Designation: A 882/A882M – 01

Standard Specification for Epoxy-Coated Seven-Wire Prestressing Steel Strand[1]

This standard is issued under the fixed designation A 882/A882M; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers ASTM Specification A 416 low-relaxation Grade 250 and Grade 270 seven-wire prestressing steel strand with protective fusion-bonded epoxy coating applied by the electrostatic deposition method or other method that will meet the coating requirements in Section 7.

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

1.2 Supplementary Requirements S1 contains requirements for epoxy-coated and filled strand. Epoxy-coated and filled strand shall not be furnished unless ordered, or by arrangement between purchaser and manufacturer.

NOTE 2—This standard is a product specification and it does not delineate requirements regarding the use of epoxy-coated strand. Proper use of epoxy-coated strand includes design considerations, handling, installing, and stressing of strands, permissible concrete curing temperature, and procedures for repairing damaged coating and protection of the ends of strands. Information and procedures for such items are presented in a report by the PCI Ad Hoc Committee on Epoxy-Coated Strand.[2]

1.3 This specification is applicable for orders in either inch-pound units (as Specification A 882) or SI units [as Specification A 882M].

1.4 The values stated in either inch-pound or SI units are to be regarded as standard. Within the test, the SI units are shown in brackets. The values stated in each system must be used independently of the other. Combining values from the two systems may result in nonconformance with this specification.

2. Referenced Documents

2.1 *ASTM Standards:*

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products[3]

A 416/A 416M Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete[4]

B 117 Practice for Operating Salt Spray (Fog) Apparatus[5]

D 968 Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive[6]

G 14 Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)[7]

G 20 Test Method for Chemical Resistance of Pipeline Coatings[7]

2.2 *Federal Highway Administration Report:*

FHWA-RD-74-18 Nonmetallic Coatings for Concrete Reinforcing Bars (February 1974)[8]

3. Ordering Information

3.1 The purchaser should specify:

3.1.1 Diameter, grade, and type of uncoated strand in accordance with Specification A 416/A 416M (latest edition).

3.1.2 Smooth or grit impregnated coating (see 6.3).

3.1.3 Quantity (in feet [metres]).

3.1.4 Requirements for certification (see Section A1.2.3).

3.1.5 Requirements for material samples (see 4.3).

3.1.6 Requirements for patching material (see 4.4).

NOTE 3—A typical ordering description for epoxy-coated strand is as follows: 84 000 feet [2560 m] of grit-impregnated epoxy-coated strand, ½-in. [12.7-mm] diameter, Grade 270 K low-relaxation on wooden reels to ASTM Specification A 882 – [A 882M –].

4. Materials

4.1 Prestressing steel strand to be coated shall meet the requirements of Specification A 416/A 416M as specified by the purchaser and shall be free of contaminants such as oil, grease, or paint.

4.1.1 Epoxy-coated strand shall have relaxation losses of not more than 4 % when initially loaded to 70 % of specified minimum breaking strength of the strand after 1000 h when tested under conditions of Specification A 416/A 416M.

4.2 The coating material shall meet the requirements listed in Annex A1 of this specification. The coating material shall be of organic composition except for the pigment, or grit if applicable, which may be inorganic if used.

4.2.1 If specified in the order, a written certification shall be furnished to the purchaser that properly identifies the number of each batch of coating material used in the order, material, quantity represented, date of manufacture, name and address of

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[2] "Guidelines for the Use of Epoxy-Coated Strand," *PCI Journal*, Precast/Prestressed Concrete Institute, Vol. 38, No. 4, July-August 1993, pp. 26–32.

[3] *Annual Book of ASTM Standards*, Vol 01.03.

[4] *Annual Book of ASTM Standards*, Vol 01.04.

[5] *Annual Book of ASTM Standards*, Vol 03.02.

[6] *Annual Book of ASTM Standards*, Vol 06.01.

[7] *Annual Book of ASTM Standards*, Vol 06.02.

[8] Available from the National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161.

manufacturer, a statement that the supplied coating material meets the requirements of Annex A1, and a statement that the coating material used in each batch is the same material as that which was qualified under the requirements of Annex A1.

4.3 If specified in the order, a representative 8-oz. [0.23-kg] sample of coating material shall be packaged in an airtight container and identified by batch number, and supplied to the purchaser.

4.4 If specified in the order, patching material compatible with the coating material and inert in concrete, and meeting the requirements of Annex A1 shall be supplied to the purchaser.

5. Surface Preparation

5.1 The surface of the steel strand to be coated shall be cleaned chemically or by another method that will impart the same cleanliness to ensure that the coated strand meets the requirements of Section 7.

