



# Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Siding with Foam Plastic Backing (Backed Vinyl Siding)<sup>1</sup>

This standard is issued under the fixed designation D7445; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope\*

1.1 This specification establishes requirements for vinyl siding with integral foam plastic backing, where the siding is manufactured from rigid PVC compound. Performance requirements and test methods addressed by this standard include materials properties and dimensions, warp, shrinkage, impact strength, expansion, appearance, and wind load resistance. Methods of indicating compliance with this specification are also provided.

NOTE 1—Backed vinyl siding is composed of two major components: the siding and the backing. It is intended that the siding portion comply with Specification D3679. Applicable portions of Specification D3679 are included in this specification. Additional requirements that pertain only to the backing as a separate material, or to the combination of siding and backing as a whole, are also included.

1.2 Backed vinyl siding shall be tested with the backing material in place or removed, as specified in the applicable requirement or test method.

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

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 2—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 *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 3—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:*<sup>2</sup>

- 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  $-30^{\circ}\text{C}$  and  $30^{\circ}\text{C}$  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
- D3679 Specification for Rigid Poly(Vinyl Chloride) (PVC) Siding
- D3892 Practice for Packaging/Packing of Plastics
- D4226 Test Methods for Impact Resistance of Rigid Poly(Vinyl Chloride) (PVC) Building Products
- D4756 Practice for Installation of Rigid Poly(Vinyl Chloride) (PVC) Siding and Soffit (Withdrawn 2023)<sup>3</sup>
- D5206 Test Method for Windload Resistance of Rigid Plastic Siding

<sup>1</sup> 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 Jan. 1, 2018. Published February 2018. Originally approved in 1979. Last previous edition approved in 2017 as D7445 – 17. DOI: 10.1520/D7445-18.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

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

**D5947** Test Methods for Physical Dimensions of Solid Plastics Specimens

**D7209** Guide for Waste Reduction, Resource Recovery, and Use of Recycled Polymeric Materials and Products (Withdrawn 2015)<sup>3</sup>

**D7793** Specification for Insulated Vinyl Siding

**E84** Test Method for Surface Burning Characteristics of Building Materials

**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

2.2 *ASCE Standard*:<sup>4</sup>

**ASCE 7-10** Minimum Design loads for Buildings and Other Structures

2.3 *International Code Council*:<sup>5</sup>

**International Building Code**

**International Residential Code**

2.4 *Vinyl Siding Institute, Inc.*:<sup>6</sup>

**VSI Vinyl Siding Installation Manual (2015)**

2.5 *Structural Building Components Association*:<sup>7</sup>

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

3.2.5 *wind load design pressure rating*—the maximum wind pressure that a backed vinyl siding product is rated to withstand, based on testing under Test Method **D5206**.

3.2.5.1 *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.

3.2.5.2 *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.

3.2.5.3 *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.

3.2.6 *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.

3.2.7 *vinyl siding*—a shaped material, made principally from rigid poly(vinyl chloride) (PVC), that is used to clad exterior walls of buildings; in this standard, vinyl siding refers to the rigid profile to which the backing material is attached.

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 vinyl siding, exclusive of backing material, 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. This limitation does not apply to the backing material.

4.2 Where rigid PVC recycled plastic as defined in Guide **D7209** is used, the siding containing the PVC recycled plastic shall meet all of the requirements of 3, Terminology; 4, Materials and Manufacture; and 5, Physical Requirements.

4.3 The poly(vinyl chloride) siding material, exclusive of backing 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** relate solely to the

## 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 *backed vinyl siding*—a vinyl cladding product sold with manufacturer-installed foam plastic backing material as an integral part of the cladding product. The vinyl cladding portion of backed vinyl siding meets the definition of vinyl siding. Backed vinyl siding is intended to be installed only with the integral backing.

3.2.2 *backing material; foam plastic backing*—a layer or layers of plastic that has been intentionally expanded to produce a reduced-density plastic containing voids consisting of open or closed cells distributed throughout the plastic.

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.

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

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

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

<sup>7</sup> 6300 Enterprise Lane, Madison, WI 53719, <http://www.sbcindustry.com>

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 foam plastic backing shall have a Flame Spread Index not greater than 75 and a Smoke Developed Index not greater than 450 when tested separately under method E84.

4.5 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.

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

4.7 Backed vinyl 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, as well as the backing material. Compliance with this requirement shall be demonstrated by one of the methods in 6.16.

## 5. Physical Requirements

5.1 *Requirements Applicable to Vinyl Siding*—The provisions of 5.1.1 – 5.1.8 apply only to the vinyl siding, exclusive of any backing material. Where necessary to perform testing, the backing material shall be removed.

5.1.1 *Length and Width*—The nominal length and width of the siding shall be as agreed upon between the purchaser and the seller. The actual length shall not be less than ¼ in. (6.4 mm) of the nominal length and the actual width shall be within ± ⅛ in. (1.6 mm) of the nominal width when measured in accordance with 6.3 and 6.4.

