

## SECTION 995 DEMOUNTABLE SIGN FACE MATERIALS

### 995-1 Acrylic Plastic Reflectors.

**995-1.1 Description:** Demountable sign letters, digits, arrows, borders and alphabet accessories shall be reflectorized and shall consist of acrylic plastic reflectors supported by embossed aluminum frames. They shall conform to the Standard alphabet for Highway Signs, of the Federal Highway Administration.

**995-1.2 Design and Fabrication:** The letter design shall be the Federal Standard Alphabet Series E, modified as necessary to accommodate the required reflectors.

All items except border strips shall be fabricated from 0.040 inch [1.0 mm] sheet aluminum. Border strips shall be of 0.032 inch [0.81 mm] sheet aluminum.

Mounting holes shall be provided within the frames, in accordance with the manufacturer's directions, to permit the use of screws, rivets or other acceptable fasteners.

The size and spacing of the reflector holes shall be such as will provide maximum night legibility and visibility of the finished cutout figure.

**995-1.3 Finishing:** After the metal fabrication has been completed, the finishing process shall be as follows:

Preparation: Aluminum frames shall be de-greased, etched and neutralized, and treated with Alodine 1200, Iridite 14-2, Bonderite 721, or equal product, and in strict accordance with the recommendations of the manufacturer of the chemical used.

Enameling: After the treating, frames shall be finished in the color specified, with baking enamel, in strict accordance with the recommendations of the manufacturers of the enamel.

**995-1.4 General Requirements:** The reflectors shall be of acrylic plastic meeting the requirements of Federal Specification L-P-380, Type I, Class 3. In order that the Department can readily check the suitability of the raw material used in the reflectors, the manufacturer shall stipulate such raw material and the identification of the particular molding compound.

The reflectors shall consist of a clear and transparent plastic face (herein referred to as the lens) and an opaque plastic back of identical material, fused to the lens under heat and pressure around the entire perimeter to form a homogeneous unit, permanently sealed against dust, water and water vapor. The reflectors shall be either yellow or colorless.

The lens shall consist of a smooth front surface, free from projections or indentations other than for identification, and a rear surface bearing a prismatic configuration such that it will effect total internal reflection of light.

### **995-1.5 Optical Requirements:**

(a) Defined Terms: The following terms, as used herein, shall have the meanings shown therefor.

Entrance Angle: The angle at reflector between direction of light incident on it and direction of reflector axis.

Observation Angle: The angle at reflector between observer's line of sight and direction of light incident on reflector.

Specific Brightness: Candlepower returned at the chosen observation angle by a reflector, per square yard [square meter] of reflecting surface, for each foot-candle [lux] of illuminance at the reflector.

(b) Specific Brightness: The specific brightness of each reflex reflector intended for use in cutout letters, symbols and accessories shall be equal to or exceed the minimum values shown in the table below, with measurements made with reflectors spinning. Failure to meet the specific brightness minimum shall constitute failure of the reflector being tested. Failure of more than two reflectors out of 50 subjected to test shall constitute failure of the LOT.

| Observation Angle (Degrees) | Entrance Angle (Degrees) | Specific Brightness (Candlepower/Square Inch/Foot-Candle) [(cd/(lx·m <sup>2</sup> ))] |
|-----------------------------|--------------------------|---------------------------------------------------------------------------------------|
| 0.1                         | 0                        | 14.0 [2016]                                                                           |
| 0.1                         | 20                       | 5.6 [806]                                                                             |

For yellow reflectors the specific brightness minimum shall be 60% of the value shown above for crystal.

(c) Optical Testing Procedure: The reflex reflector to be tested shall be located at a distance of 100 feet [30 m] from a single uniformly bright light source having an effective diameter of 2 inches [50 mm]. The light source shall be operated at approximately normal efficiency. The return light from the reflector shall be measured by means of a photoelectric photometer having a minimum sensitivity of  $1 \times 10^{-7}$  foot-candles [ $1.1 \times 10^{-6}$  lx] per scale division.

The photometer shall have a receiver aperture of 0.5 inch [13 mm] diameter, shielded to eliminate stray light. The distance from light source center to aperture center shall be 2.1 inches [53 mm] for the 0.1 degree observation angle. During testing the reflectors shall be spun so as to average orientation effect.

If a test distance other than 100 feet [30 m] is used, the source and aperture dimensions and the distance between source and aperture, shall be modified in the same proportion as the test distance.

#### **995-1.6 Durability:**

(a) Seal Test: The following test shall be used to determine if a reflector is adequately sealed against dust and water.

Submerge 50 samples in water bath at room temperature. Subject the submerged samples to a vacuum of 5 inches [17 kPa] gauge for five minutes. Restore atmospheric pressure and leave samples submerged for five minutes, then examine the samples for water intake. Failure of more than two of the 50 samples tested shall be cause for tentative rejection of the LOT. A re-sample of 100 reflectors shall be checked tested. If not more than four of these 100 samples fail, then the LOT will be considered acceptable.

(b) Heat-Resistance Test: Three reflectors shall be tested for four hours in a circulating air oven at  $175 \pm 5^\circ\text{F}$  [ $79 \pm 3^\circ\text{C}$ ]. The test specimens shall be placed in a horizontal position on a grid or perforated shelf permitting free air circulation. At the conclusion of the test the samples shall be removed from the oven and permitted to cool in air to room temperature. The samples, after exposure to heat, shall show no significant change in shape and general appearance when compared with unexposed control standards. No failures will be permitted.

(c) Corrosion Test: The assembled cutout letter, symbol or accessory shall withstand the combined corrosion test set forth in ASTM B 117.

### **995-2 Reflective Sheeting.**

**995-2.1 General:** When so specified, the demountable sign letters, digits, arrows, borders and alphabet accessories shall be reflectorized with reflective sheeting in accordance with Section 994 or 993-2, supported by flat aluminum backing. They shall conform to the Standard Alphabet for Highway Signs of the Federal Highway Administration.

**995-2.2 Design and Fabrication:** The letter design shall be the Federal Standard Alphabet, Series E, modified for legibility.

All items except border strips shall be fabricated from 0.032 inch [0.81 mm] sheet aluminum, 6061-T6 alloy, with mounting holes to permit use of screws, rivets or other acceptable fasteners.

The reflective sheeting shall be adhered to the aluminum in accordance with recommendations of the sheeting manufacturer.

All letters, digits, arrows, borders, and alphabet accessories made of encapsulated lens sheeting that have a stroke width of 3/4 inch [19 mm] or less shall be supplied with sealed edges according to the instructions of the sheeting manufacturer.

**995-3 Certification.**

The Contractor shall provide the Engineer a certified test report from the manufacturer of the demountable sign face materials confirming that the requirements of this Section are met. The certified test report shall conform to the requirements of Section 6 and include test results for entrance angle, observation angle, specific brightness, sealing durability, heat-resistance, and corrosion resistance.