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StandardSpecification for Insulated Vinyl Siding[1]

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1. Scope*

1.1 This specification establishes requirements for insulated vinyl siding, which is vinyl siding with integral foam plastic insulating material, where the vinyl siding is manufactured from rigid PVC compound. Compliance with this standard requires insulated vinyl siding to demonstrate a thermal insulation value of R-2.0 or greater. Other performance requirements and test methods addressed by this standard include materials properties and dimensions, warp, shrinkage, impact strength, expansion, appearance, thermal distortion resistance, and windload resistance. Methods of indicating compliance with this specification are also provided.

NOTE 1—Insulated vinyl siding is composed of two major components: the vinyl siding and the insulating material. It is intended that the vinyl siding portion comply with Specification D3679. Applicable portions of Specification D3679 are included in this specification. Additional requirements that pertain only to the insulation as a separate material, or to the combination of vinyl siding and insulation as a whole, are also included. For further explanation, see Appendix X1.

1.2 Insulated vinyl siding shall be tested with the insulation 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 Insulated vinyl 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.

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

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C297/C297M Test Method for Flatwise Tensile Strength of Sandwich Constructions

C578 Specification for Rigid, Cellular Polystyrene Thermal Insulation

C591 Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

C1199 Test Method for Measuring the Steady-State Thermal Transmittance of Fenestration Systems Using Hot Box Methods

C1289 Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

C1363 Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

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

D1042 Test Method for Linear Dimensional Changes of Plastics Caused by Exposure to Heat and Moisture

D1183 Practices for Resistance of Adhesives to Cyclic Laboratory Aging Conditions

D1435 Practice for Outdoor Weathering of 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

[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.

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

D4756 Practice for Installation of Rigid Poly(Vinyl Chloride) (PVC) Siding and Soffit
D5206 Test Method for Windload Resistance of Rigid Plastic Siding
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
D7445 Specification for Rigid Poly(Vinyl Chloride) (PVC) Siding with Foam Plastic Backing (Backed Vinyl Siding)
E84 Test Method for Surface Burning Characteristics of Building Materials
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 *American Society of Civil Engineers (ASCE):*[3]
ASCE 7-02 Minimum Design Loads for Buildings and Other Structures

2.3 *International Code Council–Evaluation Services (ICC-ES):*
AC05 Acceptance Criteria for Sandwich Panel Adhesives

2.4 *International Standards Organization (ISO):*
ISO/IEC Guide 65 General requirements for bodies operating product certification systems

2.5 *Federal Standards:*
16 CFR Part 460 Labeling and Advertising of Home Insulation

3. Terminology

3.1 *Definitions:*

3.1.1 *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.

3.1.2 *cohesive failure*—in the context of tensile testing, internal separation of the adhesive within the adhesive layer, resulting in attachment of adhesive material to the surface of both substrates

3.1.3 *insulation; insulating material*—foam plastic material that is combined at the factory with a vinyl siding profile to form insulated vinyl siding.

3.1.4 *insulated vinyl siding*—a vinyl cladding product sold with manufacturer-installed foam plastic insulating material as an integral part of the cladding product. The vinyl cladding portion of insulated vinyl siding meets the definition of vinyl siding.

3.1.5 *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.

3.1.6 *process average thickness*—the rolling, arithmetic mean of average specimen thicknesses measured in accordance with 6.5 for a specific product during all productions runs for the most recent six-month period.

3.1.7 *vertical coverage*—The net vertical distance of the wall covered by a single insulated vinyl siding panel, disregarding any portions of the panel that are overlapped by adjacent panels above or below.

3.1.8 *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.

3.1.9 *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 insulation is attached.

4. Materials and Manufacture

4.1 *Vinyl Siding:*

4.1.1 The vinyl siding, exclusive of foam plastic insulating 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 insulation material.

4.1.2 Where rigid PVC recycled plastic as defined in Guide D7209 is used, the vinyl siding containing the PVC recycled plastic shall meet all of the requirements of Sections 3, 4, and 5.

4.1.3 The vinyl siding material, exclusive of insulation 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 seconds. 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 measurement and description of properties for classification of the vinyl 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.)

4.2 *Foam Plastic Insulation:*

4.2.1 The foam plastic insulation shall be made of one of the following materials:

4.2.1.1 Expanded polystyrene complying with Specification C578.

4.2.1.2 Extruded polystyrene complying with Specification C578

4.2.1.3 Polyisocyanurate complying with Specification C591 or Specification C1289

4.2.2 The foam plastic insulation shall have a Flame Spread Index not greater than 75 and a Smoke Developed Index not greater than 450 when tested separately under Test Method E84.

