Designation: ~~A1055/A1055M – 10ε1~~ A1055/A1055M – 16

Standard Specification for Zinc and Epoxy Dual-Coated Steel Reinforcing Bars[1]

This standard is issued under the fixed designation A1055/A1055M; 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.

~~ε[1] NOTE—Mathematical corrections to A1.3.8 were made in December 2011.~~

1. Scope*

1.1 This specification covers deformed and plain steel reinforcing bars with a dual coating of ~~zinc alloy and an epoxy coating. The zinc-alloy layer is applied by the thermal spray coating method (metallizing)~~ zinc-alloy followed by an epoxy coating applied by the electrostatic spray method.

1.2 The zinc-alloy coating is produced as one of two types: zinc-alloy applied by the thermal spray method (Type I) or zinc-alloy applied in accordance with Specification A1094/A1094M (Type II).

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

1.3 Requirements ~~of~~for the zinc coating are contained in Table 1.

1.4 Requirements for ~~fusion-bonded~~epoxy powder coatings are contained in Annex A1.

1.5 Guidelines for construction practices at the job-site are presented in Appendix X1.

1.6 The text of this specification references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the specification.

1.7 This specification is applicable for orders in either inch-pound units [as Specification A1055] or SI ~~units.~~units [as Specification A1055M].

1.8 The values stated in either inch-pound units or SI units are to be regarded as standard. Within the text, the SI units are shown in brackets. The values stated in each system ~~are~~may not be exact equivalents; therefore, each system must be used independently of the other, except as specifically noted in Table 2. Combining values from the two systems may result in ~~nonconformance~~non-conformance with this specification.

1.9 *This ~~standard~~specification 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~~specification to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

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
A1094/A1094M Specification for Continuous Hot-Dip Galvanized Steel Bars for Concrete Reinforcement
B117 Practice for Operating Salt Spray (Fog) Apparatus
B833 Specification for Zinc and Zinc Alloy Wire for Thermal Spraying (Metallizing) for the Corrosion Protection of Steel
D4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser

[1] 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 ~~Dec. 1, 2010~~Dec. 1, 2016. Published ~~December 2010~~March 2017. Originally approved in 2008. Last previous edition approved in ~~2008~~2010 as ~~A1055 – 08a~~A1055 – 10ε1. DOI: ~~10.1520/A1055_A1055M-10E01.~~10.1520/A1055_A1055M-16.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at 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**

TABLE 1 Chemical Composition Requirements for Zinc and Zinc-Alloy Wires

Common Name (UNS)[A]	Al, max unless noted	Cd, max	Cu, max	Fe, max	Pb, max	Sn, max	Sb, max	Ag, max	Bi, max	As, max	Ni, max	Mg, max	Mo, max	Ti, max	Zn, min	Other, Total max
99.99 Zinc[B] (Z13005)	0.002[C]	0.003	0.005	0.003	0.003	0.001	...[D]	...	...	...	...	...	...	...	99.99	...
99.99 Zinc[B] (Z15005)	0.01	0.02	0.02	0.02	0.03	...	...	...	...	...	...	...	...	...	99.9	0.10 total non-Zn
99.995 Zinc (...)[E]	0.001	0.003	0.001	0.002	0.003	0.003	...	...	...	...	...	...	...	...	99.995	0.005
99.95 Zinc (...)	0.01	0.02	0.001	0.02	0.03	0.001	...	...	...	...	...	...	...	...	99.95	0.050
99.95 Zinc (...)	0.01	0.005	0.7	0.01	0.005	0.001	...	...	...	...	...	0.01	0.01	0.18	99	1.0
98Zn/2Al (Z30402)	1.5-2.5	0.005	0.005	0.02	0.005	0.003	0.10	0.015	0.02	0.002	0.005	0.02	...	...	remainder	...

[A] UNS designations were established in accordance with Practice E527.
[B] In accordance with ANSI/AWS A5.33.
[C] The following applies to all specified limits in this table. For the purposes of determining conformance with this specification, an observed value obtained from analysis shall be rounded off to the nearest unit in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding method of Practice E29.
[D] ... indicates that the element is not applicable.
[E] (...) indicates no Unified Numbering System (UNS) designation for this option.

TABLE 2 Bend Test Requirements

A615, A706, or A996		A615M, A706M, or A996M		Bend Angle (After Rebound, degrees)	Time to Completion max, s
Bar No.	~~Mandrel~~Pin Diameter in.[A]	Bar No.	~~Mandrel~~Pin Diameter mm[A]		
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[B]	9	29[B]	230	180	45
10[B]	10	32[B]	250	180	45
11[B]	11	36[B]	280	180	45
14[B]	17	43[B]	430	90	45
18[B]	23	57[B]	580	90	45

[A] ~~Mandrel~~ Pin diameters specified for similar size (shown on the same line) inch-pound bars and metric may be interchanged.
[B] Bar designation Nos. 9, 10, 11, 14, and 18 [29, 32, 36, 43, and 57] are not covered by Specification A996/A996M.

