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Standard Specification for Retroreflective Sheeting for Traffic Control¹

This standard is issued under the fixed designation D 4956; 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 Department of Defense.

^{ε1}~~Note~~ Editorial changes made to Section 6.12 in April 2007.

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~~

1.2 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.

1.3 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

B 209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate

B 209M Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

B 449 Specification for Chromates on Aluminum ~~D 523 Test Method for Specular Gloss~~

E 284 Terminology of Appearance

E 308 Practice for Computing the Colors of Objects by Using the CIE System

E 808 Practice for Describing Retroreflection

E 810 Test Method for Coefficient of Retroreflection of Retroreflective Sheeting Utilizing the Coplanar Geometry

E 811 Practice for Measuring Colorimetric Characteristics of Retroreflectors Under Nighttime Conditions

E 991 Practice for Color Measurement of Fluorescent Specimens Using the One-Monochromator Method

E 1164 Practice for Obtaining Spectrometric Data for Object-Color Evaluation

E 1247 Practice for Detecting Fluorescence in Object-Color Specimens by Spectrophotometry

E 1347 Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry

E 1349 Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional (45:0 or 0:45) Geometry

E 2152 Practice for Computing the Colors of Fluorescent Objects from Bispectral Photometric Data

E 2153 Practice for Obtaining Bispectral Photometric Data for Evaluation of Fluorescent Color

E 2301 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

G 7 Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials

G 147 Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests

G 151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources

G 152 Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic 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.

3. Terminology

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

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 ~~ten~~ 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	Highway signing, construction-zone devices, and delineators
VIII	This type designation has been replaced with Type VIII
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 medium-intensity retroreflective sheeting referred to as “engineering grade” and that is typically an enclosed lens glass-bead sheeting. Typical applications~~ Applications for this material ~~are~~ include permanent highway signing, construction zone devices, and delineators.

4.2.2 *Type II*—~~A medium-high-intensity retroreflective sheeting sometimes referred to as “super engineer grade” and that is typically an enclosed lens glass-bead sheeting. Typical applications~~ Applications for this material ~~are~~ include 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. —A retroreflective sheeting referred to as “high-intensity” that is typically manufactured as an encapsulated glass-bead retroreflective material or as an unmetallized microprismatic retroreflective element material. Applications for this material include permanent highway signing, construction zone devices, and delineators.~~

4.2.4 *Type IV*—~~A high-intensity retroreflective sheeting. This sheeting sheeting referred to as “high-intensity” that is typically an unmetallized microprismatic retroreflective element material. Typical applications~~ Applications for this material ~~are~~ include permanent highway signing, construction zone devices, and delineators.

4.2.5 *Type V*—~~A super-high-intensity retroreflective sheeting. This sheeting sheeting referred to as “super high-intensity” that 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~~ Applications include orange temporary roll-up warning signs, traffic cone collars, and post bands.

4.2.7 *Type VII*—~~A super-high-intensity retroreflective sheeting having highest retroreflectivity characteristics at long and medium road distances as determined by the R_A values of Table 1 at 0.1° and 0.2° observation angles. This sheeting is typically an unmetallized microprismatic retroreflective element material. Typical applications for this material are permanent highway signing, construction zone devices, and delineators. —Retroreflective sheeting materials previously classified as Type VII have been reclassified as Type VIII. The use of a designation as Type VII has been discontinued.~~

4.2.8 *Type VIII*—~~A super-high-intensity retroreflective sheeting having highest retroreflectivity characteristics at long and medium road distances as determined by the R_A values of Table 2 at 0.1° and 0.2° observation angles. This sheeting is typically an unmetallized microprismatic retroreflective element material. Typical applications for this material are permanent highway signing, construction zone devices, and delineators. —A retroreflective sheeting typically manufactured as an unmetallized 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 very-high-intensity retroreflective sheeting having highest retroreflectivity characteristics at short road distances as determined by the R_A values of Table 3 at 1° observation angle. This sheeting is typically an unmetallized~~

TABLE 2 8 Type VIII Sheeting^A

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
0.1 ^{°B}	-4°	1000	750	375	100	150	45	30	800	600	300
0.1 ^{°B}	+30°	460	345	175	46	69	21	14	370	280	135
0.2 [°]	-4°	700	525	265	70	105	32	21	560	420	210
0.2 [°]	+30°	325	245	120	33	49	15	10	260	200	95
0.5 [°]	-4°	250	190	94	25	38	11	7.5	200	150	75
0.5 [°]	+30°	115	86	43	12	17	5.0	3.5	92	69	35

^A Minimum Coefficient of Retroreflection (R_A) $\text{cd}/\text{ft}^2(\text{cd}\cdot\text{lx}^{-1}\cdot\text{m}^{-2})$.

