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.

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.

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[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.

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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.

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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}).

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TABLE 2 Daytime Luminance Factor (*Y* %)[A]

Color	All except Type V		Type V	
	Minimum	Maximum	Minimum	Maximum
White	27	...	15	
Yellow	15	45	12	30
Orange	10	30	7.0	25
Green	3.0	12	2.5	11
Red	2.5	15	2.5	11
Blue	1.0	10	1.0	10
Purple	2.0	10	2.0	10
Brown	1.0	9.0	1.0	9.0
Fluorescent Yellow-Green	60			
Fluorescent Yellow	40			
Fluorescent Orange	20			
Fluorescent Pink	25	...		

[A] The luminance factors shown for fluorescent colors consist of the sum of a reflectance luminance factor and fluorescence luminance factor. The luminance factor may be determined using a good approximation to Illuminant D65, requiring an instrument with an appropriately filtered light source, or by using a bispectral photometer conforming to Practice E2153.

TABLE 3 Type II Sheeting[A]

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.2°	−4°	140	100	60	30	30	10	5.0
0.2°	+30°	60	36	22	10	12	4.0	2.0
0.5°	−4°	50	33	20	9.0	10	3.0	2.0
0.5°	+30°	28	20	12	6.0	6.0	2.0	1.0

[A] Minimum Coefficient of Retroreflection (R_A) cd/fc/ft^2 (cd·lx^{-1}·m^{-2}).

TABLE 4 Type III Sheeting[A]

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.2°	−4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	−4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

[A] Minimum Coefficient of Retroreflection (R_A) cd/fc/ft^2 (cd·lx^{-1}·m^{-2}).

6.2 *Coefficient of Retroreflection*—The coefficient of retroreflection shall meet or exceed the minimum requirements for the appropriate type of sheeting (see Table 1 and Tables 3-10) as specified in 7.3.

6.3 *Daytime Color*—The color of the sheeting shall conform to requirements of Table 2 and Table 11 when tested in accordance with 7.4. Daytime color requirements were developed for a limited set of retroreflective sheetings and a limited set of measurement devices. Measurement techniques appropriate for a wider range of optical technologies and instruments are under development. Some sheeting may require visual assessment to determine the acceptability of daytime appearance.

6.4 *Accelerated Outdoor Weathering Requirements*—The retroreflective sheeting shall be weather resistant and show no appreciable cracking, scaling, pitting, blistering, edge lifting, or curling, or more than 1/32-in. (0.8-mm) shrinkage or expansion when tested in accordance with 7.6. Conduct retroreflectivity measurements after outdoor weathering at 0.2° observation and −4° and +30° entrance angles. The minimum coefficient of retroreflection (R_A) after weathering is specified in Table 12.

NOTE 3—Supplementary Requirement S3 describes a method for artificial accelerated weathering, which users of this specification may employ for preliminary judgment until outdoor weathering results are available.

6.5 *Colorfastness*—After the specified outdoor weathering, the specimen shall conform to the requirements of Table 2 and Table 11 when tested in accordance with 7.4 and 7.7.

6.6 *Shrinkage*—The retroreflective sheeting shall not shrink in any dimension more than 1/32 in. (0.8 mm) in 10 min or more than 1/8 in. (3.2 mm) in 24 h when tested in accordance with 7.8.

6.7 *Flexibility*—The sheeting shall be sufficiently flexible to show no cracking when tested in accordance with 7.9.

6.8 *Liner Removal*—The liner, when provided, shall be easily removed without soaking in water or other solutions, and shall not break, tear, or remove adhesive from the sheeting. (See 7.10.)

6.9 *Adhesion*—When tested in accordance with 7.5, the adhesive backing of the retroreflective sheeting shall produce a bond that will support a 1¾-lb (0.79-kg) weight for adhesive classes 1, 2, and 3 or a 1-lb (0.45-kg) weight for adhesive class 4 for 5 min, without the bond peeling for a distance of more than 2 in. (51 mm).

6.10 *Impact Resistance*—Retroreflective sheeting shall show no cracking or delamination outside of the actual area of impact when subjected to the impact test in accordance with 7.11.

6.11 *Nighttime Color*—The nighttime color of the sheeting shall conform to the requirements of Table 13, when tested in accordance with 7.12.

7. Test Methods

7.1 *Test Conditions*—Unless otherwise specified in this specification, condition all adhesively bonded and unbonded test samples and specimens at a temperature of 73 ± 3 °F (23 ± 2 °C) and 50 ± 5 % relative humidity for 24 h prior to testing.

7.2 *Panel Preparations*—Unless otherwise specified in this specification, when tests are to be performed using test panels, apply the specimens of retroreflective material to smooth aluminum cut from Alloy 6061-T6 or 5052-H38, in accordance with Specification B209 or B209M. The sheets shall be 0.020 in. (0.508 mm), 0.040 in. (1.016 mm), or 0.063 in. (1.600 mm) in thickness, and a minimum of 8 by 8 in. (200 by 200 mm). Prepare the aluminum in accordance with Specification B449, Class 2, or degrease and lightly acid etch before the specimens are applied. Apply the specimens to the panels in accordance with the recommendations of the retroreflective sheeting manufacturer.

7.3 *Coefficient of Retroreflection:*

7.3.1 For lots, rolls, or sheets of retroreflective sheeting at least 1 yd long in new (unexposed) condition, take three samples in accordance with 9.1. Determine the coefficients of retroreflection in accordance with Test Method E810.

