



TRUCK MOUNTED SOLAR POWERED FLASHING ARROW PANEL MGS-06-08B

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

2.0 MATERIALS. The FAP shall consist of an arrow panel, mounting frame and rotating or folding mechanism, remote control switches and circuitry, and a lockable control cabinet housing electronic components in a self-contained solar/battery power supply. Each unit shall be fully assembled when delivered.

2.1 FAP PANEL ASSEMBLY.

(1) FAP shall be aluminum and contain a minimum of 25 LED lamps. Lamps shall be energized from a control cabinet mounted inside the battery compartment and controlled by the remote control switches located inside the truck cab.

(2) A nominal 5 ¾ 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 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 of 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 but recommended, and it shall be located in the uppermost corner of the panel on the driver's side.

(4) LED lamps shall be PAR-46, yellow, 5 3/4inch (140 mm) diameter, 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 the visibility and legibility performance standards as stated in section 2.5 Performance.

(5) Overall size of the FAP shall be a nominal 3 feet (900 mm) by 6 feet (1800 mm).

(6) The average truck bed height is 52 to 56 inches. When fully raised in the display position, the bottom of the FAP board shall be at least a height of 8 feet (2100 mm) from the ground. The FAP shall have an electrical-hydraulic lifting mechanism that includes a fully functioning manual lifting and lowering relief mechanism as a backup. The FAP shall be design to maintain a maximum height of 11 feet - 9 inches in the storage/travel position.

(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 remote cab control will be considered the standard control. An optional wireless remote control, if available, shall perform the same functions as the remote cab control.

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

(3) The remote cab control switches shall include an on/off switch, a dim/bright selector switch, an operation mode selector switch, an LED power-on lamp, and be equipped for top of dash mounting. The control shall be provided with at least 30 feet (9 meters) of multi-conductor, salt resistant, weather proof cable and a NEMA 4 surface base cover connector plug to connect the NEMA 4 side entry hood connector mounted approximately 4 feet (1200 mm) from the base of the frame and controller. The remote cab control shall be assembled in a manner to allow easy access to internal circuitry and switches for service and repair, such as machine screws. All electronic components shall be solid state and electrically protected by fuses or circuit breakers.

(4) The optional wireless remote control unit, if available, shall be FCC approved. The wireless modules shall derive power from a 12-volt source. 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 "on-time" 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, in-line fuse, or circuit breaker shall be provided at the power supply end of the circuit between the power supply and the controller mounted inside the battery box. The fuse or breaker shall be rated to handle the maximum lamp load of all lamps. An additional fuse or breaker shall be located of the controller cabinet, protecting the circuit supplying the remote cab control.

2.3 POWER SUPPLY.

(1) Solar Panels: Wattage of the solar panels shall be adequate to fully charge batteries, and shall 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 fully enclosed (sides, top, bottom) lockable, weatherproof box, mounted at the base of the frame of the FAP support, shall be made of minimum 14-gauge steel, with louvered side panels for cross-flow ventilation and with the sides and bottom coated with acid-resistant protector. The battery box shall be large enough to sufficiently house and service the controller, batteries and charger. The lid of the battery box shall be hinged and include a stabilizer rod to allow ease of maintenance and repair of batteries, charger and or photoelectric control.

(5) Voltage Regulator: The voltage regulator shall be solid-state, micro-processor-based, utilizing constant positive 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 prevent overcharging of the batteries by the solar panels when the panel is turned off. An automatic disconnect device shall be included to protect the entire system in case of low voltage.

(6) Disconnect and Enclosures: Disconnect plug and receptacle shall be determined by the current, voltage, and number of contacts required for proper operation. Connectors shall have screw terminations and accommodate a wire size of up to #12AWG. The male connector shall be enclosed in a NEMA 4 rated surface base enclosure and cover. The female connector shall be enclosed in a NEMA 4 side-entry hood enclosure. Multi-conductor cable shall enter the bottom of the enclosures through a waterproof, flame-resistant, salt and corrosion resistant cable connector with a sealing nut and internal ratchet containing a neoprene cable gland.

