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Standard Specification for Color and Appearance Retention of Solid Colored Plastic Siding Products[1]

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ε[1] NOTE—Section 4.1.5 was editorially corrected in September 2003.

1. Scope

1.1 This specification establishes requirements and test methods for the color and appearance retention of solid colored plastic siding products.

1.2 Color retention testing provides a method for estimating the acceptability of color change in a siding product over a period of years of service.

1.3 Methods of indicating compliance with this specification are provided.

2. Referenced Documents

2.1 *ASTM Standards:*

D 883 Terminology Relating to Plastics[2]

D 1435 Practice for Outdoor Weathering of Plastics[2]

D 1600 Terminology for Abbreviated Terms Related to Plastics[2]

D 2244 Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates[3]

D 3679 Specification for Rigid Poly Vinyl Chloride (PVC) Siding[4]

E 805 Practice for Identification of Instrumental Methods of Color or Color-Difference, Measurement of Materials[3]

G 147 Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests[5]

2.2 *Other Reference:*

Vinyl Siding Institute (VSI) Technical Research Report for Weatherability of Vinyl Siding Products, VS2W

NOTE 1—This report supports the conclusion that commercial vinyl siding products which demonstrate weathering behavior within conformance to these standards during a two year test program can be anticipated to provide acceptable color retention properties for the expected life of the product.

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminologies D 883 and D 1600 unless otherwise noted.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *color region*—parameters that define the color space for a siding measured with Hunter Units, Illuminant C, 2° observer, specular component included.

3.2.1.1 *Discussion*—The color values used to classify colors by region will be established by measuring the Hunter L, a, b color values from the sample population, calculating the average for Hunter L, a, b, and then choosing the integer from the corresponding L, a, b average values (that is, no rounding up or down) to be used to classify colors by region.

3.2.2 *ellipsoid value*—a mathematical calculation derived by inserting the measured ΔL, Δa, and Δb values of a weathered specimen into an ellipsoid equation.

3.2.3 *Region 1—Brown*:

L = 20 to 49
a = −1 to 5
b = 2 to 11

3.2.4 *Region 2—Medium Blue*:

L = 45 to 64
a = −8 to 1
b = −12 to −2

3.2.5 *Region 3—Light Blue*:

L = 65 to 89
a = −8 to 1
b = −12 to −2

3.2.6 *Region 4—Green*:

L = 50 to 84
a = −12 to −1
b = −1 to 10

3.2.7 *Region 5—Medium Beige*:

L = 50 to 74	L = 50 to 64	L = 65 to 74
a = 0 to 1	a = −2 to 1	a = −7 to 0
b = 4 to 12	b = 11 to 14	b = 11 to 12

3.2.8 *Region 6—Light Beige*:

L = 75 to 84	L = 85 to 93	L = 75 to 84
a = 0 to 1	a = −7 to 1	a = −7 to −1
b = 4 to 12	b = 4 to 12	b = 11 to 12

[1] This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.24 on Plastic Building Products.

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[2] *Annual Book of ASTM Standards*, Vol 08.01

[3] *Annual Book of ASTM Standards*, Vol 06.01

[4] *Annual Book of ASTM Standards*, Vol 08.04

[5] *Annual Book of ASTM Standards*, Vol 14.04

3.2.9 *Region 7—Gold*:

L = 65 to 93
a = 0 to 4
b = 13 to 30

3.2.10 *Region 8—Yellow*:

L = 65 to 93
a = −10 to −1
b = 13 to 30

3.2.11 *Region 9—White*:

L = 85 to 100 a = −2 to 1 b = −1 to 3 All L = 94 to 100

3.2.12 *Region 10—Light Gray*:

L = 65 to 84
a = 0 to 1
b = −1 to 3

3.2.13 *Region 11—Mauve*:

L = 65 to 93 a = 2 to 11 b = 2 to 12 L = 65 to 93 a = 5 to 11 b = 13 to 15 L = 50 to 64 a = 2 to 11 b = 2 to 15

3.2.14 *Region 12—Medium Gray*:

L = 50 to 64
a = 0 to 1
b = −1 to 3

3.2.15 *Region 13—Dark Gray*:

L = 25 to 49
a = −1 to 5
b = −1 to 1

3.2.16 *Region 14—Dark Blue*:

L = 25 to 44
a = −8 to 3
b = −12 to −2

3.2.17 *Region 15—Dark Green*:

L = 25 to 49
a = −20 to −2
b = −1 to 11

3.2.18 *Region 16—Dark Red*:

L = 25 to 49
a = 6 to 30
b = −1 to 25

4. Classification

4.1 *Definitions*—Definitions are in accordance with Terminologies D 883 and D 1600 unless otherwise noted.

4.1.1 *color retention standards*—predictive color regions described by a three dimensional model which constitute acceptable color retention levels resulting from weathering of a specific product type and color. Color retention standards are defined by equations that describe the three dimensional ellipsoid value.