D4417 Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)
~~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
G62 Test Methods for Holiday Detection in Pipeline Coatings

2.2 *American Welding Society:*[3]
ANSI/AWS A5.33 Specification for Solid and Ceramic Wires and Ceramic Rods for Thermal Spraying
AWS C2.23M/C2.23 Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc, and Their Alloys and Composites for the Corrosion Protection for Steel
AWS C2.25/C2.25M Specification for Thermal Spray Feedstock—Solid and Composite Wire and Ceramic Rods

~~2.3 *NACE International Standard:*[4]~~
~~RP-287 Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surface Using a Replica Tape~~

[3] Available from American Welding Society (AWS), ~~550 NW LeJeune Rd.,~~ 8669 NW 36 St., #130, Miami, FL ~~33126,~~33166-6672, http://www.aws.org.

2.3 *Society for Protective Coatings Specifications:*[4]
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
2.4 *Concrete Reinforcing Steel Institute:*[5]
Voluntary Certification Program for Fusion Bonded Epoxy Coating Applicator Plants
2.5 *American Concrete Institute Standard:*[6]
ACI 301 Specifications for Structural Concrete

3. Terminology

3.1 *Definitions of Terms Specific to This ~~Standard:~~ Specification:*

3.1.1 *batch, n*—epoxy powder or patching material contained in an individual shipping release or shipping order.

3.1.2 *damaged coating, n*—area surrounded by coating where steel surface is visible to a person with normal or corrected vision.

3.1.3 *disbonding, n*—loss of adhesion between the fusion-bonded ~~powder~~epoxy coating and the zinc-coated steel reinforcing bar.

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

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

3.1.6 *lot, n*—bars of one size and pattern of deformations contained in an individual shipping release or shipping order.

3.1.7 *patching material, n*—a liquid two-part, epoxy coating used to repair damaged ~~or uncoated areas.~~coating and to coat or uncoated areas on the surface of a coated bar, or to coat cut ends of a coated bar.

3.1.8 *thermal spray coating (metallizing), n*—a zinc and zinc alloy, or both, wire used in depositing a metallized layer of zinc by thermal spraying (metallizing) using oxy-fuel or electric-arc thermal spraying which is applied onto a clean, heated metallic substrate to form a continuous coating.

3.1.9 *wetting agent, n*—a material that ~~lowers~~decreases 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 zinc-alloy and epoxy dual-coated steel reinforcing bars under this specification shall contain the following information:

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

4.1.2 Quantity of bars,

4.1.3 Size designation and grade of bars,

4.1.4 Requirements for the zinc-alloy coating, Type I or Type II (5.2 and 5.3), and that Type II product be chemically treated by the galvanizer,

4.1.5 Requirements for the epoxy powder coating (5.4),

4.1.6 Quantity of patching material, and

4.1.7 ASTM designation A1055 [A1055M] and year of issue.

4.2 ~~It~~ The purchaser shall ~~be the responsibility of the purchaser to specify all requirements that are necessary for the coated steel reinforcing bars under this specification. Such requirements to be considered include but are~~ have the option to specify additional requirements, including, but not limited to the following:

~~4.1.1 Reinforcing bar specification and year of issue,~~

~~4.1.2 Quantity of bars,~~

~~4.1.3 Size and grade of bars,~~

~~4.1.4 Requirements for the zinc coating (5.2),~~

4.2.1 Requirements for ~~the~~providing powder coating ~~and provision of test data~~ samples from each batch (~~5.3 and~~ 5.4),

4.2.2 ~~Requirements for patching material~~ Approval from the coating manufacturer that the patching material supplied is compatible (5.5),

~~4.1.7 Quantity of patching material,~~

~~[4] Available from National Association of Corrosion Engineers (NACE), 1440 South Creek Dr., Houston, TX 77084-4906, http://www.nace.org.~~
[4] Available from Society for Protective Coatings (SSPC), ~~40 24th St., 6th Floor,~~ 800 Trumbull Dr., Pittsburgh, PA ~~15222-4656,~~15205, http://www.sspc.org.
[5] Available from Concrete Reinforcing Steel Institute (CRSI), 933 North Plum Grove Rd., Schaumburg, IL ~~60173-4767,~~60173-4758, http://www.crsi.org.
[6] Available from American Concrete Institute (ACI), ~~P.O. Box 9094,~~ 38800 Country Club Dr., Farmington Hills, MI ~~48333-9094, http://www.aci-int.org.~~48331-3439, http://www.concrete.org.

