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An American National Standard

Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Siding[1]

This standard is issued under the fixed designation D3679; 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 materials, dimensions, warp, shrinkage, impact strength, expansion, appearance, and wind load resistance of extruded single-wall siding manufactured from rigid (unplasticized) PVC compound. Methods of indicating compliance with this specification are also provided.

1.2 The use PVC recycled plastic in this product shall be in accordance with the requirements in Section 4.

1.3 Rigid (unplasticized) PVC soffit is covered in Specification D4477.

1.4 Siding produced to this specification shall be installed in accordance with Practice D4756. Reference shall also be made to the manufacturer's installation instructions for the specific product to be installed.

NOTE 1—Information with regard to siding maintenance shall be obtained from the manufacturer.

1.5 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.

1.6 The following precautionary caveat pertains to the test method portion only, Section 6, 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.*

NOTE 2—There is no known ISO equivalent to this standard.

1.7 *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]

D618 Practice for Conditioning Plastics for Testing
D635 Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
D696 Test Method for Coefficient of Linear Thermal Expansion of Plastics Between −30°C and 30°C with a Vitreous Silica Dilatometer
D883 Terminology Relating to Plastics
D1042 Test Method for Linear Dimensional Changes of Plastics Caused by Exposure to Heat and Moisture
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
D2457 Test Method for Specular Gloss of Plastic Films and Solid Plastics
D3892 Practice for Packaging/Packing of Plastics
D4226 Test Methods for Impact Resistance of Rigid Poly(Vinyl Chloride) (PVC) Building Products
D4477 Specification for Rigid (Unplasticized) Poly(Vinyl Chloride) (PVC) Soffit
D4756 Practice for Installation of Rigid Poly(Vinyl Chloride) (PVC) Siding and Soffit
D5033 Guide for Development of ASTM Standards Relating to Recycling and Use of Recycled Plastics (Withdrawn 2007)[3]
D5206 Test Method for Windload Resistance of Rigid Plastic Siding
D5947 Test Methods for Physical Dimensions of Solid Plastics Specimens
E631 Terminology of Building Constructions
E1753 Practice for Use of Qualitative Chemical Spot Test Kits for Detection of Lead in Dry Paint Films
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 D20 on Plastics and is the direct responsibility of Subcommittee D20.24 on Plastic Building Products.

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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] The last approved version of this historical standard is referenced on www.astm.org.

***A Summary of Changes section appears at the end of this standard**

2.2 *ASCE Standard:*

ASCE 7-10 Minimum Design Loads for Buildings and Other Structures[4]

2.3 *International Code Council:*[5]

International Building Code

International Residential Code

2.4 *Vinyl Siding Institute, Inc.:*[6]

VSI Vinyl Siding Installation Manual (2015)

2.5 *Structural Building Components Association:*[7]

ANSI/SBCA FS 100-2012 Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies

3. Terminology

3.1 Definitions are in accordance with Terminologies D883, E631, and D1600, unless otherwise specified.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *center-pinning*—an installation technique in which the siding panel is fastened tightly through the nail slot at the center length of the panel, in order to cause thermal expansion and contraction to occur equally in both directions from the center.

3.2.2 *heavily textured siding*—in this standard, any vinyl siding using separate postextrusion processing to produce a textured surface.

3.2.2.1 *Discussion*—Post-extrusion-forming does not include embossing of the surface or forming of the faces of the profile, but does include such processes as heat forming, vacuum forming and compression molding applied to the surface after the profile is extruded.

3.2.3 *nominal*—the value that a manufacturer consistently uses to represent a specific property or dimension of a vinyl siding product in public claims including, but not limited to, product literature, advertisements, quotations, and certificates of conformance.

3.2.4 *process average thickness*—the rolling, arithmetic mean of average specimen thicknesses measured according to 6.5 for a specific product during all productions runs for the most recent six month period.

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

3.2.6 *wind load design pressure rating*—the maximum wind pressure that a vinyl siding product is rated to withstand, based on testing under Test Method D5206; there are two types of wind load design pressure rating used in this standard:

3.2.6.1 *standard wind load design pressure rating*—the wind load design pressure rating for a siding product when installed 1) over a sheathing material designed and attached such that it is capable of resisting 100 % of positive and negative wind pressures occurring under design conditions at the building location; and 2) with the standard fastening method specified in building codes, general installation instructions, and the siding manufacturer's instructions.

