

**MISSOURI DEPARTMENT OF TRANSPORTATION (MoDOT)
TRAILER MOUNTED FLASHING ARROW PANEL SPECIFICATIONS
(SOLAR POWERED, WITH LED LAMPS)**

Description

The trailer mounted flashing arrow panel shall consist of an arrow panel, mounting frame and rotating mechanism, control switches and circuitry, a control box housing electronic components, trailer, and self-contained power supply. Each unit shall be fully assembled when delivered.

Panel and Mounting Assembly

The arrow panel shall be aluminum and contain a minimum of 15 LED (Light Emitting Diode) lamps. Lamps shall be energized from control switches located in a lockable weatherproof aluminum box located in the arrow panel support frame.

A nominal 5 1/2-inch, 360° 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. 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.

A lamp of the same type used on the panel face shall be provided on the backside of the panel and be continuously energized or flashed when the arrow panel 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.

Lamps shall be PAR-46 yellow, 5 1/2" DIA., LED lamps specifically designed for solar applications. Each lamp shall have an optical lense and contain enough light emitting diodes to meet the existing MoDOT specifications for visibility and legibility performance standards as stated later in these specifications.

Overall size of the arrow panel shall be a nominal 4 feet by 8 feet.

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

The arrow panel shall consist of a nominal 3-inch by 1 inch by 1/8 inch welded aluminum channel with a 1/16 inch 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 arrow panel shall be corrosion resistant wiring and shall be attached to the panel approximately every 8-inches. Company names or logos shall not be placed on the arrow panel.

The arrow panel shall be supported on a two or four vertical post framework consisting of a minimum of 2-inch by 2-inch by 1/8 inches thick welded steel tubing. All open ends of tubing shall be capped and welded shut. Steel supports shall be welded to the deck plate and the deck plate welded to the frame and cross members. The panel shall be rotatable from a horizontal to a vertical position electrically, hydraulically, by winch and cable (minimum 1/4- inch diameter galvanized aircraft cable) with automatic brake, with a screw type mechanism, or by a self-locking, manually operated square stainless steel tube. The supporting frame shall have a locking device to secure the panel in the horizontal and vertical positions. When in the

horizontal position, the panel shall rest on a rigid frame support, relieving the load from the rotating device. Angle and cross bracing of the vertical supports shall be provided at the top and bottom of the supports to ensure a rigid frame. Manually operated winch mechanisms shall be located on the right, or passenger side, of the trailer.

The support frame shall be painted one coat of primer and one coat of Dupont Automotive Deluxe Enamel Code 93-75306 (yellow), or Chrome Enamel 13432 (yellow), of Federal Standard 595, or equal. A high-visibility, Safety Orange Paint, such as Sherwin Williams Omaha Orange Paint, which is similar to Federal Standard 595B #12243, or equal, may be used in lieu of yellow paint.

Control and Wiring

The control switches shall provide left and right flashing arrows, double flashing arrow, and caution modes of operation. The caution mode shall consist of flashing 4 lamps using the upper and lower lamps of the left and right arrowheads. Left and right flashing arrows shall flash 10 lamps, 5 in the arrowhead and 5 in the horizontal shank simultaneously. The double flashing arrow shall flash 13 lamps, 5 in each arrowhead and 3 in the horizontal shank simultaneously.

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.

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.

Control circuitry shall provide dimming of all lamps to prevent blinding during night operation. Dimming shall be by manual and automatic control. The photoelectric cell shall automatically reduce the flashing arrow light intensity as ambient light reduces. The photoelectric control shall be mounted on the side or bottom of the arrow control cabinet.

A readily accessible cartridge fuse or circuit breaker shall be provided in the circuit between the power supply and arrow panel control. The fuse or breaker shall be rated to handle the maximum lamp load of 14 lamps. The fuse or breaker shall be located in the control cabinet.

Solar Panels: Solar panels shall be a minimum of 100-110 watt panels, with a remote battery charger backup. Solar panels shall be mounted above top of arrow panel with a 4 degree pitch from the horizontal position to encourage shedding of dirt and rainwater.

Battery Charger: A built in 50 amp, 120 volt AC input, 12 volts DC output battery charger with charge indicator shall be included and shall be mounted at the base of the frame of the arrow panel support, inside a lockable, weatherproof, battery box.

Batteries: Batteries shall be the gel cell type; a minimum of 6 batteries, , with a minimum of 700 amp-hours of energy when fully charged, wired to provide 12 volt DC power supply.

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

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.

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, aluminum box located on the frame of the arrow panel support.

Locks: A lockable box shall be mounted on the trailer deck to protect the batteries and battery charger from theft and damage from falling or flying objects.

Performance: The flashing arrow must be visible on a sunny day for a distance of one mile. The flashing arrow must be able to operate for 20 continuous days in the single arrow mode during day/night light conditions with the solar panel disconnected or covered. A device shall be provided to indicate the remaining charge in the batteries. The arrow panel support frame shall contain a device to align the arrow panel to oncoming traffic and to adjust the arrow panel 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° minimum to both the left and right of center and 4° minimum both up and down of center.

Trailer

Dimensions: Minimum trailer dimensions shall be length 110" and width 76" (fender to fender).

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

Axle: Single, minimum 2,000-pound capacity, tubular, with 5-hole, 4.5" B.C. circle pattern on idler hub.

Wheels: 15-inch steel, safety rim, 5 lug bolts.

Tires: 15-inch, load range B, tubeless, radial highway tread (P205/75R15 minimum.)

Springs: Minimum 3-leaf, double eye, minimum 1,200 lb. capacity for each spring.

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

Deck: 12 sq. ft. minimum, 10 gauge, smooth plate or open deck.

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

Safety Chain: Two, 5/16 inch x 34-inch 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.

- Screw Jack: Tongue mounted, 2,000-pound capacity, steel base 4" x 4" square foot, minimum size and capacity.
- Leveling Legs: Adjustable on 1" increments with foot pads (4" x 4" minimum), mounted on four corners of frame, perforated 1 3/4" square tube x 12-gauge wall locked in place by 3/8" diameter snapper pins, secured to trailer frame by wire cable or chain.
- Hitch: Easily removable combination, 2" diameter ball coupler and a 3 inch inside diameter, flat pintle ring, adjustable 24-inch to 36-inch, in 2-inch increments.
- Paint: Entire trailer - one coat primer, one coat Dupont Automotive Deluxe Enamel Code 93-75306 (yellow) or Chrome Enamel 13432 (yellow) of Federal Standard 595, including all surfaces under deck and on underside of fenders. A high-visibility, Safety Orange Paint, such as Sherwin Williams Omaha Orange Paint, which is similar to Federal Standard 595B #12243, or equal, may be used in lieu of yellow paint.
- Lights: (DOT Approved) 12-volt, two tail/stop/turn signal; side, rear and tongue reflectors. Wires shall be identified as to function.

General

All units shall meet or exceed the specifications for advance warning arrow panels as listed in Part 6F.53 of the Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD) Millennium Edition, December, 2000.

Owner's Manual

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