



Designation: A1124/A1124M – 23

# Standard Specification for Textured Epoxy-Coated Steel Reinforcing Bars<sup>1</sup>

This standard is issued under the fixed designation A1124/A1124M; 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 covers deformed steel reinforcing bars with protective epoxy coating applied by the electrostatic spray method followed by a texturing surface treatment material.

NOTE 1—The coating applicator is identified throughout this specification as the manufacturer.

1.2 Other organic coatings and texturing surface treatment materials may be used provided they meet the requirements of this specification.

1.3 Requirements for coatings are contained in Annex A1 of Specification [A775/A775M](#).

1.4 Requirements for texturing surface treatment material are contained in [Annex A1](#).

1.5 Requirements for patching material are contained in Annex A2 of Specification [A775/A775M](#).

1.6 Guidelines for construction practices at the job-site are presented in [Appendix X1](#).

1.7 This specification is applicable for orders in either inch-pound units (as Specification A1124) or SI units [as Specification A1124M].

1.8 The values stated in either inch-pound units or SI units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.9 *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.*

1.10 *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>

[A615/A615M](#) Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

[A706/A706M](#) Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement

[A775/A775M](#) Specification for Epoxy-Coated Steel Reinforcing Bars

[A944](#) Test Method for Comparing Bond Strength of Steel Reinforcing Bars to Concrete Using Beam-End Specimens

[A996/A996M](#) Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

[A1035/A1035M](#) Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement

[B117](#) Practice for Operating Salt Spray (Fog) Apparatus  
[D374/D374M](#) Test Methods for Thickness of Solid Electrical Insulation

[D2967](#) Test Method for Corner Coverage of Powder Coatings

[D3170](#) Test Method for Chipping Resistance of Coatings

[D4060](#) Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser

[D7127](#) Test Method for Measurement of Surface Roughness of Abrasive Blast Cleaned Metal Surfaces Using a Portable Stylus Instrument (Withdrawn 2021)<sup>3</sup>

[E2937](#) Guide for Using Infrared Spectroscopy in Forensic Paint Examinations

[G8](#) Test Methods for Cathodic Disbonding of Pipeline Coatings

[G14](#) Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee [A01](#) on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee [A01.05](#) on Steel Reinforcement.

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<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).

G20 Test Method for Chemical Resistance of Pipeline Coatings

G62 Test Methods for Holiday Detection in Pipeline Coatings

2.2 ACI Standards:<sup>4</sup>

ACI 301 Specifications for Structural Concrete

2.3 AMPP Standards:<sup>5</sup>

RP-287-87 Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surface Using a Replica Tape

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

SSPC-SP 10 Near-White Blast Cleaning

SSPC-VIS 1 Pictorial Surface Preparation Standards for Painting Steel Surfaces

### 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *conversion coating, n*—preparation of the blast-cleaned steel surface prior to coating application that is designed to pretreat the metal to promote coating adhesion, reduce metal-coating reactions, improve corrosion resistance, and increase blister resistance.

3.1.2 *disbonding, n*—loss of adhesion between the fusion-bonded epoxy coating and the steel reinforcing bar.

3.1.3 *fusion-bonded epoxy coating, n*—product containing pigments, thermosetting epoxy resins, crosslinking agents, and other additives, which is applied in the form of a powder onto a clean, heated metallic substrate and fuses to form a continuous barrier coating.

3.1.4 *holiday, n*—discontinuity in a coating that is not discernible to a person with normal or corrected vision.

3.1.5 *patching material, n*—liquid two-part epoxy coating used to repair damaged or uncoated areas.

3.1.6 *R<sub>v</sub>, n*—the vertical distance between the highest peak and lowest valley in a sampling length averaged over the five sampling lengths comprising the evaluation length measured in accordance with Test Method D7127.

3.1.7 *texturing surface treatment material, n*—a product applied immediately following the application of a fusion-bonded epoxy coating to improve bond strength to concrete.

3.1.8 *wetting agent, n*—material that lowers the surface tension of water allowing it to penetrate more effectively into small discontinuities in the coating, giving a more accurate indication of the holiday count.

