. The FAP shall consist of an arrow panel, rotating or folding mechanism, control switches and circuitry, a control box housing electronic components, and self-contained solar/battery power supply, as specified, all mounted on a towable trailer. Each unit shall be fully assembled when delivered.

2.1 FAP Panel Assembly.
(1) The FAP (housing) shall be aluminum and contain a minimum of 25 LED (Light Emitting Diode) lamps. Lamps shall be energized from control switches located in a lockable weatherproof box made of durable corrosion resistant metal material located on the arrow panel support frame.

(2) A nominal 5 3/4-inch (140 mm), 360 degree tunnel visor with full-attachment flange shall be provided for each lamp. Visors shall be attached to the panel with stainless steel machine screws. Visors shall be removable without removing the screws. Water proof material shall be provided between each lamp and the panel face, to absorb vibration and prevent intrusion of moisture. The panel or lamp holder shall be notched to match a projection on the lamp to ensure proper lamp alignment. All lamps shall be replaceable from the front of the panel.

(3) A lamp of the same type used on the panel face shall be provided on the back side of the panel and be continuously energized or flashed when the FAP is operating. A visor is not required on this lamp. It shall be located in the uppermost corner of the panel on the driver's side.

(4) Lamps shall be PAR-46 yellow, 5 ¾ inch (140 mm) dia., LED lamps specifically designed for solar applications. Each lamp shall have an optical lens and contain enough light emitting diodes to meet the existing MoDOT specifications for visibility and legibility performance standards as stated later in these specifications.

(5) Overall size of the FAP shall be a nominal 4 feet (1200 mm) by 8 feet (2400mm).

(6) Panel mounting height shall be 7 to 9 feet (2100 to 2700 mm) from the roadway surface to the lowest point on the panel. The bottom edge of the panel shall be relatively level when in use.

(7) The FAP (housing) shall consist of a nominal 3-inch x 1 inch x 1/8 inch (75 mm x 25 mm x 3 mm) welded aluminum channel with a 1/16 inch (1.5 mm) thick aluminum sheet attached to the front and back. The front and back surfaces of the panel shall be painted non-reflective flat black. All wiring inside the FAP shall be corrosion resistant wiring and shall be attached to the panel approximately every 8 inches (200 mm). All panels shall have an access door for ease of access to terminal strips/wiring connections/diodes if equipped. Company names or logos shall not be placed on the FAP.

2.2 CONTROL AND WIRING.
(1) A trailer mounted control will be considered the standard control. An optional wireless remote control, if available, should perform the same functions as the trailer mounted control.

(2) The control switches shall provide MUTCD Sequential Arrow (Merge Right or Left), Flashing Double Arrow and Alternating Diamond Caution.

(3) The control shall include an on/off switch, a dim/bright selector switch, an operation mode selector switch, and a photoelectric cell. All electronic components shall be solid state and electrically protected by fuses or circuit breakers. All cables and control wiring shall enter the control cabinet from either the back or the bottom through salt-resistant, weatherproof connectors. No external or spliced wire connections will be accepted outside of the control cabinet.

(4) The optional wireless remote control unit, if available, shall be FCC approved. The wireless modules should derive power from the controller and remote respectively. Remote wireless FAP and remote shall have a permanently affixed unique I.D. label or plaque.
(5) The flashing rate of the lamps shall not be less than 25 or greater than 40 flashes per minute. Lamp "ontime" shall be at least 50 percent.

(6) Control circuitry shall provide dimming of all lamps to prevent blinding during night operation. Dimming shall be by manual and automatic controls, capable of at least 50 percent from full brilliance. The photoelectric cell shall automatically reduce the flashing arrow light intensity as ambient light reduces.

(7) A readily accessible cartridge fuse or circuit breaker shall be provided in the circuit between the power supply and FAP control. The fuse or breaker shall be rated to handle the maximum lamp load of all lamps. The fuse or breaker shall be located in the control cabinet.

2.3 POWER SUPPLY.
(1) Solar Panels: Wattage of the solar panels shall be adequate to fully charge batteries, and will contain a remote battery charger back-up as described below. Solar panels shall be mounted above top of FAP with a minimum 4 degree pitch from the horizontal position to encourage shedding of dirt and rainwater.

(2) Battery Charger: The battery charger with charge indicator shall be included and shall be mounted at the base of the frame of the FAP support, inside a lockable, weatherproof, battery box. The battery charger shall have the capability to charge the battery bank within a 48 to 72 hour time period from a 120 VAC utility power source.

(3) Batteries: Batteries shall be the A.G.M. type (Absorb Glass Mat), class GC2, rated at no less than 200 amp hours per battery when fully charged. The quantity of batteries shall provide enough power to run the unit at full load for 15 consecutive days on battery power only. Solar charging shall be disabled during this 15 day period. An optional package shall be provided for 30 day continuous days.

(4) Battery Box: A lockable, weatherproof, battery box shall be made of minimum 14-gauge steel, with louvered side panels for cross-flow ventilation and with bottom and sides coated with acid-resistant protector.

(5) Voltage Regulator: The voltage regulator shall be solid-state micro-processor-based, utilizing constant positive drive voltage and pulse with modulation to optimize battery charging; measuring battery voltage and adjusting current from the solar panels so the batteries are not overcharged, and also preventing overcharging of batteries by the solar panels when the sign is

turned off. An automatic disconnect device shall be included to protect the entire system in case of low voltage.