4.3 *Adhesives:*

4.3.1 The suitability for outdoor use of an adhesive used to bond the vinyl siding and the insulation, if any, shall be determined by the following procedure.

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

4.3.1.1 Prepare a minimum of 10 samples consisting of two Douglas fir-larch blocks or other appropriate substrates, bonded by the adhesive, in accordance with Test Method C297/C297M. Each block is to be 2.0 inches square. The adhesive shall be applied and cured in accordance with the adhesive manufacturer's instructions.

(1) The material selected for use as the substrate shall be capable of withstanding the accelerated aging described in 4.3.1.2 without damage or deterioration of the substrate.

NOTE 3—Other appropriate substrates, such as metal or plastic, compatible with the adhesive according to the manufacturer's guidelines, can be used in place of the Douglas fir-larch blocks. Because in accordance with 4.3.1.4.1 at least 75 % of samples must fail in a cohesive mode, a substrate should be selected that is expected to be stronger than the adhesive and which will form a tight bond with the adhesive.

4.3.1.2 Subject 50 percent of the samples to accelerated aging under Test Method D1183, Test Condition C, for three cycles. The low-temperature portion of the cycle is not required to be colder than -40°F (-40°C) and the relative humidity during this portion of the cycle shall not be greater than 10 % RH.

4.3.1.3 Condition and test all of the samples in accordance with Test Method C297/C297M.

4.3.1.4 *Acceptable Performance:*

(1) For a valid test, the mode of failure for no fewer than 75 % of the samples shall be cohesive. Only samples that failed cohesively are counted in the following. The average ultimate tensile strength of the samples that were subjected to accelerated aging shall not be less than 80 % of the average ultimate tensile strength of the samples that were subjected to conditioning only.

(2) As an alternative, adhesives that are covered by a current report, issued by an agency accredited under ISO Guide 65, as a Type I, Class 2 adhesive in accordance with Acceptance Criteria AC05, will have exhibited acceptable performance under the above procedure.

NOTE 4—Compatibility of the adhesive with the vinyl siding and insulation used in the insulated vinyl siding is evaluated separately, under 5.2.4.

4.4 *Insulated Vinyl Siding:*

4.4.1 Insulated 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 insulation 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 insulation material. Where necessary to perform testing, the insulation material shall be removed.

5.1.1 *Length and Width*—The nominal length and width of the vinyl 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 ±1⁄16 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 vinyl 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 3.1.6 shall be no thinner than 0.001 in. below the nominal thickness.

5.1.3 *Camber*—A full length of vinyl 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*—The vinyl siding shall have a minimum impact strength of 60 in.•lbf (6.78 J) when tested in accordance with 6.8.

5.1.6 *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.

5.1.7 *Uniformity of Color*—The color specified shall be uniform on the exposed surface of the vinyl siding panels, except in the case of variegated colors. 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 $\pm\Delta b_H = 1.0$.

5.1.8 *Weathering*—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.

5.1.9 *Coefficient of Linear Expansion*—The vinyl 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.

5.2 *Requirements Applicable to Insulated Vinyl Siding*—The provisions of 5.2.1–5.2.5 apply to insulated vinyl siding, including the integral foam insulation material. Testing shall be conducted on both the vinyl siding and the insulating material, or with the insulating material in place, as described in the referenced test method.

5.2.1 *Thermal Distortion*—The insulated vinyl siding shall be free of bulges, waves, and ripples, and an overlap shall not

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

open more than ¼ in. (6 mm) when tested to a minimum temperature of 150°F (66°C) in accordance with the procedure in 6.12.

5.2.2 *Windload Resistance*—Insulated vinyl siding shall be able to withstand a minimum test pressure of 30.58 lbf/ft^2 (2093 Pa) when tested in accordance with 6.14. If the manufacturer of insulated vinyl siding provides documentation to support compensation for pressure equalization, the test pressure shall be determined from Annex A1 using the documented pressure equalization factor.

5.2.2.1 Refer to Annex A1 for applications where the effective negative design pressure as specified in ASCE 7-02 is greater than 29.12 lbf/ft^2 (1394 Pa) (for example, wind-zone areas greater than 110 mph (177 km/h) or elevations above 30 ft (9.1 m), or exposures other than exposure category B), or for application of pressure equalization compensation for insulated vinyl siding.

