



Designation: A934/A934M – 22

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

This standard is issued under the fixed designation A934/A934M; 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 and plain steel reinforcing bars which prior to surface preparation are prefabricated and then coated with a protective fusion-bonded epoxy coating by electrostatic spray or other suitable method.

1.2 Prefabricated steel reinforcing bars coated with fusion-bonded epoxy powder coating in accordance with this specification are intended to be fabricated before being coated.

1.3 Organic coatings other than epoxy may be used provided they meet the requirements of this specification.

1.4 Requirements for epoxy coatings are contained in [Annex A1](#).

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

1.6 Guidelines for application process and product test procedures of epoxy coatings for steel reinforcing bars are presented in [Appendix X1](#).

1.7 Guidelines for construction practices at the job-site for coated steel reinforcing bars are presented in [Appendix X2](#).

1.8 This specification is applicable for orders in either inch-pound units (as Specification A934) or SI [metric] units [as Specification A934M].

1.9 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.

1.10 *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.*

<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.

Current edition approved Sept. 1, 2022. Published November 2022. Originally approved in 1995. Last previous edition approved in 2019 as A934/A934M – 19. DOI: 10.1520/A0934\_A0934M-22.

1.11 *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

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

[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)

[G20](#) Test Method for Chemical Resistance of Pipeline Coatings

[G42](#) Test Method for Cathodic Disbonding of Pipeline Coatings Subjected to Elevated Temperatures

[G62](#) Test Methods for Holiday Detection in Pipeline Coatings

<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.

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

2.2 *NACE International Standard:*<sup>3</sup>

**RP 0287 Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape**

2.3 *SSPC Specifications:*<sup>4</sup>

**SSPC-SP 10 Near-White Blast Cleaning**

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

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

2.4 *ACI Specifications:*<sup>5</sup>

**ACI 301 Specifications for Structural Concrete**

**ACI 315 Details and Detailing of Concrete Reinforcement**

2.5 *CRSI Documents:*<sup>6</sup>

**Voluntary Certification Program for Fusion-Bonded Epoxy Coating Applicator Plants**

4.1.2 Quantity of bars,

4.1.3 Size and grade of bars, and

4.1.4 ASTM designation 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 **(5.2.2)**,

4.2.3 Quantity of patching material **(5.3.3)**,

4.2.4 Additional requirements for test frequency (Section 10),

4.2.5 Coated specimens shall be provided by the manufacturer out of the same production lot of coated reinforcement being furnished to the purchaser **(13.1)**.

4.2.6 Requirements for inspection **(13.1)**,

4.2.7 Manufacturer qualification and certification requirements (if any),

4.2.8 A report of the results of the tests performed on the coated steel reinforcing bars (Section 15),

4.2.9 Requirements for patching material to be sent to purchaser **(5.3)**,

4.2.10 Special packing, bar or bundle marking, loading or storage requirements, and

4.2.11 Other special requirements, if any.

NOTE 1—A typical ordering description is as follows:

Deformed Grade 60 bars to ASTM A615 – \_\_\_\_; 20 000 ft, No. 6; cut to specified lengths and fabricated prior to coating; epoxy-coated to ASTM A934 – \_\_\_\_; 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; cut to specified lengths and fabricated prior to coating; epoxy-coated to ASTM A934M – \_\_\_\_; 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, A706, A996, or A1035 [A615M, A706M, A996M, or A1035M] as specified by the purchaser and shall be free of contaminants such as oil, grease, or paint.

NOTE 2—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. 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**. Upon request, the purchaser shall be provided with test data for review.

5.2.1 A written certification shall be furnished to the purchaser that properly identifies the lot designation of the 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 this specification. The powder coating shall be used within the powder coating manufacturer's written recommended shelf life.

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *conversion coating, n*—preparation of the blast-cleaned metal 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 coating and to coat uncoated areas on the surface of a coated bar.

3.1.6 *prefabricated bars, n*—steel reinforcing bars that are cut to specified lengths and bent to the required shapes prior to coating.

3.1.7 *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 epoxy-coated prefabricated 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)**,

<sup>3</sup> Available from NACE International (NACE), 15835 Park Ten Pl., Houston, TX 77084, <http://www.nace.org>.

<sup>4</sup> Available from Society for Protective Coatings (SSPC), 800 Trumbull Drive, Pittsburgh, PA 15205, <https://www.sspc.org>.

<sup>5</sup> Available from American Concrete Institute (ACI), 38800 Country Club Dr., Farmington Hills, MI 48331-3439, <http://www.concrete.org>.

