

**STATE OF NEW JERSEY  
DEPARTMENT OF TRANSPORTATION  
TRENTON, NEW JERSEY 08625**

**METRIC SPECIFICATIONS FOR FIBER OPTIC TWO  
COLOR TURN ARROW**

N.J. Specification No. EBM-TS-3

Effective Date: July 1, 2001

New Jersey Department of Transportation Specifications for a Fiber Optic Two Color Turn Arrow.

The purpose of these specifications is to describe minimum acceptable design and operating requirements for a Fiber Optic Two Color Turn Arrow.

**GENERAL - I**

- 1-1 The traffic control signal head shall conform to the following:
- A. Manual on Uniform Traffic Control Devices (MUTCD)
  - B. Adjustable Face Vehicle Traffic Control Head Standard  
Institute of Transportation Engineers (ITE)
  - C. Adjustable Face Vehicle Traffic Control Polycarbonate Signal Head EBM-TS-1.

**CONSTRUCTION - II**

- 2-1 The signal shall consist of a matrix of fiber optic bundles displaying two indications in the same housing. The housing shall consist of a traffic signal head conforming to the current New Jersey Department of Transportation Specification for Adjustable Face Vehicle Traffic Control Polycarbonate Signal Head, EBM-TS-1.
- 2-2 One message shall be green and the other shall be yellow with each indication display separately and never concurrently. No moving parts shall be permitted to change the display. Both messages shall be bright in color with a flat black background. The displays shall be made from a single row of lensed fiber optic bundles.
- 2-3 Each output bundle shall have biconvex fire polished glass 16 millimeter diameter lens. The lenses will be held in place within a black anodized, aluminum holder by a mechanically locked snap ring. It shall not be secured by using heat formed or heat shrinkable processes which can misdirect light and reduce output. The lenses shall be parallel with the signal face and properly focused on the fiber bundle. The lens holders shall be hexagonal in shape and shall be mechanically threaded to the fiber optic output bundle. No epoxies or glues shall be necessary to hold the output bundle or lens assembly in place.
- 2-4 The signal shall be discernible from one lane only attracting attention under any lighting conditions varying from total darkness to bright sunlight or where high intensity

background lighting is present. A hood or visor or some other means of shielding shall not be necessary to ensure visibility.

- 2-5 When not energized, the signal shall be blanked out (unreadable) with no phantom images, regardless of solar intensity or direction.
- 2-6 The signal shall have a 60 degree minimum to 68 degree maximum viewing angle centered about the optical axis.

### **ELECTRICAL - III**

- 3-1 Fixture wire shall be 19 stranded (Class C) no. 18 AWG copper wire capable of withstanding all adverse effects of moisture, corrosive atmosphere and temperatures associated with the operation of the signal head.
- 3-2 The lamp shall be a multi-mirror reflector quartz halogen bulb operating at an approximate color temperature of 2 627 °C. It shall have an average rated life of 8 000 hours of operation at a supplied 10.8 volts consuming 42 watts of power.
- 3-3 There shall be one transformer to operate each light source. It shall have a Class A insulation impregnated with a double coating of epoxy resin or lacquer so as to preclude intrusion of moisture. It shall not be painted. The output voltage with a load on the transformer shall be 10.8 volts AC.

### **FIBER OPTIC UNIT - IV**

- 4-1 The fiber optic module unit shall be constructed to retro-fit in any standard 300 millimeter signal housing having lens mounting screws in the corners of the door. The spacing of the fiber bundles shall have a nominal 25 millimeter spacing between centers.
- 4-2 The matrix message panel shall be black anodized 5052-H32 aluminum 3 millimeters thick and shall not be painted. A thermo-formed polycarbonate 3 millimeter thick message panel shall also be acceptable.
- 4-3 The fiber optic bundles inside the unit shall have a protective ABS plastic backcover to prevent fiber damage during installation or relamping of the signal.
- 4-4 Individual fiber optic bundles shall not be jacketed or encased in order to prevent long term condensation effects from thermal cycling.
- 4-5 Lamps shall be mounted in such a way so as to prevent their reflectors collecting water from condensation or gasket leaks.
- 4-6 A heavy plastic mylar water shield shall be used to prevent possible water leaks to drip onto the lamps causing premature failures.
- 4-7 There shall be one colored glass filter for each light source.

- 4-8 The filters shall be color fast and in accordance with the I.T.E. Signal Color Specification for chromaticity.
- 4-9 The optics shall be a glass on glass fiber with an 83% core to 17% cladding ratio. It shall have an average numerical aperture of 0.56 with a maximum transmission attenuation of 800 decibels per kilometer. Each fiber shall have a  $0.051 \pm 0.005$  millimeter diameter with an included acceptance angle of 68 degrees.
- 4-10 All fiber ends shall be ground smooth and polished to an 8 micron finish, minimum. Bundled fiber strands shall be kept free from the contamination of water and polishing agents. Breakage shall be limited to 3% of the total bundle area.
- 4-11 The input fiber bundle located at each light source shall have maximum diameter of 19 millimeters.
- 4-12 The output fiber bundle located at the face of the signal shall have a minimum diameter of 5 millimeters.
- 4-13 All fiber bundles shall be bifurcated (40/60 split of the total number of the fibers in the bundle). All fiber bundles shall have an evenly randomized distribution of the fibers across the bundle so that contiguous fibers lead to alternate lamps.
- 4-14 Each output bundle shall lead to a lamp pair of different signal indications.
- 4-15 Forty percent of the fiber in the display shall lead to the yellow filtered lamp assembly and the other 60% of the fiber shall lead to the green filtered lamp assembly.
- 4-16 Two spare output bundles shall be provided for the lamp pair. Damaged output bundles shall be replaceable using the spares.
- 4-17 The fiber optic unit shall be completely self contained and removable from the door.

#### **INSTRUCTIONS AND GUARANTEE - V**

- 5-1 Upon request, one wiring diagram and installation manual shall be provided.
- 5-2 A Certificate of Compliance shall be provided stating that testing of the optical fiber has been performed and that fiber used in the traffic signals meets the quality standards.
- 5-3 A sample plug from every production run of fiber used in the signal fabrication shall be finished and processed at one end and tested for roundness of the fiber, core to clad fusion, fiber diameter, and optical transmission.
- 5-4 No changes or substitutions in these requirements will be accepted unless authorized in writing. Inquiries regarding this specification shall be addressed to the Manager, Office of Traffic Signal and Safety Engineering, New Jersey Department of Transportation, 1035 Parkway Avenue, P.O. Box 613, Trenton, New Jersey 08625.
- 5-5 The signal shall carry a one year guarantee from the date of delivery against any imperfections in workmanship and material.

- 5-6 The company agrees upon the request of the Manager, Office of Traffic Signal and Safety Engineering to deliver to the Office, a sample of the signal to be supplied in compliance with these specifications and test before acceptance. After completion of the test, the sample shall be returned.