# CORROSION PROTECTIVE COATINGS ZINC/ORGANIC TYPE

**GM7113M**

**1 SCOPE.** This specification covers the basic requirements for a non-oily corrosion protective coating consisting of zinc plate and subsequent aluminum rich organic topcoat.

1.1 The coating is suitable for internally and externally threaded and nonthreaded ferrous parts where high levels of corrosion protection are required. When applied over steel that is to be coupled to aluminum, the coating provides exceptional galvanic protection.

1.2 APPLICATION. It is recommended that the internally threaded part (nut) be coated in a variable speed, canting centrifuge, which applies paint coating by a gravity flow-through system. Parts without internal threads may be coated by other processes.

1.3 Use of this finish on threaded surface and/or bearing surface of joints could affect the torque-tension relationship. It is recommended that a torque-tension study of the fastener joint be performed before releasing the finish on a new application.

## 2 REFERENCED STANDARDS.

| | | |
|---|---|---|
| GM500M | GM4298P | GM9501P |
| GM510M | GM4465P | GM9508P |
| GM1000M | GM9064P | ANSI B18 |
| GM4345M | GM9071P | |

## 3 REQUIREMENTS.

3.1 RESTRICTED AND REPORTABLE CHEMICALS (GM1000M). All materials supplied to this specification must comply with the requirements listed in GM1000M, "Restricted and Reportable Chemicals."

3.2 APPEARANCE. The coating shall have a uniform gray/green appearance and shall be free from tears, sags, and excess coating which affects appearance and performance. The coating shall not be oily or tacky to the touch. During normal handling practice, parts shall not leave particulate residue on equipment, hands or gloves.

3.3 THICKNESS. When applied to threaded products, the coating shall not have an adverse effect on normal installation and removal practices. The zinc chromate plating thickness shall be minimum of 6 µm unless otherwise specified.

3.3.1 The typical coating thickness shall be 12 to 20 µm.

3.3.2 The maximum thickness of coating which may be applied to threads on threaded products is limited by the basic thread size (tolerance h or H). After coating, parts must gage with appropriate basic size GO thread gage. Threads may be produced undersize/oversize (before coating) to accommodate the coating thickness, providing the finish product (after coating) meets all specified mechanical properties. Where mechanical properties are not specified, undersizing/oversizing is subject to approval by the pertinent engineer, and all undersize/oversize shall be within permissible limits as agreed upon.

3.4 GASOLINE RESISTANCE. Coated parts shall be exposed per GM9501P. There shall be no color change or coating removal to previous surface or lifting or peeling of film or visible defect in the film after exposure.

3.5 CORROSION RESISTANCE. Parts coated to this specification shall be capable of withstanding neutral salt spray testing per GM4298P for a minimum of 400 h. After testing, there shall be no red rust on significant surfaces, except sharp edges.

3.5.1 For initial approval and PPAP submissions parts must be tested per GM4298P to meet the corrosion resistance requirements on significant surfaces per 3.5. For normal production, processes that are in statistical process control shall yield parts that are capable of meeting the same salt spray requirements. A periodic NSS test of the parts being processed on each line running this coating should be conducted per ANSI B18.18.2M. Table 2 of ANSI B18.18.2M indicates an inspection level of B for NSS, with NOTE 4 referencing Table B in Appendix 1 and Table 3. Since this coating is not included in the list of finishing operations in Table B, to actual control checks to be made and recorded shall be based on chemical manufacturer's instructions.

3.5.2 When this coating is specified for fasteners, the parts shall be power-driven, with properly maintained equipment, into a nut or tapped hole, in a manner simulated to production and perpendicular against a flat surface. After salt spray exposure, the significant surfaces of the fastener shall be evaluated. Significant surfaces are defined as those surfaces left exposed when the parts have been installed in a normal manner.

3.5.3 Significant surfaces on other than threaded fasteners shall be defined as the surface, or portion of the part, that can be touched with a 13 mm ball, unless otherwise noted on the engineering drawing. On other surfaces, such as holes, recesses, threads, etc., where control of coating cannot be obtained, the above requirements do not apply. Acceptance or rejection of parts coated to this specification will be based on results monitored on significant surfaces.