<sup>6</sup> Available from Concrete Reinforcing Steel Institute (CRSI), 933 N. Plum Grove Rd., Schaumburg, IL 60173-4758, <http://www.crsi.org>.

5.2.2 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 the batch designation.

5.2.3 The powder coating shall be maintained in a temperature-controlled environment following the written recommendations of the powder coating manufacturer until ready for use, at which point the powder coating shall be given sufficient time to reach approximate plant ambient temperature.

5.3 Patching material for repairing damaged coating and uncoated areas of coated bars shall be inert in concrete and feasible for repairs at the applicator plant.

5.3.1 The powder coating manufacturer shall specify the approved patching material to be used with their powder.

5.3.2 Patching material shall be approved in accordance with Annex A2 in Specification **A775/A775M** prior to use.

5.3.3 If specified in the order, patching material shall be supplied to the purchaser.

## 6. Prefabrication of Steel Reinforcing Bars

6.1 The steel reinforcing bars to be coated shall have been prefabricated in accordance with the purchaser's requirements or project specifications prior to surface preparation.

NOTE 3—Drive rolls on shear beds and backup barrels on benders should be protected with a suitable covering to minimize crushing or creating rollover damage to the steel reinforcing bar deformations during the fabrication process.

## 7. Surface Preparation of Steel Reinforcing Bars

7.1 The surface of the steel reinforcing bars shall be cleaned by abrasive blast steel grit to near-white metal in accordance with SSPC-SP 10.

7.1.1 The final surface condition shall be defined according to SSPC-VIS 1.

7.1.2 Average blast profile roughness depth readings of 1.5 mils to 4.0 mils [37  $\mu\text{m}$  to 100  $\mu\text{m}$ ], as determined by replica tape measurements using RP 0287 or other methods acceptable to the purchaser, shall be considered suitable as an anchor pattern.

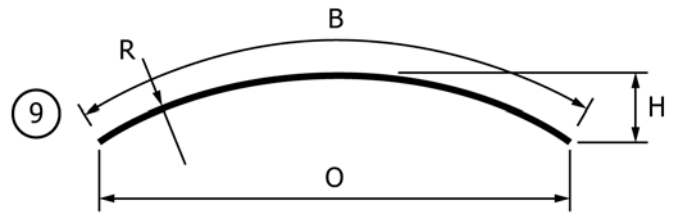
NOTE 4—The use of a profilometer type surface measurement instrument that measures the peak count as well as the maximum profile depth is recommended.

7.2 A steel grit of Rockwell Hardness C50 or higher shall be used. A maximum of 5 % steel shot is allowable in the media.

NOTE 5—Recycled steel grit abrasive should be maintained so as to minimize contaminants such as oil, salt, and dust caused by the blasting operation.

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

NOTE 6—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.



**FIG. 1 Bend Type 9 (ACI 315)**

7.4 It shall be permissible for the manufacturer to use a chemical wash or conversion of the 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.

## 8. Coating Application

8.1 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.

8.2 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 cure requirements. The temperature of the surface immediately prior to coating shall be measured using infrared guns or temperature-indicating crayons at least once every 30 min during continuous operations.

NOTE 7—The use of infrared and temperature-indicating crayon measurement of the steel reinforcing bars is recommended.

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

8.4 Cleaned, uncoated steel reinforcing bars shall be handled by personnel wearing clean gloves to prevent contamination of the steel surface.

## 9. Requirements for Coated Steel Reinforcing Bars

### 9.1 Coating Thickness:

9.1.1 The coating thickness on straight sections of bars after curing shall be 7 mils to 12 mils [175  $\mu\text{m}$  to 300  $\mu\text{m}$ ]. The coating thickness on bent sections of bars after curing shall be 7 mils to 16 mils [175  $\mu\text{m}$  to 405  $\mu\text{m}$ ]. Bent sections of bars are defined as the entire radius of each bend and portions of the bar extending 6 in. [150 mm] beyond the beginning and ending bend points on the bar. Bars that are bent with a radius such as Bend Type 9 (Fig. 1) shall have the same coating thickness requirements as straight bars, when the "H" dimension is equal to or less than one-half of the "R" dimension.

NOTE 8—Section 9.1.1 permits a maximum coating thickness of 16 mils [405  $\mu\text{m}$ ] on bent sections of bars. Discussion of the effect of the permissible increased coating thickness on the anchorage capacity of bent bars embedded in concrete is presented in **Appendix X3**.