3.2.6.2 *alternative wind load design pressure rating*—the wind load design pressure rating for a siding product when installed over a sheathing not designed and attached such that it is capable of resisting 100 % of positive and negative wind pressures occurring under design conditions at the building location, or when the siding is not fastened in the standard way; as specified by the manufacturer.

3.2.6.3 *Discussion*—The standard test conditions, configuration, and fastening method used in this Specification are specified in 6.14, while alternative sheathing and installation conditions are specified by the manufacturer and must be reflected in the product's installation instructions. Alternative ratings apply only when the specified sheathing and fastening conditions are used. See Annex A1 for information on differences between the standard wind load design pressure rating and alternative wind load design pressure ratings, and how to determine standard and alternative design pressure ratings.

3.2.7 *vinyl siding*—a shaped material, made principally from rigid poly(vinyl chloride) (PVC), that is used to clad exterior walls of buildings.

3.2.7.1 *Discussion*—Any exception to a homogeneous rigid PVC compound is present in a coextruded or laminated capstock.

4. Materials and Manufacture

4.1 The siding shall be made of one or more layers of poly(vinyl chloride) (PVC) compound. Any layers of materials other than poly (vinyl chloride) (PVC) compound shall be kept to less than 20 % by volume.

4.2 Where rigid PVC recycled plastic as defined in Guide D5033 is used, the siding containing the PVC recycled plastic shall meet all of the requirements of Section 3, Terminology; Section 4, Materials and Manufacture; and Section 5, Physical Requirements.

4.3 The poly(vinyl chloride) siding material, when tested in accordance with Test Method D635, shall not exceed an average extent of burn of 4 in. (100 mm), with an average time of burn not to exceed 10 s. A minimum sample thickness of 0.035 in. (0.9 mm) is required. (**Warning—**The flammability testing data, conclusions, and recommendations of Test Method D635 related solely to the measurement and description of properties for classification of the poly(vinyl chloride) siding material in response to flame under controlled laboratory conditions and shall not be used for the description or appraisal of the fire hazard of vinyl siding under actual fire conditions.)

4.4 The PVC compound when extruded into siding shall maintain uniform color and be free of any visual surface or structural changes, such as peeling, chipping, cracking, flaking, or pitting.

4.5 The PVC compound shall be compounded so as to provide the heat stability and weather exposure stability required for the siding market application.

[4] Available from American Society of Civil Engineers (ASCE), 1801 Alexander Bell Dr., Reston, VA 20191, http://www.asce.org.

[5] Available from International Code Council (ICC), 500 New Jersey Ave., NW, 6th Floor, Washington, DC 20001, http://www.iccsafe.org.

[6] National Housing Center, 1201 15th Street NW, Suite 220, Washington, DC 20005, http://www.vinylsiding.org

[7] 6300 Enterprise Lane, Madison, WI 53719, http://www.sbcindustry.com

4.6 PVC siding shall not contain elemental lead (Pb) or compounds of that material other than traces incidental to raw materials or the manufacturing process. This limitation applies to both PVC substrate and to any cap or film material. Compliance with this requirement shall be demonstrated by one of the methods in 6.16.

5. Physical Requirements

5.1 *Length and Width*—Actual length shall not be less than ¼ in. (6.4 mm) of the nominal length and the actual width shall be within ±1⁄16 in. (1.6 mm) of the nominal width when measured in accordance with 6.3 and 6.4.

5.2 *Thickness*—Except for heavily textured siding, these requirements pertain only to measurements of the portions of the siding that are exposed after installation of the panel, measured in accordance with the procedure in 6.5. For heavily textured siding, these requirements apply to the portion of the siding selected for measurement in accordance with 6.5. The average thickness of each specimen shall be no less than 0.035 in. No individual measurement shall be thinner than 0.003 in. below the nominal thickness. The process average thickness as defined in 3.2.4 shall be no thinner than 0.001 in. below the nominal thickness.

5.3 *Camber*—A full length of siding (typically 10 or 12 ft (3.05 or 3.61 m)) shall not have a camber greater than ⅛ in. (3.2 mm) when measured in accordance with 6.6.

