



Layer Adhesion Testing of Polymer Fuel Tanks

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. The purpose of this standard is to test the adhesion strength between the layers of a multilayer polymer fuel tank

1.2 Applicability. This standard applies to all multilayer, polymer fuel tanks.

1.3 Remarks. This is a component level test only. Nothing in this standard supersedes vehicle level requirements.

2 References

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

2.1 External Standards/Specifications.

ISO 527-1

ISO 527-2

2.2 GM Standards/Specifications.

GMW3059

GMW3086

2.3 Additional References. None.

3 Test Preparation and Evaluation

3.1 Resources.

3.1.1 Facilities. The test facilities must be accredited/certified to perform fuel tank testing.

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

3.1.1.2 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.

3.1.2 Equipment.

- Instron, or equivalent, Tensile Testing Equipment
- Fuel safe environmental chambers for soaking tanks
- Regulated fuel disposal facilities/capabilities
- Saws/equipment capable of cutting test specimens from fuel tank floor

3.1.2.1 Fuels. Certified test fuels can be purchased from Gage Products.

- CM15A: Gasoline – Fuel C with 15% methanol content, aggressive
- Isooctanes; 2,2,4-Trimethylpentane, also known as isooctane or iso-octane

3.1.3 Test Vehicle/Test Piece. Six (6), multilayer, polymer fuel tanks. Tanks must be from the same mold run.

- Two (2) tanks for dry peel and tensile evaluation
- Two (2) tanks for CM15A soak, peel, and tensile evaluation
- Two (2) tanks for Isooctane soak, peel, and tensile evaluation

3.1.4 Test Time.

Fuel Soak time:	20 weeks
Tank Dry time:	2 d minimum with no exhaust ventilation, or 12 h minimum with concentrated exhaust ventilation
Test time:	≤ 1 d

3.1.5 Test Required Information. The test shall be performed on **as-molded** production tanks with a minimum of 48 h aging at 23 °C ± 2 °C. Fuel soaked samples/results are to be compared to un-soaked samples/results.

3.1.6 Personnel/Skills. Personnel must be trained and certified to use required equipment and understand sensitivity of peel strength/layer adhesion testing.

3.2 Preparation. Tanks must be soaked prior to peel strength/layer adhesion testing. See 4.1.

3.3 Conditions.

3.3.1 Environmental Conditions. See 4.1.1 for tank soaking conditions.

3.3.2 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.

Note: Deviations shall have been agreed upon by both GM Engineering and GM Materials Engineering.

3.4 Instructions. See Section 4.

3.5 Data. Record number of samples tested, width and thickness of each sample, and individual peel strength values to review with GM Engineering.

3.6 Safety.

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

3.7 Documentation. Samples of components or material released to this standard shall be tested for conformity with the requirements of this standard and approved by the responsible GM Department prior to the start of delivery of production level components or materials.

Any change to the component or material, e.g., design, function, properties, manufacturing process and/or location of manufacture requires a new release of the product. It is the sole responsibility of the supplier to provide the customer, unsolicited, with documentation of any change or modification to the product/process, and to apply for a new release.

If not otherwise agreed to, the entire verification test shall be repeated and documented by the supplier prior to start of delivery of the modified or changed product. In some cases, a shorter test can be agreed to between the responsible GM department and the supplier.

3.7.1 Test Results. Reference GMW3086 for interpretation of results. Supply photos of completed test specimens.

4 Requirements and Procedure

4.1 Soak Procedure. As detailed in 3.1.3, prepare the first set of two (2) tanks for dry peel testing. Prepare the next set of two (2) tanks by filling to 40% of volume capacity with CM15A and fill the remaining two (2) tanks to 40% volume capacity with Isooctanes.

4.1.1 Test Position and Conditions. Tanks may be soaked at rest on the ground in chambers to maintain thermal requirements. Soak at 40 °C ± 3 °C for 20 weeks.

4.1.2 Dry Out Period. Soaked tanks must be emptied and allowed to dry in a properly vented chamber for a minimum of 2 d. If there is concentrated exhaust ventilation applied over tank opening in vacuum/fume hood, the tank may be considered dry after 12 h.