



## Corrosion Protective Coatings - Fluorocarbon Type

### 1 Scope

**1.1 Material Description.** This specification covers the basic requirements for fluorocarbon post treatments. It is supplied in black color unless otherwise specified. The coating system is free of hexavalent chromate, with no hexavalent chromate in the final product per GMW3059 requirements, GMW3034 will be used as a referee test. The coating can be applied over any combination of zinc phosphate, zinc plate, iron phosphate, or grit blast pretreatments. Substrate pretreatment requirements, where they exist, are to be shown separately on drawings or applicable documents.

**1.2 Symbols.** Not applicable.

**1.3 Applicability.** This coating is suitable for simple formed metal parts, castings, clips, and other ferrous parts which are not adversely affected by baking temperatures in the range of 150 °C to 190 °C. These coatings may also be used to reduce friction and wear on material surfaces or as an anti-scurf type finish. This specification covers three (3) thicknesses of coatings (8 µm, 13 µm and 18 µm). The thickness is specified on the part drawing by a suffix code as listed in Table 1, and Section 8 of this document. This coating is not recommended for use on threaded fasteners. Consult GM Fastening Engineering for suitable alternatives.

### 2 References

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

#### 2.1 External Standards/Specifications.

|             |            |             |             |
|-------------|------------|-------------|-------------|
| AIAG CQI-12 | ASTM F1470 | SAE/USCAR-5 | SAE/USCAR-7 |
| ASTM D2714  | SAE J2527  |             |             |

#### 2.2 GM Standards/Specifications.

|         |         |          |          |
|---------|---------|----------|----------|
| 9985670 | GMW3059 | GMW14729 | GMW14829 |
| GMW3034 | GMW3286 |          |          |

### 3 Requirements

**3.1 Appearance.** The coating shall have a uniform black appearance and shall be free from tears, sags, streaks, and excess coating that affect appearance and performance. The coating shall dry to the touch and shall not discolor or affect painted surfaces. During normal handling practice, parts shall not leave particulate residue on equipment, hands, or gloves.

**3.2 Thickness.** Unless otherwise specified, the coating thickness shall be according to Table 1.

**3.3 Corrosion Resistance.** Parts coated to this specification shall be capable of withstanding neutral salt spray (NSS) testing per GMW3286 for the minimum hours specified. After testing, there shall be no red rust on significant surfaces.

**3.3.1** For normal production process, NSS test shall be part of applicator's statistical process control to ensure that the parts meet the corrosion resistance requirements. Consult AIAG CQI-12 for guidelines on periodic NSS testing.

**3.3.2** Parts must be NSS tested per GMW3286 to meet the corrosion resistance requirements on significant surfaces per 3.3 for initial approval of the finish, applicators and Production Part Approval Process (PPAP) submissions. NSS test need not be completed prior to shipment of parts.

**3.3.3** Significant surfaces on parts shall be all surfaces. Deep recesses, such as blind holes and the interior of tubes are excluded unless otherwise specified on the drawing.

**3.4 Flexibility and Chip Resistance.** The coating must withstand the normal extensions, flexing and compressions encountered by springs and spring clips during end product assembly, without evidence of flaking or loss of adhesion from the base metal. It shall withstand normal handling and storage conditions without chipping or flaking or other coating damage. Coating shall not lose flexibility or any other properties after a shelf life of one (1) year.

**3.5 Adhesion.** Parts coated to this specification shall show no evidence of blistering or other appearance changes, other than a whitish blush, after exposure to humidity testing per GMW14729 for 96 h, minimum. When tape tested per GMW14829, Method B, 10 minutes after removal from humidity, there shall be minimum 99.0% of coating retention. This test is applicable for initial approval and PPAP submission parts and yearly thereafter. A sample size of minimum three (3) shall be used for this test.

**3.6 Hydrogen Embrittlement.** All parts heat treated or highly cold worked to the specified core or surface hardness greater than Rockwell Scale C Hardness (HRC) 32, which are processed through hydrogen generating process, shall be processed per SAE/USCAR-5 and tested for de-embrittlement per SAE/USCAR-7 before fluorocarbon coating. The maximum material hardness in the drawing or relevant specification shall be used to determine if de-embrittlement baking is required. If a part is heavily cold worked or heat treated to high strength/hardness but is without a maximum hardness limit stated in the drawing or specification, the applicator shall obtain the hardness data from the customer in order to determine if de-embrittlement baking is required. The sample size for the SAE/USCAR-7 test shall be per ASTM F1470.

**3.7 Solvent Resistance.** Coated parts shall show no evidence of coating softening or other failure when rubbed 10 times with a swab saturated with a suitable solvent as suggested by the chemical supplier. Coated parts shall show no evidence of coating softening or other failure after 72 h immersion in a room temperature solution of 50% windshield washer solution (9985670) and tap water. Nor shall there be any visual deleterious effects after a 4 h drying period. Failure to meet this test shall be cause for immediate rejection.

**3.8 Presence of Cured Coating.** When the coating is thoroughly cured, there shall be no discoloration when 1 to 4 drops of 6% anhydrous copper sulfate and 16% sulfuric acid by weight are placed on the surface of a coated part for 60 s. If no coating is present, the droplets become black in 5 s. This test is only applicable to parts with zinc substrate. The presence of fluorocarbon in the coating may be determined by Infrared (IR) Spectroscopy for referee purposes.

**3.9 Weatherability.** For qualification of new materials, parts coated with colored fluorocarbon coating, other than black or gray, shall be exposed to 2500 kJ/m<sup>2</sup> in Xenon arc weatherometer per SAE J2527 with no color degradation. Colorfastness may be confirmed through visual examination of the tested parts or through an exposure report detailing the color change in the tested material in CIELAB color difference units as per SAE J2527.

**3.10 Coefficient of Friction and Wear Tests.** For qualification of new materials, coefficient of friction and wear tests shall be performed. Tests shall be conducted on specimens per test method ASTM D2714 modified for use with dry film lubricants. The test shall be run at ambient temperatures, utilizing coated test rings and omitting the oil, until coating wear is indicated by the coefficient rising to 0.30. Coefficient of friction, 0.15 maximum (ASTM D2714 4500 cycles, steel test specimens). Wear cycles 100 000 minimum (steel test specimens).

## 4 Manufacturing Process

Not applicable.

## 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.