Designation: F2833 – 11

Standard Specification for Corrosion Protective Fastener Coatings with Zinc Rich Base Coat and Aluminum Organic/Inorganic Type[1]

This standard is issued under the fixed designation F2833; 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 the basic requirements for chromium-free fastener coatings that combine an inorganic zinc-rich basecoat with an aluminum-rich topcoat that contains an integrated lubricant.

1.2 These coatings are applied by conventional dip-spin, dip-drain, or spray methods to ferrous parts which can be handled through a cleaning, or phosphate, coating, and baking operation. Phosphating or shot blast is required to clean and prepare the surface of the steel. These coatings are bake cured at temperatures up to 500°F.

NOTE 1—If used, phosphate to be used in accordance with Specification F1137, grade 0.

1.3 *Units*—The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *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:*[2]

B117 Practice for Operating Salt Spray (Fog) Apparatus

D610 Practice for Evaluating Degree of Rusting on Painted Steel Surfaces

D3359 Test Methods for Measuring Adhesion by Tape Test

F606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets

F606M Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets (Metric)

F1137 Specification for Phosphate/Oil Corrosion Protective Coatings for Fasteners

F1470 Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection

F1624 Test Method for Measurement of Hydrogen Embrittlement Threshold in Steel by the Incremental Step Loading Technique

F1789 Terminology for F16 Mechanical Fasteners

F1940 Test Method for Process Control Verification to Prevent Hydrogen Embrittlement in Plated or Coated Fasteners

3. Classification

3.1 When the zinc phosphate option is used, its coating weight shall be in the range of 8-20 g/square meter. If used, phosphate to be used in accordance to Specification F1137 grade 0.

3.2 These coatings are classified into 5 different types:

3.2.1 *Grade 1*—requires a minimum basecoat thickness of 0.27 mils applied in one coat. An organic topcoat with an integrated lubricant is applied at a minimum thickness of 0.20 mils in one coat and ; with no additional layers.

3.2.2 *Grade 2*—requires a minimum basecoat thickness of 0.27 mils applied in two coats bulk or one coat sprayed. An organic topcoat with an integrated lubricant is applied at a minimum thickness of 0.20 mils in one coat; with no additional layers.

3.2.3 *Grade 3*—requires a minimum basecoat thickness of 0.27 mils applied in one coat. This basecoat is dark gray in color. A black organic topcoat with an integrated lubricant is applied at a minimum thickness of 0.20 mils in two coats bulk or one coat sprayed; with no additional layers.

3.2.4 *Grade 4*— requires a minimum basecoat thickness of 0.27 mils applied in one coat. An inorganic topcoat with an integrated lubricant is applied at a minimum thickness of 0.20 mils and an integrated lubricant in one coat; with no additional layers.

3.2.5 *Grade 5*—requires a minimum basecoat thickness of 0.27 mils applied in one coat. An organic pigmented topcoat

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[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.

TABLE 1 Coating Properties

Grade	Topcoat type	Total number of coating layers	Average Coating Thickness (mil)	Average Coating Weight (g/m^3)	Minimum SST hrs
1	Organic	2	0.47–0.59	32–40	840
2	Organic	3	0.47–0.71	32–51	1200
3	Organic/black	3	0.47–0.71	37–41	840
4	Inorganic	2	0.47–0.59	34–41	1000
5	Organic/various colors	2	0.47–0.59	32–39	840

with an integrated lubricant is applied at a minimum thickness of 0.20 mils in one coat for additional corrosion protection with no additional layers.

4. Ordering Information

4.1 Orders for material in accordance with this specification shall include the following information:

4.1.1 Quantity of parts,

4.1.2 Color of coating,

4.1.3 Grade of coating (see Table 1),

4.1.4 Any additions to specifications as agreed upon by the purchaser and the supplier, and

4.1.5 Certification and test report requirements.

5. Performance Requirements

5.1 *Appearance*—The coating shall have a uniform appearance free from tears and other discontinuities which may affect the appearance or performance, or both, of the coating.

5.2 *Adhesion*—When practical, the coating shall show less than 5 % removal following the tape adhesion test in 6.3. Due to the nature of the coating, some removal is expected, but removal of the coating that exposes the substrate indicates poor adhesion and is cause for rejection.

5.3 *Corrosion Resistance*—The coating shall be capable of withstanding exposure to salt spray test (SST) for the minimum hours (h) specified in Table 1. Unless otherwise defined, acceptable corrosion resistance shall be Rust Grade 6 or higher (see Test Method D610 for definition) on significant surfaces (see Terminology F1789 for definition).

5.4 *Blisters*—There shall be no signs of blisters after testing in accordance with 6.1.

5.5 *Thread Fit*—The coating shall not have an adverse effect on normal installation and removal practices as determined by the proper GO thread gauge.

5.5.1 The thickness of the coating is limited by the basic thread size (3A GO gauge for external threads 6h for metric product, 2B GO gauge for internal threads, 6H for metric product). Where greater thickness is necessary, the internal threads may be produced oversized (before coating) providing the finished product (after coating) meets all the specified mechanical properties. Where mechanical properties are not specified, oversizing is subject to the approval of the purchaser.

6. Test Methods

6.1 Corrosion—Corrosion resistance shall be tested in accordance with Practice B117 followed by Test Method D610 to rate the amount of corrosion.

6.2 *Coating Thickness*—The coating thickness shall be determined by magnetic induction, X-ray fluorescence spectroscopy, microscopic examination of a cross-section taken perpendicular to the significant surfaces, or weigh-strip-weigh method. When using magnetic induction, or X-ray fluorescence, an average of ten measurements on the flat surface of one part shall be used.

NOTE 2—The weigh-strip-weigh method involves weighing the test specimen before and after the coating is stripped. The method requires a reagent that does not attack the base metal (for example, 20 % NaOH).

6.3 *Adhesion*—Where practical, adhesion of the coating shall be tested in accordance with Test Methods D3359 Scribe-Grid Test. Determination if base material is exposed may be done by visually inspecting the part, or exposing the part to salt spray test (see Practice B117) for 96 h and observing if red rust occurs.

6.4 *Hydrogen Embrittlement*—When specified in the purchase order, testing shall be conducted in accordance with Test Methods F606, or F1940. (See also, Test Methods F606M.)

6.4.1 In the event that hardness reductions occur in test specimens due to coating curing times and temperatures, testing per shall be conducted alternatively in accordance with F1624.

7. Sampling

7.1 Sampling for testing shall be conducted based on lot size in accordance with Practice F1470.

8. Rejection and Rehearing

8.1 Materials that fail to conform to the requirements of this specification shall be rejected.

9. Keywords

9.1 aluminum; chromium; coating; corrosion; dip spin; fasteners; protection; resistance; rust; sealer; zinc