GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW3011

Zinc Phosphate - Generic Qualifications

1 Scope

This specification details the general material performance, paint layering compatibility, and processing requirements for GM worldwide approval of zinc phosphate conversion coatings.

1.1 Material Description. Materials qualified to this standard shall meet the performance shown in Table A1, Appendix A. Any material development issues, such as chemical or performance values that fall outside specified ranges, must be discussed with the appropriate GM Materials Engineer for resolution. Material must successfully complete a production trial in a target facility prior to release for general use.

1.2 Symbols. Not applicable.

1.3 Applicability. This specification applies to zinc phosphate conversion coating materials that are intended for use on automotive vehicles and associated components. These coatings must provide a crystalline, corrosion-resistant, paint adhesion promoting surface to the substrates shown in Table 1. Additional substrates may be required by the GM Engineer facilitating the approval testing.

2 References

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

2.1 External Standards/Specifications.

ISO 3892	ISO 9717

2.2 GM Standards/Specifications.

GM4389M	GMW3005	GMW14704	GMW14873
GMW2	GMW3059	GMW14829	GMW15192
GMW8	GMW8738 (ID)	GMW14872	GMW15282
GMW11	GMW14700		

(ID) = This standard is limited to internal distribution within General Motors and shall not be distributed outside this company. Contact the appropriate GM Lead Engineer for further instructions.

2.3 Additional References.

ACT Test Panel Technologies, Hillsdale, Michigan (www.acttestpanels.com)

TMC003 Material Safety Data Sheet guidance documents (available at www.gmsupplypower.com).

3 Requirements

3.1 Requirements on Test Specimens.

3.1.1 Chemical Fingerprint. GM may conduct analyses of the materials supplied to this specification. Analyses may also be performed on representative panels. The analyses established for initial approval shall constitute a reference standard and shall be part of the submission package. Information on the technology's ingredient formulation ranges and manufacturing Key Control Characteristics (KCC) must be provided as part of the submission package. If a product change is proposed that is outside the technology formulation limits, the applicable GM Materials Engineer must be notified. All ingredient ranges, key manufacturing control limits, and Certificate of Analysis ranges must pass standard gage repeatability and reproducibility studies.

3.1.2 Delivery Documentation. The supplier shall be responsible for submitting a Certificate of Analysis with each batch of material arriving at a plant. This document shall be prepared and provide data in accordance with the requirements detailed in GM4389M.

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3.1.3 Product Information. The engineer responsible for technical qualification shall be contacted prior to test initiation. A product data sheet, product composition, and all related product processing information must be submitted for review at that time.

3.2 Test Panel Preparation.

3.2.1 Test Panel Substrates. The specific substrate types to be used are shown in Table 1.

- Cold Rolled Steel (CRS)
- Electrogalvanized (EG) Steel
- Hot Dip Galvanized (HDG) Steel
- Galvannealed (Zinc-Iron (Zn-Fe) Alloy)
- Aluminum (Al)

Note: Other metal substrates may be requested and included for Generic Approval and Plant Specific Testing.

Table 1: Test Panel Substrates

Type	Specification
CRS	GMW2-M-STS
EG	GMW11-M-STS
HDG	GMW8-M-STS
ZnFe	GMW8-M-STS
Al	GMW15192 (X611 or AA6016)

3.2.2 Additional Test Panel Substrate Requirements.

- **Thickness:** 0.75 mm to 0.90 mm.
- **Roughness:** A maximum profilometer roughness of 0.8 µm to 1.6 µm is allowed on the test substrates. Initial test panel roughness must be recorded prior to any coating applications. A 2.5 mm bandwidth cutoff is to be used.

3.2.3 Sample Size. For each test condition, three (3) samples are required unless a different quantity is determined by mutual agreement with the applicable GM Materials Engineer. All substrates, pretreatments and coating layers shall be fully identified with source, product code, batch number, bake description and film build.

3.2.4 Aging. When testing over fully layered panels, the samples shall be subject to an aging period of at least 72 h at room temperature following the final layer bake cycle.

3.2.5 Paint System to be Applied. The decision regarding the required paint system to be applied to the test panels (Electrophoretic Priming Operation (ELPO), primer, and topcoat) shall be agreed upon by the responsible engineer and supplier prior to initial testing. All test panels have to be prepared with an approved non-chrome passivation material. The applicable GM Materials Engineer and supplier shall agree upon the selection of the passivation material.