(6) Controller: A solid-state, LED optimized, controller shall be utilized to minimize wattage consumption and maximize battery life. Control circuitry shall provide a negative ground to each lamp at all times. Frame-ground circuitry to the lamps will not be permitted. Individual ground circuits to each lamp shall be provided. Positive power shall be supplied to each lamp through individual circuits from solid-state load switches in the control cabinet. The controller cabinet shall be assembled in a manner to allow easy access to internal control circuitry, such as with machine screws for service and repair purposes. Continuous, positive 12-volts to the lamp will not be permitted. The positive power to each lamp shall be reduced to zero voltage by the solid state load switches. It shall have reverse-polarity and short-circuit protection. The voltage regulator and controller shall be in a lockable, weatherproof, box located on the frame of the FAP support.

2.4 Trailer.
(1) Welding: The trailer welding shall be in accordance with American Welding Society standards.

(2) Dimensions: Minimum trailer dimensions shall be length 100 inches (2500 mm) and width 70 inches (1800 mm) (fender to fender).

(3) Frame: Structural steel tubing, (minimum square tubing 2 1/2 inch x 2 1/2inch x 11-gauge (62.5 mm x 62.5 x 11-gauge) wall thickness or minimum 2 inch (50 mm) square tubing x 1/8 inch (3 mm) wall thickness) minimum 3 cross braces (with tie-down loops on front corners.)

(4) Axle: Single, minimum 2,000-pound (900-kg) capacity, tubular, with 5-hole, 4.5 inch (110 mm) B.C. circle pattern on idler hub.

(5) Wheels: 15-inch (375 mm) steel, safety rim, 5 lug bolts.

(6) Tires: 15-inch (375 mm), load range C, tubeless, radial highway tread (ST205/75R15 minimum.)

(7) Springs: Minimum 3-leaf, double eye, minimum 1,200-pound (540-kg) capacity for each spring or adequate torsion type axle.

(8) Tongue: 3-inch x 3-inch x 3/16 inch (75 mm x 75 mm x 4.8 mm) steel tubing (removable for shipping and to prevent theft.). Tongue weight approximately 10-15 percent of gross weight. Minimum 4-foot (1200 mm) hitch-to-trailer clearance.

(9) Deck: 12 sq. ft. (3.6 sq. m) minimum, 10 gauge, smooth plate or open deck.

(10) Fenders: 16 gauge steel, inside closed in above deck, round, full wheel coverage.

(11) Safety Chain: Two, 5/16 inch x 34-inch (8 mm x 860 mm) long plated steel chains connected to a loop that is welded to the tongue. Chain shall have yield strength equal to weight of trailer and payload, or greater. Chain loop shall have yield strength equal to chain, or greater.

(12) Screw Jack: Tongue mounted, 2,000-pound (900-kg) capacity, steel base 2 inch x 4 inch foot (50 mm x 100 mm), minimum size and capacity.

(13) Leveling Legs: Adjustable on minimum 1" increments with foot pads (2 inch x 4 inch minimum), mounted on four corners of frame, perforated 1 ¾ inch (40 mm) square tube x 12-gauge wall locked in place by 3/8 inch (9.5 mm) diameter snapper pins, secured to trailer frame by wire cable or chain. Screw Jacks that meet the tongue jack requirements are an acceptable alternative.

(14) Hitch: Easily removable combination, 2 inch (50 mm) diameter ball coupler and a 3 inch (75 mm) inside diameter, flat pintle ring, adjustable 24-inch (600 mm) to 36-inch (900 mm), in 2-inch (50 mm) increments.

(15) Paint: Entire trailer - one coat primer, one coat high-visibility, Safety Orange Paint similar to Federal Standard 595B #12243, including all surfaces under deck and on underside of fenders. Powder coat of the same color is acceptable.

(16) Lights: LED and DOT Approved 12-volt, two tail/stop signals and two separate tail/turn signals; side, rear and tongue reflectors. Tail lights shall have metal guard protective assemblies. Wires shall be identified as to function. Each CMS unit shall have a trailer lighting system with a 7-wire flat prong round RV male molded plug.

2.5 Performance. Any display mode must be visible on a sunny day for a distance of one mile. The FAP must be able to operate for 15 continuous days in the flashing double arrow mode during day/night light conditions with the solar charging system disconnected. A device shall be provided to indicate the remaining charge on the batteries. The FAP support frame shall contain a device to align the FAP to oncoming traffic and to adjust the FAP so its bottom edge is relatively level when in use. The panel lamp must be visible during the “on time” at an angle of 15 degrees minimum to both left and right center and 4 degrees minimum both up and down of center.

2.6 Owner's Manual. The successful bidder shall furnish manuals as specified in RFB.

3.0 WARRANTY. New units delivered to the Missouri Department of Transportation must be covered by the manufacturer’s standard warranty for a minimum of one year, which includes on-site repair (parts, labor, and travel), at no expense to MoDOT.

3.1 All units manufactured shall be exactly the same as the units tested.

3.2 All units shall meet or exceed the specifications for FAP boards as listed in Part 6F.61 of the current Federal Highway Administration’s Manual on Uniform Traffic Control Devices (MUTCD).