Designation: D4956 – 19

Standard Specification for Retroreflective Sheeting for Traffic Control[1]

This standard is issued under the fixed designation D4956; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

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. This specification does not address inks, overlays, or other imaging methods that may be applied to retroreflective sheeting material to create traffic signs or other devices.

1.2 Although this specification provides photometric requirements for retroreflective sheeting under evaluation, minimum performance requirements of in-service signs or other devices are outside the scope of this document.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 The following safety hazards caveat pertains only to the test methods portion, Section 7, of this specification. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate

B209M Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

B449 Specification for Chromates on Aluminum

D2794 Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

E284 Terminology of Appearance

E308 Practice for Computing the Colors of Objects by Using the CIE System

E808 Practice for Describing Retroreflection

E810 Test Method for Coefficient of Retroreflection of Retroreflective Sheeting Utilizing the Coplanar Geometry

E811 Practice for Measuring Colorimetric Characteristics of Retroreflectors Under Nighttime Conditions

E991 Practice for Color Measurement of Fluorescent Specimens Using the One-Monochromator Method

E1164 Practice for Obtaining Spectrometric Data for Object-Color Evaluation

E1247 Practice for Detecting Fluorescence in Object-Color Specimens by Spectrophotometry

E1347 Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry

E1349 Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional (45°:0° or 0°:45°) Geometry

E2152 Practice for Computing the Colors of Fluorescent Objects from Bispectral Photometric Data

E2153 Practice for Obtaining Bispectral Photometric Data for Evaluation of Fluorescent Color

E2301 Test Method for Daytime Colorimetric Properties of Fluorescent Retroreflective Sheeting and Marking Materials for High Visibility Traffic Control and Personal Safety Applications Using 45°:Normal Geometry

E3165 Test Method for Nighttime Retroreflected Chromaticity of Retroreflective Sheeting

G7/G7M Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials

G113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials

G147 Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests

[1] This specification is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.38 on Highway Traffic Control Materials.

Current edition approved July 1, 2019. Published July 2019. Originally approved in 1989. Last previous edition approved in 2017 as D4956 – 17. DOI: 10.1520/D4956-19.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

G151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources
G155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

2.2 *Other Standards:*
ISO 4892-2:2006 Plastics—Methods of Exposure to Laboratory Light Sources—Part 2: Xenon-Arc Lamps[3]
ISO 4892-2:2006/Amd.1:2009 Plastics—Methods of Exposure to Laboratory Light Sources—Part 2: Xenon-Arc Lamps[3]
EN 12899-1:2007 Fixed, Vertical Road Traffic Signs—Part 1: Fixed Signs[4]

3. Terminology

3.1 *Definitions*—Definitions of terms are as described in Terminology E284, Practice E808, and Terminology G113.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *reboundable sheeting, n*—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 nine types and five classes of retroreflective sheeting. Types are determined by conformance to the retroreflectance, color, and durability requirements listed in 6.1 and may be of any construction providing that those requirements are met. Type designation is provided as a means for differentiating functional performance. Typical examples of applications are provided for descriptive information only and are not intended to be limitations or recommendations. Common identifiers for each type are listed in 4.2.

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
VII	This type designation has been replaced with Type VIII
VIII	Highway signing, construction-zone devices, and delineators
IX	Highway signing, construction-zone devices, and delineators
X	This type designation has been replaced with Type VIII
XI	Highway signing, construction-zone devices, and delineators

4.2 Retroreflective sheeting shall be classified as follows (the type sequence is not indicative of performance level):

4.2.1 *Type I*—A retroreflective sheeting referred to as "engineering grade" that is typically an enclosed lens glass-bead retroreflective material or a microprismatic retroreflective element material. Applications for this material include permanent highway signing, construction zone devices, and delineators.

4.2.2 *Type II*—A retroreflective sheeting referred to as "super engineer grade" that is typically an enclosed lens glass-bead retroreflective material or a microprismatic retroreflective element material. Applications for this material include permanent highway signing, construction zone devices, and delineators.

