



## **Polyoxymethylene Copolymer - Carbon Filled, Electrostatically Dissipative, Gasoline Compatible**

### **1 Scope**

**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 specification covers the properties of a carbon powder and/or fiber filled, pellet formed, injection moldable, polyoxymethylene (acetal) copolymer. The different types are categorized by their level and type of carbon filler:

- **C1:** 4% to 7% Carbon powder
- **C2:** 7% to 10% Carbon powder
- **C3:** 10% to 15% Carbon powder + Carbon fiber blend
- **C4:** 10% to 15% Carbon fiber

**1.2 Symbols.** The material abbreviation according to ISO 11469 is:

- **C1:** >POM-CD5<
- **C2:** >POM-CD8<
- **C3:** >POM-(CD+CF)12<
- **C4:** >POM-CF12<

**1.3 Applicability.** Typical applications include fuel system components requiring electrostatically dissipative properties such as:

- **C2:** Inlet control valves and fuel pump module components.
- **C3:** Inlet control valves and filter components.

### **2 References**

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

#### **2.1 External Standards/Specifications.**

|               |             |              |             |
|---------------|-------------|--------------|-------------|
| ASTM D1603    | ISO 179/1eA | ISO 1183-1/2 | ISO 11469   |
| ASTM E1131    | ISO 188     | ISO 1817     | ISO 29988-2 |
| IEC 62631-3-1 | ISO 294-1   | ISO 3146     | SAE J1645   |
| ISO 75-1/2    | ISO 527-1/2 | ISO 11357-3  | SAE J1681   |

#### **2.2 GM Standards/Specifications.**

|         |         |         |          |
|---------|---------|---------|----------|
| GMW3013 | GMW3059 | GMW3221 | GMW14270 |
|---------|---------|---------|----------|

#### **2.3 Additional References.**

##### **2.3.1 Fuel (Fuel Specification).**

- CE10 Gasoline – Fuel C with 10% bioethanol content (GMPT-6-025)
- CM15A Gasoline – Fuel C with 15% methanol content, aggressive (GMPT-4-15)

**Note:** The fuels are available from Gage Products at <http://www.gageproducts.com/index.html> or Haltermann Solutions at <https://www.haltermannsolutions.com/test-reference-fuels/>. Fuel Specifications are limited to internal distribution within General Motors. Contact the GM Lead Engineer for further instructions.

### 3 Requirements

#### 3.1 Requirements on Test Specimens. Reference GMW3221.

Unless otherwise specified, injection molding of test specimens shall be accomplished per ISO 294-1 with the conditions for injection molding from ISO 29988-2. Unless otherwise specified, test methods and specimen dimensions are to be in accordance with GMW3013.

All tests shall be performed on unannealed specimens immediately following a conditioning period of 24 h minimum in a controlled atmosphere per GMW3221, Code A, unless otherwise specified. In addition, tests specified at temperatures below or above 23 ( $\pm 2$ ) °C, shall be conducted at the specified temperature using specimens conditioned at the specified temperature for 4 h minimum.

**3.2 Requirements on Delivery.** Important physical, mechanical and thermal properties that characterize the material, are summarized in Table 1. The color shall be specified on drawings, in material specifications, and otherwise.

**3.3 Compound Properties (Black).** See Table 1. The following are also required for full standard approval. The minimum number of lots per test required is one unless otherwise specified. See the Acetal tab on the Plastics Submission Template and GMW3013 for test details and parameters.

- Poisson's Ratio.
- Stress/strain data points and curves at the following temperatures:  
-30 °C, +23 °C, +85 °C, and after 1000 h fuel soak.  
**Note:** See GMMPD tab on Plastics Submission Template (located in GM SupplyPower) for test details.
- Coefficient of Linear Thermal Expansion (CLTE) data – In direction of flow and cross flow.  
**Note:** See GMMPD tab on Plastics Submission Template (located in GM SupplyPower) for test details.
- Differential Scanning Calorimetry (DSC) curve.
- Fourier Transform Infrared (FTIR) spectroscopy curve.
- Mold shrinkage.
- Melt Flow Rate.

