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

Description

The truck mounted flashing arrow panel shall consist of an arrow panel, mounting frame and rotating mechanism, remote control switches and circuitry, a control cabinet housing electronic components mounted in a 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 a control cabinet mounted inside the battery compartment and controlled by remote control switches located inside the truck cab.

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 3 feet by 6 feet.

Panel mounting height shall be a nominal 4 1/2 feet from the bottom of the support frame to the lowest point on the panel.

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 four vertical post framework consisting of a minimum of 2-inch by 2-inch by 1/8 inch thick welded steel tubing. All open ends of tubing shall be capped and welded shut. The panel shall be rotatable from a horizontal to a vertical position electrically, hydraulically, by winch and cable (minimum 1/4" diameter, galvanized aircraft cable) with automatic brake, with a screw type mechanism, or by a self-locking, manually operated square stainless steel tube. All manually operated winch mechanisms shall be mounted on the right, or passenger, side of the truck, as according to the drawing on Attachment 2.

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. (See the drawing on Attachment 2.)

The support frame shall be painted one coat of primer and one coat of Du pont 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 remote cab control switches shall provide left and right flashing arrows, a 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 and may be energized when the cab control power switch is placed in the "on" position. 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 remote cab control 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 of multi-conductor, salt-resistant, weatherproof cable and a NEMA 4 surface base with cover connector plug to connect to the NEMA 4 side entry hood connector mounted approximately 4 feet from the base of the frame and controller. (See the drawing on Attachment 2.) All electronic components shall be solid state and electrically protected by fuses or circuit breakers. 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 with machine screws.

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 weatherproof photoelectric control shall be mounted on the side of the battery box.

A readily accessible cartridge fuse or circuit breaker shall be provided at the power supply end of the circuit between the power supply and controller mounted inside of the battery box. The fuse or breaker shall be rated to handle the maximum lamp load of 14 lamps. An additional fuse or breaker shall be located on the controller cabinet, protecting the circuit supplying the remote cab control.

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 4 degree pitch from the horizontal position to encourage shedding of dirt and rainwater.

Battery Charger: A built-in 50 amp, 120 volts 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 deep-cycle type; a minimum of 3 batteries, 12 VDC marine-type or equivalent, with a minimum of 1000 amp-hours of energy when fully charged, or a minimum of 6 batteries, 6 VDC marine-type or equivalent, with a minimum of 700 amp-hours of energy when fully charged, wired to provide a 12-volt DC power supply.

Battery Box: A lockable, weatherproof, battery box, mounted at the base of the frame of the arrow panel support, shall be made of minimum 14-gauge steel, with louvered side panels for cross-flow ventilation and with the bottom and sides coated with acid-resistant protector. The battery box shall be large enough to sufficiently house and service the controller, batteries and charger.

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 prevent 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. 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 internal control circuitry, such as with machine screws, for service and repair purposes. The controller shall be provided with approximately a 4 foot long weather and salt-resistant, multi-conductor cable and side entry hood connector to provide a means of connection from the remote cab control. (See the drawing on Attachment 2.) 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, aluminum enclosure mounted inside the lockable, weatherproof, battery box mounted at the base of the frame.

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 # 12 AWG. The male connector shall be enclosed in a NEMA 4 rated surface base enclosure with 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 and salt and corrosion resistant cable connector with a sealing nut and internal ratchet containing a neoprene cable gland. (See the drawing on Attachment 2.)

Locks: A lockable box shall be mounted on the frame of the arrow panel support to protect the batteries and battery charger from theft and damage from falling or flying objects.

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. Units shall be skid mounted to slip into the back of dump trucks.

