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Standard Specification for Retroreflective Sheeting for Traffic Control¹

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^{ε1} NOTE—Editorial correction were made to Section 7 and Table 11 in February 1992.

1. Scope

1.1 This specification covers flexible non-exposed glass bead lens and microprismatic retroreflective sheeting designed for use on traffic control signs, delineators, barricades, and other devices.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 The following safety hazards caveat pertains only to the test method portion, Section 8, of this specification. *This standard does not purport to address the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- B 209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate²
- B 449 Practice for Chromate Treatments on Aluminum³
- D 523 Test Method for Specular Gloss⁴
- E 97 Test Method for Directional Reflectance Factor, 45-deg 0-deg, of Opaque Specimens by Broad-Band Filter Reflectometry⁵
- E 284 Definitions of Terms Relating to Appearance of Materials⁵
- E 308 Method for Computing the Colors of Objects by Using the CIE System⁵
- E 805 Practice for Identification of Instrumental Methods of Color or Color-Difference, Measurement of Materials⁵
- E 808 Practice for Describing Retroreflection⁵
- E 810 Test Method for Coefficient of Retroreflection of Retroreflective Sheeting⁵
- E 991 Practice for Color Measurement of Fluorescent Specimens⁵
- E 1164 Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation⁵

G 23 Practice for Operating Light Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials⁵

3. Terminology

3.1 **Definition**—Definition of terms are as described in Definitions E 284 and Practice E 808.

3.2 Descriptions of Terms:

3.2.1 **reboundable sheeting**—retroreflective material intended to be attached to flexible impact resistant plastic devices, such as traffic drum-like channelizing devices.

4. Classification

4.1 Retroreflective sheeting shall consist of a white or colored sheeting having a smooth outer surface and that essentially has the property of a retroreflector over its entire surface. There are six types and five classes of retroreflective sheeting. Typical examples of materials and applications are provided for descriptive information only and are not intended to be limitations or recommendations.

4.1.1 The typical applications for the retroreflective sheeting addressed in this specification are:

Type	Typical Application
I	Highway Signing, construction-zone devices, and delineators
II	Highway Signing, construction-zone devices, and delineators
III	Highway Signing, construction-zone devices, and delineators
IV	Highway Signing, construction-zone devices, and delineators
V	Delineators
VI	Temporary roll-up signs, warning signs, traffic cone collars, and post bands

4.2 Retroreflective sheeting shall be classified as follows:

4.2.1 **Type I**—A medium-intensity retroreflective sheeting referred to as “engineering grade” and typically enclosed lens glass-bead sheeting. Typical applications for this material are permanent highway signing, construction zone devices, and delineators.

4.2.2 **Type II**—A medium-high-intensity retroreflective sheeting sometimes referred to as “super engineering grade” and typically enclosed lens glass-bead sheeting. Typical applications for this material are permanent highway signing, construction zone devices, and delineators.

4.2.3 **Type III**—A high-intensity retroreflective sheeting, that is typically encapsulated glass-bead retroreflective material. Typical applications for this material are permanent highway signing, construction zone devices, and delineators.

4.2.4 **Type IV**—A high-intensity retroreflective sheeting. This sheeting is typically an unmetallized microprismatic retroreflective element material. Typical applications for this

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² Annual Book of ASTM Standards, Vol 02.02.

³ Annual Book of ASTM Standards, Vol 02.05.

⁴ Annual Book of ASTM Standards, Vol 06.01.

⁵ Annual Book of ASTM Standards, Vol 14.02.

material are permanent highway signing, construction zone devices, and delineators.

4.2.5 *Type V*—A super-high-intensity retroreflective sheeting. This sheeting is typically a metallized microprismatic retroreflective element material. This sheeting is typically used for delineators.

4.2.6 *Type VI*—An elastomeric high-intensity retroreflective sheeting without adhesive. This sheeting is typically a vinyl microprismatic retroreflective material. This sheeting is typically used for orange temporary roll-up warning signs, traffic cone collars, and post bands.

4.3 *Backing Classes*—The backing required for retroreflective sheeting Types I through V shall be classified as follows:

4.3.1 *Class 1*—The adhesive backing shall be pressure-sensitive, require no heat, solvent, or other preparation for adhesion to smooth, clean surfaces.

4.3.2 *Class 2*—The adhesive backing shall have an adhesive that shall be activated by applying heat and pressure to the material. The temperature necessary to form a durable permanent bond shall be a minimum of 150°F (66°C).

4.3.2.1 The Class 2 material shall be repositionable under normal shop conditions and at substrate temperatures up to 100°F (38°C) and without damage to the material. The Class 2 material may be perforated to facilitate removal of air in heat-vacuum laminators, but the perforations must be of a size and frequency such that they do not cause objectionable blemishes when the sheeting is printed.