5.1.2 *Thickness*—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. 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.

5.1.3 *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.

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

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

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

5.1.7 *Gloss*—The gloss of smooth and embossed vinyl 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 vinyl siding shall be tested in accordance with 6.11.

5.1.8 *Uniformity of Color*—The color specified shall be uniform on the exposed surface of the vinyl siding panels, except on the case of variegated colors. When tested in accordance with 6.13, the total color change,  $\Delta E$ , 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  $\pm \Delta b_H = 1.0$ .

5.1.9 *Weathering*:

5.1.9.1 The vinyl 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 4—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.

5.2 *Requirements Applicable to Backed Vinyl Siding*—The provisions of 5.2.1 – 5.2.3 apply to backed vinyl siding, including the integral foam backing material. Testing shall be conducted with the backing material in place, as described in the referenced test method.

5.2.1 *Surface Distortion*—The backed vinyl siding shall be free of bulges, waves, and ripples when tested to a minimum temperature of 150°F (66°C) in accordance with the procedure in 6.12. This distortion is called “oil-canning.”

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

5.2.2.1 *Minimum Test Pressure*—Backed siding shall be able to withstand a minimum test pressure of 22.5 lbf/ft<sup>2</sup> (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. If the manufacturer of backed siding provides documentation to support compensation for pressure equalization, the test pressure shall be determined from Annex A1 using the documented pressure equalization factor.

NOTE 5—The static test pressure of 22.5 lbf/ft<sup>2</sup> (1077 Pa) for backed siding 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<sup>2</sup> (1436 Pa) negative design pressure, to match the default wind design conditions of Table R703.3(1) in the 2015 International Residential Code. Provision is made for compensation for pressure equalization specific to the product if supporting documentation

**TABLE 1 Gloss Values**

Manufacturer’s Specified Gloss Value	Permitted Difference from Manufacturer’s Specified Gloss Value
Less than or equal to 35	±8
Greater than 35	±10

is provided, using procedures in [Annex A1](#).

**NOTE 6**—Refer to [Annex A1](#) for an explanation as to how the negative design pressure was established, and for applications where the effective negative design pressure as specified in ASCE 7-10 is different from 30.0 lbf/ft<sup>2</sup> (1436 Pa) (for example, wind-zone areas greater than about 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).

(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 7**—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.

**5.2.2.2 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 8**—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.

**5.2.2.3 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](#).

**5.2.3 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 in.

**5.2.3.1** For panels shorter than 6 ft (1829 mm) in length, the minimum nail slot width shall be  $\frac{3}{8}$  in. (11.4 mm).

**5.2.3.2** 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).

$$WS = P_c \times (\alpha \times 100 \text{ }^\circ\text{F} \times L) + T_c \quad (1)$$

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,

$\alpha$  = coefficient of linear thermal expansion,  $4.5 \times 10^{-5}$  in./in./°F or actual known coefficient for material used, as determined by [6.9](#),

$L$  = length of panel, inches, and

$T_c$  = 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. Additional sampling and testing of the product, as agreed upon between the purchaser and the manufacturer, are not precluded by this section.

**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  $\frac{1}{16}$  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 long specimens, each at least 26 in. (600 mm) long, in the normal mode for installation. Lay the two specimens on a flat surface. Measure to the nearest  $\frac{1}{16}$  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 1 in. (25 mm) from one end of the specimens, make five 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** 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](#). The thickness of the siding shall be measured at a minimum of 5 locations equally spaced across the entire portion of the siding that will be exposed after installation. All measurements shall be taken to the nearest 0.001 in. Calculate and report the average of these measurements. Also report the thinnest individual measurement.

**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  $\frac{1}{16}$  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  $10 \pm 0.01$  in. ( $254 \pm 0.254$  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  $160 \pm 1^\circ\text{F}$  ( $71 \pm 0.5^\circ\text{C}$ ). 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  $160 \pm 1^\circ\text{F}$  ( $71 \pm 0.5^\circ\text{C}$ ).

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 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.

6.7.2.2 Condition specimens at  $73.4 \pm 3.6^\circ\text{F}$  ( $23 \pm 2^\circ\text{C}$ ) and  $50 \pm 5\%$  relative humidity for at least 24 h.

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

6.7.2.4 Place specimens in the test medium.

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

6.7.2.6 Repeat conditioning in accordance with 6.7.2.2.

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

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

6.7.2.9 Calculate the percent shrinkage as  $(D/10) \times 100$ .

6.7.2.10 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. Backed siding shall be tested with any backing material removed. Conditioning time for quality-control tests shall be at least 1 h.

6.8.1 For purposes of evaluating failure of the specimen under section 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**.