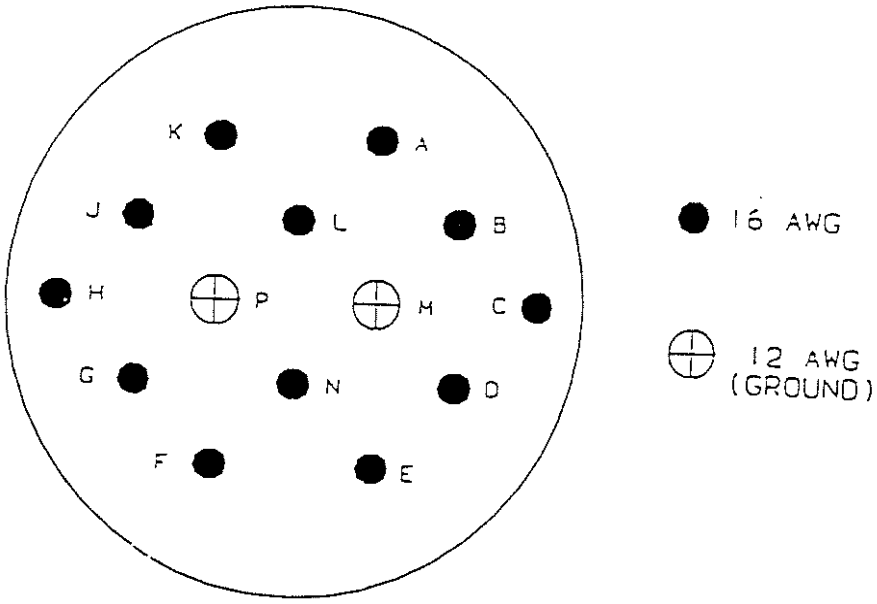
Performance: The flashing arrow must be visible on a sunny day for a distance of one mile. The flashing arrow must be able to operate for 20 continuous days in the single arrow mode during day/night light conditions with the solar panel disconnected or covered.. A device shall be provided to indicate 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.