^B Values for 0.1° observation angle are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

TABLE 3 9 Type IX Sheeting^A

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
0.1 ^{°B}	-4°	660	500	250	66	130	30	530	400	200
0.1 ^{°B}	+30°	370	280	140	37	74	17	300	220	110
0.2 [°]	-4°	380	285	145	38	76	17	300	230	115
0.2 [°]	+30°	215	162	82	22	43	10	170	130	65
0.5 [°]	-4°	240	180	90	24	48	11	190	145	72
0.5 [°]	+30°	135	100	50	14	27	6.0	110	81	41
1.0 [°]	-4°	80	60	30	8.0	16	3.6	64	48	24
1.0 [°]	+30°	45	34	17	4.5	9.0	2.0	36	27	14

^A Minimum Coefficient of Retroreflection (R_A) $\text{cd}/\text{ft}^2(\text{cd}\cdot\text{lx}^{-1}\cdot\text{m}^{-2})$.

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

microprismatic retroreflective element material. Typical applications for this material are permanent highway signing, construction zone devices, and delineators. —A retroreflective sheeting typically manufactured as an unmetallized cube corner microprismatic retroreflective element material. Applications for this material include permanent highway signing, construction zone devices, and delineators.

4.2.10 *Type X*—A super-high intensity retroreflective sheeting having highest retroreflective characteristics at medium road distances as determined by the R_A values of Table 4 at 0.1° and 0.2° observation angles. This sheeting is typically an unmetallized microprismatic element material. Typical applications for this material are permanent highway signing, construction zone devices, and delineators. —Retroreflective sheeting materials previously classified as Type X have been reclassified as Type VIII. The use of a designation as Type X has been discontinued.

4.2.11 *Type XI*—A retroreflective sheeting typically manufactured as an unmetallized 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.

TABLE 4 10 Type XI Sheeting^A

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
0.1 ^{°B}	-4°	800	600	300	80	120	40	24	640	480	240
0.1 ^{°B}	+30°	400	300	150	40	60	20	12	320	240	120
0.2 [°]	-4°	560	420	210	56	84	28	17	450	340	170
0.2 [°]	+30°	280	210	105	28	42	14	8.4	220	170	84
0.5 [°]	-4°	420	315	150	42	63	19	13	340	250	125
0.5 [°]	+30°	150	110	53	15	23	7.0	5.0	120	90	45
1.0 [°]	-4°	120	90	42	12	18	5.0	4.0	96	72	36
1.0 [°]	+30°	45	34	16	5.0	7.0	2.0	1.0	36	27	14

^A Minimum Coefficient of Retroreflection (R_A) $\text{cd}/\text{ft}^2(\text{cd}\cdot\text{lx}^{-1}\cdot\text{m}^{-2})$.

^B Values for 0.1° observation angle are supplementary requirements that shall only apply when specified by the purchaser in the contract or order.

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

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 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.

6.1.1 *Type I*—Minimum Coefficient of Retroreflection—Table 5 Table 1; Outdoor Weathering—24 months, see 6.4; Daytime Luminance Factor—Table 6 Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be 12 months.

6.1.2 *Type II*—Minimum Coefficient of Retroreflection—Table 7 Table 3; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 6 Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be 12 months.

6.1.3 *Type III*—Minimum Coefficient of Retroreflection—Table 8 Table 4; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 6 Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be 12 months.

6.1.4 *Type IV*—Minimum Coefficient of Retroreflection—Table 9 Table 5; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 10 and Table 14; Daytime Luminance Factor—Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be 12 months.

TABLE 5_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/ft²(cd·lx^{−1}·m^{−2}).

TABLE 6 2 Daytime Luminance Factor (Y %) ^A

Color	Unmetalized		Metalized	
	Minimum	Maximum	Minimum	Maximum
White	27	—	15	—
White	27	—	15	—
Yellow	15	45	12	30
Yellow	15	45	12	30
Orange	14	30	7.0	25
Orange	10	30	7.0	25
Green	3.0	12	2.5	11
Green	3.0	12	2.5	11
Red	2.5	15	2.5	11
Red	2.5	15	2.5	11
Blue	1.0	10	1.0	10
Blue	1.0	10	1.0	10
Brown	4.0	9.0	1.0	9.0
Brown	1.0	9.0	1.0	9.0
Fluorescent Yellow-Green	60	—	—	—
Fluorescent Yellow	40	—	—	—
Fluorescent Orange	20	—	—	—

^A The luminance factor S_s 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 Test Method E 2301.

