



## **Polypropylene Homopolymer – Heat Stabilized, Coolant Resistant for Coolant Surge Tank**

### **1 Scope**

**1.1 Material Description.** This specification covers the properties of a coolant resistant heat stabilized polypropylene homopolymer.

**1.2 Symbols.** The material abbreviations according to ISO 11469 are shown in Table 1.

**1.3 Applicability.** Typical application for this material is coolant system surge tanks.

**1.4 Remarks.** The specification is classification according to following types: Coolant System surge tanks for normal, and turbo charged engines.

- **T1:** Normal coolant system surge tank serviceability  $\leq 120\text{ }^{\circ}\text{C}$ .
- **T2:** Improved coolant system surge tank serviceability  $\leq 120\text{ }^{\circ}\text{C}$ .
- **T3:** Glass filled (percent (%) by mass), homopolymer for high temperature demanding system with surge tank serviceability of  $\geq 120\text{ }^{\circ}\text{C}$ .

### **2 References**

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

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

|            |            |            |           |
|------------|------------|------------|-----------|
| ASTM D3012 | ISO 294    | ISO 1183   | ISO 11469 |
| ISO 75     | ISO 527-1  | ISO 1873-2 | SAE J1686 |
| ISO 179    | ISO 527-2  | ISO 3451-1 |           |
| ISO 188    | ISO 1133-2 | ISO 4577   |           |

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

|         |         |          |
|---------|---------|----------|
| GMW3013 | GMW3221 | GMW14270 |
| GMW3059 | GMW3420 |          |

### **3 Requirements**

**3.1 Requirements on Test Specimens.** 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.

Unless otherwise specified, injection molding of test specimens shall be accomplished per ISO 294 with the conditions for injection molding from ISO 1873-2.

All test specimens shall be brought to equilibrium in standard conditions for temperature, moisture and tested in that state as defined in GMW3221, Code A, unless the test method indicates that standard, conditioning is not required. Condition specimens for a minimum of 24 h prior to testing or until moisture equilibrium is reached. If specimens are tested outside the conditioned environment, they shall be tested within ten (10) minutes of removal.

The minimum values specified in the property tables must be met by test specimens in natural, black, or in a standard sampled color if natural or black are not available. For colored grades where other pigment and additive systems (e.g., stabilizer) are used, the impact values shall not decrease more than 10% from the specified minimum value.

**3.2 Compound Properties (Natural and Black),** Reference Table 1. The following are also required for full standard approval.

- The minimum number of lots per test required is one (1) in natural
- Poisson's Ratio
- Coefficient of Linear Expansion (CLTE)
- Mold Shrinkage, Stress/Strain Curve at multiple temperatures (e.g., -30 °C, +23 °C, +85 °C and after coolant exposure)

See GMW3013 for the test procedures and parameters.

**Table 1: Compound Properties (Natural and Black)**

| Mechanical Property                                 | Standard                                                                                                                                    | Unit                        | Types and Requirements                                            |                              |                              |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------------------------------------------|------------------------------|------------------------------|
|                                                     |                                                                                                                                             |                             | T1                                                                | T2                           | T3                           |
| ISO Symbol                                          | ISO 11469                                                                                                                                   | -                           | >PP<                                                              | >PP<                         | >PP-GF20<                    |
| Density                                             | ISO 1183, Method A                                                                                                                          | g/cm <sup>3</sup>           | Target Range<br>0.89 to 0.91                                      | Target Range<br>0.89 to 0.91 | Target Range<br>1.03 to 1.06 |
| Ash                                                 | ISO 3451-1 (650 °C)                                                                                                                         | % by mass                   | -                                                                 | -                            | 20                           |
| Melt Volume Rate                                    | 230 °C with 21.5 g weight per<br>ISO 1133-2, Procedure B                                                                                    | cm <sup>3</sup> /10 minutes | Target<br>0.4 to 2.0                                              | Target<br>0.2 to 1.5         | Target<br>1.5 to 3.5         |
| Tensile Strength at Yield                           | ISO 527-1, ISO 527-2,<br>Specimen A, 50 mm/minute                                                                                           | MPa                         | 28 to 34                                                          | 30 to 40                     | -                            |
| Tensile Strength at Break                           | ISO 527-1, ISO 527-2,<br>Specimen A, 5 mm/minute                                                                                            | MPa                         | -                                                                 | -                            | 70 to 85                     |
| Tensile Modulus                                     | ISO 527-1, ISO 527-2                                                                                                                        | MPa                         | ≥ 700                                                             | ≥ 900                        | ≥ 3500                       |
| Notched Charpy Impact at +23 °C                     | ISO 179/1eA                                                                                                                                 | kJ/m <sup>2</sup>           | ≥ 4                                                               | ≥ 6                          | ≥ 7                          |
| Notched Charpy Impact at -30 °C                     | ISO 179/1eA                                                                                                                                 | kJ/m <sup>2</sup>           | ≥ 1                                                               | ≥ 1                          | ≥ 2                          |
| Deflection Temperature Under Load, 0.45 MPa         | ISO 75 (reference SAE J1686),<br>flatwise                                                                                                   | °C                          | ≥ 90                                                              | ≥ 95                         | ≥ 135                        |
| Tensile Strength Retention after Heat Aging         | ISO 188, 1000 h at +100 °C                                                                                                                  | % retention                 | ≥ 80                                                              | ≥ 80                         | -                            |
|                                                     | ISO 188, 1000 h at +140 °C                                                                                                                  |                             | -                                                                 | -                            | ≥ 80                         |
| Thermal Oxidation Stability                         | ISO 4577, ASTM D3012 ,<br>504 h ± 3 h at +150 °C ± 3 °C in<br>an air circulating oven                                                       | Not applicable              | No visual indication of local discoloration and or<br>brittleness |                              |                              |
| Tensile Strength at Break after Exposure to Coolant | Test per 3.4 of this document,<br>ISO 527-1, ISO 527-2, Test<br>speed 50 mm/minute for unfilled<br>and 5 mm/minute for glass<br>reinforced. | % retention                 |                                                                   |                              |                              |
|                                                     | 504 h                                                                                                                                       |                             | ≥ 80                                                              | -                            | -                            |
|                                                     | 840 h                                                                                                                                       |                             | -                                                                 | ≥ 80                         | ≥ 80                         |