SSPC: The Society for Protective Coatings

PAINT APPLICATION SPECIFICATION NO. 9

Measurement of Dry Coating Thickness Using Ultrasonic Gages

1. Scope

1.1 This standard describes procedures to measure the thickness of dry, homogeneous coatings applied on a variety of surfaces such as concrete, wood, wallboard, plastic, fiber and composite material using commercially available ultrasonic coating thickness gages. These procedures are intended to supplement manufacturers' operating instructions for the manual operation of the gages and are not intended to replace them.

1.2 The procedures for calibration, adjustment, and general use of ultrasonic coating thickness gages are described in ASTM D6132 and the gage manufacturer's instructions. This document focuses on the correct method for taking measurements.

1.3 Current ultrasound technology may not be capable of accurately measuring the DFT of some coatings (see Notes 9.1 and 9.2).

2. Description

2.1 The procedures described in this standard include criteria for determining the number of measurements, location of measurements, and whether the dry film thickness (DFT) of the coating conforms to project specifications.

2.2 DESCRIPTION OF GAGES: Ultrasonic gages use a transducer in the probe to send pulses into the coating and measure the time taken by that pulse to return to the probe tip to calculate coating thickness (see Note 9.3).

2.3 DEFINITIONS

2.3.1 Gage Reading: A single instrument reading.

2.3.2 Spot Measurement: The average of three or at least three gage readings made within a 15-cm (6-inch) diameter circle.

Discussion: Acquisition of more than three gage readings within a spot is permitted. Any unusually high or low gage readings that are not repeated consistently are discarded. The average of the acceptable gage readings is the spot measurement.

SSPC-PA 9 was first issued in April 2008, and was revised in July 2015, with editorial revisions issued in August 2015 and February 2018.

2.3.4 Homogeneous: Of the same or similar in composition or structure. In this standard, the term "homogeneous coating" refers to a coating of uniform composition throughout that does not contain large, solid particles such as sand.

3. References

3.1 The date of the referenced standards in effect at the time of publication of this standard is shown below. Upon mutual agreement, the latest revision of a referenced standard in effect on the date of invitation to bid may be used, provided it does not change the technical requirements of this SSPC standard. Standards marked with an asterisk (*) are referenced only in the Notes, which are not requirements of this standard.

3.2 If there is a conflict between the requirements of any of the cited referenced standards and this standard, the requirements of this standard shall prevail.

3.3 ASTM INTERNATIONAL STANDARDS[1]

*	**D1005-95(2013)**	Standard Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers
*	**D4138-07a(2013)**	Standard Test Methods for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means
*	**D4414-95(2013)**	Standard Practice for Measurement of Wet Film Thickness by Notch Gages
	D6132-13	Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Coating Thickness Gage
*	**D7091-13**	Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals

3.4 SSPC STANDARDS

*	**SSPC-PA 2(2015)**	Procedure for Determining Conformance to Dry Coating Thickness Requirements

[1] ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, phone int+1-610-832-9500. For referenced ASTM standards, visit the ASTM website-http://www.astm.org>

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4. Gage Requirements

The ultrasonic gage shall be capable of measuring the thickness of a coating over a non-metallic substrate. To qualify under this standard, the gage shall have a minimum accuracy within ±5 percent. All gages shall be calibrated and adjusted following the manufacturer's instructions and be in accordance with ASTM D 6132.

5. Calibration and Verification of Accuracy

5.1 ASTM D6132 describes three operational steps necessary to ensure accurate coating thickness measurement: calibration, verification of accuracy and adjustment of coating thickness measuring gages, as well as proper methods for obtaining coating thickness measurements. These steps shall be completed before taking coating thickness measurements to determine conformance to a specified coating thickness range. Verification of accuracy shall be performed in accordance with ASTM D6132.