5.4 *Heat Shrinkage*—The average heat shrinkage shall not exceed 3.0 % when determined by the method described in 6.7.

5.5 *Impact Resistance*—Siding shall have a minimum impact strength of 60 in.·lbf (6.78 J) when tested in accordance with 6.8.

5.6 *Coefficient of Linear Expansion*—The siding shall have a coefficient of linear expansion not greater than 4.5 by 10^{-5} in./in./°F (8.1 by 10^{-5} mm/mm/°C) when tested in accordance with 6.9.

5.7 *Gloss*—The gloss of smooth and embossed siding shall be uniform across the exposed surface. The average of all readings for a panel determined in 6.11.2.5 shall not differ from the manufacturer's specified gloss value more than the permitted variation in Table 1, and each individual reading shall not vary more than 10 points from the average. Gloss of smooth and embossed siding shall be tested in accordance with 6.11.

TABLE 1

Manufacturer's Specified Gloss Value	Permitted difference from Mfg. Spec. Gloss Value
Less than or equal to 35	±8
Greater than 35	±10

5.8 *Surface Distortion*—The siding shall be free of bulges, waves, and ripples when tested to a minimum temperature of 120°F (49°C) in accordance with the procedure in 6.12. This distortion is called "oil-canning."

5.9 *Uniformity of Color*—When tested in accordance with 6.13, the total color change, ΔE, between a production specimen and the appropriate reference specimen or agreed-upon color coordinates shall not vary by more than 1.5, and the chromatic coordinates thereof shall not change by more than $\pm\Delta a_H = 1.0$ and $\pm\Delta b_H = 1.0$.

5.10 *Weathering*—The siding shall maintain a uniform color and be free of any visual surface or structural changes such as peeling, chipping, cracking, flaking, and pitting when tested in accordance with 6.10.

NOTE 3—Weathering-conformance-testing requirements are to reflect performance of a "typical" extrusion siding profile representing a specific color of PVC compound and a specific extrusion technology. In no case is there an implied requirement for testing all the various shaped and sized siding profiles produced in this color. The lengthy outdoor weatherability testing for new products may be performed concurrently with market development and sales of siding to existing markets. Completion of weatherability testing prior to marketing of the product is not required.

5.11 *Wind Load Resistance*—The siding shall withstand a minimum static test pressure and a standard wind load design pressure rating shall be determined.

5.11.1 *Minimum Test Pressure*—The siding panel(s) shall be able to withstand a minimum static test pressure of 22.5 lbf/ft^2 (1077 Pa) when tested in accordance with 6.14. The average maximum sustained static test pressure determined in 6.14 shall be equal to or greater than this value.

NOTE 4—The static test pressure of 22.5 lbf/ft^2 (1077 Pa) was established to withstand structural loading conditions that occur in wind exposures of approximately 110 mph (177 km/h) (V_{ASD}) for mean roof heights of 30 ft (9.1 m) and less in exposure category B, and corresponds to 30.0 lbf/ft^2 (1436 Pa) negative design pressure, to match the default wind design conditions of Table 703.3(1) in the 2015 International Residential Code.

NOTE 5—Refer to Annex A1 for an explanation as to how the negative design pressure was established, and for applications where effective negative design pressure as specified in ASCE 7-10 is different from 30.00 lbf/ft^2 (1436 Pa) (for example, wind-zone areas greater than 110 mph (177 km/h) (V_{ASD}) (225 km/h (V_{ULT})) or mean roof height above 30 ft (9.1 m), or exposures other than exposure category B).

5.11.1.1 The design-pressure values can be negative (suction loads) or positive. The negative values are the largest in magnitude and are the values used in this specification.

NOTE 6—In that the siding is being tested as a weather-resistant exterior product applied to an existing exterior structural wall, forces (negative) working to pull the siding off the wall, fasteners, or disengage locks will be the most important criteria for testing. Positive wind forces test the integrity of the total wall sections, and do not provide a measure of the performance of the siding.

5.11.2 *Standard Wind Load Design Pressure Rating*—The standard wind load design pressure rating shall be determined from the results of testing in accordance with 6.14, using the procedures described in A1.3.

NOTE 7—The standard design pressure rating is valid for applications where the siding is installed over sheathing and its fastening that are capable of independently resisting both positive and negative wind pressures occurring under design conditions at the building location. For applications over other sheathing, a different design pressure rating is applicable, and is determined in accordance with A1.3. Determination of a rating other than the standard design pressure rating is not required by this section.

