GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW3359

Non-Electrolytically Applied Zinc-Rich Coating

1 Scope

This standard covers the basic requirements for a corrosion resistant non-electrolytically applied zinc-rich coating. Besides corrosion protection, the coating also provides consistent frictional properties.

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose/Material Description. This coating specification covers zinc flake coating with or without a top coat.

Coating Types: Three levels of corrosion protection are provided by the following types:

Type A: High corrosion resistant coating.

Type B: Medium corrosion resistant coating.

Type C: Low corrosion resistant coating.

Note: When not explicitly specified, the default coating type shall be Type A. Parts contracted and Production Part Approval Processed ("PPAPed") before January 1, 2014, that is without the coating Type (A, B, or C) specified, may continue to default to Type B.

Note: Type C coating systems may be without top coat if coefficient of friction (CoF) requirements are met. Treatment with an additional lubricant to meet CoF is permissible.

1.2 Symbols. Not applicable.

1.3 Applicability. This coating is suitable for externally and internally threaded fasteners size M6 or larger, and other ferrous parts where high level of corrosion protection and freedom from hydrogen embrittlement are required. This coating is not recommended for the following types of parts:

- Bolts and nuts of sizes < M6.
- Parts with internal drive recess and blind holes.
- Parts mating against magnesium surfaces.
- Loose washers with diameter < 14 mm.
- Parts where electrical conductivity is required.

1.4 Remarks.

1.4.1 This coating process does not generate hydrogen; however, pre-treatment processes, i.e., acid pickling could cause hydrogen adsorption. Non-electrolytically applied zinc-rich coating has high permeability which allows effusion of hydrogen during curing which might have been absorbed during acid pickling. See precautions in 3.1.1.

1.4.2 Use of this coating system 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 this finish on any new application.

1.4.3 The corrosion performance is influenced by part geometry, substrate material, and application process. The coating systems approved to this specification were tested to meet all requirements using common steel fasteners. For new designs, applications, and parts with complex geometries or difficult to clean material such as castings and powder metal, extra validation testing is highly recommended.

1.4.4 This finish is suitable for service temperatures from -50 °C to +120 °C. Applications outside of this temperature range shall be reviewed with the responsible Materials Engineering organization before usage.

1.4.5 Dip-spin coating is a bulk process. If parts are prone to nesting, stick together (flat washers), or easily damaged by mechanical tumbling, dip-spin coating method is not recommended. Alternatives include spray and dip-drain methods.

In the case of flat washers, additional handling may be required between the coating and curing step to reduce the amount of parts sticking together. Final sorting of parts stuck together will be necessary to ensure all washers have sufficient coating on both sides.

1.4.6 Shot blasting is not a preferred pre-treatment method for internally threaded parts (nuts), nut-washer and bolt-washer assemblies. If shot blasting is used, extra care shall be taken to ensure shots are not trapped in the coated parts.

1.4.7 This coating is relatively soft, and is prone to “dusting”. It is expected that equipment handling high volumes of coated parts (such as automated bolt feeders) will require regular cleaning to remove the coating dust.

1.4.8 The curing process of these coatings occurs between 200 °C to 350 °C and may temper high hardness metals. It is the responsibility of the fastener manufacturer to ensure their parts still meet mechanical and material requirements after coating.

2 References

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

2.1 External Standards/Specifications.

AIAG CQI-12	ISO 9227	ISO 17025	SAE/USCAR-7
ISO 1463	ISO 16047	SAE/USCAR-5	SAE/USCAR-11

2.2 GM Standards/Specifications.

9984094	GMW3059	GMW14729	GMW16551
9985670	GMW14270	GMW14829	
9985809	GMW14700	GMW14872	

2.3 Additional References.

- GM Part Number (P/N) 11502644, test washer.
- GM P/N 11515490, Electrodeposition Primer (ELPO) coated test washer.
- GM P/N 11516090, test nut.
- GM P/N 11516105, surrogate bolt.
- GM P/N 11570102, M10 heavy hex bolts.

3 Requirements

The parts coated to this specification shall meet the following technical requirements and demonstrated by the test methods described. The appropriate tests for different situations: New chemical approval, new applicator approval, Production Part Approval Process (PPAP), and regular process control testing, are described in Appendix A, Table A1. Procedures and requirements for new chemical and applicator approval are described in Appendix B.

Note: For fasteners with weight-saving indented heads, it is allowable to have up to 1% of a delivered batch to exhibit coating bubbles and flaking inside the indentation. This deviation extends to 3.2 through 3.6 for the inside of the indentation only.

3.1 Pre-treatment and Post-treatment.

3.1.1 All coated parts with surface or core hardness > 320 HV (32 HRC), and processed through an acidic or hydrogen-generating pre-treatment process shall be processed per SAE/USCAR-5. The referee method for detection of embrittlement shall be per SAE/USCAR-7.

The maximum material hardness in the drawing or relevant specification shall be used to determine if de-embrittlement treatment is required. If a part is heavily cold worked or heat treated to high strength/hardness,