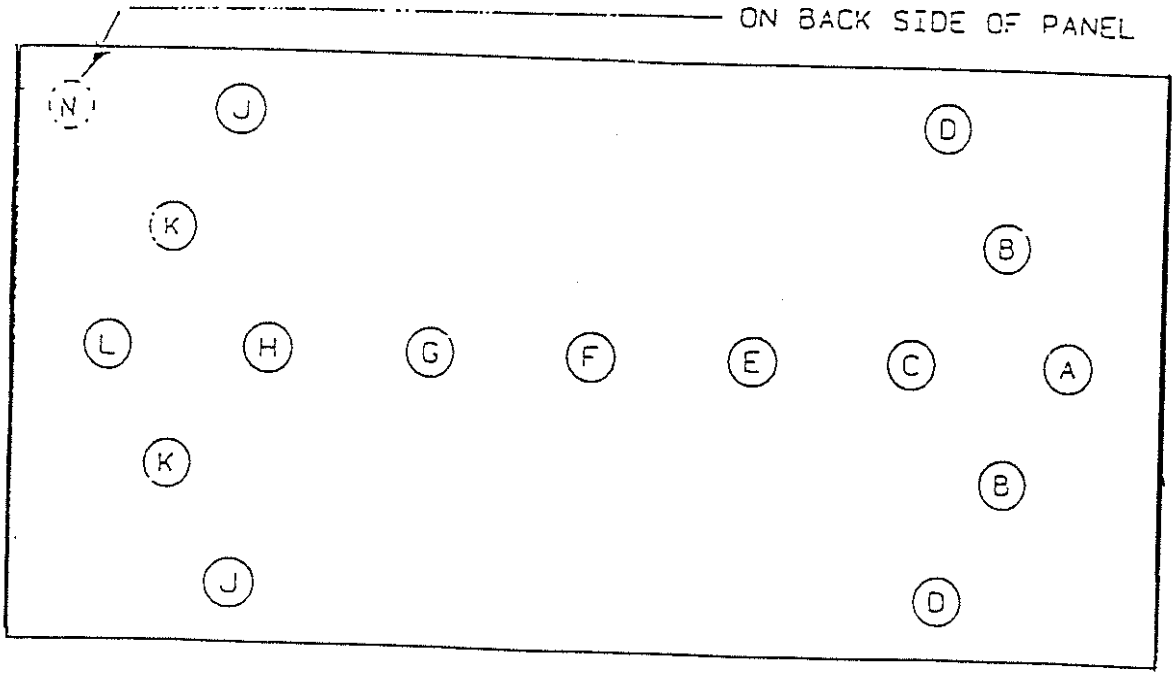
Owner's Manual

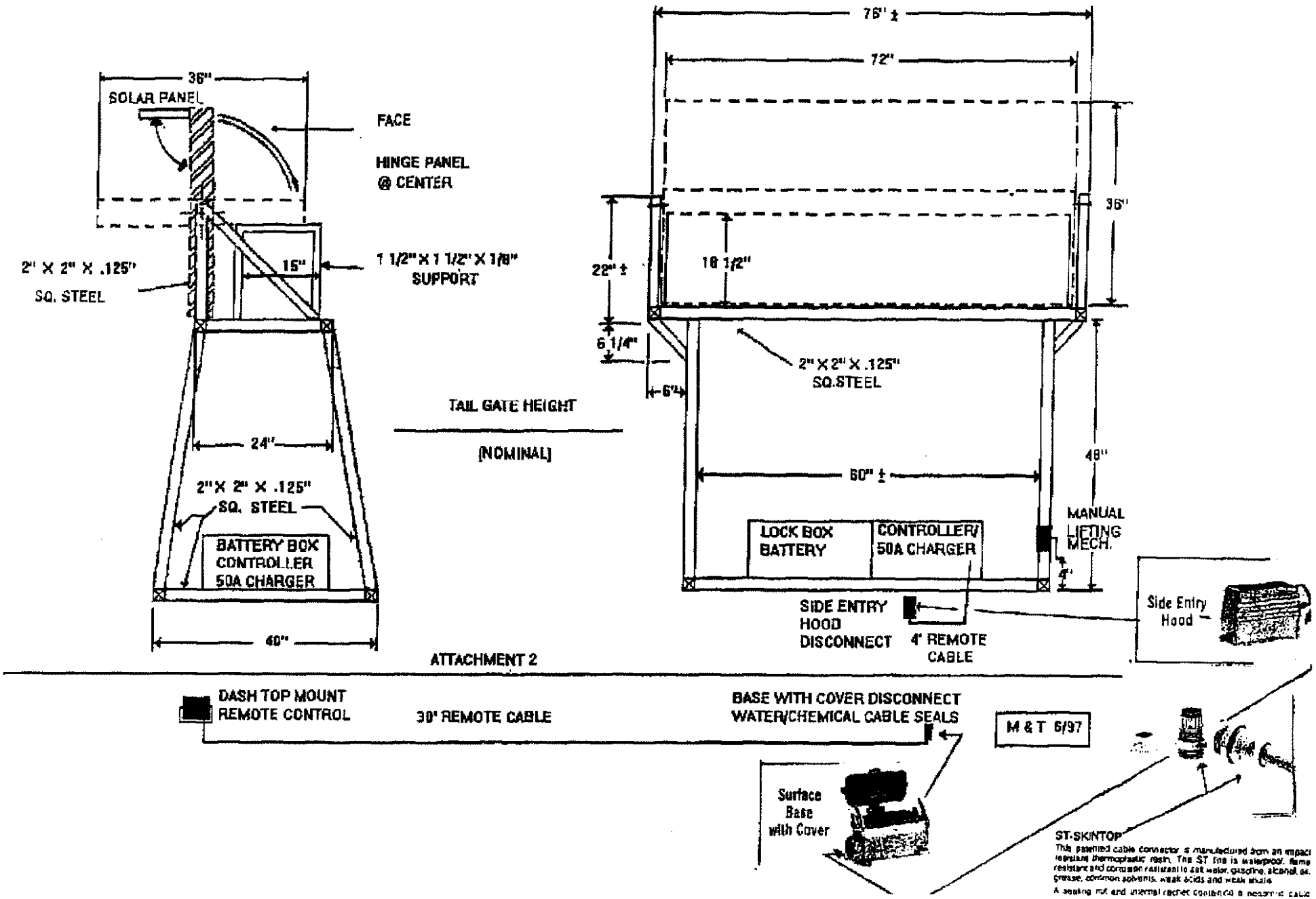
The successful bidder shall furnish two Owner's Manuals for each arrow panel. Each manual shall include the manufacturer's instructions for maintenance and operation of the power supply, arrow panel and control. Each manual shall also include a detailed, schematic, wiring diagram showing all circuits 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.

ATTACHMENT ONE

14 PIN
CONNECTOR





SUPPLIER TO DESIGNATE WIRING COLOR CODE.
PINS M AND P ARE NEGATIVE 12-VOLT GROUND.

SOLAR TRUCK MOUNTED ARROW PANEL