### 4. Ordering Information

4.1 Orders for textured epoxy-coated steel reinforcing bars under this specification shall contain the following information:

4.1.1 Specification and year of issue for the reinforcing bars to be coated (5.1),

4.1.2 Quantity of bars,

4.1.3 Size and grade of bars, and

4.1.4 ASTM designation A1124/A1124M and year of issue.

4.2 The purchaser shall have the option to specify additional requirements, including but not limited to the following:

4.2.1 Requirements for review of test data to demonstrate that the powder coating meets Annex A1 (5.2),

4.2.2 Representative sample of epoxy powder coating (5.3),

4.2.3 Requirements for review of test data to demonstrate that the textured coating meets Annex A1 (5.4),

4.2.4 Representative sample of texturing surface treatment material (5.5),

4.2.5 Quantity of patching material (5.6.2),

4.2.6 Specific requirements for test frequency (9.1),

4.2.7 A report of the results of the tests performed on the coated steel reinforcing bars (14.1),

4.2.8 Requirements for inspection (12.1),

4.2.9 Manufacturer qualification and certification requirements (if any), and

4.2.10 Other special requirements, if any.

NOTE 2—It is recommended that the coating application procedures and processes be audited by an independent certification program for epoxy coating applicator plants such as that provided by the Concrete Reinforcing Steel Institute, or equivalent.<sup>6</sup>

NOTE 3—A typical ordering description is as follows: Deformed Grade 60 bars to ASTM A615 – \_\_\_\_; 20 000 ft, No. 6, 40 ft 0 in. long in secured lifts with sufficient spacers or padding, or both; textured epoxy-coated to ASTM A1124 – \_\_\_\_; including written certifications for the powder coating and coated bars, and 1 qt of patching material.

Deformed Grade 420 bars to ASTM A615M – \_\_\_\_; 6000 m, No. 19, 12 m long in secured lifts with sufficient spacers or padding, or both; textured epoxy-coated to ASTM A1124M – \_\_\_\_; including written certifications for the powder coating and coated bars, and 1 L of patching material.

### 5. Materials

5.1 Steel reinforcing bars to be coated shall meet the requirements of one of the following specifications: A615/A615M, A706/A706M, A996/A996M, or A1035/A1035M, as specified by the purchaser and shall be free of contaminants such as oil, grease, or paint.

NOTE 4—Prior to coating, the steel reinforcing bars should be inspected for their suitability for coating. Bars with sharp edges on the deformations, rolled-in slivers, or other surface imperfections are difficult to coat properly and should not be coated. The coating will flow away from the sharp edges and may result in inadequate coating thickness at these points.

5.2 The powder coating shall meet the requirements of Annex A1 of Specification A775/A775M. Upon request, the purchaser shall be provided with the test report for review.

5.2.1 A written certification shall be furnished to the purchaser that properly identifies the number of each lot of powder coating used in the order, material quantity represented, date of manufacture, name and address of the powder coating manufacturer, and a statement that the supplied powder coating is the same composition as that qualified according to Annex A1 of Specification A775/A775M.

5.2.2 The powder coating shall be stored in a temperature-controlled environment following the written recommendations of the powder coating manufacturer until ready for use.

<sup>4</sup> Available from American Concrete Institute (ACI), 38800 Country Club Dr., Farmington Hills, MI 48331-3439, <http://www.concrete.org>.

<sup>5</sup> Available from Association for Materials Protection and Performance (AMPP), 15835 Park Ten Place, Houston, TX 77084, <https://www.ampp.org>.

<sup>6</sup> CRSI Voluntary Certification Program for Fusion Bonded Epoxy Coating Applicator Plants.

At that point, if the storage temperature is below the plant ambient temperature, the powder coating shall be given sufficient time to reach approximate plant ambient temperature. The powder coating shall be used within the powder coating manufacturer's written recommended shelf life.

5.3 If specified in the order, a representative 8 oz [0.2 kg] sample of the powder coating shall be supplied to the purchaser from each batch. The sample shall be packaged in an airtight container and identified by batch number.

5.4 The texturing surface treatment material shall meet the requirements of **Annex A1**. Upon request, the purchaser shall be provided with the test report for review.

5.4.1 A written certification shall be furnished to the purchaser that properly identifies the number of each lot of texturing surface treatment material used in the order, material quantity represented, date of manufacture, name and address of the powder coating manufacturer, and a statement that the supplied texturing surface treatment material is the same composition as that qualified according to **Annex A1** of this specification.

5.5 If specified in the order, a representative 8 oz [0.2 kg] sample of the texturing surface treatment material shall be supplied to the purchaser from each batch. The sample shall be packaged in an airtight container and identified by batch number.

5.6 Patching material for repairing damaged coating shall be compatible with the coating, inert in concrete, and feasible for repairs at the applicator plant or at the fabricating shop. Patching material shall be approved in accordance with Annex A2 of Specification **A775/A775M** prior to use.

