Designation: D6864 – 11

An American National Standard

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

This standard is issued under the fixed designation D6864; 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.

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.

NOTE 1—There is no known ISO equivalent to this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D883 Terminology Relating to Plastics

D1435 Practice for Outdoor Weathering of Plastics

D1600 Terminology for Abbreviated Terms Relating to Plastics

D2244 Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

D3679 Specification for Rigid Poly(Vinyl Chloride) (PVC) Siding

E805 Practice for Identification of Instrumental Methods of Color or Color-Difference Measurement of Materials

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

2.2 *Other Reference:*

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

NOTE 2—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 D883 and D1600 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 sample, measured with Hunter Units, sphere geometry (di:8), Illuminant C, 2° observer, specular component included.

3.2.1.1 *Discussion*—The color values used to classify colors by region were 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, by truncating any fractional result) to be used to classify colors by region. Thus average values greater than zero are truncated *down* to the next lowest integer, and average values less than zero are truncated *up* to the next highest integer. All values greater than -1 and less than +1 truncate to 0.

3.2.2 *color retention standards*—predictive color regions described by a three dimensional model, which constitutes acceptable color retention levels resulting from weathering of a specific product type and color.

3.2.2.1 *Discussion*—Color retention standards are defined by equations that describe the three dimensional ellipsoid value.

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

3.2.4 *temperate northern climate—in weathering testing*, a North American metropolitan area testing site within 73 to 100°W longitude and 37 to 45°N latitude.

4. Classification

4.1 *Definitions*—Definitions are in accordance with Terminologies D883 and D1600 unless otherwise noted.

4.2 *Color Regions*—The color region for a color is determined by measuring the Hunter L, a, b color values for a sample. Use the integer value (by truncating any fractional

[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.

Current edition approved April 1, 2011. Published April 2011. Originally approved in 2003. Last previous addition approved in 2010 as D6864 - 10. DOI: 10.1520/D6864-11.

[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.

result) to determine the color region for the color using the following region boundaries.

4.2.1 *Region 1—Brown:*

L = 20 to 49	L = 25 to 49
a = –1 to 5	a = –8 to 5
b = 2 to 11	b = 12 to 25

4.2.2 *Region 2—Medium Blue:*

L = 45 to 64
a = –25 to 1
b = –25 to –2

4.2.3 *Region 3—Light Blue:*

L = 65 to 93
a = –12 to 1
b = –25 to –2

4.2.4 *Region 4—Green:*

L = 50 to 84	L = 50 to 64	L = 50 to 64	L = 65 to 93	L = 85 to 93
a = –12 to –1	a = –25 to –3	a = –25 to –13	a = –25 to –13	a = –12 to –3
b = –1 to 10	b = 11 to 30	b = –1 to 10	b = –25 to 30	b = –1 to 3

4.2.5 *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 = –12 to –1
b = 4 to 12	b = 11 to 15	b = 11 to 12

4.2.6 *Region 6—Light Beige:*

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

4.2.7 *Region 7—Gold:*

L = 65 to 93	L = 65 to 93
a = 0 to 4	a = 5 to 25
b = 13 to 30	b = 16 to 30

4.2.8 *Region 8—Yellow:*

L = 65 to 93
a = –12 to –1
b = 13 to 30

4.2.9 *Region 9—White:*

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

4.2.10 *Region 10—Light Gray:*

L = 65 to 84
a = 0 to 1
b = –1 to 3

4.2.11 *Region 11—Mauve:*

L = 65 to 93	L = 65 to 93	L = 50 to 64	L = 50 to 64
a = 2 to 25	a = 5 to 25	a = 2 to 25	a = –2 to 1
b = 2 to 12	b = 13 to 15	b = 2 to 30	b = 16 to 30

4.2.12 *Region 12—Medium Gray:*

L = 50 to 64
a = 0 to 1
b = –1 to 3

4.2.13 *Region 13—Dark Gray:*

L = 25 to 49
a = –1 to 5
b = –1 to 1

4.2.14 *Region 14—Dark Blue:*

L = 25 to 44
a = –25 to 3
b = –25 to –2

4.2.15 *Region 15—Dark Green:*

L = 25 to 49	L = 25 to 49
a = –25 to –2	a = –25 to –9
b = –1 to 11	b = 12 to 25

4.2.16 *Region 16—Dark Red:*

L = 25 to 49
a = 6 to 30
b = –1 to 25

4.2.17 *Region 17—Purple:*

L = 25 to 44	L = 45 to 49	L = 50 to 93
a = 4 to 30	a = 2 to 30	a = 2 to 25
b = –25 to –2	b = –25 to –2	b = –25 to 1

4.3 *Ellipsoid Value Equations*—Use the following equations to determine the ellipsoid value representing the change in color due to weathering. Use the equation that corresponds to the color region determined for the specimen's initial color (prior to weathering) in 4.2.

4.3.1 *Region 1—Brown:*

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

4.3.2 *Region 2—Medium Blue:*

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

4.3.3 *Region 3—Light Blue:*

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

4.3.4 *Region 4—Green:*

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

4.3.5 *Region 5—Medium Beige:*

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

4.3.6 *Region 6—Light Beige:*

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

4.3.7 *Region 7—Gold:*

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

4.3.8 *Region 8—Yellow:*

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

4.3.9 *Region 9—White:*

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

4.3.10 *Region 10—Light Gray:*

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

4.3.11 *Region 11—Mauve:*

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