Designation: D5795 – 16 (Reapproved 2024)

Standard Test Method for Determination of Liquid Water Absorption of Coated Wood and Wood Based Products Via "Cobb Ring" Apparatus[1]

This standard is issued under the fixed designation D5795; 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 test method is intended to serve as a means for measurement of liquid water that passes through a wetted paint film, and which is subsequently absorbed and retained by the underlying wood or wood-based substrate. Alternative techniques for the use of the "Cobb Ring" apparatus are described.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *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.*

1.4 *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]

D9 Terminology Relating to Wood and Wood-Based Products

D16 Terminology for Paint, Related Coatings, Materials, and Applications

D1193 Specification for Reagent Water

D5235 Test Method for Microscopic Measurement of Dry Film Thickness of Coatings on Wood Products

D6132 Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Coating Thickness Gage

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *Cobb unit (C.U.), n*—the weight of distilled water absorbed by the underlying wood substrate in grams per 645 cm^2 (100 $in.^2$) of surface area (discounting additional areas contributed by texturing or grooves) per 24-h time period.

3.1.2 *Cobb unit (C.U.) factor, n*—a dimensionless mathematical term which, for a given ring size, may be multiplied times the weight change after 24 h to calculate the Cobb unit value.

3.1.2.1 *Discussion*—The C.U. factor is calculated as follows:

SI Units

$$C.U.Factor = \frac{64516}{RingArea(mm^2)} = \frac{64516}{\pi r^2} \quad (1)$$

Imperial Units

$$C.U.Factor = \frac{100}{RingArea(in.^2)} = \frac{100}{\pi r^2} \quad (2)$$

where:

r = radius, mm (in.)

For example, for 100 mm (4 in.) inside diameter or 50 mm (2 in.) internal radius ring:

$$C.U.\ Factor = \frac{64516}{3.14(50)^2} - \frac{64516}{7850} - 8.22 \quad (3)$$

3.1.3 *wood based products, n*—boards or other form of structured or decorative materials manufactured from wood fibers, flakes or strands or veneers and various resin binders otherwise known as engineered wood products or wood composite.

4. Summary of Test Method

4.1 Suitable size rings of metal or plastic are adhered or clamped to the flat, coated surface of composite wood panels to be tested.

[1] This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.52 on Factory Coated Wood 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.

4.2 The assembly is equilibrated at a constant temperature and humidity and weighed.

4.3 The weighed assembly is placed on horizontal surface[3] in a controlled temperature and humidity room or environmental chamber. Water is placed in the ring and left in contact with the board face for 24 h.

4.4 After 24 h the remaining water is removed from the ring, the assembly blotted dry and reweighed.

4.5 The increase in weight of the assembly due to water uptake is calculated by simple subtraction and then converted to Cobb units through the use of the C.U. factor (see 3.1.2).

5. Significance and Use

5.1 This test method provides a simple quantitative measure of water absorption by coated wood or wood based products.

5.2 This test method has demonstrated utility for wood or wood based products ranging in thickness from approximately 6 mm to 25 mm (¼ in. to 1 in.).

5.3 Conditioning of substrate, coated sample preparation, application method, dry film thickness, cure conditions, and number of replicate specimens should be agreed upon between the purchaser and the supplier of the coating material.

5.4 Such measurements are used as indicators or predictors of the anticipated performance of coated wood or wood based products during exterior exposure. They may be used for developmental evaluation of coatings, substrates, or both. They may also be useful for quality control or monitoring of the production of coated wood and wood based products.

6. Apparatus

6.1 *Rings,* may be cut from stainless steel, aluminum or plastic pipes. To avoid damage to the test assembly caused by warping of the wooden substrate due to water absorption on one side only, it is recommended to use flexible rings. Measure the rings diameter to the nearest 1 mm (0.040 in.).

NOTE 1—The ring diameter can be any size, but useful results have been obtained with rings of 102 mm (4 in.) or larger inside diameter, wall thickness of 10 mm (⅜ in.) and height of 25 mm (1 in.). Rings of 100 mm to 254 mm (4 in. to 10 in.) are commonly used. If suitable flexible rings cannot be purchased, they can be prepared in the laboratory. To prepare flexible rings, an appropriate film made from a semi-flexible non-absorbent plastic (for example, surface treated polyethylene film with thickness about 0.10 mm (0.004 in.) could be used. Wrap the film around on a rigid pipe of the required diameter, and heat weld or glue the wrapped film along its edge. Subsequently cut the pipe with wrapped and welded polyethylene film into suitable rings.

6.2 *Environmental Chamber,* capable of maintaining 23 °C ± 2 °C (73 °F ± 4 °F) and 50 % ± 5 % relative humidity, or other agreed upon options.

6.3 *Saw,* suitable for cutting of samples.

6.4 *Caulk Gun or Applicator,* or, a clamp and gasket device for holding the ring tightly against the board is needed.

6.5 *Balance,* with sufficient capacity (typically 400 g) and 0.01 g accuracy.

7. Materials

7.1 *Butyl or Silicone Caulk,* which has been determined not to contribute to assembly weight change through absorption of water or interaction with the coating.

7.2 *Distilled Water,* (see Specification D1193).

7.3 *Test Boards,* appropriately identified, coated or uncoated, cut to a square size that is 25.4 mm (1 in.) greater than the ring diameter. A minimum of three replicates is recommended.

7.4 *Control Samples,* coated or uncoated without rings will also be required. These will be used to assess the degree of equilibration that is achieved.

8. Hazards

8.1 Use saws with goggles, dust mask, and proper machine safeguards to prevent injury.

8.2 Caulking compounds may be flammable and contain toxic solvents. See manufacturer's instructions for proper use and disposal.

9. Procedure

9.1 Measure and record the coating thickness on the samples designated for testing, including thickness of individual coats (if distinguishable). Follow procedures described in Test Methods D5235 or D6132 (if applicable).

9.2 *Sealing of Rings to the Coated Face of the Samples:*

9.2.1 A continuous bead of caulk is applied to one edge of the ring. The caulked side of the ring is then attached to the sample with gentle pressure and a slight twisting motion; to maintain an accurate and uniform test area, only minor caulk "squeeze-out" should occur inside of the ring. Carefully remove this minor caulk "squeeze-out" to prevent errors in later calculations. Care must be taken not to smear caulk over the coating surface to avoid invalidating results. Consider the use of caulks with contrasting colors to aid in verification of removal. If flexible rings are used, they should be supported from the inside by a segment of rigid pipe with the appropriate diameter during the sealing process. Flexible rings with a wall thickness of less than 0.5 mm (0.20 in.) do not require sealant on the edge against the coating but can be anchored entirely by the caulk filled around the outside at the base of the ring. After the caulk cures, remove the supporting ring.

9.2.2 Alternatively, the assembly may be produced with a clamp and gasket device. Satisfactory results can also be obtained from clamp and gasket devices that are of self design and locally produced by any machine shop.

9.2.3 To enhance reproducibility, do not generate data by a combination of the caulk procedure and the clamp and gasket procedure.

9.2.4 Also, for improved reproducibility, all rings must be of the same nominal internal diameter.

9.3 *Equilibration:*

9.3.1 Allow the samples with rings and controls without rings to equilibrate for seven days at 23 °C ± 2 °C (73 °F ±

[3] The specification of a solid, continuous horizontal surface or a discontinuous (wire rack, expanded metal, etc.) is required. Surface must be consistent from laboratory to laboratory since this can influence the rate of evaporation of moisture and, thus, retention of moisture and Cobb values.