5.11.3 *Alternative Design Pressure Ratings*—Design pressure ratings other than the standard wind load design pressure rating, for use with different sheathing materials or using different installation or fastening, are permitted to be determined in accordance with testing under 6.14, using the procedures in Annex A1.

5.12 *Nail Slot Allowance for Thermal Expansion*—For siding panels utilizing nail slots to allow for thermal expansion and contraction, the nail slot shall be sized to allow for the expected range of expansion and contraction over a range of 100°F. Compliance with this requirement shall be demonstrated either by the test method in 6.15 or by sizing of the nail slots according to the specifications in the following sections. The instrument used shall be capable of measuring to the nearest 0.01 in. The manufacturing tolerance shall not exceed -0.030 inch.

5.12.1 For panels shorter than 6 ft (1829 mm) in length, the minimum nail slot width shall be ⅜ in. (11.4 mm).

5.12.2 For panels 6 ft (1829 mm) in length or longer the minimum nail slot width shall be determined according to the following formula. The minimum width shall be the width resulting from application of the formula, rounded to the next lower quarter-inch. Regardless of the results of the calculation, the minimum nail slot width for panels 6 feet or longer shall be 1 in. (25.4 mm).

$$WS = P_c \times (\alpha \times 100\,°F \times L) + T_c \quad (1)$$

where:

WS = Minimum width of nail slot, in.
P_c = Center-pinning coefficient: 1 if manufacturer's instructions require panel to be center-pinned; 1.5 if center-pinning is not required
α = Coefficient of linear thermal expansion, 4.5×10^{-5} in./in./°F or actual known coefficient for material used, as determined by 6.9
L = Length of panel, inches
T_c = Centering tolerance: 0.25 in.

6. Test Methods

6.1 *General*—The inspection and test procedures contained in this section are used to determine the conformance of products to the requirements of this specification. Each producer who represents its products as conforming to this specification shall be permitted to use statistically based sampling plans that are appropriate for each manufacturing process, but shall keep the essential records necessary to document, with a high degree of assurance, his claim that all of the requirements of this specification have been met.

6.2 *Conditioning and Test Conditions*—Condition the test specimen in accordance with Procedure A of Practice D618 and test under those conditions, unless otherwise specified herein.

6.3 *Length*—Lay the specimen on a flat surface and measure with a steel tape. Measure the length of a siding panel to the nearest 1⁄16 in. (1.6 mm) at the center, the butt edge, and the bottom of the top lock. The average of the three measurements is the actual length.

6.4 *Width*—Interlock two specimens, each at least 26 in. (660 mm) long, in the normal mode for installation. Lay the two specimens on a flat surface. Measure to the nearest 1⁄16 in. (1.6 mm), the distance between the lowest butt edge of the top specimen and the lowest butt edge of the bottom specimen. Commencing approximately one in. (25 mm) from one end of the specimens, make 5 measurements at 6-in. (152-mm) intervals, making sure that the measurement is made perpendicular to the butt edge. Average the measurements. The average constitutes the exposed width of siding.

6.5 *Thickness*—Thickness shall be measured in accordance with Test Method A of Test Method D5947. The micrometer shall be calibrated in accordance with Section 8 of Test Method D5947. All measurements shall be taken to the nearest 0.001 inch. Calculate and report the average of these measurements. Also report the thinnest individual measurement.

6.5.1 *Non-Heavily Textured Siding*—The thickness of the siding shall be measured at a minimum of five locations equally spaced across the entire portion of the siding that will be exposed after installation.

6.5.2 *Heavily Textured Siding*—The thickness of the siding shall be measured at a minimum of five locations on a flat surface such as an end tab or other surface that is representative of the extruded thickness. More than one panel shall be used as necessary to provide a random selection of measurement locations.

6.6 *Camber*—Place a full length of siding (typically 10 or 12 ft (3.05 or 3.61 m)) on a flat surface alongside a straightedge at least as long as the siding specimen. Measure the maximum space between edge of the siding specimen and the straightedge for each edge to the nearest 1⁄16 in. (1.6 mm).

