



Barrier Coatings for Galvanic Corrosion Applications

1 Scope

Note: This standard describes the requirements for a coating system used to mitigate or eliminate galvanic corrosion between dissimilar metals and carbon fiber, especially threaded fastened joints.

1.1 Material Description. The barrier coating system is designed to mitigate or eliminate the galvanic reaction between dissimilar metals and carbon fiber. Note that this coating is not meant to protect the coated component against general corrosion. A separate base-finish may be necessary depending on application. Consult Materials and Fastening Engineering.

1.2 Symbols. Not applicable.

1.3 Applicability. This coating is suitable for internally and externally threaded parts (size $\geq$ M6) and non-threaded ferrous parts where galvanic cell interactions exist, and a high level of corrosion protection is required. This is not recommended for the following without Materials/Fastening Engineering approval:

1.3.1 Bolts and nuts of sizes $<$ M6.

1.3.2 Loose washers of all sizes.

1.3.3 Parts where electrical conductivity is required.

1.4 Remarks.

1.4.1 The material covered in this specification may not be suitable for all components. Each application must be reviewed with the responsible Materials Engineer before usage.

1.4.2 Use of this coating system on threaded surface and/or bearing surface of joints may affect the torque-tension relationship. The coating system shall have an integrated or separately applied lubricant to address general assembly requirements, as defined in 3.9.1. However, a torque-tension study of the fastener joint before releasing this coating on new applications is recommended.

1.4.3 The material in this specification is suitable for temperatures up to 150 °C. Consult Materials Engineering for higher temperature applications.

1.4.4 The coating is generally thicker than common fastener coatings, and may not be compatible with smaller internal drive fasteners. This may be accommodated by oversizing the fastener internal drive. Consult Fastening Engineering for these types of fasteners.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ISO 1463	ISO 16047	VDA 235-203	SAE 5W30
----------	-----------	-------------	----------

2.2 GM Standards/Specifications.

9985670	9986333	GMW4700	GMW14829
9985809	GMW3059	GMW14700	GMW16551
9986153	GMW3286	GMW14729	GMW17026

3 Requirements

The parts finished to this specification shall meet the following technical requirements demonstrated by the test methods described. The appropriate tests for different situations (i.e., chemical approval, Production Part Approval Process (PPAP), and regular process control testing) are described in Appendix A, Table A1 and shall be discussed with the appropriate Materials Engineer.

3.1 Appearance. The coating shall have a uniform appearance and shall be free from uncoated areas and excess coating which affect appearance and performance. The coating shall be dry to touch and not be oily or tacky. The coating shall be completely cured and shall have good adhesion to metal substrate or other base plating or coating. The color shall be black.

3.2 Adhesion Characteristics. Parts coated to this specification shall show no evidence of blistering or other appearance changes after exposure to humidity testing per GMW14729 for a minimum of 240 h. After removal from humidity exposure for at least 10 minutes there shall be a minimum of 99.0% coating (topcoat) retention after the tape adhesion test per GMW14829 Method B. In the case of threaded fasteners, steel test panels processed under near production conditions may be substituted for the adhesion test.

3.3 Flexibility and Chip Resistance. The coating shall resist chipping or flaking under normal handling conditions that are detrimental to performance. The qualification test is as follows:

3.3.1 Obtain a batch of M6 or similar size hexalobular internal drive pan head screws (e.g., GM part number 11546571). Bare screws shall be plated according to the process intended for production release. (e.g., GMW4700 Type B with no top coat + barrier coating + top coat) Top coat can include, but is not limited to, friction modifiers or any other material required to meet specific performance requirements.

3.3.2 If the coating process is a batch type process, the batch size must be production representative. In this case, a small number of test screws may be coated with other similar size/shape fasteners for this test.

3.3.3 The test screws shall be power driven and seated with production-type tooling into test panels.

3.3.4 Pre-condition the test screws (mounted on the test panel) to GMW14700 Method C, using 1 L (2 pints) of gravel. Expose parts to corrosion test and evaluate per 3.4.

3.4 Corrosion Resistance.

3.4.1 Neutral Salt Spray. After exposure to Neutral Salt Spray (NSS) per GMW3286, coated parts shall exhibit no appearance change after 240 h and shall exhibit no base metal corrosion (red rust) on significant surfaces after 1000 h.

3.4.2 Accelerated Galvanic Corrosion. Expose coated parts, per GMW17026 to 150% of test (by mass loss). Other test criteria (i.e., sample size, assembly process, test orientation, and acceptance criteria) shall be defined by the application-specific validation plan between Product Engineering and Materials Engineering.

3.4.2.1 Test results will be impacted by material combinations therefore production intent processes and components are required for approval and validation testing. Assemblies tested to this specification must include components used in the production joint to simulate actual vehicle conditions. The coating process including the same substrate type, intended base plating or coating, as well as top coats shall be as close to production intent as possible. Fasteners shall be assembled to production intent specifications including torque and tension.

3.5 Temperature Resistance. Parts shall be heated to 150 °C (part temperature) for 24 h and meet the adhesion requirements per 3.2 and corrosion resistance requirements per 3.4.

3.6 Coating Thickness. The coating thickness in this specification refers to the barrier coating only. Preceding plating or coating layers shall be defined in the appropriate specification.

3.6.1 The optimum coating thickness depends on the design of the joint and coating system. Maximum and minimum coating thickness and the intended coverage area must be defined on the parts drawing. Typically, for bolts/screws, this area includes the head and underhead surface area in contact with the mating parts.

3.6.2 For threaded fasteners, if there are coatings on the threads, then the part must also pass thread gaging requirements, per GMW16551. Undersizing/oversizing of threads to meet this requirement is allowed, as long as all mechanical properties of the fastener are maintained and approved by GM fastening engineering. Similarly, the internal or external drive feature may be resized to accommodate the coating. Mechanical properties and size requirements must be within specification after coating.

3.6.3 For parts other than threaded fasteners, there is no limit on maximum total coating thickness, as long as the finish meets all other requirements and does not negatively affect the function of the part.