5.2 Gages shall be calibrated by the equipment manufacturer, its authorized agent, or an accredited calibration laboratory. A test certificate or other documentation showing traceability to a national metrology institution is required. There is no standard time interval for re-calibration, nor is one absolutely required. Calibration intervals are usually established based upon experience and the work environment, or when specified. A one-year calibration interval is a typical starting point suggested by gage manufacturers.

5.3 To guard against measuring with an inaccurate gage, gage accuracy shall be verified according to the procedures described in ASTM D6132. Verification shall be performed, at minimum, at the beginning and end of each work shift. The user is advised to verify gage accuracy during measurement acquisition (e.g., hourly) when a large number of measurements are being obtained. If the gage is dropped or suspected of giving erroneous readings during the work shift, its accuracy shall be rechecked.

5.4 Record the serial number of the gage, the reference standard used, the stated thickness of the reference standard as well as the measured thickness value obtained, and the method used to verify gage accuracy. If the same gage, reference standard, and method of verification are used throughout a job, the information need be recorded only once. The stated value of the standard and the measured value shall be recorded each time accuracy is verified.

5.5 If the gage fails the post-measurement accuracy verification check, all measurements acquired since the last accuracy verification check are suspect. In the event of physical damage, wear, or high usage, or after an established calibration interval, the gage shall be rechecked for accuracy of measurement. If the gage is not measuring accurately, it shall not be used until it is repaired and/or recalibrated (usually by the gage manufacturer).

6. Measurement Procedures

6.1 Verify that the gage will provide accurate readings of the coating to be measured, using the procedure in Note 9.2.

6.2 NUMBER OF READINGS: Repeated gage readings, even at points close together, often differ due to small surface irregularities of the coating and the substrate (see Notes 9.4 and 9.5). Therefore, a minimum of three (3) gage readings shall be made for each spot measurement of the coating. For each new gage reading, move the probe to a new location within the 15-cm (6-inch) diameter circle defining the spot. Each gage reading shall be at least 5 cm (2 inches) from the other gage readings. Discard any single unusually high or low gage readings that are not repeated consistently. The average of the acceptable gage readings is the spot measurement. See Note 9.6 regarding removal of couplant after completing spot measurements.

6.3 NUMBER OF MEASUREMENTS: Unless otherwise specified in the procurement documents (project specification), an area measurement is obtained by taking five (5) separate spot measurements (average of the gage readings, described in Section 6.2) randomly spaced throughout each 10-m^2 (approximately [~] 100-ft^2]) area to be measured and representative of the coated surface. The five spot measurements shall be made for each 10-m^2 (~100-ft^2) area as follows:

6.3.1 For areas of coating not exceeding 30 m^2 (~300 ft^2) in area, each 10-m^2 (~100 ft^2) (or increment thereof) area shall be measured.

6.3.2 For areas of coating greater than 30 m^2 (~300 ft^2) in area and not exceeding 100 m^2 (~1,000 ft^2) in area, three 10-m^2 (~100-ft^2) (or increment thereof) areas shall be arbitrarily selected by the inspector and measured.

6.3.3 For areas of coating greater than 100 m^2 (~1000 ft^2) in area, the first 100 m^2 (~1000 ft^2) shall be measured as stated in Section 6.3.2. For each additional 100-m^2 (~1000-ft^2) coated area (or increment thereof), arbitrarily select and measure one 10-m^2 (~100-ft^2) area.

6.4 NONCONFORMING AREAS: If the coating thickness for any 10-m^2 (~100-ft^2) area is not in compliance with the contract documents, the procedure described here shall be followed to assess the magnitude of the nonconforming thickness.

6.4.1 Determine the spot DFT at 1.5-m (5-ft) intervals in eight equally spaced directions radiating outward from the nonconforming 10-m^2 (~100-ft^2) area. If there is no place to measure in a given direction, then no measurement in that direction is necessary. Acquire spot measurements in each direction (up to the maximum surface area coated during the work shift) until two consecutive conforming spot measurements are acquired in that direction or until no additional measurements

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