4.2.3 Specific requirements for ~~test frequency~~ sampling and test frequency for thickness, continuity, flexibility, and adhesion (9.1),

4.2.4 Whether a report on tests performed on the coated steel reinforcing bars being furnished is required (8.4.1 and Section 14),

4.2.5 ~~Additional specimens to be provided to the purchaser for testing from the coated steel reinforcing bars being furnished~~ Requirements for inspection (12.1), ~~and~~

4.2.6 Manufacturer qualification and certification requirements (if ~~any).~~any), and

~~NOTE 2—It is recommended that the coating application procedures and processes be audited by an independent certification program for coating applicator plants such as that provided by the Voluntary Certification Program or equivalent.~~

4.2.7 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 coating applicator plants such as that provided by the Voluntary Certification Program or equivalent.

5. Materials

5.1 ~~Steel reinforcing bars to be coated shall meet the requirements of one of the following specifications: A615M, A706M, or A996M [A615, A706, or A996] as specified by the purchaser and shall be free of contaminates such as oil, grease, or paint.~~*Steel Reinforcing Bars for Type I Zinc-Alloy Coated Bars:*

5.1.1 Steel reinforcing bars to be coated shall meet the requirements of one of the following specifications: A615, A706, or A996 [A615M, A706M, or A996M] as specified by the purchaser and shall be free of contaminants such as oil, grease, or paint when received at the manufacturer's plant and prior to cleaning and coating.

NOTE 3—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 those points.

~~NOTE 3—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 *Zinc-Alloy ~~Wire:~~ Wire for Type I Zinc-Alloy Coated Bars:*

5.2.1 The thermal spray coating feedstock material shall be specified according to Specification B833 or to AWS C2.25/C2.25M.

5.2.2 The wire shall conform to one of the chemical composition requirements prescribed in Table 1.

5.2.3 The wire shall be clean and free of corrosion, adhering foreign material, scale, seams, nicks, burrs, and other defects which would interfere with the operation of thermal spraying equipment. The wire shall uncoil readily and be free of bends or kinks that would prevent its passage through the thermal spray gun.

5.2.4 The wire shall be a continuous length per spool, coil, or drum. Splices or welds are permitted, provided that they do not interfere with the thermal spray equipment or coating process.

5.2.5 The starting end of each coil shall be tagged to indicate winding direction and to be readily identifiable with ASTM designation.

5.3 *Type II Zinc-Alloy Coated Bars:*

5.3.1 The product to be epoxy coated shall conform to the requirements of Specification A1094/A1094M.

5.4 *Epoxy Powder Coating:*

5.4.1 The epoxy powder coating shall ~~meet~~ conform to the requirements of Annex A1. Upon request, the purchaser shall be provided with ~~the test report for review.~~data confirming the epoxy powder coating conforms to the requirements of Annex A1.

5.4.2 A written certification shall be furnished to the purchaser that properly identifies the number of each ~~lot~~batch of epoxy powder coating used in the ~~order~~ purchase order, material quantity represented, date of manufacture, name and address of the epoxy powder coating manufacturer, and a statement that the supplied epoxy powder coating is the same composition as that qualified ~~according to~~ in accordance with Annex A1 of this specification.

5.4.3 The epoxy powder coating shall be transported and stored in a temperature-controlled environment ~~following the written~~in accordance with the documented recommendations of the manufacturer of the epoxy powder coating ~~manufacturer~~ until ready for use. At that point, if the storage temperature is below the plant ambient temperature, the epoxy 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.~~a temperature that is within ±5°F [±2°C] of the plant ambient temperature.

5.4.4 The epoxy powder coating shall be used within the epoxy powder coating manufacturer's written recommended shelf life.

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

5.6 ~~If specified in the order, patching material compatible with the coating, inert in concrete, and approved by the powder coating manufacturer, shall be supplied to the purchaser.~~Patching material for repairing damaged epoxy coating shall conform to the requirements of Annex A2 in Specification A775/A775M.

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

5.6.2 If specified in the purchase order or contract, patching material 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-SP10. The following visual standard of comparison may be used to define the final surface condition: SSPC-VIS 1. Average blast profile maximum roughness depth readings of 1.5 to 4.0 mils [0.04 to 0.10 mm] as determined by replica tape measurements using NACE RP-287, shall be considered suitable as an anchor pattern.~~*Type I:*

6.1.1 Blast media found to be contaminated with soluble salts shall be rejected.

NOTE 4—It is recommended that incoming steel reinforcing bars and blast media be checked for soluble salt contamination prior to use. Steel reinforcing bars found to be soluble salt contaminated from exposure to deicing salts or salt spray should be cleaned by acid washing or other suitable methods to remove soluble salt contaminants from the surface prior to abrasive blast cleaning.

