



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 Appendix A, Table A1. 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.

1.4 Remarks. Not applicable.

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.

GMW2

GMW3059

GMW14704

GMW15192

GMW8

GMW8738 (ID)

GMW14829

GMW15282

GMW11

GMW14270

GMW14872

GMW15287

GMW3005

GMW14700

GMW14873

GMW15531

(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)

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 GMW17045.

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-STC
EG	GMW11-M-STC
HDG	GMW8-M-STC
ZnFe	GMW8-M-STC
Al	GMW15192 (X611 or AA6016)

3.2.2 Additional Test Panel Substrate Requirements.

- **Thickness:** 0.60 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 Appendix A, Table A1.

3.3.1 Accelerated Corrosion Testing. GM laboratory cosmetic corrosion testing is required. All test cycles must achieve the equivalent of 5 years cosmetic corrosion exposure minimum. Creep is to be evaluated using GMW15282, measure average creep and maximum peak to maximum peak. Laboratory testing to be performed per GMW14872. For Aluminum substrate, report average creep and maximum peak. Laboratory testing to be performed per GMW15287.

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 6 months (visual only) and 1 year of exposure. Creepback shall be measured per GMW15282. Record in total millimeters (mm) 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.

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. The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.

3.3.4 Full Durability Vehicle. Road testing can be performed at any global GM Corrosion Engineering proving ground approved to run GMW15531. A 5 year minimum equivalent road schedule per GMW8738 is to be performed when required.

Note: If a maximum peak to maximum peak scribe on the Durability Vehicle is outside of the maximum creep requirement, additionally measure the Average Creep using the definition noted in 3.3.1 Accelerated Corrosion Testing above or final compliance consideration.

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	1.0 to 4.0	120 to 370
Hot Dip Galvaneal	1.5 to 5.0	140 to 460	1.8 to 4.0	170 to 400
Galvannealed	1.5 to 5.0	140 to 460	1.4 to 4.0	90 to 370
Electrogalvanized	1.5 to 5.0	140 to 460	1.0 to 4.0	90 to 370
Hot Dip Galvanized	1.5 to 5.0	140 to 460	1.4 to 4.0	90 to 370
Zinc-Nickel	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	1.0 to 2.7	90 to 250

3.5 All materials supplied to this standard must comply with GMW3059, **Restricted and Reportable Substances**, including the requirement to obtain a GM-approved International Material Data System (IMDS) submission.

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 Appendix A, Table A1) 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