Designation: F1136/F1136M – 11

Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners[1]

This standard is issued under the fixed designation F1136/F1136M; 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 water-based zinc/aluminum dispersion inorganic basecoats and optional sealers and topcoats for fasteners. The basecoat can contain chrome (C) or be non-chrome (NC).

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, coating, and baking operation, and which are not adversely affected by baking temperatures up to 330°C [626°F].

1.3 The coating process does not induce the possibility of internal hydrogen embrittlement providing that the fasteners have not been cleaned or pre-treated with an acid or phosphate. Alkaline cleaning or vapor degreasing is required along with shot blasting to remove rust or scale.

1.4 The values stated in either SI units or inch-pound 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.

1.5 *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:*[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)

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

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 These coatings are classified into six grades according to the requirements in Table 1.

3.1.1 Grade 1 requires a minimum basecoat thickness of 4µm [16g/m^2] or 0.16 mil (0.052 oz/ft^2). This is usually applied in two coats to bulk parts, or one coat to racked parts. No topcoat is applied in Grade 1.

3.1.2 Grade 2 requires a minimum basecoat thickness of 5µm [20 g/m^2] or 0.20 mil (0.066 oz/ft^2). This is usually applied in two coats to bulk parts, or one coat to racked parts. No topcoat is applied in Grade 2.

3.1.3 Grade 3 requires a minimum basecoat thickness of 5µm [20 g/m^2] or 0.20 mil (0.066 oz/ft^2) and a single coat of the clear sealer. The sealer provides additional corrosion protection and greater lubricity than Grade 2.

3.1.4 Grade 4 requires a minimum basecoat thickness of 8µm [28 g/m^2] or 0.31 mil (0.092 oz/ft^2). This is usually applied in three coats to bulk parts, or one to two coats to racked parts. No topcoat is applied in Grade 4.

3.1.5 Grade 5 requires a minimum basecoat thickness of 5µm [20 g/m^2] or 0.20 mil (0.066 oz/ft^2) and a single coat of the lubricated sealer. The sealer provides additional corrosion protection than Grade 2 and greater lubricity than Grade 3.

[1] This specification is under the jurisdiction of ASTM Committee F16 on Fasteners and is the direct responsibility of Subcommittee F16.03 on Coatings on Fasteners.

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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.

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

TABLE 1 Coating Classification

Grade No.	Topcoat Type	Coating Thickness		Coating Weight		Minimum SST Hours (h)	
		Metric Average (mil)	Inch Average (mil)	Metric Average (g/m^2)	Inch Average (oz/ft^2)	(C)	(NC)
1	None	4 to 5	0.16 to 0.20	16 to 20	0.052 to 0.066	240	----
2	None	5 to 8	0.20 to 0.31	20 to 28	0.066 to 0.092	500	240
3	Clear Sealer	6 to 12	0.24 to 0.47	22 to 34	0.072 to 0.111	1000	720
4	None	8 to 15	0.31 to 0.59	28 to 50	0.092 to 0.164	1000	500
5	Lubricated Sealer	6 to 12	0.24 to 0.47	22 to 34	0.072 to 0.111	1000	720
6	Pigmented Topcoat	8 to 15	0.31 to 0.59	23 to 40	0.075 to 0.131	500	500

3.1.6 Grade 6 requires a minimum basecoat thickness of 5µm [20 g/m^2] or 0.20 mil (0.066 oz/ft^2) with various pigmented topcoats applied. The topcoats can be black or various other colors.

4. Ordering Information

4.1 Orders for parts under this specification shall include the following information:

4.1.1 Quantity of parts,

4.1.2 Grade of coating as given in Table 1,

4.1.3 Specify chrome (C) or non-chrome (NC). Unless otherwise specified, coating to this specification will be supplied with chrome,

4.1.4 4 For Grade 6, specify the type of topcoat (that is, Grade 6; Black, Type X), and

4.1.5 Any additions to the specification as agreed upon between the purchaser and the supplier.

5. Requirements

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

5.2 *Adhesion*—The coating shall show less than 5 % removal following the tape adhesion test. Due to the nature of the coating, some removal is expected, but removal of the coating to expose 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 gage.

5.5.1 The thickness of the coating is limited by the basic thread size (3A GO gage for external threads, 2B GO gage for internal threads). 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.

5.6 *Hydrogen Embrittlement*—When specified in the purchase order, the applicator shall certify that the process did not expose the parts to acid or phosphating to guarantee the absence of internal hydrogen embrittlement.

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 1—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*—Adhesion of the coating shall be tested in accordance with Test Methods D3359 Scribe-Grid Test, where practical. 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, F606M or F1940. In the event that hardness reductions occur in test specimens due to coating curing times and temperatures, testing shall be conducted alternatively in accordance with Test Method F1624.

7. Inspection

7.1 When requested by the purchaser, samples shall be acquired in accordance with Guide 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; chrome; coating; corrosion; dip spin; fasteners; protection; resistance ; rust; sealer; zinc

SUMMARY OF CHANGES

Committee F16 has identified the location of selected changes to this standard since the last issue (F1136–10) that may impact the use of this standard. (Approved November 1, 2011.)

(1) Combined standards F1136 and F1136M. *(2)* Revised 6.4.

Committee F16 has identified the location of selected changes to this standard since the last issue (F1136–04) that may impact the use of this standard. (Approved December 1, 2010.)

(1) 6.4.1 was added.