



Polyoxymethylene Copolymer – Acid Resistant, Injection Moldable

1 Scope

1.1 Material Description. This specification covers the properties of a highly stabilized, acid resistant, injection moldable, polyoxymethylene (acetal) copolymer. Acceptable fuels are gasoline and alcohol contented gasoline, and biodiesel as defined in Table 1.

1.2 Symbols. The material abbreviation according to ISO 11469 is Polyoxymethylene (acetal) (POM).

1.3 Applicability. Typical applications include the following: fuel system components where increased resistance to acid exposure is necessary. Use in gasoline and diesel fuel is acceptable per the temperatures referenced in Table 1.

1.4 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

ISO 75-1/2	ISO 527-1/2	ISO 3146	SAE J1681
ISO 179/1eA	ISO 1133	ISO 11357-3	
ISO 188	ISO 1183 Method A	ISO 11469	
ISO 294-1	ISO 1817	ISO 29988-2	

2.2 GM Standards/Specifications.

GMW3013	GMW3059	GMW3221	GMW14270
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2.3 Additional References.

None.

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 under or over $+23 \pm 2$ °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: Poisson's Ratio, Coefficient of Linear Thermal Expansion (CLTE), Mold Shrinkage, Electronic Stress/Strain Curves at -30 °C, +23 °C, +85 °C and after 1000 h fuel soak, Melt Flow Rate, Shear Modulus Curve, Differential Scanning Calorimetry (DSC) Curve, and Infrared Spectroscopy Curve. The minimum number of lots per test required is one (1). See GMW3013 for the test procedures.

3.4 Swell After Fuel Soak. On a standard ISO International tensile bar, measure 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:

d₁ = The original measurement

d₂ = The measurement after fuel soak

3.5 Acid Resistance Test under 1.5% Strain. Personnel performing testing should have documented training and skill sets as deemed appropriate by the user of this standard. All applicable safety laws, regulations, and personal protective equipment must be adhered to/utilized. The test facilities shall be in good working order and shall have a valid calibration level. As standard ISO International tensile bars shall be used for this analysis; the tensile bars shall be conditioned according to ISO 29988-2 for polyoxymethylene, prior to commencement of testing.

3.5.1 Procedure.

3.5.1.1 Control: Restrain five (5) control ISO International tensile test bars at 1.5%, while conditioning for 24 h at 60 °C. Individual strain gauges/restraint fixtures may be used, but fixtures that allow for three (3) bars to five (5) bars at once are preferred to reduce variation in stress. Next, remove bars from restraint fixture(s) and allow to relax for 24 h. Test tensile properties per ISO 527-1/2 to establish properties of bars that have been stressed, with no acid application.

3.5.1.2 Instructions.

- **Step A:** Restrain a minimum of 105 ISO International tensile test bars at 1.5%. Cover the gauge length (neck) of the tensile bar with cheesecloth. Spray 2 mL of Eagle One MAG Cleaner on cheesecloth to saturate. Let stand for 1 minute, then carefully remove cheese cloth.
- **Step B:** Place bars in oven at +60 °C for 23 h.
- **Step C:** Carefully remove bars, observe and record appearance.
- **Step D:** Cool for 1 h to room temperature +23 ± 2 °C. Remove three (3) bars, neutralize with water spray/rinse, allow to rest for 24 h; then test for tensile properties per ISO 527-1/2. ***This is considered completion of one (1) test cycle.***

Repeat Step A through Step D.

- Collect three (3) test bars every cycle thereafter, for tensile testing per ISO 527-1/2, except at cycle 5, cycle 10, cycle 15, and cycle 20, where five (5) bars will be tested.
- The test is concluded when failure is observed, record final cycle number. Failure of bars is deemed when complete break is observed.
- Record the appearance of the bars per test cycle, the number of cycles the bars survive, and the percentage of tensile retention as compared to the control, stressed bars per 3.5.1.1.

3.5.1.3 Interpretation of Results.

- Visual inspection of bars throughout test will indicate early signs of cracking, crazing, and discoloration of the POM due to acid attack. The level of property degradation is determined by the percent retention of the tensile properties in comparison to the control, stressed bars 3.5.1.1.
- Requirements listed in Table 1.

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

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.