

ITEM 648

ENCAPSULATED LENS REFLECTIVE SHEETING FOR
TRAFFIC CONTROL SIGNS
(HI-INTENSITY GRADE)

648.1 Description. This item shall govern for encapsulated lens reflective sheeting consisting of spherical lens elements adhered to a synthetic resin and encapsulated by a flexible transparent weatherproof plastic having a smooth outer surface. The sheeting shall have a precoated adhesive backing protected by a plastic liner.

648.2 Materials.

A. Photometric

The reflective sheeting shall have the following minimum brightness values at .2°, .5°, and 1.5° divergence expressed as average candlepower per footcandle per square foot (candelas per lux per square meter) of material. Measurements shall be conducted in accordance with standard photometric testing procedures for reflex-reflectors, paragraph 4.4.7 of Federal Specification L-S-300A, "Sheeting and Tape, Reflective; Non-Exposed Lens Adhesive Backing".

TABLE I
MINIMUM BRIGHTNESS VALUES

Div. Ang. Inc. Ang.	Silver-White			Yellow		
	.2°	.5°	1.5°	.2°	.5°	1.5°
-4°	250.0	95.0	4.0	170.0	62.0	3.0
40°	120.0	54.0	2.0	80.0	35.0	1.5
Div. Ang. Inc. Ang.	Red			Green		
	.2°	.5°	1.5°	.2°	.5°	1.5°
-4°	35.0	13.0	0.7	30.0	12.0	0.5
40°	16.0	7.4	0.3	14.0	6.8	0.2
Div. Ang. Inc. Ang.	Orange					
	.2°	.5°	1.5°			
-4°	70.0	25.0	1.1			
40°	33.0	14.0	0.5			

Rainfall performance measurements shall be conducted in accordance with standard rainfall test specified in Federal Specification L-S-300A and the brightness of the reflective sheeting totally wet by rain, shall not be less than 90% of the above values.

B. Color

The diffuse day color of the reflective sheeting shall conform to the requirements of the Table II and shall be determined in accordance with ASTM E97, "Standard Method of Test for 45 Deg., 0-Deg. Directional Reflectance of Opaque Specimens by Filter Photometry". (Geometric characteristics must be confined to illumination incident within 10 degrees of and centered about, direction 45 degrees from the perpendicular to the test surface; viewing is within 15 degrees of and centered about the perpendicular to the test surface. Conditions of illumination and observation must not be interchanged.) The standards to be used for reference shall be the Munsell Papers designated in Table II. Paper must be recently calibrated on a spectrophotometer.

The test instrument shall be one of the following:

1. Gardner Multipurpose Reflectometer
2. Gardner Model AC02a Color Difference Meter
3. Meeco Model V Colormaster
4. Hunterlab D25 Color Difference Meter

TABLE II

CIE CHROMATICITY COORDINATE LIMITS_(Y)

Color	x	y	x	y	x	y	x	y	Reflectance Limit		Ref. Std. MUNSELL PAPERS	
									Min.	Max		
Silver-White	.303	.287	.368	.353	.340	.380	.274	.316	30.0		5PB	7/1
Green	.030	.380	.166	.346	.286	.428	.201	.776	3.0	8.0	10G	3/8
Yellow	.498	.412	.557	.442	.479	.520	.438	.472	16.0	40.0	1.25Y	6/12
Red	.613	.297	.708	.292	.636	.364	.558	.352	4.0	11.0	7.5R	3/12
Orange	.550	.360	.630	.370	.581	.418	.516	.394	20.0	30.0	2.5YR	5.5/14.0

C. Adhesive

1. The reflective sheeting shall include a pre-coated pressure adhesive or a tack-free heat activated adhesive, either of which shall be applied exactly as specified by the sheeting manufacturer to recommend, properly prepared flat surfaces without necessity of additional adhesive coats on the reflective sheeting or application surface.
2. The protective liner attached to the adhesive shall be removed by peeling without soaking in water or other solvents and shall be easily removed after accelerated storage for four hours at 150°F. under weight of 2.5 pounds per square inch (0.18 kg per square cm).
3. The adhesive coated sheeting, when applied at 72°F. and conditioned for 24 hours at this temperature, shall form a durable bond to clean, smooth, corrosion and weather resistant substrates when exposed to temperatures of -30° to 160° F. Sheeting applied to 6.0 in. x 6.0 in. (15.0 cm x 15.0 cm) cleaned and etched panels of 0.040 inch (1.02 mm), 6061-T6 aluminum, conditioned for 24 hours at 72°F. and 50% relative humidity and further conditioned for 18 hours at -10°F., shall show no separation from the substrate or cracking at -10° F. when subjected to a 10 inch pound (103 cm kg) impact of a 2 inch (50 mm) steel ball (1.19 pounds, (0.540 kg)) dropped from a height of 8 1/2 inches (21.59 cm) through a 2 1/8 inch (5.4 cm) tube. The test panel shall be centered and supported by its edges over a 4.0 inch by 4.0 inch (10 cm x 10 cm) open area and the impact point shall be in the center of the open area.

The sheeting shall resist peeling from the application surface when a 5 lb./inch width (2.27 kg per 2.54 cm) force is applied as outlined in ASTM D903.