7.3.1.1 To conform to this specification, the average of the three coefficients of retroreflection shall meet the minimum

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TABLE 5 Type IV Sheeting[A]

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Purple	Brown	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
0.20°	–4°	360	270	145	50	65	30	14	18	290	220	105
0.20°	+30°	170	135	68	25	30	14	6.8	8.5	135	100	50
0.50°	–4°	150	110	60	21	27	13	6.0	7.5	120	90	45
0.50°	+30°	72	54	28	10	13	6	2.9	3.5	55	40	22

[A] Minimum Coefficient of Retroreflection (R_A) cd/fc/ft^2 (cd·lx^{-1}·m^{-2}).

TABLE 6 Type V Sheeting[A]

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Purple
0.20°	–4°	700	470	280	120	120	56	28
0.20°	+30°	400	270	160	72	72	32	16
0.50°	–4°	160	110	64	28	28	13	6.4
0.50°	+30°	75	51	30	13	13	6.0	3.0

[A] Minimum Coefficient of Retroreflection (R_A) cd/fc/ft^2 (cd·lx^{-1}·m^{-2}).

limits given in 6.2 and none of the coefficients of retroreflection obtained on any of the samples shall be less than 80 % of the values required in 6.2.

7.4 *Daytime Color:*

7.4.1 Determine the chromaticity and luminance factor *Y* (%) for CIE standard illuminant D65 and the 1931 CIE 2° standard observer in accordance with Practice E308, Test Methods E1347, E1349, and E2301, and Practices E991, E1164, E2152, and E2153, as applicable. The luminance factor is the sum of the reflectance luminance factor and the fluorescence luminance factor. Bispectral measurement provides the individual factors, while measurement with simulated D65 provides their sum.

7.4.1.1 For fluorescent specimens, it is necessary either that the physical illumination of the specimen be a good approximation to illuminant D65, requiring an instrument with an appropriately filtered light source, or else that a bispectral photometer conforming to Test Method E2301 be used. The presence of fluorescence may be determined through use of Practice E1247.

7.4.2 There are three types of 45/0 (0/45) instruments: annular, circumferential, and uniplanar (see Fig. 1). Measurement of prismatic sheeting with circumferential instruments may require multiple measurements. Measurement of prismatic sheeting with uniplanar instruments definitely requires multiple measurements.

7.4.2.1 If the measurement geometry is circumferential, then the testing laboratory must verify that the apertures in the ring are sufficiently close for acceptable approximation to an annular measurement. This may depend on the optical construction of the specimen, and must be determined by the testing laboratory. Multiple measurements of the same specimen area at different rotations may be averaged to improve the approximation to an annular measurement.

7.4.2.2 If the measurement geometry is uniplanar, then a sequence of measurements shall be made on the same specimen area at incremental rotations, and the measurement values shall be taken as averages over all the rotations. The number of rotations shall be large enough for acceptable approximation to an annular measurement. The number depends on the optical construction of the specimen and must be determined by the testing laboratory.

7.4.3 Instruments (spectrophotometers, colorimeters) used to measure daytime color shall have 45/0 or 0/45 illumination and viewing geometry. The referee instrument shall have 10° apertures for both illumination and viewing. Use of aperture sizes deviating from these may affect the measurement results.

7.5 *Adhesion*—Apply the sheeting to a test panel, 0.040 in. (1.016 mm) minimum thickness, prepared as specified in 7.2. Bond 4 in. (102 mm) of a 1 by 6-in. (25.4 by 152-mm) specimen to a test panel. Condition (see 7.1) and then attach the weight to the free end and allow it to hang free at an angle of 90° to the panel surface for 5 min.

7.6 *Outdoor Weathering*—Conduct outdoor exposures in accordance with Practice G7/G7M. During exposure, test panels shall be open backed and oriented at an angle of 45° from the horizontal and facing the equator in accordance with Practice G7/G7M. Expose two panels per location for the number of months specified in Table 12. Conduct exposures in locations with the climate types shown in Table 14. Panel labeling, and conditioning and handling of panels prior to exposure and during evaluation periods shall be in accordance with Practice G147.

7.6.1 *Specimen Mounting for Type VI Sheetings*—Clamp the ends of 4 by 12-in. (100 by 300-mm) specimens between 1 by 8 by 5⁄64-in. (25 by 200 by 2-mm) 6061-T6 aluminum bars, and attach these bars to mounting strips on the outdoor exposure rack. Expose the specimens so that the long axis is parallel to the ground so that bolts used to clamp specimen ends do not interfere with attachment to the test rack. Fig. 2 is a diagram showing the arrangement of the clamping bars and the test specimen.

7.6.2 *Washing Panels After Exposure*—Following exposure, gently wash the panels using a soft cloth or sponge and clean water or a dilute solution of a mild detergent (1 % by weight in water, maximum concentration). After washing, rinse thoroughly with clean water, and blot dry with a soft, clean cloth. After washing and drying, condition the panels at room temperature for at least 2 h prior to conducting any property measurements.

7.6.3 *Measurement of Coefficient of Retroreflection*—After panels have been washed, dried, and conditioned in accordance with 7.6.2, measure retroreflectance at 0.2° observation and –4° and 30° entrance angles. Report the average of the coefficient of retroreflection measured at each geometry on the two panels from each exposure location.

NOTE 4—The use of two samples per weathering deck is considered a minimum and reflects historical practice and practicality. Statistical

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