6. Application of Coating

6.1 The coating shall be applied to the cleaned surface as soon as possible after cleaning and before reoxidation of the surface discernible to the unaided eye occurs. However, in no case shall application of the coating be delayed more than 10 minutes after cleaning, unless otherwise permitted by the purchaser.

6.2 The coating shall be applied by the electrostatic deposition method, or other method that will meet the coating requirements in Section 7, and fully cured in accordance with the recommendations of the manufacturer of the coating material.

6.3 The coating may be smooth or grit-impregnated.

6.3.1 Inert particles (grit) shall be impregnated into the surface of the coating when grit-impregnated strand is ordered. Such particles shall not cause the coating to fail the requirements of Section 7. The particles shall be inert in concrete and non-reactive with concrete additives and soluble salts.

6.3.2 The epoxy on the surface of grit-impregnated strand shall be capable of reaching a temperature of 150°F [66°C] without reducing the transfer of prestress by bond from the strand to the surrounding concrete.

NOTE 4—**Warning:** At temperatures above 165°F [74°C], currently available epoxy begins to soften and lose its ability to transfer load from strand to concrete by bond. At 200°F [93°C] practically all transfer capacity will be lost.

7. Requirements for Coated Strands

7.1 *Thickness of Coating*:

7.1.1 The film thickness of the coating after curing shall be 25 to 45 mils [0.64 to 1.14 mm].

7.1.2 The thickness of the coating film shall be determined with a magnetic gauge or other method, with ±5 % allowable error, capable of measuring along a curved surface.

7.1.3 The thickness of the coating film shall be measured on the crown of the wires, on a straight length of the strand. The magnetic gage shall be placed at one point in the strand and readings shall be taken at the crown of each outer wire.

7.1.4 For each reel of strand, thickness measurements shall be conducted at five locations spaced approximately even along the manufactured length of the strand. Records of inspection during manufacturing shall be available when requested.

7.2 *Continuity of Coating*:

7.2.1 After curing, the coating shall be free of holes, voids, cracks, and damaged areas discernible to the unaided eye.

7.2.2 During the coating process, a continuous holiday detection procedure shall be employed using an appropriate holiday detector that uses water as the conductor and follows the procedure furnished by the manufacturer of the holiday detector. (A holiday is a pinhole in the coating not discernible to the unaided eye.)

7.2.3 During the continuous holiday detection procedure, if more than two holidays per hundred feet [30 m] are detected, the strand shall be rejected and corrective action shall be instituted. Coated strand with two holidays or less per hundred feet [30 m] shall be patched in accordance with the patching material manufacturer's recommendation.

7.3 *Adhesion of Coating*:

7.3.1 The adhesion and shear strength of the coating shall be evaluated by bending a sample from a finished reel of coated strand 180° around a mandrel diameter equal to 32 times the nominal diameter of the strand. Test specimens shall be at thermal equilibrium between 68 and 86°F [20 and 30°C].

7.3.2 No cracking or disbonding of the coating shall be visible to the unaided eye on the outside radius of the bent strand. Evidence of cracking or disbonding of the coating shall be considered cause for rejection of the coated strand represented by the bend test sample. Retests shall be conducted in accordance with 9.1.

7.3.3 Fracture of the steel wire or strand in the bend test for adhesion of coating shall not be considered as an adhesion failure of the coating, and another specimen from the same production shift may be substituted.

7.3.4 The adhesion of coating shall also be evaluated by a tension test in accordance with Section 6 of Specification A 416. The coated strand shall satisfy the requirements for breaking strength, yield strength (1 % extension), and ultimate elongation described in Specification A 416/A 416M. No cracks visible to the unaided eye shall occur in the coating up to an elongation of 1 % (yield strength).

7.3.5 Sample length for the bend test shall be at least 5 ft, 0 in. long [1500 mm]. Sample length for the tension test shall follow the requirements of Test Methods and Definitions A 370.

7.4 *Bond with Concrete or Grout*:

7.4.1 Pull-out tests shall be conducted on grit-impregnated coated strand to ensure proper bond properties. Pull-out specimens shall be cast in concrete cylinders with dimensions shown in Table 1. The untensioned strand shall be embedded concentrically along the longitudinal axis of the specimen. The minimum force at 0.001 in. [0.025 mm] slip shall be applied as shown in Fig. 1, by a hydraulic or mechanical jack when concrete reaches a compressive strength between 4000 and 5000 psi [30 and 35 MPa], and measured with a calibrated load indicator at a slip of 0.001 in. [0.025 mm]. The strain rate shall not exceed 0.01 in./in. [mm/mm] per minute. A dial gage shall be used at the unloaded end to indicate slip. Minimum force at 0.001 in. [0.025 mm] slip shall be at least equal to or greater