6.7 *Heat Shrinkage:*

6.7.1 *Apparatus:*

6.7.1.1 *Scriber,* similar to that described in Test Method D1042, with the exception that the needle points shall be separated by 10 ± 0.01 in. (254 ± 0.254 mm).

6.7.1.2 *Test Media,* a controlled-temperature water bath of 5 gal (10 L) or more, equipped with an efficient stirrer that will maintain uniform temperature throughout. Heater and temperature-control devices must maintain the water at 160 ± 1°F (71 ± 0.5°C). Use a wire rack to raise and lower specimens into the water bath. As an alternative to the use of a water bath, the specimens may be heated for 30 min in a uniformly heated forced-air oven maintained at a temperature of 160 ± 1°F (71 ± 0.5°C).

6.7.1.3 Make measurements with any device capable of measuring the distance between two scribe marks to the nearest 0.01 in. (0.254 mm).

6.7.2 *Procedure:*

6.7.2.1 Scribing shall be done on either the front or back surface of the siding as necessary to provide a clean, recognizable line.

6.7.2.2 Cut three specimens from the siding panel, each 1 in. (25.4 mm) wide by 12 in. (305 mm) long. Cut one specimen from the center and one from each of the extreme edges of the flat surface. The long axis shall be parallel to the machine direction.

6.7.2.3 Condition specimens at 73.4 ± 3.6°F (23 ± 2°C) and 50 ± 10 % relative humidity for at least 24 hours.

6.7.2.4 Make a slight mark with the scribe on each specimen so that a reference point will be clearly visible.

6.7.2.5 Place specimens in the test medium.

6.7.2.6 Remove specimens after 30 min and place on a flat surface until cool.

6.7.2.7 Repeat conditioning in accordance with 6.7.2.3.

6.7.2.8 Make a second mark with the scribe on each specimen, using the same center.

6.7.2.9 Measure the distance, *D*, between the scribe marks to the nearest 0.01 in. (0.254 mm).

6.7.2.10 Calculate the percent shrinkage as (*D*/10) × 100.

6.7.2.11 Report the average shrinkage of the three specimens tested.

6.8 *Impact Resistance*—Test impact resistance of siding in accordance with Test Method D4226, Procedure A, impactor head configuration H.25. 4 in.-lb increments (0.5 in. height increments with 8 lb falling weight) shall be used. Minimum sample dimensions shall be 1.5 by 1.5 in. Samples shall be tested with the normally exposed surface facing up. Conditioning time for quality-control tests shall be at least 1 hour.

6.8.1 For purposes of evaluating failure of the specimen under 3.2.1 of Test Method D4226, a ductile tear of less than 0.2 in. (5 mm) in length shall not be considered a failure. Any brittle break of any dimensions is considered a failure.

6.9 *Coefficient of Linear Expansion*—Conduct this test in accordance with Test Method D696.

6.9.1 *Alternative Specimen Preparation*—Specimens prepared from strips cut from extruded siding are permitted to be used in testing under Test Method D696. Where such specimens are used, they shall be cut with the long dimension parallel to the long axis of the siding panel. Guides shall be used in accordance with Test Method D696 to prevent bending or twisting of the specimen in the dilatometer.

6.10 *Weatherability:*

6.10.1 A minimum of three samples shall be exposed at each of at least three test sites. Test sites shall be located in a northern temperate climate, represented by Cleveland, Ohio or Louisville, Kentucky; a hot, humid climate represented by Miami, Florida; and a hot, dry climate represented by Phoenix, Arizona. The samples shall be exposed for a minimum of 24 months.

6.10.2 Samples shall consist of a flat section of siding with minimum dimensions of 2 in. by 3 ¾ in. (25 mm by 95 mm).

6.10.3 Samples shall be representative of the product to be evaluated.

NOTE 8—Samples prepared in the laboratory in the same manner as commercial samples are permitted to be used as an alternative to a commercial part. If the commercial product is extruded, the laboratory specimen must be extruded; if the commercial product is injection molded, the laboratory specimen must be injection molded, and so forth.

6.10.4 Select a minimum of four specimens per sample per test site to allow for three test specimens and one file specimen for each sample evaluated.

6.10.5 Mark each specimen permanently to ensure retention of identity during and after exposure testing.

NOTE 9—Use of a vibratool leaves a permanent mark that satisfies this criterion.