5.6.1 The patching material manufacturer shall specify the metal's surface preparation, and the procedures for application of the patching material.

5.6.2 If specified in the order, patching material conforming to Annex A2 of Specification **A775/A775M** and recommended by the powder coating manufacturer shall be supplied to the purchaser.

## 6. Surface Preparation

6.1 The surface of the steel reinforcing bars to be coated shall be cleaned by abrasive blast cleaning to near-white metal in accordance with SSPC-SP 10. Additional surface treatment, as indicated in **6.3**, shall be permitted.

6.1.1 Use of SSPC-VIS 1 as a visual standard of comparison to define the final surface condition shall be permitted.

6.1.2 Average blast profile maximum roughness depth readings of 1.5 mils to 4.0 mils [0.04 mm to 0.10 mm], as determined by replica tape measurements using NACE RP-287-87, shall be considered suitable as an anchor pattern.

NOTE 5—The use of a “profilometer” type surface measurement instrument that measures the peak count as well as the maximum profile depth is recommended.

NOTE 6—Abrasive blast cleaning of steel reinforcing bars with a high degree (>90 %) of grit in the cleaning media provides the most suitable anchor profile for coating adhesion. After grit has been recycled, a small portion will take on the appearance of shot.

6.2 Multidirectional, high-pressure dry air knives shall be used after blasting to remove dust, grit, and other foreign matter from the blast-cleaned steel surface. The air knives shall not deposit oil on the steel reinforcing bars.

NOTE 7—It is recommended that incoming steel reinforcing bars and blast media be checked for salt contamination prior to use. Blast media found to be salt-contaminated should be rejected. Steel reinforcing bars found to be salt-contaminated from exposure to deicing salts or salt spray should be cleaned, by acid washing or other suitable methods, to remove salt contaminants from the surface prior to blast cleaning.

6.3 It shall be permissible for the manufacturer to use a chemical wash or conversion of the blast-cleaned steel reinforcing bar surface, or both, to enhance coating adhesion. This pretreatment shall be applied after abrasive cleaning and before coating, in accordance with the written application instructions specified by the pretreatment manufacturer.

## 7. Coating and Texturing Surface Treatment Material Application

7.1 If pretreatment is used in the preparation of the surface, the powder coating shall be applied to the cleaned and pretreated steel reinforcing bar surface as soon as possible after surface treatments have been completed, and before visible oxidation of the surface occurs as discernible to a person with normal or corrected vision. In no case shall application of the coating be delayed more than 3 h after cleaning.

7.2 The fusion-bonded epoxy powder coating shall be applied in accordance with the written recommendations of the manufacturer of the powder coating for initial steel surface temperature range and post application curing requirements. During continuous operations, the temperature of the surface immediately prior to coating shall be measured using infrared guns or temperature indicating crayons, or both, at least once every 30 min.

NOTE 8—The use of infrared and temperature-indicating crayon measurement of the steel reinforcing bars is recommended.

7.3 The powder coating shall be applied by electrostatic spray or other suitable method.

7.4 The texturing material shall be applied in accordance with the written recommendations of the manufacturer of the powder coating for initial steel surface temperature range and post application curing requirements. During continuous operations, the temperature of the surface immediately prior to coating shall be measured using infrared guns or temperature indicating crayons, or both, at least once every 30 min.

7.5 The texturing material shall be applied by electrostatic spray or other suitable method.

## 8. Requirements for Textured Coated Steel Reinforcing Bars

### 8.1 Coating Thickness:

8.1.1 Once per batch for each bar size and not less than once per day, coating thickness after curing shall be measured on production bars without the texturing surface treatment material. To do so, the texturing surface treatment material shall be omitted from a length of bar not less than 20 ft. The coating

thickness on the bar without the texturing surface treatment material shall be between 7 mils and 12 mils [175  $\mu\text{m}$  and 300  $\mu\text{m}$ ].

8.1.2 Total coating and texturing material thickness measurements after curing shall be 10 mils to 20 mils [250  $\mu\text{m}$  to 500  $\mu\text{m}$ ]. The upper thickness limit shall not apply to repaired areas of damaged coating.

8.1.3 A single recorded steel reinforcing bar coating thickness measurement is the average of three individual gauge readings obtained between four consecutive deformations. A minimum of five recorded measurements shall be taken approximately evenly spaced along each side of the test specimens (a minimum of ten recorded measurements per bar).

8.1.4 For acceptance purposes, the average of all recorded coating thickness measurements shall not be less than the specified minimum thickness or more than the specified maximum thickness. No single recorded coating thickness measurement shall be less than 80 % of the specified minimum thickness or more than 120 % of the specified maximum thickness.