**3.4 Swell After Fuel Soak.** On a standard tensile bar, measure the length, width, and thickness, prior to start of test. Measure length, width, and thickness again after 1000 h fuel soak. Calculate percent change in each direction:

$$\frac{d_2 - d_1}{d_1}$$

**Where:**

**d<sub>1</sub>:** Is the original measurement, and

**d<sub>2</sub>:** Is the measurement after fuel soak.

**3.5 Performance Requirements.** Performance requirements shall be specified on part drawings or in component specifications.

**3.6 Initial Source Approval.** No shipments shall be made by any supplier until representative initial production samples have been approved by the appropriate Materials Engineering department(s) as meeting the requirements of this specification.

**3.7** 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.

Table 1: Compound Properties (Black)

| Mechanical Properties                                    | Standard                                                                                                                 | Unit              | Type C1                    | Type C2                    | Type C3                    | Type C4                    |
|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| Density                                                  | ISO 1183-1/2                                                                                                             | g/cm <sup>3</sup> | 1.36 to 1.41               | 1.39 to 1.45               | 1.40 to 1.44               | 1.40 to 1.48               |
| Carbon Black                                             | ASTM D1603 or ASTM E1131 Thermogravimetric Analysis (TGA) - Filler amount and discern/state the ratio of powder to fiber | %                 | Target Range<br>4 to 7     | Target Range<br>7 to 10    | Target Range<br>10 to 15   | Target Range<br>10 to 15   |
| Tensile Modulus                                          | ISO 527-1/2                                                                                                              | MPa               | 1800 to 2600               | 2400 to 3500               | 6600 to 9500               | 2900 to 3600               |
| Tensile Strength at Yield                                | ISO 527-1/2                                                                                                              | MPa               | Report                     | Report                     | Report                     | Report                     |
| Elongation at Yield                                      | ISO 527-1/2                                                                                                              | %                 | Report                     | Report                     | Report                     | Report                     |
| Tensile Strength at Break                                | ISO 527-1/2                                                                                                              | MPa               | ≥ 44                       | ≥ 44                       | ≥ 70                       | ≥ 44                       |
| Charpy Notched Impact Strength at +23 °C                 | ISO 179-1/1eA                                                                                                            | kJ/m <sup>2</sup> | ≥ 3.5                      | ≥ 2                        | ≥ 3.5                      | ≥ 2                        |
| Charpy Notched Impact Strength at -30 °C                 | ISO 179-1/1eA                                                                                                            | kJ/m <sup>2</sup> | Report one (1) lot         | Report one (1) lot         | Report one (1) lot         | Report one (1) lot         |
| Melting Temperature                                      | ISO 3146 or ISO 11357-3                                                                                                  | °C                | Target Range<br>160 to 170 | Target Range<br>160 to 170 | Target Range<br>160 to 170 | Target Range<br>165 to 175 |
| Heat Deflection Temperature Under Load, (HDT/A); 1.8 MPa | ISO 75-1/2                                                                                                               | °C                | ≥ 78                       | ≥ 78                       | ≥ 145                      | ≥ 78                       |
| Volume Resistivity                                       | IEC 62631-3-1, Optional SAE J1645; ≤ 100 V                                                                               | Ω m               | ≤ 1 × 10 <sup>4</sup>      | ≤ 1 × 10 <sup>4</sup>      | ≤ 1 × 10 <sup>4</sup>      | ≤ 1 × 10 <sup>4</sup>      |
| Tensile Strength at Yield after Heat Aging<br>Note 1     | ISO 527-1/2, Heat Age per ISO 188, 1000 h at +120 °C                                                                     | % Retention       | ≥ 75                       | ≥ 95                       | ≥ 90                       | ≥ 75                       |