6.10.6 All exposures shall be conducted at an angle of 45° South, plywood backed, in accordance with Practices D1435 and G147.

6.10.7 After a minimum of 24 months of exposure, remove the samples and inspect each exposed test specimen for appearance and surface condition. Record observations and inspection date in a permanent record.

6.11 *Gloss:*

6.11.1 *Apparatus*—Measure gloss using a 75° geometry glossmeter that meets the requirements of the Apparatus section of D2457.

6.11.2 *Procedure:*

6.11.2.1 Gloss measurements shall be made in accordance with the procedure in Section 9 of D2457, unless otherwise specified herein.

6.11.2.2 Measure gloss on one piece of siding on at least three widely separated sections across the width of the exposed surface of the panel. At least one reading shall be taken on each face of the panel. Care needs to be taken to ensure that a new surface area is used for each reading since instrument contact may leave scratches on the specimen surface. The area tested must be flat. If a flat area on the exposed surface cannot be found due to the style or depth of embossing of the panel being tested, then a non-exposed area of the panel shall be chosen in its place. Such locations shall be representative of the gloss of the area that will be exposed after installation.

6.11.2.3 Measure gloss parallel to the direction of embossing. When the embossing pattern is not apparent, measure the gloss in the direction of extrusion.

6.11.2.4 Each reading shall be within the appropriate limit specified in 5.7.

6.11.2.5 The average of all readings shall be used to represent the gloss of the sample.

6.12 *Surface Distortion:*

6.12.1 *Test Specimen/Apparatus:*

6.12.1.1 The test specimen shall consist of three courses of siding, a minimum of 6 ft (1.83 m) in length, mounted on a flat rigid frame in accordance with the manufacturer's recommended installation instructions.

6.12.1.2 Heat-sensing elements shall be located at the midpoint of the backside of the second course of siding.

6.12.1.3 *Radiant-Heat Rod,* 600 W for each linear foot (0.31 m), mounted parallel to the middle course and approximately 32 in. (810 mm) away from the surface of the siding.

6.12.1.4 *Temperature-Control Device,* used to regulate the temperature of the radiant-heat rod, shall be able to maintain the conditions specified in 6.12.2.1.

6.12.2 *Procedure:*

6.12.2.1 Heat the test panel (second course of siding) at a rate of 3.0 to 6.0°F/min (1.7 to 3.3°C/min) until a minimum temperature of 120°F (49°C) is achieved as measured by the heat-sensing element on the midpoint of the backside of the second course. During this heating period, observe the test panel for surface distortion.

6.12.2.2 Failure is defined as the appearance of bulges, waves, or ripples before a temperature of 120°F (49°C) is reached.

6.13 *Color Uniformity*—Calculate the difference between the L_H, a_H, and b_H color coordinates for a production specimen to those of either the appropriate reference specimen or the agreed upon color coordinates for that specific color product in accordance with Test Method D2244. Calculate the total

difference ΔE between the production specimen and the reference specimen in accordance with Test Method D2244.

6.14 *Wind Load Resistance*—Conduct the test on wind load resistance of finished siding in accordance with Test Method D5206. The average maximum sustained static test pressure determined from this testing is used in 5.11. For purposes of determining compliance with the minimum test pressure and standard design pressure requirements in 5.11, the test structure shall be constructed with vertical studs 16 inches on center, the siding in the test installation shall be installed over wood sheathing with a nominal thickness of 7⁄16 to ½ inch, and fastened as follows:

6.14.1 *Fastener Type*—Roofing nail, smooth shank, 0.120 in. (⅛ in. nominal; 3.2 mm) shank diameter, 5⁄16 in. (7.9 mm) head diameter, length as necessary to penetrate into sheathing and stud a total of 1 ¼ in. (32 mm). For vertical siding, length as necessary to penetrate the thickness of the sheathing plus ¼ in. (6.4 mm).

6.14.2 *Fastener Spacing*—Every 16 in. (406 mm) into center of stud for horizontal siding. For vertical siding, every 12 inches into sheathing only.

6.14.3 Fasteners shall not be driven tightly against the siding. Allow approximately 1⁄32 in. (0.8 mm) clearance between the fastener head and siding surface.

NOTE 10—The installation details described in 6.14 conform to the minimum requirements of the 2015 International Residential Code and the VSI Vinyl Siding Installation Manual.