(7) Controller: A solid-state, LED optimized, controller shall be utilized to minimize wattage consumption and maximize battery life. The 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 the internal control circuitry, such as with machine screws, for service and repair purposes. Provide a 35-foot controller cable for the wired and wireless option. In addition provide controller charging from the vehicle's 12-volt power outlet for the wireless option. Continuous, positive 12-volts to the lamps 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, battery box mounted at the base of the frame. Ability to program the display and monitor the display from inside truck with vendor's supplied handheld controller. Controller supplied shall not have a power saving sleep mode. The remote cab control switches shall provide MUTCD Sequential Arrow (Merge Right or Left), Flashing Double Arrow and Alternating Diamond Caution. All graphics shall completely fill display area and be legible.

2.4 FRAMEWORK.

(1) The FAP shall be supported on a four vertical post framework consisting of welded steel tubing in accordance with American Welding Society standards. All open ends of tubing shall be capped and welded shut. Each panel shall contain a tie down anchor point on each side, (left, right) of the frame to accommodate a 4 to 6 inch (100-150 mm) wide strap to anchor to the truck. Angle and cross bracing of the vertical supports shall be provided at the top and bottom of the supports to ensure a rigid frame. See drawing on Attachment 1. Each FAP shall be equipped with two forklift tubes for ease of installation as shown in Attachment 1.

(2) The support frame shall be painted one coat of primer and one coat of high-visibility, Safety Orange Paint similar to Federal Standard 595B #12243. Powder coat of the same color is acceptable.

2.5 Optional Emergency Alert Lights. The Emergency Alert System (EAS) shall be comprised of six white illumination LED light heads placed in two rows of three.

The three high mounted lights should be between 72 to 106 inches from the road surface; see attached photo suggested location A.

The three low mounted lights should be between 42 to 54 inches from the road surface; see attached photo suggested location B.

The vertical separation between the two rows of lights shall be a minimum of 38 inches.

The lights shall be visible when CMS or FAP is in the activated or deployed position.

The optional emergency alert lights shall be powered by the truck's battery system.

Nominal Criteria:

- Watts/Amps @ 12VDC: 27.2W / 2.26A
- Operating Voltage: 10~41 VDC
- Kelvin Rating: 6000K
- Shock Resistance: GB/T 10485-2007/11.4.4.2
- Raw Lumens: 2600
- Flashes: 90 per minute
- Automatic Dimming Feature
- Mounting Type: Universal Surface
- Operating Temp: -40~150 degrees C.
- Lead / Connector: 19" w/Waterproof ATP
- Dimensions: 7.59" L x 1.73" H x 3.05" D
- Housing: A403 High Purity Aluminum
- Virtually Unbreakable Polycarbonate Lens
- 93% Optic Purity
- Stainless Steel Mounting Bracket & Hardware
- UV Polyester Powder Coat Finish
- Instant On/Off – Means No Warm Up
- Pressure Relief Valve (Known as Military Breather)
- Over / Under Voltage Protection
- Integrated Thermal Management
- Beam pattern: Horizontal spread of 40 degrees or less / Vertical spread of 30 degrees or more
- Sharp optical " cut off "
- Easy disconnects shall be used on all wiring so that when the CMS or FAP is removed the (EAS) shall also be easily removed and stay attached to one of those devices.

Handheld Controller shall be a momentary on/off switch. A 35 foot control wire with the handheld controller shall be supplied.