3.3 Test Panel Conditions. Test methods and performance requirements are shown in Table A1, Appendix A.

3.3.1 Accelerated Corrosion Testing. GM laboratory cosmetic corrosion testing is required. All test cycles must achieve the equivalent of five (5) years cosmetic corrosion exposure minimum. Creep is to be evaluated using GMW15282 (maximum peak to maximum peak). Lab testing is per GMW14872.

3.3.2 Outdoor Exposure Testing. Prior to outdoor exposure testing, initial tape adhesion per GMW14829 must be performed. Outdoor exposure testing is to be performed per GMW14873. Results are to be evaluated after six (6) months (visual only) and one (1) year of exposure. Creepback shall be measured per GMW15282. Record in total millimeters of creep.

After exposure, panels shall undergo deionized water immersion per GMW14704.

The applicable GM Materials Engineer and supplier must agree upon the specific details of this requirement prior to the initiation of testing.

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3.3.3 Road Test Options. Testing can be performed on test panels that are attached to the exterior of a vehicle on a Proving Ground road test schedule or on a full vehicle processed with the phosphate materials being qualified. The decision regarding panel testing or full vehicle testing shall be agreed upon by the GM Engineer and supplier prior to initial testing. A GMW8738 five (5) year road schedule is to be used for this option.

3.4 Physical Requirements.

3.4.1 Appearance. Upon visual inspection (without magnification), the phosphate coating on samples shall be smooth and uniform prior to the application of subsequent paint layers.

3.4.2 Phosphate Crystal Size. The phosphate crystal morphology shall exhibit a maximum, predominant crystal size of 25 µm. Voids or streaking are not permitted. However, primary body and body metal components are to target crystal sizes in the range of 2 µm to 10 µm.

3.4.3 Phosphate Coating Weight. Phosphate coating weight is to be determined using ISO 3892 and ISO 9717. These coating weight requirements are substrate dependent and must comply with the limits shown in Table 2.

Note: Phosphate coatings nucleated by zinc based, and other Rapid Nucleating Conditioner (RNC) materials, will conform to the coating specifications shown under columns identified as RNC in Table 2. Phosphate crystal size range for RNC will be 1 µm to 10 µm.

Table 2: Coating Weight Requirements

Substrate	Coating (g/m^2)	Coating (mg/ft^2)	RNC (g/m^2)	RNC (mg/ft^2)
Cold Rolled Steel	1.5 to 5.0	140 to 460	1.3 to 4.0	120 to 370
Electrogalvanized	1.5 to 5.0	140 to 460	1.4 to 4.0	130 to 370
Zinc-Nickel	1.5 to 5.0	140 to 460	1.4 to 4.0	130 to 370
Hot Dip Galvanized	1.5 to 5.0	140 to 460	1.4 to 4.0	130 to 370
Galvannealed	1.5 to 5.0	140 to 460	1.4 to 4.0	130 to 370
Aluminum	1.5 to 5.0	140 to 460	1.4 to 4.0	130 to 370

4 Manufacturing Process

4.1 Storage Requirements. The materials approved to this specification must be stable for 360 days at +5 °C to +35 °C as defined by the ability to pass all test requirements (per Table A1, Appendix A) after 360 days storage (potential at the application facility or assembly plant). If there is any disagreement with these requirements, the supplier must contact the GM Engineer.

4.2 Mini-submissions. Some approvals will require mini-submissions when only minor changes are made to previously approved phosphate materials. Tests may be added or deleted according to the type and amount of material modifications. These requirements shall be determined prior to testing by agreement between the GM Engineer and supplier (see Table A2, Appendix A, for minimum general requirements).

5 Rules and Regulations

5.1 Legal Regulations. All materials must satisfy applicable laws, rules, regulations and recommendations valid in the country of usage.

5.2 Language. In the event of conflict between the English and domestic language, the English language shall take precedence.

5.3 Inspection and Rejection. Samples of components or materials released to a GM material specification shall be tested for conformity with the requirements of this material specification and approved by the responsible Engineering department prior to commencement of delivery of bulk supplies.

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