



Painted Brake Calipers – Paint Performance Requirements

1 Scope

1.1 Material Description. This standard defines the tests and requirements on painted areas of brake calipers. Possible variants are:

- Cast aluminum, painted.
- Cast iron, zinc nickel plated and painted.
- Cast iron, painted with subsequently reprocessed (machined surface) and zinc coated.

1.2 Symbols. Not applicable.

1.3 Applicability. Painted brake calipers and brackets.

1.4 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

AIAG CQI-11	ISO 2808	ISO 4892-2	SAE J2527
AIAG CQI-12	ISO 4892-1	ISO 17025	SAE J2635

2.2 GM Standards/Specifications.

GMW3059	GMW14334	GMW14829	GMW15357
GMW4700	GMW14665	GMW14872	GMW15891
GMW14270	GMW14698	GMW15282	GMW16745
GMW14333	GMW14729	GMW15287	

2.3 Additional References. Not applicable.

3 Requirements

3.1 Requirements on Test Specimens.

3.1.1 Painted brake calipers shall be tested in the as received condition using production processes and approved materials. If the part design does not provide enough test surface, adequate test panels are allowed. Test panels to be approved by GM Materials Engineering.

3.1.2 Testing facilities shall be qualified per ISO 17025.

3.1.3 Safety. This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

3.2 Performance Requirements.

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

3.2.2 Zinc Nickel Plating Requirements. Zinc Nickel alloy electroplating is required for cast iron calipers prior to painting. Zinc Nickel alloy plating shall be specified as GMW4700 ZnNi type B. The plating sealers or surface treatments are normally modified to be paint compatible.

3.2.3 Anodize Requirements. Aluminum castings shall be anodized per GMW14665 FETu, (see 7.1) prior to paint.

3.2.4 Organic Coating Requirements.

3.2.4.1 Visual. The paint finish shall be free of blisters, drip marks or other surface irregularities.

3.2.4.2 Coating Thickness. The coating thickness is measured with a suitable coating thickness measuring device (e.g., the eddy current principle or ferromagnetic) to an accuracy of $\pm 2 \mu\text{m}$.

3.2.4.2.1 The coating thickness shall be 70 μm minimum in the decorative area and 40 μm minimum in all other areas except for machined surfaces. Machined surfaces shall be free of organic coating. The decorative areas of the caliper shall be identified on the engineering drawing.

3.2.4.2.2 Coating thicknesses (dry film builds) are to be measured per ISO 2808. Individual paint layers are to be measured and reported independently. Referee method is cross sectioning and measuring metallographically.

3.2.4.3 Cure Test. Test per GMW15891 with an appropriate solvent specified by the paint manufacturer. If no solvent is identified then Methyl Ethyl Ketone shall be used.

Samples shall show no more than slight, barely observable change to the paint surface (Rating of 0 or Rating 1).

3.2.4.4 Organic Coating Performance Requirements.

3.2.4.4.1 Scratch Resistance. Per GMW14698; Tip 2, 4 N minimum.

Requirement: No visible penetration in the as received condition and after brake fluid test.

3.2.4.4.2 Cross Hatch Test. Per GMW14829, Method A; Rating 0 or Rating 1, in delivery conditions, after temperature resistance test and humidity testing.

3.2.4.4.3 Humidity Environmental Test. Expose painted parts per GMW14729. There shall be no evidence of blistering or other appearance changes at end of humidity exposure after 240 h.

3.2.4.4.4 Temperature Resistance. The test parts are stored for 1 h $\pm$ 5 minutes at 200 °C $\pm$ 5 °C.

Requirement: No fundamental change in color and loss of adhesion in Cross Hatch Test.

3.2.5 Corrosion.

3.2.5.1 For Cast Iron: Cyclic Corrosion Test. After exposure to cyclic corrosion testing per GMW14872, EXT, All, 4s, Method 1/2, the parts shall have a corrosion Rating of 10 per GMW15357 after six (6) test cycles (only zinc coated areas are excluded from the assessment after six (6) cycles). Minimum Rating of 7 per GMW15357 after Exposure C. Scribe creepback on painted surfaces per GMW15282 after test end for information only.

3.2.5.2 For Cast Aluminum: Filiform Resistance. Painted part must meet a filiform resistance requirement of 4 mm maximum length of any filament from the scribe line, when tested per GMW15287, for a period of 672 h in humidity. Furthermore, there shall be no filament growth on the non-scribed test surfaces at the end of the test, because this is an indication of insufficient coating coverage at that site. (Excluding sample prepared cut edges) SAE J2635 is an alternate procedure that could be used to meet this requirement, if agreed upon by GM Materials Engineering.

3.2.6. Resistance to Fuel. All paint products must have acceptable fuel resistance per GMW14333, Rating 2.

3.2.7 Resistance to Brake Fluid. Suitable test samples are fully immersed in brake fluid and stored for 10 minutes $\pm$ 1 minutes at 80 °C $\pm$ 5 °C. Subsequently remove the brake fluid residues with a suitable cloth and evaluate according to requirement.

Requirement: No etching or flaking off the paint finish, and scratch resistance per GMW14698. No fundamental change in color.

3.2.8 Resistance to Cleaning Agents. Resistance to wheel cleaners per GMW14334, Rating 2.

3.2.9 Resistance to Water Jet Test. Test per GMW16745, Method B. Maximum paint removal of 60 mm².

3.2.10 Weatherometer Resistance. Per SAE J2527 or ISO 4892-1, ISO 4892-2.

3.2.10.1 International Organization for Standardization Procedure. Test as per the conditions of ISO 4892-1 and ISO 4892-2.

- Inner and outer filter: Borosilicate
- Radiant exposure: 0.50 W/m² at 340 nm
- Test Program Cam Number seven (7)
- 102 minutes ± 0.5 minutes light only
- 18 minutes ± 0.5 minutes light and spray
- Black-standard temperature: 80 °C ± 3 °C
- Exposure Radiant Energy: ≥ 1500 kJ/m²

Requirement: Allowable gloss loss must be largely removed by polishing. The surface shall show no cracks, no pores or other damages.

3.2.10.2 SAE International Procedure. Test as per the conditions of SAE J2527, Method A with extended filters.

- Exposure Radiant Energy: ≥ 1250 kJ/m²

Requirement: Allowable gloss loss must be largely removed by polishing. The surface shall show no cracks, no pores or other damages.

3.3 Restricted and Reportable Substances. 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

Coatings shall be free of Chromium VI. Chromium VI is not permitted as an adhesion promoter.

4.1 General Processing for Cast Iron Calipers. The following is a description of a typical process for cast iron calipers. The process is not intended to be all inclusive and is for illustration only. The cast iron is descaled, caustic cleaned, Zinc Nickel plated, pretreated by zinc phosphate, primer coated (typical wet apply or ecoat), top coated (color coat) and clear coated.

4.2 General Processing for Cast Aluminum Calipers. The following is a description of a typical process for cast aluminum calipers. The process is not intended to be all inclusive and is for illustration only. Cast A356-T6 calipers are descaled, cleaned, anodized, primer coated, top coated (color coat) and clear coated.

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.

A new approval must be received for any changes, e.g., properties, manufacturing process, location of manufacture, etc. If not otherwise agreed, all testing and documentation normally required for initial release must be completed.

It is the responsibility of the supplier to inform the customer in a timely manner, without solicitation, and to include documentation of all modifications of materials and/or processes and to apply for a new release.