



Hydrolytic Resistance of Polyamide to Coolants

1 Introduction

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. This standard shall be used to determine the hydrolytic resistance of glass fiber reinforced Polyamide 66 to the influence of water/coolant mixtures at elevated temperatures.

1.2 Applicability. This standard is particularly suitable for assessing materials intended for use in the engine cooling circuit.

2 References

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

2.1 External Standards/Specifications.

ISO 179-1

ISO 527-1

ISO 527-2

2.2 GM Standards/Specifications.

GMW3420

GMW16270

3 Resources

3.1 Facilities. Materials test laboratory.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Autoclave. An autoclave with electronically-controlled electrical heating system or pressure vessels, preferably stainless steel, suitable for use in drying ovens. The dimensions and volume of the vessels shall be in accordance with the shape and number of the test pieces to be stored simultaneously in the test fluid.

3.2.2 Testing Machines. Testing machines which are equipped in such a manner as to determine the specified properties according to 4.3.4.

3.2.3 Test Fluid. Mixtures of radiator anti-freeze agents according to GMW3420 and distilled water shall be used. Unless agreed otherwise, the mixture ratio shall be 1:1 by volume. Concentrated anti-freeze agents must not be used. Any one of the approved products may be used as a test fluid. The test fluid shall not be changed during storage.

3.2.4 Desiccator.

3.2.5 Cotton Cloth.

3.3 Test Piece. Appropriate test bars injection molded from Polyamide 66 reinforced with glass fibers, with stable hydrolytic heat stabilizer according to e.g., GMW16270P PA66-GF30.

3.4 Test Time. See Table 1, Table 2 and Table 3.

3.5 Test Required Information. The testing of 1:1 water/antifreeze mixtures at temperatures $> +108^{\circ}\text{C}$ (boiling point of the mixture) shall be performed in an autoclave or pressure vessels under increased pressure. Loss of

pressure would lead to a severe delay in the mixtures reaching boiling point. The autoclave or pressure vessels shall be designed for the pressure loads and the relevant safety regulations observed. The autoclave or pressure vessels shall only be opened once cooled down and returned to room temperature.

3.6 Personnel/Skills. Trained Laboratory Test Engineer.

4 Procedure

4.1 Preparation. For initial sample approval and arbitration purposes, the minimum time period between manufacturing and testing shall be 7 days. For routine quality control purposes, the time period shall be minimum 72 h.

Before testing, the test pieces shall be stored at a temperature of $+23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for at least 8 h and shall be free from strain during this period.

4.2 Conditions.

4.2.1 Environmental Conditions. The tests shall be performed on dry as molded test specimens according to ISO 527-1 and ISO 527-2, where possible Type A.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions.

4.3.1 Preconditioning. The test according to the properties in 4.3.4.1 shall be performed without any further pre-treatment.

4.3.2 Storage. The test specimens shall be stored in the test medium in the autoclave for the test time and test temperature according to 4.3.4.2 and 4.3.4.3 respectively.

After test time the test specimens shall be cooled down in the test medium to $+23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

Then the test specimens shall be removed from the test medium, rinsed with water and wiped dry with a cotton cloth.

After cleaning the test specimen shall be stored in a desiccator.

4.3.3 Test after Storage. Within 7 days (maximum) after the storage in the autoclave (4.3.2) the properties according to 4.3.4.2 and 4.3.4.3 respectively shall be tested.

4.3.4 Determination of Properties.

Note: The properties are only applicable for test specimens (see 4.2.1), not for molded parts.

4.3.4.1 Determination of property values of the material in the as-received condition according to Table 1.

Table 1: Properties in the As-Received Condition, Dry As-Molded

Properties	Standard	Unit
Stress at Break	ISO 527-1	MPa
Strain at Break	ISO 527-1	%
Charpy Impact Strength at $+23\text{ }^{\circ}\text{C}$	ISO 179-1/1eU	kJ/m ²

4.3.4.2 Determination of property values after 504 h $+0\text{ h}/-2\text{ h}$ storage according to Table 2.

Table 2: Property Values after Storage, 504 h $+0\text{ h}/-2\text{ h}$ at $+130\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$

Properties	Standard	Unit
Stress at Break	ISO 527-1	MPa
Strain at Break	ISO 527-1	%
Charpy Impact Strength at $+23\text{ }^{\circ}\text{C}$	ISO 179-1/1eU	kJ/m ²