6.15 *Nail Slot Allowance for Thermal Expansion*—As an alternative to conformance with the nail slot width specification in 5.12.1 or 5.12.2, provision for thermal expansion and contraction shall be demonstrated through the following test procedure.

6.15.1 *Samples*—At least three samples of each profile in which the siding is produced shall be provided. The length of each sample shall be at least 50 % of the longest length in which the profile is produced, and not shorter than 12 ft (3658 mm).

6.15.2 *Test Chamber*—The test chamber shall consist of an environmentally controlled room or compartment capable of providing an air temperature range of at least 0°F to 100°F (-18°C to 38°C) without exposure of the panel to radiant energy from heating or cooling elements. Air temperature shall be controlled such that a rate of temperature change of 2°F (1.11°C) per minute can be achieved over the full temperature range, and the minimum and maximum temperatures can be maintained for at least 15 minutes. Means for circulating air to provide a uniform air temperature throughout the chamber shall be provided. A vertical wall shall be provided for mounting of samples. The wall shall be insulated such that, with no panels mounted, the inner surface of the wall does not deviate more than 10°F (5.5°C) from the air temperature at the high and low temperature extremes after a holding period of 5 minutes. The test chamber shall be of sufficient size to accommodate the longest panel to be tested, including expected thermal expansion of the panel. Means shall be provided to measure the actual temperature of the surface of each panel at a minimum of three evenly-spaced locations along the length of the panel.

6.15.3 *Length Measurement*—A means for measuring the length of each sample throughout the temperature range shall be provided. The method utilized for length measurement shall not be influenced by the temperature of the chamber and shall have a minimum resolution of no greater than 0.0625 in. (1.59 mm).

6.15.4 *Procedure*—Install the sample panels on the wall inside the test chamber, following the manufacturer's instructions for fastener type, spacing, location and tightness. At ambient temperature measure and record the length of each panel and the temperature of the panel, averaged from a minimum of three locations along the length of the panel.

6.15.4.1 *Test Cycle*—Test cycles shall be performed by raising the air temperature to 100°F ± 5°F (38°C ± 2.75°C) at an average rate of 2°F (1.11°C) per minute, holding the air temperature at 100°F (38°C ± 2.75°C) for 15 minutes, lowering the air temperature to 0°F ± 5°F (-18°C ± 2.75°C) at an average rate of 2°F (1.11°C) per minute, holding at 0°F (-18°C ± 2.75°C) for 15 minutes, and returning to ambient temperature at an average rate of 2°F per minute.

6.15.4.2 *Conditioning*—Close the test chamber and perform at least two conditioning cycles using the procedure in 6.15.4.1. No interruption is required between conditioning cycles.

6.15.4.3 *Test*—Following completion of the conditioning cycles, conduct three test cycles using the procedure in 6.15.4.1. It is acceptable for the test cycles to follow immediately upon completion of the final conditioning cycle, and no interruption is required between test cycles. After a minimum holding period of 15 minutes at the high and low extremes of each test cycle, measure and record the length of each panel and the temperature of the panel, averaged from a minimum of three locations along the length of the panel.

6.15.5 *Normalization*—From among the length measurements recorded for all three cycles, identify the shortest and longest length of each panel, and the average panel temperature at the time that length was recorded. Determine the maximum difference in length, ΔL, and the maximum difference in temperature, ΔT, by subtracting the smaller from the larger. Normalize the change in length to the full length of the panel over a 100°F (38°C) temperature range using the following formula:

$$E_t = \Delta L \; x \; (100/\Delta T) \; x \; (L_f/L_t) \qquad (2)$$

where:

E_t = Total thermal expansion and contraction of a full length panel over a range of 100 °F (38 °C)
ΔL = Maximum change in length of the tested panel
ΔT = Maximum change in temperature of the tested panel
L_f = Longest length in which the panel is produced
L_t = Actual length of the panel as tested

6.15.6 *Acceptable Performance*—When tested in accordance with this procedure, the result of $(E_t \times 2) + 0.25$ in. for each of the three samples for each profile shall not be greater than the width of the nail slot. If the manufacturer's installation instructions require the panel to be center-pinned, the result of $E_t + 0.25$ in. for each of the three samples for each profile shall not be greater than the width of the nail slot.