3.6 RELIEF OF EMBRITTLEMENT. All steel parts having a hardness above HRC32 and all highly stressed cold worked parts subsequently plated with metal are subject to embrittlement because of hydrogen absorption. Unless otherwise specified, this condition shall be relieved by heating immediately after plating. The temperature 200°C for 4 h has been found suitable in some instances; however, higher temperatures and/or longer time may be found necessary. Hardened parts which have been tempered at less than 175°C shall be heated @ 150°C and held for 8 h, or longer, if necessary. Suitable relief of hydrogen embrittlement of highly stressed spring steel parts is considered doubtful.

3.6.1 When supplementary treatment is specified for a part that requires baking after plating, the supplementary treatment shall be applied after the baking operation.

3.7 FLEXIBILITY AND CHIP RESISTANCE. The coating must withstand the normal extensions, flexing and compres-

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sions encountered by springs and spring clips during end product assembly, without evidence of flaking or loss of adhesion from the base metal. It shall withstand normal handling and storage conditions without chipping or flaking.

3.7.1 Panels or parts coated with the coating, excluding thread fasteners - under the discretion of the user, shall be exposed per GM9508P. After exposed the minimum rating shall be 6.

3.8 ADHESION CHARACTERISTICS. Parts coated to this specification shall show no evidence of blistering or other appearance changes, other than a whitish blush, after exposure to humidity testing per GM4465P for 96 h min. When tape tested per GM9071P, 10 minutes after removal from humidity there will be no more than 3.0 mm total peel back (peel back, adding both sides of scribed line) from the lines scribed in an X, and no other peeling in the area under the tape. This is not applicable to parts with insufficient surface area for the scribe.

3.9 TORQUE/TENSION REQUIREMENTS. Parts with external machine threads, 6 mm and larger nominal thread diameter, shall be subject to torque/tension testing. The torque values at specified tension, for appropriately sized test parts (see Table 1), shall be measured per GM9064P after coating per this specification. The 6-sigma torque range must lie within the listed range. Suppliers will report the torque results to the Chairman, GM Finish Committee.

**TABLE 1**

| Thread Size | Bolt P/N(1) | Nut P/N(2) | Torque (N-m) | Tension (kN) |
|---|---|---|---|---|
| M6 x 1 | 11516103 | 11516088 | 8-12 | 9.8 |
| M8 x 1.25 | 11516104 | 11516089 | 20-28 | 17.8 |
| M10 x 1.5 | 11516105 | 11516090 | 40-55 | 28.3 |
| M12 x 1.75 | 11516106 | 11516091 | 70-95 | 41.1 |
| M14 x 2.0 | 11516107 | 11516092 | 110-150 | 56.1 |
| M16 x 2.0 | 11516108 | 11516093 | 170-230 | 76.5 |

(1) Test bolts are GM500M (9.8), 6e6g, plain hex head bolts.
(2) Test nuts are GM510M (10), 4H (before plating) zinc plating per GM4345M, 3U24/0.

**4 INITIAL SOURCE APPROVAL.** No shipment shall be made by any supplier until representative initial production samples have been approved by the materials engineering department of the purchasing division as meeting the requirements of this specification. Initial approval of the coating applicator shall include verification that the coater has supplied part 11516104, coated per this specification, and that that part, thusly coated, has withstood a minimum 1000 h neutral salt spray exposure, per GM4298P, with no red rust evident on significant surfaces.

4.1 Completed copies of the Material Safety Data Sheet meeting GM information requirements must be submitted with any new submissions or whenever a composition change has occurred.

**5 INSPECTION AND REJECTION.** All shipments of material or parts under contract or purchase order manufactured to this specification shall be equivalent in every respect to the initial samples approved by engineering. There shall be no changes in either formulation or manufacturing processes permitted without prior notification and approval by materials engineering. Lack of notification by the supplier constitutes grounds for rejection of any shipment. While samples may be taken from incoming shipments and checked for conformance to this specification, the supplier shall accept the responsibility for incoming shipments meeting this specification without dependence upon purchaser's inspection.

5.1 REFEREE INSPECTION - NOT PERMITTED.

**6 APPROVED SOURCES.** Engineering qualification of an approved source is required for this specification. Only sources listed in the GM Corporate Materials File under this specification number have been qualified by materials engineering as meeting the requirements of this specification. Sources are available through the on-line MATSPC System.

**7 GENERAL INFORMATION.** This standard was originated and approved by the Finish Committee in April 1993. The latest revisions include:

| Rev | Date | Description |
|---|---|---|
| A | 7/95 | Added 3.1 and revised 3.3.2, 3.5.1 |
| B | 7/96 | Added 1.3 |

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