6.10 *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  $3 \frac{3}{4}$  in. (25 mm by 95 mm).

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

NOTE 9—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 4 specimens per sample per test site to allow for 3 test specimens and 1 file specimen for each sample evaluated.

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

NOTE 10—Use of a vibratool leaves a permanent mark that satisfies this criterion.

6.10.6 All exposures shall be conducted at an angle of  $45^\circ$  South, plywood backed, in accordance with Practice **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  $75^\circ$  geometry glossmeter that meets the requirements of the Apparatus section of Test Method **D2457**.

6.11.2 *Procedure:*

6.11.2.1 Gloss measurements shall be made in accordance with the procedure in Section 9 of Test Method **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. Use new surface area for each reading to avoid scratches caused by instrument contact. 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 5.1.7.

6.11.2.5 The average reading 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 backed vinyl 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.

(1) *Horizontal Siding*—The middle course shall consist of two lengths of backed vinyl siding, both with a factory-fabricated end, one section overlapping the other section. The end of the overlapping section shall be located not less than 3 in. (76 mm) and not more than 6 in. (152 mm) from the center

of the course. Unless specified otherwise by the manufacturer's installation instructions, the insulation of the two lengths of backed vinyl siding shall be butted firmly together.

(2) *Vertical Siding*—The middle course shall consist of a single, uninterrupted backed vinyl siding panel, without overlap.

6.12.1.2 A thermocouple or other heat-sensing element shall be located at the horizontal midpoint of the backside of the middle course of backed vinyl siding. The heat-sensing element shall be in contact with the back of the vinyl cladding. Any backing material removed to facilitate placement of the heat sensing element shall be replaced.

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 backed vinyl 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.

6.12.1.5 *Gap Measurement Device*—A cylindrical pin gauge,  $\frac{1}{4} \pm 0.005$  in. ( $6 \pm 0.127$  mm) in diameter is used to evaluate the size of any gap in the overlapped sections of horizontal backed vinyl siding during the heating period. The pin gauge is attached to a rod such that the gauge can be inserted into a gap while held parallel to the plane of the backed vinyl siding. The rod shall be sufficiently long to permit insertion of the gauge from beyond the edge to the test frame, not interfere with the exposure of the sample to radiant heat, and otherwise not interfere with conduct of the test.

#### 6.12.2 Procedure:

6.12.2.1 Heat the test panel (middle course of backed vinyl siding) at a rate of 3.0 to 6.0°F/min (1.7 to 3.3°C/min) until a minimum temperature of 150°F (66°C) is achieved as measured by the heat-sensing element on the midpoint of the backside of the middle course. For temperatures equal to or greater than 130°F (54°C), the rate of heating is permitted to be not less than 2.0°F/min (1.1°C/min), provided that the average heating rate from the ambient temperature to 150°F (66°C) is within 3.0 to 6.0°F/min (1.7 to 3.3°C/min). When a temperature of 150°F (66°C) is attained, shut off the heat source.

6.12.2.2 During this heating period, observe the middle course of the backed vinyl siding for surface distortion and observe for any opening or gap at the end of the overlapped section. If the overlap appears to have opened to approximately  $\frac{1}{4}$  in. (6 mm), attempt to insert the gap measurement device into the opening. If the device can be inserted in to the opening to any depth at any location along the overlap, the opening shall be considered to be at least  $\frac{1}{4}$  in. (6 mm).

6.12.2.3 Failure is defined as:

(1) the appearance of bulges, waves, or ripples on any surface of the middle course of the backed vinyl siding;

(2) occurrence of a gap or opening  $\frac{1}{4}$  in. (6 mm) or greater at any point along the end of the overlapped section, as determined by use of the gap measurement device, at any time or before a temperature of 150°F (66°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  $\Delta E$  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 5.2.2. For purposes of determining compliance with the minimum test pressure and standard design pressure requirements in 5.2.2, the test structure shall be constructed with vertical studs 16 in. on center. The siding shall be tested with the foam plastic backing attached to the vinyl siding. The siding in the test installation shall be installed over wood sheathing with a nominal thickness of  $\frac{7}{16}$  to  $\frac{1}{2}$  in., and fastened as follows:

6.14.1 *Fastener type*—Roofing nail, smooth shank, 0.120 in. ( $\frac{1}{8}$  in. nominal; 3.2 mm) shank diameter,  $\frac{5}{16}$  in. (7.9 mm) head diameter, length as necessary to penetrate into sheathing and stud a total of 1  $\frac{1}{4}$  in. (32 mm). For vertical siding, length as necessary to penetrate the thickness of the sheathing plus  $\frac{1}{4}$  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 in. into sheathing only.

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

NOTE 11—The installation details described 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 5.2.3.1 or 5.2.3.2, provision for thermal expansion and contraction shall be demonstrated through the following test procedure.

6.15.1 *Samples*—At least 3 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