4.1.2 *Region 1—Brown*:

$$\frac{(\Delta L - 1.6)^2}{(5.2)^2} + \frac{(\Delta a + 1.0)^2}{(3.0)^2} + \frac{(\Delta b - 0.5)^2}{(2.5)^2} = \text{Ellipsoid Value}$$

4.1.3 *Region 2—Medium Blue*:

$$\frac{(\Delta L + 1.0)^2}{(6.0)^2} + \frac{(\Delta a + 0.6)^2}{(2.9)^2} + \frac{(\Delta b - 0.8)^2}{(5.4)^2} = \text{Ellipsoid Value}$$

4.1.4 *Region 3—Light Blue*:

$$\frac{(\Delta L + 0.3)^2}{(6.4)^2} + \frac{(\Delta a + 0.1)^2}{(2.7)^2} + \frac{(\Delta b - 0.8)^2}{(4.3)^2} = \text{Ellipsoid Value}$$

4.1.5 *Region 4—Green*:

$$\frac{(\Delta L - 0.2)^2}{(5.9)^2} + \frac{(\Delta a - 0.8)^2}{(4.8)^2} + \frac{(\Delta b - 0.2)^2}{(5.6)^2} = \text{Ellipsoid Value}$$

4.1.6 *Region 5—Medium Beige*:

$$\frac{(\Delta L + 0.4)^2}{(5.8)^2} + \frac{(\Delta a - 0.0)^2}{(2.8)^2} + \frac{(\Delta b - 0.0)^2}{(4.0)^2} = \text{Ellipsoid Value}$$

4.1.7 *Region 6—Light Beige*:

$$\frac{(\Delta L - 0.0)^2}{(5.0)^2} + \frac{(\Delta a - 0.2)^2}{(2.6)^2} + \frac{(\Delta b - 0.3)^2}{(5.4)^2} = \text{Ellipsoid Value}$$

4.1.8 *Region 7—Gold*:

$$\frac{(\Delta L + 0.6)^2}{(6.6)^2} + \frac{(\Delta a + 0.3)^2}{(3.4)^2} + \frac{(\Delta b + 0.4)^2}{(4.7)^2} = \text{Ellipsoid Value}$$

4.1.9 *Region 8—Yellow*:

$$\frac{(\Delta L + 0.3)^2}{(5.5)^2} + \frac{(\Delta a - 1.0)^2}{(3.3)^2} + \frac{(\Delta b + 0.1)^2}{(5.5)^2} = \text{Ellipsoid Value}$$

4.1.10 *Region 9—White*:

$$\frac{(\Delta L - 0.6)^2}{(8.2)^2} + \frac{(\Delta a + 0.0)^2}{(3.3)^2} + \frac{(\Delta b - 1.9)^2}{(5.3)^2} = \text{Ellipsoid Value}$$

4.1.11 *Region 10—Light Gray*:

$$\frac{(\Delta L + 1.8)^2}{(7.0)^2} + \frac{(\Delta a - 0.2)^2}{(2.1)^2} + \frac{(\Delta b - 1.3)^2}{(4.0)^2} = \text{Ellipsoid Value}$$

4.1.12 *Region 11—Mauve*:

$$\frac{(\Delta L - 0.4)^2}{(6.5)^2} + \frac{(\Delta a - 0.8)^2}{(4.0)^2} + \frac{(\Delta b - 1.1)^2}{(4.5)^2} = \text{Ellipsoid Value}$$

4.1.13 *Region 12—Medium Gray*:

$$\frac{(\Delta L + 1.0)^2}{(6.6)^2} + \frac{(\Delta a + 0.3)^2}{(2.5)^2} + \frac{(\Delta b - 0.5)^2}{(3.0)^2} = \text{Ellipsoid Value}$$

4.1.14 *Region 13—Dark Gray*:

$$\frac{(\Delta L - 0.1)^2}{(5.1)^2} + \frac{(\Delta a + 0.8)^2}{(3.4)^2} + \frac{(\Delta b + 0.1)^2}{(3.0)^2} = \text{Ellipsoid Value}$$

4.1.15 *Region 14—Dark Blue*:

$$\frac{(\Delta L - 0.3)^2}{(5.2)^2} + \frac{(\Delta a - 1.0)^2}{(3.6)^2} + \frac{(\Delta b + 1.3)^2}{(4.5)^2} = \text{Ellipsoid Value}$$

4.1.16 *Region 15—Dark Green*:

$$\frac{(\Delta L - 0.0)^2}{(5.0)^2} + \frac{(\Delta a + 0.4)^2}{(3.0)^2} + \frac{(\Delta b + 0.2)^2}{(3.8)^2} = \text{Ellipsoid Value}$$

4.1.17 *Region 16—Dark Red*:

$$\frac{(\Delta L - 0.4)^2}{(5.4)^2} + \frac{(\Delta a - 0.8)^2}{(4.0)^2} + \frac{(\Delta b - 0.2)^2}{(3.0)^2} = \text{Ellipsoid Value}$$

5. Procedure for Measuring Color Retention

5.1 *Test Site Setup and Exposure Duration Test Times*:

5.1.1 Samples shall be exposed at three test sites: Temperate Northern represented by a site located in Louisville, KY or Cleveland, OH; hot, humid represented by a site located in