TABLE 7 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) $cd/ft^2(cd \cdot lx^{-1} \cdot m^{-2})$.

TABLE 8 4 Type III Sheeting ^A

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° ^B	-4°	300	200	120	54	54	24	14
0.1° ^B	+30°	180	120	72	32	32	14	10
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) $cd/ft^2(cd \cdot lx^{-1} \cdot m^{-2})$.

^B Values for 0.1° observation angle are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

TABLE 9 5 Type IV Sheeting ^A

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
0.1° ^B	-4°	500	380	200	70	90	42	25	400	300	150
0.1° ^B	+30°	240	175	94	32	42	20	12	185	140	70
0.2°	-4°	360	270	145	50	65	30	18	290	220	105
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22

^A Minimum Coefficient of Retroreflection (R_A) $cd/ft^2(cd \cdot lx^{-1} \cdot m^{-2})$.

^B Values for 0.1° observation angle are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

6.1.5 *Type V*—Minimum Coefficient of Retroreflection—Table 11 Table 6; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 12; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be 12 months.

6.1.6 *Type VI*—Minimum Coefficient of Retroreflection—Table 13 Table 7; Outdoor Weathering—6 months, see 6.4; Daytime Luminance Factor—Table 6 and Table 14 Table 2.

6.1.7 *Type VII*—Minimum Coefficient of Retroreflection—Table 1; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 10 and Table 14; Other requirements: When sheeting is specified for construction work zone

TABLE 11.6 Type V Sheeting^A

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue
0.1° ^B	-4°	2000	1300	800	360	360	160
0.1° ^B	+30°	1100	740	440	200	200	88
0.2°	-4°	700	470	280	120	120	56
0.2°	+30°	400	270	160	72	72	32
0.5°	-4°	160	110	64	28	28	13
0.5°	+30°	75	51	30	13	13	6.0

^A Minimum Coefficient of Retroreflection (R_A) cd/ft²(cd·lx⁻¹·m⁻²).

^B Values for 0.1° observation angle are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

TABLE 13.7 Type VI Sheeting^A

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
0.1° ^B	-4°	750	525	190	90	105	68	600	450	300
0.1° ^B	+30°	300	210	75	36	42	27	240	180	120
0.2°	-4°	500	350	125	60	70	45	400	300	200
0.2°	+30°	200	140	50	24	28	18	160	120	80
0.5°	-4°	225	160	56	27	32	20	180	135	90
0.5°	+30°	85	60	21	10	12	7.7	68	51	34

^A Minimum Coefficient of Retroreflection (R_A) cd/ft²(cd·lx⁻¹·m⁻²).

^B Values for 0.1° observation angle are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

applications, the outdoor weathering shall be 12 months. Retroreflective sheeting materials previously classified as Type VII have been reclassified as Type VIII.

6.1.8 *Type VIII*—Minimum Coefficient of Retroreflection—Table 2 Table 8; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 10 and Table 14; Daytime Luminance Factor—Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be 12 months.

6.1.9 *Type IX*—Minimum Coefficient of Retroreflection—Table 3 Table 9; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 10 and Table 14; Daytime Luminance Factor—Table 2; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be 12 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 4 Table 10; Outdoor Weathering—36 months, see 6.4; Daytime Luminance Factor—Table 10 and Table 14; Other requirements: When sheeting is specified for construction work zone applications, the outdoor weathering shall be 12 months.

6.2 *Coefficient of Retroreflection*—The coefficient of retroreflection shall meet or exceed the minimum requirements for the appropriate type of sheeting (see Tables 1-5, Tables 7-9, Table 11, and Table 13—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 17, and one of the following: Table 6, Table 10, Table 12, or Table 14—The color of the sheeting shall conform to requirements of Table 2 and Table 11 when tested in accordance with 7.4. Daytime and nighttime color shall have substantially the same hue. 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.

TABLE 17.1 Color Specification Limits (Daytime)^A

Color	1		2		3		4	
	x	y	x	y	x	y	x	y
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Green ^B	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Blue ^B	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355

^A The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 Standard Colorimetric System measured with CIE Standard Illuminant D65.

^B The saturation limit of green and blue may extend to the border of the CIE chromaticity locus for spectral colors.