8.1.5 Measurements shall be made in accordance with SSPC-PA 2, following the instructions for calibration and use recommended by the thickness gauge manufacturer. Pull-off or fixed probe gauges shall be used. “Pencil-type” pull-off gauges that require the operator to observe the reading at the instant the magnet is pulled from the surface shall not be used.

8.1.6 The coating thickness shall be measured on the body of a straight length of steel reinforcing bar between the deformations.

## 8.2 Coating Texture:

8.2.1 Texture measurements shall be made in accordance with Test Method **D7127** by using a portable stylus type profilometer.

8.2.2 For each lot, a minimum of five texture measurements shall be taken along the longitudinal deformation of the reinforcement, each over a minimum length of 0.75 in. [19 mm].

8.2.3 The average of five measurements shall have an  $R_z$  value between 8 mils and 18 mils [200  $\mu\text{m}$  and 460  $\mu\text{m}$ ].

## 8.3 Coating Continuity:

8.3.1 The manufacturer’s plant shall have an operational in-line 67.5 V, 80 000  $\Omega$ , wet-sponge type direct-current

holiday detector or equivalent method with an automated holiday counting system to determine the acceptability of the epoxy-coated steel reinforcing bars prior to shipment.

8.3.2 If in-line detector or equivalent method is inoperable or unavailable, an off-line holiday detector or handheld detector shall be permitted, provided that 100 % of the epoxy-coated steel reinforcing bars are tested and all holiday counts are recorded.

NOTE 9—Handheld holiday detector checks should be performed each production day to verify the accuracy of the in-line system. Handheld holiday detectors offer a reliable way to correlate data obtained from the in-line holiday detector and automated counting system.

8.3.3 On average, there shall not be more than one holiday per foot [3 holidays per meter] on a coated steel reinforcing bar. The average applies to the full production length of a bar.

8.3.4 A wetting agent shall be used in accordance with Test Methods **G62** in the inspection for holidays on the coated steel reinforcing bars.

## 8.4 Coating Flexibility:

8.4.1 The coating flexibility shall be evaluated by bending production coated steel reinforcing bars at a uniform rate around a mandrel of specified size within a maximum specified time period as prescribed in **Table 1**. The two longitudinal ribs shall be placed in a plane perpendicular to the mandrel radius. The test specimens shall be between 68 °F and 86 °F [20 °C and 30 °C].

8.4.2 Cracking or disbonding of the coating on the outside radius of the bent bar visible to a person with normal or corrected vision shall be considered cause for rejection of the coated steel reinforcing bars represented by the bend test sample.

NOTE 10—The qualification requirements for coating flexibility (see **A1.4.2.1**) prescribe bending a No. 6 [No. 19] deformed bar around a 6 in. [150 mm] diameter mandrel. The bend test requirements in **Table 1** for evaluating the coating flexibility of production-coated steel reinforcing bars, for bar sizes Nos. 3 to 8 [Nos. 10 to 25], are not compatible with fabrication bending practices. Finished bend diameters for bar sizes Nos. 3 to 8 [Nos. 10 to 25] used in actual construction are smaller than the mandrel diameters in **Table 1**. Thus, the finished bends of production-coated bars, particularly the smaller bar sizes used for stirrups and ties, should be examined closely for hairline cracking on the outside radius of the bent bar. If hairline cracking is present, it should be repaired with patching material.

**TABLE 1 Bend Test Requirements**

A615, A706, A996, or A1035		A615M, A706M, A996M, or A1035M		Bend Angle (After Rebound, degrees)	Time to Completion max, s
Bar No.	Mandrel Diameter, in. <sup>A</sup>	Bar No.	Mandrel Diameter, mm <sup>A</sup>		
3	3	10	75	180	15
4	4	13	100	180	15
5	5	16	125	180	15
6	6	19	150	180	15
7	7	22	175	180	45
8	8	25	200	180	45
9	9	29	230	180	45
10	10	32	250	180	45
11	11	36	280	180	45
14	17	43	430	90	45
18	23	57	580	90	45

<sup>A</sup> Mandrel diameters specified for similar size (shown on the same line) inch-pound and metric bars may be interchanged.

8.4.3 A test in which fracture or partial failure of the steel reinforcing bar, or cracking or disbonding caused by imperfections in the bar surface visible after performing the bend test occurs, shall be considered an invalid test and the test shall be repeated on a new specimen.

