

SSPC: The Society for Protective Coatings

PAINT APPLICATION SPECIFICATION NO. 9

Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages

1. Scope

1.1 This standard describes procedures to measure the thickness of dry, homogeneous coatings applied on cementitious surfaces 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 using ultrasonic coating thickness gages are described in ASTM D 6132 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 8.1 and 8.2).

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 8.3).

2.3 DEFINITIONS

2.3.1 Gage Reading: A single reading at one point.

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

2.3.3 Structure: A unit composed of one or more connected concrete members. It is possible for a single concrete shape (beam, pipe, channel, etc.) to be considered a structure if it is painted in a shop.

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.

2.3.5 Calibration: The controlled and documented process of measuring traceable calibration standards and verifying that the results are within the stated accuracy of the gage. Calibrations are typically performed by the gage manufacturer or by a qualified laboratory in a controlled environment using a documented process. The standards used in the calibration are such that the combined uncertainties of the resultant measurement are less than the stated accuracy of the gage.

2.3.6 Verification: An accuracy check performed by the user using known reference standards.

2.3.7 Adjustment: The act of aligning the gage's thickness readings to match those of a known sample in order to improve the accuracy of the gage on a specific surface or in a specific portion of its measurement range.

3. References

3.1 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern, unless otherwise specified. 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 STANDARDS¹

* D 4138	Standard Test Methods for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means
D 6132	Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Gage

¹ ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Standards are available online from <http://www.astm.org>.

- * **D 7091** 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
- * **SSPC-PA 2** Measurement of Dry Coating Thickness with Magnetic Gages

4. Gage Requirements

The ultrasonic gage shall be capable of measuring the thickness of a coating over a cementitious substrate. To qualify under this standard, the gage shall have a minimum accuracy within $\pm 10\%$. All gages shall be calibrated and adjusted following the manufacturer's instructions and be in accordance with ASTM D 6132.

5. Measurement Procedures

5.1 Verify that the gage will provide accurate readings over the coating to be measured, using the procedure in Note 8.2.

5.2 SPOT MEASUREMENT: Repeated gage readings, even at points close together, usually differ due to surface irregularities of the coating and the substrate (see Notes 8.4 and 8.5). 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 reading that cannot be repeated consistently. Take the average of the acceptable gage readings as the spot measurement (see Note 8.6).

5.3 NUMBER OF MEASUREMENTS: Make five (5) separate spot measurements (average of the gage readings, see Section 5.2) spaced arbitrarily over each 10 m² (108 ft²) area to be measured unless otherwise specified. The five spot measurements shall be made for each 10 m² (108 ft²) of area as follows:

5.3.1 For structures not exceeding 30 m² (323 ft²) in area, each 10 m² (108 ft²) (or increment thereof) area shall be measured.

5.3.2 For structures not exceeding 100 m² (1,076 ft²) in area, three 10 m² (108 ft²) (or increment thereof) areas shall be arbitrarily selected by the inspector and measured.

5.3.3 For structures exceeding 100 m² (1,076 ft²) in area, the first 100 m² (1,076 ft²) shall be measured as stated in Section 5.3.2 and for each additional 100 m² (1,076 ft²) of area (or increment thereof), one 10 m² (108 ft²) area shall be arbitrarily selected by the inspector and measured.

5.3.4 If the dry film thickness for any 10 m² (108 ft²) area or increment thereof (see Sections 5.3.1, 5.3.2 and 5.3.3) is not in compliance with the requirements of Section 6, additional measurements shall be made to isolate the non-conforming area, and each 10 m² (108 ft²) area painted during that work shift shall be measured.

5.4 SPECIFYING THICKNESS: Both a maximum and a minimum thickness are customarily specified for the coating. If a maximum thickness value is not specified, (as in Restriction Level 4 of Table 1) the specified thickness shall be the minimum and there shall be no maximum.

Table 1
Restriction Levels
Coating Thickness on Concrete

Thickness	Spot Reading	Area Reading
Level 1		
Minimum	As specified	As specified
Maximum	As specified	As specified
Level 2		
Minimum	As specified	As specified
Maximum	125% of maximum	As specified
Level 3		
Minimum	75% of minimum	As specified
Maximum	125% of maximum	As specified
Level 4		
Minimum	75% of minimum	As specified
Maximum	Unrestricted	Unrestricted