



Designation: A 884/A 884M – 00a

## Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement<sup>1</sup>

This standard is issued under the fixed designation A 884/A 884M; 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.

*This standard has been approved for use by agencies of the Department of Defense.*

### 1. Scope

1.1 This specification covers plain and deformed steel wire and plain and deformed steel welded wire fabric with protective epoxy coating. A Class A minimum coating thickness is required for wire and welded wire fabric intended for use as reinforcement in concrete and masonry. A Class B minimum coating thickness is required for wire and welded wire fabric intended for use as reinforcement in earth. A Type 1 coating is a designation of fusion-bonded epoxy coating that has been designed to be sufficiently flexible to allow fabrication of the coated wire or welded wire fabric. A Type 2 coating is a designation of fusion-bonded epoxy coating that has not been designed to be sufficiently flexible to allow fabrication of the coated wire or welded wire fabric.

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

1.2 Other organic coatings may be used provided they meet the requirements of this specification.

1.3 This specification is applicable for orders in either SI units (Specification A 884M) or in inch-pound units [Specification A 884].

1.4 The values stated in either SI or inch-pound units are to be regarded as standard. Within the text, the inch-pound units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other except as specifically noted in Table 1. Combining values from the two systems may result in nonconformance with this specification.

1.5 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:

<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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**TABLE 1 Test Requirements**

Wire Size No. MW or MD, mm	Wire Size No. W or D, in.	Mandrel Diameter, mm [in.]	Time to Complete, s (maximum)
6.5 to 39	1 to 6	twice the diameter of the wire being tested	15
>39	>6	four times the diameter of the wire being tested	45

A 82 Specification for Steel Wire, Plain, for Concrete Reinforcement<sup>2</sup>

A 185 Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement<sup>2</sup>

A 496 Specification for Steel Wire, Deformed, for Concrete Reinforcement<sup>2</sup>

A 497 Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement<sup>2</sup>

A 775/A 775M Specification for Epoxy-Coated Steel Reinforcing Bars<sup>2</sup>

A 934/A 934M Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars<sup>2</sup>

G 12 Test Method for Nondestructive Measurement of Film Thickness of Pipeline Coatings on Steel<sup>3</sup>

#### 2.2 NACE International Standard:

RP-287-87 Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surface Using a Replica Tape<sup>4</sup>

#### 2.3 Society for Protective Coatings Specifications:

SSPC-SP 10 Near-White Blast Cleaning<sup>5</sup>

SSPC-VIS 1 Pictorial Surface Preparation Standards for Painting Steel Surfaces<sup>5</sup>

#### 2.4 Naval Facility Guide Specification:

NFGS 03201 Manufacture of Prefabricated Epoxy-Coated Rebar for Oceans and Other Severe Environments<sup>6</sup>

#### 2.5 American Concrete Institute Specification:

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 01.04.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 06.02.

<sup>4</sup> Available from NACE International, 1440 South Creek, Houston, TX 77084.

<sup>5</sup> Available from Society for Protective Coatings, 40 24th Street, Pittsburgh, PA 15222.

<sup>6</sup> Available from NFESC, 560 Center Drive, Port Hueneme, CA 93043.

ACI 301 Specifications for Structural Concrete<sup>7</sup>

### 3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *conversion coating, n*—a 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 reinforcement.

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

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

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

3.1.6 *wetting agent, n*—a 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 It shall be the responsibility of the purchaser to specify all requirements that are necessary for the coated wire and welded wire fabric under this specification. Such requirements to be considered include, but are not limited to, the following:

4.1.1 Wire or welded wire fabric specification and year of issue,

4.1.2 Wire size,

4.1.3 Wire spacing and sizes, if welded wire fabric,

4.1.4 Length and width of sheets or rolls,

4.1.5 Quantity, and

4.1.6 Class and type of coating,

4.1.7 Requirements for the epoxy powder coating and provision of test data (5.2 and 5.3),

4.1.8 Requirements for patching material (5.4),

4.1.9 Quantity of patching material,

4.1.10 Specific requirements for test frequency (9.1),

4.1.11 Additional specimens to be provided to the purchaser for testing from the coated wire or welded wire fabric being furnished (12.1),

4.1.12 Whether a report on tests performed on the coated wire or welded wire fabric being furnished is required (15.2), and

4.1.13 Manufacturer qualification and certification requirements (if any).

NOTE 2—It is recommended that the manufacturing procedures and processes be audited by an independent certification program for epoxy coating applicators plants, such as that provided by the Navy Facility Guide Specification or equivalent.

NOTE 3—A typical ordering description is as follows: 150 sheets, fabric style 150 by 300 MD 45 by MD 26 [6 by 12 D 7 by D 4] epoxy-coated

steel welded wire fabric, deformed with Class A Type 2 coating for use as concrete reinforcement and produced to Specification A 884/A 884M\_\_\_\_\_ including written certifications for the powder coating and coated welded wire fabric, and 1 L [1 qt] of patching material.

### 5. Materials

5.1 Plain or deformed steel wire or welded wire fabric to be coated shall meet the requirements of one of the applicable Specifications A 82, A 185, A 496, or A 497 as specified by the purchaser and shall be free of surface contaminants such as oil, grease, or paint when received at the manufacturer's plant and prior to cleaning and coating.

5.2 Type 1 coatings shall meet the requirements of and shall be qualified in accordance with Annex A1 of Specification A 775/A 775M. Type 2 coatings shall meet the requirements of and shall be qualified in accordance with Annex A1 of Specification A 934/A 934M.