8.5 The requirements for textured epoxy-coated steel reinforcing bars shall be met at the manufacturer's plant prior to shipment.

## 9. Number of Tests

9.1 The purchaser shall have the option to specify the sampling and test schedule for the number and frequency of tests for coating thickness, continuity, and flexibility.

9.2 If the number and frequency of tests are not specified by the purchaser the following apply:

9.2.1 Tests for coating thickness shall be made on a minimum of two bars of each size every two production hours,

9.2.2 Bend tests for coating flexibility shall be conducted on at least one bar of each size every four production hours, and

9.2.3 Random tests shall be made for coating continuity.

## 10. Retests

10.1 If the specimen for coating thickness or flexibility fails to meet the specified requirements, two retests on random samples shall be conducted for each failed test. If the results of both retests meet the specified requirements, the coated steel reinforcing bars represented by the samples shall be accepted.

## 11. Permissible Amount of Damaged Coating and Repair of Damaged Coating

11.1 The maximum amount of repaired damaged coating shall not exceed 1 % of the total surface area in each 1 ft [0.3 m] of the bar. This limit on repaired damaged coating shall not include sheared or cut ends that are coated with patching material (see 11.4).

11.2 All damaged coating due to fabrication and handling (to the point of shipment to the job-site) shall be repaired with patching material conforming to Annex A2 of Specification **A775/A775M**.

NOTE 11—If the amount of repaired damaged coating in any 1 ft [0.3 m] length of a coated bar exceeds 1 %, that section should be removed from the coated steel reinforcing bar and discarded. In patching damaged coating, care should be taken not to apply the patching material over an excessive area of the intact coating during the repair process. Too large an area of thick patching material, especially on smaller-size reinforcing bars, is likely to cause a reduction in bond strength of the bars to concrete.

11.3 Repaired areas shall have a minimum coating thickness of 7 mils [175  $\mu$ m].

11.4 When coated bars are sheared, saw-cut, or cut by other means during the fabrication process, the cut ends shall be coated with patching material. Coated steel reinforcing bars shall not be flame cut.

11.5 Repair of damaged coating shall be performed in accordance with the patching material manufacturer's written recommendations.

## 12. Inspection

12.1 Inspection of the textured epoxy-coated steel reinforcing bars shall be agreed upon between the purchaser and the manufacturer as part of the purchase order or contract.

## 13. Rejection

13.1 Textured epoxy-coated steel reinforcing bars represented by test specimens that do not meet the requirements of this specification shall be rejected and marked with a contrasting color paint or other suitable identification. At the manufacturer's option, the affected lot shall be replaced or, alternatively, stripped of coating, recleaned, recoated, and resubmitted for acceptance testing in accordance with the requirements of this specification.

NOTE 12—If the coating is not to be stripped from the rejected steel reinforcing bars, the bars should be scrapped or, with the purchaser's approval, used as uncoated steel reinforcing bars.

## 14. Certification

14.1 The purchaser shall be furnished with, at the time of shipment, written certification that samples representing each lot of coated steel reinforcing bars have been either tested or inspected as directed in this specification, and the requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished.

14.2 A material test report, certificate of inspection, or similar document printed from or used in electronic form from an electronic data interchange (EDI) transmission shall be regarded as having the same validity as a counterpart printed in the certifier's facility. The content of the EDI-transmitted document must meet the requirements of the invoked ASTM standard(s) and conform to any EDI agreement between the purchaser and the supplier. Notwithstanding the absence of a signature, the organization submitting the EDI transmission is responsible for the content of the report.

NOTE 13—The industry definition invoked here is: EDI is the computer-to-computer exchange of business information in a standard format such as ANSI ASC X12.

## 15. Handling and Identification

15.1 All systems for handling textured epoxy-coated steel reinforcing bars shall have padded contact areas. All bundling bands shall be padded or suitable banding shall be used to prevent damage to the coating. All bundles of coated steel reinforcing bars shall be lifted with a strong back, spreader bar, multiple supports, or a platform bridge to prevent bar-to-bar abrasion from sags in the bundles of coated steel reinforcing bars. The bars or bundles shall not be dropped or dragged.

15.2 If circumstances require storing coated steel reinforcing bars outdoors for more than two months, protective storage measures shall be implemented to protect the material from sunlight, salt spray, and weather exposure. If the manufacturer stores coated steel reinforcing bars outdoors without protective covering, the date on which the coated bars are placed outdoors shall be recorded on the identification tag on the bundled steel. Textured epoxy-coated steel reinforcing bars, whether individual bars or bundles of bars, or both, shall be covered with