4.2.3 *Type III*—A retroreflective sheeting referred to as "high-intensity" that is typically manufactured as an encapsulated glass-bead retroreflective material or as a microprismatic retroreflective element material. Applications for this material include permanent highway signing, construction zone devices, and delineators.

4.2.4 *Type IV*—A retroreflective sheeting referred to as "high-intensity" that is typically an unmetalized microprismatic retroreflective element material. Applications for this material include permanent highway signing, construction zone devices, and delineators.

4.2.5 *Type V*—A retroreflective sheeting referred to as "super high-intensity" that is typically a metalized microprismatic retroreflective element material. This sheeting is typically used for delineators.

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

4.2.7 *Type VII*—The use of a designation as Type VII has been discontinued.

4.2.8 *Type VIII*—A retroreflective sheeting typically manufactured as an unmetalized cube corner microprismatic retroreflective element material. Applications for this material include permanent highway signing, construction zone devices, and delineators.

4.2.9 *Type IX*—A retroreflective sheeting typically manufactured as an unmetalized cube corner microprismatic retroreflective element material. Applications for this material include permanent highway signing, construction zone devices, and delineators.

4.2.10 *Type X*—The use of a designation as Type X has been discontinued.

4.2.11 *Type XI*—A retroreflective sheeting typically manufactured as an unmetalized cube corner microprismatic retroreflective element material. Applications for this material include permanent highway signing, construction zone devices, and delineators.

NOTE 1—All retroreflective sheetings, but especially microprismatic sheetings, may have unique performance characteristics outside of the range of the standard geometries presented in the tables that define the types. Certain applications may require the use of a particular product within a particular type in order to achieve a desired level of retroreflectivity in a given situation. In these cases, information concerning additional performance characteristics must be obtained.

4.3 *Backing Classes*—The backing required for retroreflective sheeting 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.

[3] Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, http://www.iso.org.

[4] Available from European Committee for Standardization (CEN), Avenue Marnix 17, B-1000, Brussels, Belgium, http://www.cen.eu.

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 (D4956),

5.1.2 Classification type (see Section 4),

5.1.3 Adhesive class (see 4.3),

5.1.4 Daytime color (see 6.3),

5.1.5 Length and width of sheets (see 8.1),

5.1.6 Length and width of rolls (see 8.2),

5.1.7 Supplementary information, if required by the purchaser, including:

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 Supplementary Requirement S1), and

5.1.7.3 Reboundable sheeting requirements (see Supplementary Requirement S2),

5.1.8 Indication that the sheeting is intended for work zone use, if applicable, to determine which weathering requirements apply, and

5.1.9 Any additional information.

6. Performance Requirements

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

NOTE 2—The 0.1° observation angle supplementary R_A requirements previously listed in this section have been moved to Appendix X3 to highlight their optional nature.

6.1.1 *Type I*—Minimum Coefficient of Retroreflection—Table 1; Outdoor Weathering—24 months, see 6.4; Daytime Luminance Factor—Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be twelve months.

6.1.2 *Type II*—Minimum Coefficient of Retroreflection—Table 3; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be twelve months.

6.1.3 *Type III*—Minimum Coefficient of Retroreflection—Table 4; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be twelve months.

6.1.4 *Type IV*—Minimum Coefficient of Retroreflection—Table 5; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be twelve months.

6.1.5 *Type V*—Minimum Coefficient of Retroreflection—Table 6; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be twelve months.

6.1.6 *Type VI*—Minimum Coefficient of Retroreflection—Table 7; Outdoor Weathering—six months, see 6.4; Daytime Luminance Factor—Table 2.

6.1.7 *Type VII*—Retroreflective sheeting materials previously classified as Type VII have been reclassified as Type VIII.

6.1.8 *Type VIII*—Minimum Coefficient of Retroreflection—Table 8; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be twelve months.

6.1.9 *Type IX*—Minimum Coefficient of Retroreflection—Table 9; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be twelve months.

6.1.10 *Type X*—Retroreflective sheeting materials previously classified as Type X have been reclassified as Type VIII.

6.1.11 *Type XI*—Minimum Coefficient of Retroreflection—Table 10; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be twelve months.

TABLE 1 Type I Sheeting[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/fc/ft^2 (cd·lx^{-1}·m^{-2}).