D. 1. General

The reflective sheeting shall have sufficient strength and flexibility so that it can be handled, processed, and applied according to the recommendations of the sheeting manufacturer without appreciable damage. Following liner removal, the reflective sheeting shall not shrink more than 1/32" (0.79 mm) in 10 minutes nor more than 1/8" (3.18 mm) in 24 hours in any dimension per 9.0" (22.9 cm) square at 72°F and 50% RH.

The sheeting with liner removed, conditioned for 24 hours at 72°F. and 50% RH., shall be sufficiently flexible to show no cracking when slowly bent, in one seconds' time, around 1/8" (3.18 mm) mandrel with adhesive side contacting mandrel. Note:

For ease of testing, spread talcum powder on adhesive to prevent sticking to mandrel.

2. Surface - The sheeting surface shall be smooth and facilitate cleaning and wet performance, and exhibit 85° gloss meter rating of not less than 50 (ASTM D-523). The surface of the sheeting with the heat activated adhesive shall be readily processed in accordance with recommendations of the sheeting manufacturer, compatible with recommended transparent and opaque process colors and show no loss of the color coat with normal handling, cutting, and application.

The sheeting shall permit cutting and color processing at temperatures of 60-100°F. and relative humidities of 20-80%. The sheeting shall be permit cleaning by wiping with a clean soft rag dampened in V.M. & P. Naphtha or mineral spirits.

The reflective sheeting shall possess stable and durable spherical lens elements which, following extraction, shall show no deterioration following submersion in a 5N solution of sulfuric acid (H₂SO₄) for 30 minutes at 72° F.

E. Effective Performance Life

1. Reflective sheeting which is processed, applied to approved sign base materials, and cleaned, according to manufacturer's recommendations for traffic control signs, shall be considered as performing effectively for the number of years stated by the bidder if the sheeting has not deteriorated due to natural causes to the extent that: 1) the sign is ineffective for its intended purpose when viewed from a vehicle, or 2) the average night time reflective brightness is less than that specified in Table III below. The bidder's only liability shall be replacement of all reflective sheeting failing to give satisfactory performance for the number of years stated by the bidder.

TABLE III

EFFECTIVE PERFORMANCE LIFE

<u>Sheeting Type & Color</u>	Average Minimum Candlepower per foot candle per square foot at 0.2° divergence and <u>-4° incidence*</u>	Effective Performance <u>Life**</u>
Silver-White	200	_____ Years
Green	24.0	_____ Years

Yellow	136.0	_____ Years
Red	28.0	_____ Years
Orange	56.0	_____ Years

*Candlepower measurement shall be made, following sign cleaning, in accordance with procedures recommended in Section 648.2.

**Performance years for each color shall be stated by the bidder.

2. The reflective material exposed for 24 months in Florida at 45°, south facing, shall not support fungus growth and accumulate dirt to the extent that the reflective brightness before cleaning is less than 75% of the reflective brightness after cleaning, when measured at 0.2 divergence and -4° incidence. The supplier shall furnish written evidence or samples showing conformance to this requirement.

F. General Characteristics and Packaging

The reflective sheeting as supplied shall be free from ragged edges, cracks, and extraneous materials, and shall be furnished in both rolls and sheets. When the reflective sheeting is furnished in continuous rolls, the average number of splices shall not be more than three per 50 yards (45.7 m) of material with a minimum of four splices in any 50 yard length. Splices shall be suitable for continuous application as supplied.

On signs fabricated from encapsulated lens reflective sheeting, some wrinkling, streaking, and mottling shall be permitted, on visual quality inspection, if not apparent under normal viewing conditions for the intended use. The sheeting manufacturer shall assure that these conditions are not progressive and will not adversely affect performance.

Rolls shall be packed snugly in corrugated fiberboard boxes in accordance with commercially accepted standards.

Rolls 3.0 in. (7.6 cm) to 12.0 in. (30.5 cm) in width shall be packed in corrugated fiberboard cartons of minimum 200.0 lb. (90.7 kg) test. Rolls 13.0 inch (33.0 cm) to 24.0 inch (61 cm) in width shall be packed in corrugated fiberboard cartons of 275.0 lb. (124.7 kg) test. Rolls 25.0 inch (63.5 cm) in width and above shall be packed in corrugated cartons of minimum 350.0 lb. (158.8 kg) test. Rolls wider than 6.0 inch (15.2 cm) and 10.0 yards (9.2 m) in length or longer shall be supported and suspended by the roll core within the cartons by means of plugs within built-up and reinforced corrugated pads.

Cut sheets shall be packaged flat between pressed composition boards or corrugated pads of the same dimensions as the sheets and shall be

packaged in accordance with commercially accepted standards and in accordance with the recommendations of the sheeting manufacturer.

The reflective sheeting as supplied, stored under normal conditions, shall be suitable for use for at least one year after purchase.

NOTE: Metric equivalents in parenthesis.

648.2 Measurement and Payment. Encapsulated Lens Reflective Sheeting for Traffic Control Signs (Hi-Intensity Grade) shall not be paid for directly, but shall be incidental to Item 624, titled "Aluminum Signs".

There are line code(s), description(s), and unit(s) for this item.

END OF ITEM 648