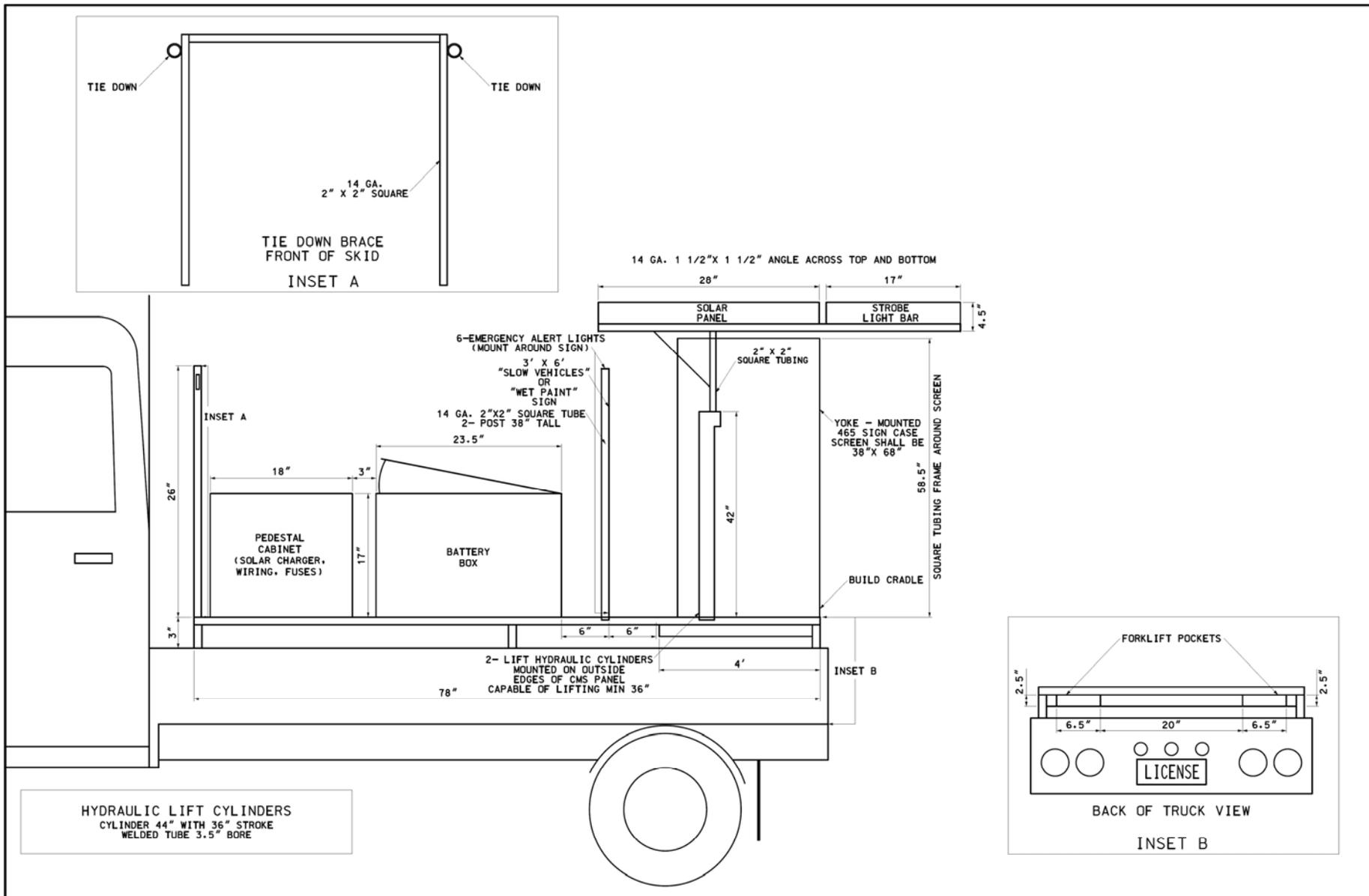
2.6 Performance. Any display mode must be visible on a sunny day for a distance of one mile. The FAP must be able to operate for 15 continuous days in the flashing double arrow mode during day/night light conditions with the solar charging system disconnected. A device shall be provided to indicate the 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.

2.7 Owner's Manual. The successful bidder shall furnish two Owner's Manuals for each FAP. Each manual shall include the manufacturer's instructions for maintenance and operation of the FAP. Each manual shall also include a detailed, schematic, wiring diagram showing all circuits and components from the power supply through the control to the FAP. The schematic diagram shall list all transistors, resistors, triacs, diodes and other components with the manufacturer's name and part number.

3.0 WARRANTY. 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).



IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.