5.2.1 A written certification shall be furnished to the purchaser that properly identifies the designation 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 in accordance with 5.2.

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. At this 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 0.2 kg [8 oz] 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 If specified in the order, patching material, compatible with the coating and inert in concrete, and recommended by the coating manufacturer shall be supplied to the purchaser.

### 6. Surface Preparation

6.1 The surface of the steel wire or welded wire fabric to be coated shall be cleaned by abrasive blast cleaning to near-white metal in accordance with SSPC-SP10. The final surface condition shall be defined according to SSPC-VIS 1. Average blast profile maximum roughness depth readings of 40 to 100 μm [1.5 to 4.0 mils] as determined by replica tape measurements using NACE RP-287-87 shall be considered suitable as an anchor pattern.

NOTE 4—Abrasive blast cleaning of wire and welded wire fabric 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.

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

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

<sup>7</sup> Available from the American Concrete Institute, 38800 International Way, P.O. Box 9094, Farmington Hills, MI 48333-9094.

NOTE 6—It is recommended that incoming wire and welded wire fabric and blast media should be checked for salt contamination prior to use. Blast media found to be salt contaminated should be rejected. Wire and welded wire fabric 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 reinforcement 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 Application

7.1 The powder coating shall be applied to the cleaned and pretreated (if used) surface as soon as possible after surface treatments have been completed, and before visible oxidation of the surface occurs 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 cure 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 7—The use of infrared and temperature-indicating crayon measurement of the reinforcement is recommended.

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

## 8. Requirements for Coated Wire or Welded Wire Fabric

### 8.1 Coating Thickness:

8.1.1 *Class A*—Coating thickness measurements after curing shall be greater than or equal to 175  $\mu\text{m}$  [7 mils]. A finding that more than 5 % of the coating thickness measurements are below 125  $\mu\text{m}$  [5 mils] shall be considered cause for rejection.

8.1.2 *Class B*—For acceptance purposes, at least 90% of all coating thickness measurements after curing shall be  $\geq 450 \mu\text{m}$  [18 mils], for both plain and deformed welded wire fabric used for earth reinforcement, such as in mechanically stabilized embankments. A finding that more than 5 % of the coating thickness measurements are below 400  $\mu\text{m}$  [16 mils] shall be considered cause for rejection.

8.1.3 A minimum of fifteen coated wire or welded wire fabric thickness measurements shall be taken approximately evenly spaced along each side of the test specimen.

8.1.4 Measurements shall be made in accordance with Test Method G 12 following the instructions for calibration and use recommended by the thickness gage manufacturer. Pull-off or fixed-probe gages shall be used. Pencil-type pull-off gages that require the operator to observe the reading at the instant the magnet is pulled from the surface shall not be used.

### 8.2 Coating Continuity:

8.2.1 There shall not be more than an average of six holidays per metre [two holidays per foot] on the coated wire

(spool and individual lengths).

8.2.2 In welded wire fabric, there shall not be more than an average of 18 holidays per metre [6 holidays per linear foot] when the wire spacing is 100 mm [4 in.] or less, and there shall not be more than an average of 12 holidays per metre [4 holidays per foot] when the wire spacing is greater than 100 mm [4 in.]. When measuring the number of holidays, at least 13 mm [0.5 in.] of wire shall be included on each side of the intersection being checked. Damage at cut ends shall not be counted. Voids (uncoated areas) at welded intersections shall be counted. If more than one void is present within 13 mm [0.5 in.] of the intersection area, it shall be counted as one void.

8.2.3 Holidays checks to determine acceptability of the wire or welded wire fabric shall be made at the manufacturer's plant with a 67½-V, 80 000- $\Omega$ , wet-sponge-type dc holiday detector.

NOTE 8—Holiday detection is not intended for use at the job site.

### 8.3 Bend Test—Type 1 Coating Requirement Only:

8.3.1 The flexibility of the coating shall be evaluated by bending production coated steel wire and welded wire fabric at a uniform rate 180° (after rebound) around a mandrel of specified size as prescribed in Table 1. The test specimens shall be between 20 and 30°C [68 and 86°F].

8.3.2 Cracking or disbonding of the coating on the outside radius of the bent wire or welded wire fabric visible to a person with normal or corrected vision shall be considered cause for rejection of the coated wire or fabric represented by the bend test sample.

8.4 *Place of Testing*—Testing of coated steel wire or welded wire fabric shall be done at the manufacturer's plant prior to shipment.

8.5 *Time of Testing*—The requirements for coated wire or welded wire fabric 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, flexibility, and continuity.

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

9.2.1 Tests for coating thickness and continuity shall be made on a minimum of 0.3 m [1 ft] of each size wire or welded wire fabric coated during each production hour.

9.2.2 Bend tests for Type 1 coating flexibility shall be conducted on at least one wire of each size or style of fabric from each 2 h of production.

## 10. Retests

10.1 If the specimen for coating thickness, continuity, or bend test (if applicable) fails to meet the specified requirements, two retests on random specimens shall be conducted for each failed test. If the results of both retests meet the specified requirements, the coated material represented by the specimens shall be accepted. Test specimens not found to meet the specified requirements shall not be used or sold as epoxy-coated wire or welded wire fabric.

## 11. Handling and Identification

11.1 All systems for handling coated reinforcement shall