NOTE 5—The static test pressure of 30.58 lbf/ft^2 (2093 Pa) for insulated vinyl siding was established to withstand structural loading conditions that occur in 110 mph (177 km/h) wind-zone areas for elevations of 30 ft (9.1 m) and less in exposure category B, and is equivalent to 29.12 lbf/ft^2 (1394 Pa) negative design pressure. Refer to Annex A1 for an explanation as to how the 29.12 lbf/ft^2 (1394 Pa) negative design pressure was established. Provision is made for compensation for pressure equalization specific to the product if supporting documentation is provided, using procedures in Annex A1.

NOTE 6—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. In that the insulated vinyl siding is being tested as a weather-resistant exterior product applied to an existing exterior structural wall, forces (negative) working to pull the insulated vinyl 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 insulated vinyl siding.

5.2.3 *Nail Slot Allowance for Thermal Expansion*—For vinyl 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 inches.

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

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

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 vinyl siding used, as determined by 6.9

L = Length of panel, inches

T_c = Centering tolerance: 0.25 in.

5.2.4 *Compatibility of Adhesives*—When subjected to cyclical conditioning and tested in accordance with 6.17, samples composed of the vinyl siding and insulation bonded with the adhesive, if any, used in the insulated vinyl siding shall not exhibit a decrease in average ultimate tensile strength greater than 20 %, compared to samples not subjected to cyclical conditioning. This requirement is not applicable to insulated vinyl siding that does not contain any adhesive.

5.2.5 *Thermal Insulation Value*—The thermal insulation value (R-value) of the insulated vinyl siding shall be not less than R-2.0 when measured in accordance with 6.18.

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.

NOTE 7—Each producer who represents its products as conforming to this specification typically uses statistically based sampling plans that are appropriate for each manufacturing process to verify on-going compliance. Specifications for quality control programs are beyond the scope of this Standard Specification. 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 that has been verified as accurate to within ±1⁄16 in. (1.6 mm) against a calibrated standard. Measure the length of a vinyl 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 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 vinyl 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. The thickness of the vinyl siding shall be measured at a minimum of five locations equally spaced across the entire portion of the vinyl 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 vinyl 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 vinyl siding specimen. Measure the maximum space between the edge of the vinyl 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, heat the specimens 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 Cut three specimens from the vinyl 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 ± 3.6°F (23 ± 2°C) and 50 ± 10 % relative humidity for at least 24 hours.

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) × 100.

6.7.2.10 Report the average shrinkage of the three specimens tested.

6.8 *Impact Resistance*—Test impact resistance of vinyl 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. Insulated vinyl siding shall be tested with any insulation material removed. Conditioning time for quality-control tests shall be at least one hour.

6.8.1 For purposes of evaluating failure of the specimen under subsection 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, separately for samples of the vinyl siding and samples of the insulation.

6.9.1 *Alternative Specimen Preparation for Vinyl Siding Samples*—Specimens prepared from strips cut from extruded vinyl 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 vinyl 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 vinyl siding with minimum dimensions of 2 by 3¾ in. (25 by 95 mm).

6.10.3 Samples shall be representative of the product to be evaluated. Samples shall be taken either from commercial products or from laboratory samples. Laboratory samples shall be produced in the same manner as the commercial products to be evaluated.

NOTE 8—Production of laboratory samples in the same manner includes use of the same method of forming the product. For example, if the commercial product is extruded, the laboratory specimen shall be extruded; if the commercial product is injection molded, the laboratory specimen shall 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 vibrating engraver 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 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° 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 vinyl 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 a 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 5.1.6.

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

6.12 *Thermal Distortion:*

6.12.1 *Test Specimen/Apparatus:*

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

(1) Horizontal Siding—The middle course shall consist of two lengths of insulated 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 insulated vinyl siding shall be butted firmly together.

(2) Vertical Siding—The middle course shall consist of a single, uninterrupted insulated 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 back side of the middle course of insulated vinyl siding. The heat-sensing element shall be in contact with the back of the vinyl cladding. Any insulation or 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 insulated 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, ¼ ± 0.005 in. (6 ± 0.127 mm) in diameter is used to evaluate the size of any gap in the overlapped sections of horizontal insulated 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 insulated 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 insulated 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 insulated 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 ¼ in. (6 mm), attempt to insert the gap measurement device into the opening. If the device can be inserted into the opening to any depth at any location along the overlap, the opening shall be considered to be at least ¼ 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 insulated vinyl siding; or

(2) occurrence of a gap or opening ¼ 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 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 ΔE between the production specimen and the reference specimen in accordance with Test Method D2244.

6.14 *Windload Resistance*—Conduct the test on windload resistance of finished insulated vinyl siding in accordance with Test Method D5206. The insulated vinyl siding shall be tested with the insulation attached to the vinyl siding.

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 three samples of each profile in which the insulated vinyl 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 to 100°F (–18 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