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

6.1.3 Average blast profile roughness depth readings shall be 1.5 to 4.0 mils [40 to 100 µm]. Measurements shall be determined by either:

6.1.3.1 A "Profilometer" type surface instrument that measures the peak count as well as the maximum profile depth, used in accordance with the written instructions of the manufacturer of the instrument and Test Methods D4417, Method B, or

6.1.3.2 Replica tape measurements using Test Methods D4417, Method C.

NOTE 5—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 of it will take on the appearance of shot.

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

~~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.~~

~~NOTE 5—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.~~*Type II:*

6.2.1 Prior to epoxy coating, the surface of Type II zinc-alloy coated bars produced to Specification A1094/A1094M shall be visually inspected to ensure freedom from surface contaminants such as dirt, dust, and oils. Any such contaminants shall be removed prior to epoxy coating.

~~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.~~

7. Zinc-Alloy Coating Application

~~7.1 A thin zinc-alloy layer shall be applied by a thermal arc spray (metallization) system directly after the blast cleaning and before the powder coating in accordance with AWS C2.23M/C2.23 and the written specification of the zinc alloy supplier.~~

~~7.1.1 Thermal spray equipment shall be set up, calibrated, and operated according to the manufacturer's instructions and technical manuals or the Thermal Coating Spray applicator's recommendation.~~

~~7.2 The zinc-alloy coating shall be applied to the cleaned steel reinforcing bar surface as soon as possible after the bar has been cleaned 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 30 minutes after cleaning.~~

7.1 ~~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 minutes. At no time shall the temperature of the bar exceed 700°F [334°C].~~*Type I:*

7.1.1 A thin zinc-alloy layer shall be applied by a thermal arc spray (metallization) system directly after the abrasive blast cleaning and before application of the epoxy powder coating in accordance with AWS C2.23M/C2.23 and the written specification of the zinc alloy supplier.

7.1.1.1 Thermal spray equipment shall be set up, calibrated, and operated in accordance with the manufacturer's instructions and technical manuals, or the Thermal Coating Spray applicator's recommendation.

7.1.2 The zinc-alloy coating shall be applied to the cleaned steel reinforcing bar surface as soon as possible after the bar has been cleaned and before visible oxidation of the surface occurs as visible to a person with normal or corrected vision. In no case shall application of the coating be delayed more than 30 minutes after cleaning.

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

7.1.4 The fusion-bonded epoxy powder coating shall be applied in accordance with the written recommendations of the manufacturer of the epoxy powder coating for initial steel surface temperature range and post-application curing requirements. During continuous operations, the temperature of the metal surface immediately prior to coating shall be measured using infrared guns or temperature-indicating crayons, or both, at least once every 30 minutes. At no time shall the temperature of the metal surface exceed 700°F [334°C].

NOTE 6—The use of both infrared and temperature-indicating crayon measurement of the surface temperature of steel reinforcing bars is recommended.
~~NOTE 7—The use of both infrared and temperature-indicating crayon measurement of the steel reinforcing bars is recommended.~~

7.2 ~~The powder coating shall be applied by electrostatic spray or other suitable method.~~*Type II:*

7.2.1 The zinc-alloy coating shall be applied in conformance to the requirements of Specification A1094/A1094M. Except in the case of continuous galvanizing followed by immediate in-line application of epoxy coating, the product shall be chemically treated by the galvanizer to provide a surface suitable for application of epoxy coating at another location.

8. Requirements for Coated Steel Reinforcing Bars

8.1 *Coating Thickness:*

8.1.1 The coating thickness of the ~~zinc~~zinc-alloy layer shall be a minimum of 1.4 mils [35 ~~µm].~~µm] for Type I and a minimum of 2.0 mils [50 µm] for Type II.

8.1.2 The total coating thickness measurements of the combined zinc-alloy layer and the epoxy coating layer after curing shall be 7 to 12 mils [175 to 300 µm] for bars sizes Nos. 3 to 5 ~~[Nos. 10~~ [10 to 16] and 7 to 16 mils [175 to 400 µm] for bar sizes Nos. 6 to 18 ~~[Nos. 19~~ [19 to 57]. The upper thickness limit shall not apply to repaired areas of damaged coating.

8.1.3 Coating thicknesses shall be measured and recorded for both ~~zinc~~zinc-alloy and epoxy thickness. A ~~single recorded~~ single-recorded steel reinforcing bar coating thickness measurement is the average of three individual gage 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).

NOTE 7—The ~~zinc~~zinc-alloy thickness will be measured by either using a bar that has only the ~~zinc~~zinc-alloy coating applied or by use of a duplex measuring device capable of reading the ~~zinc~~zinc-alloy and epoxy coatings simultaneously.

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~~ 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 Thickness measurements shall be made in accordance with ~~SSPC-PA-2~~ SSPC-PA 2 and in accordance with the manufacturer's instructions for the measuring device, following the instructions for calibration and use recommended by the thickness ~~gage~~gauge manufacturer. "Pencil-type" pull-off ~~gages~~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.