4.3.3 *Class 3*—The adhesive backing shall have a positionable low-tack pressure-sensitive adhesive that requires no heat, solvent, or other preparation for adhesion to smooth, clean surfaces. It shall be repositionable up to a temperature of 100°F (38°C) without damage to the material.

4.3.4 *Class 4*—The adhesive backing shall have a low-temperature pressure-sensitive adhesive that permits sheeting applications at temperatures down to +20°F (−7°C) without the aid of heat, solvent, or other preparation for adhesion to smooth, dry, clean surfaces.

4.3.5 *Class 5*—This shall be a nonadhesive backing made of material commercially used for self-supporting products such as traffic cone collars, temporary roll-up warning signs, and post bands.

5. Ordering Information

5.1 The purchaser using this specification shall include the following information:

- 5.1.1 ASTM designation (D 4956),
- 5.1.2 Classification type (see Section 4),
- 5.1.3 Adhesive class (see 4.3),
- 5.1.4 Daytime color (see 7.3),
- 5.1.5 Length and width of sheets (see 6.1),
- 5.1.6 Length and width of rolls (see 6.2), and
- 5.1.7 Supplementary information, if required by the purchaser.

5.1.7.1 Compliance with the minimum coefficient of retroreflection for 0.1° observation angle is a supplementary requirement which shall apply only when specified. An observation angle of 0.1° may be specified where the long distance performance of a sheeting is to be a requirement,

5.1.7.2 Fungus-resistance testing requirements (see S1),

5.1.7.3 Reboundable sheeting requirements (see Supple-

mentary Requirement S2), and

5.1.8 Any additional information.

6. General Requirements

6.1 *Sheets*—When the retroreflective material is in sheet form, the design, dimension, and tolerances shall be as specified by the purchaser.

6.2 *Rolls*—When ordered in rolls, the retroreflective material shall be evenly wound on a core of sufficient rigidity to prevent distortion of the roll. The maximum number of splices shall be 4/50-yd (46 m) roll. Each splice shall be visible at the edge of the roll. The length and width will be specified by the purchaser.

6.3 *Color Processing*—The sheeting shall permit color processing with compatible transparent and opaque process colors in accordance with the sheeting manufacturer's recommendation at temperatures between 60 to 100°F (16 to 38°C) and relative humidity at 20 to 80 %.

7. Performance Requirements

7.1 This is a summary of the minimum performance requirements for each type of retroreflective sheeting.

7.1.1 *Type I*—Minimum Coefficient of Retroreflection—Table 1; Artificial Weathering—1000 h, see 7.4; Reflectance or daytime lightness—Table 2

7.1.2 *Type II*—Minimum Coefficient of Retroreflection—Table 3; Artificial Weathering—2200 h, see 7.4; Reflectance or daytime lightness—Table 2; Other requirements: When the color orange is specified the artificial weathering will be 500 h.

7.1.3 *Type III*—Minimum Coefficient of Retroreflection—Table 4; Artificial Weathering—2200 h, see 7.4; Reflectance or daytime lightness—Table 2; Other Requirements: When the color orange is specified the artificial weathering will be 500 h.

7.1.4 *Type IV*—Minimum Coefficient of Retroreflection—Table 5; Artificial Weathering—2200 h, see 7.4; Reflectance or daytime lightness—Table 6; Other Requirements: When the color orange is specified the artificial weathering will be 500 h.

7.1.5 *Type V*—Minimum Coefficient of Retroreflection—Table 7; Artificial Weathering—2200 h, see 7.4; Reflectance or daytime lightness—Table 8

7.1.6 *Type VI*—Minimum Coefficient of Retroreflection—Table 9; Artificial Weathering—250 h, see 7.4; Reflectance or daytime lightness—Table 2

7.2 *Coefficient of Retroreflection*—The coefficient of retroreflection shall meet or exceed the minimum requirements of Tables 1, 3, 4, 5, 7 and 9 as specified in 8.3.

7.3 *Daytime Color*—The color of the sheeting shall conform to requirements of Table 10 and one of the following Tables 2, 6, or 8 when tested in accordance with 8.4.

TABLE 1 Type I Sheetings^a

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.2°	−4°	70	50	25	9.0	14	4.0	1.0
0.2°	+30°	30	22	7.0	3.5	6.0	1.7	0.3
0.5°	−4°	30	25	13	4.5	7.5	2.0	0.3
0.5°	+30°	15	13	4.0	2.2	3.0	0.8	0.2

^a Minimum Coefficient of Retroreflection (R_A) cd/ft² (cd/m²)