GM WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW3086

Plastic Fuel Tank

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.

This specification covers the material requirements for blow moldable plastic fuel tanks. Component testing and full vehicle system validation is still required.

1.1 Material Description.

1.1.1 Type 1. Coextruded Polyethylene based multilayer tank design for lower permeation.

1.1.2 Type 2. Monolayer Polyethylene based tank for general usage.

1.2 Symbols. Marking of plastic fuel tanks shall follow requirements in GMW14106 Specification for Integrated Fuel Tank Assembly.

1.3 Typical Applications. Fuel tanks used for fuel storage in the recommended temperature limits of 90 ℃ continuous and 110 ℃ excursion. The excursion limit is for localized external hot spots which may result from exhaust routing, failed exhaust testing, etc.

1.4 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

ECE R34.01, Annex 5
EEC 70/221
ISO 1817
SAE J1681

2.2 GM Standards/Specifications.

GMW16
GMW3059
GMW3221
GMW14106
GMW14800
GMW14846
GMW14847
GMW14848
GMW14849
GMW14850
GMW14853
GMW14860
GMW15449
GMW15450
GMW15800
GMW15801
GMW15802
GMW16787

2.3 Additional References.

TMC003 Material Safety Data Sheet guidance documents (available at www.gmsupplypower.com).

3 Requirements

3.1 Requirements on Test Specimens. Testing should be performed in a controlled atmosphere per GMW3221, Code A, when applicable.

3.2 Constructions. The type of construction shall be defined on the part drawing and the following. Tank manufacturers must use material sources listed in the GM Materials File (i.e., MATSPC) for the materials making up their construction.

3.2.1 Type 1. Six Layer Construction. Refer to Table 1 and Figure A1 for Typical Coextrusion Layer Structure.

Table 1: Typical Coextrusion Layer Structure

Layer	Material	Specification
1	Virgin HDPE	GMW16 Type 1
2	Adhesive - PE based	GMW15802
3	EVOH barrier	GMW15801
4	Adhesive - PE based	GMW15802
5	Regrind from process only	EVOH should be evenly distributed in regrind layer
6	Virgin HDPE with carbon black	GMW16 Type 1 GMW15800

EVOH = Ethylene Vinyl Alcohol
HDPE = High Density Polyethylene
PE = Polyethylene

3.2.1.1 Dispersion of Regrind Layer. Ethylene Vinyl Alcohol (EVOH) should be evenly distributed in the regrind layer to avoid delamination. Refer to Figure A2 and Figure A3 for examples of good and bad dispersions, respectively. Uniform distribution implies round particles and no evidence of elongated particles or platelets.

3.2.1.2 Pinch Area. The EVOH barrier layer should kiss (meet) below the pinch off area. A good pinch will provide higher impact strength. Refer to Figure A4 and Figure A5 for examples of bad and good pinch off, respectively.

3.2.2 Type 2: Monolayer Constructions. Monolayer tank wall will be made entirely of GMW16 Type 1 or Type 2.

3.2.2.1 Regrind. Any usage of regrind content shall be limited to the percentage that was validated and submitted for Production Parts Approval Process (PPAP). The type of regrind must be of the same material that was validated and submitted for PPAP. The regrind must be clean, dry, and free of contamination.

3.3 Material Performance. Test frequency and sample size shall be agreed upon by the supplier and the GM Product Engineer.

3.3.1 -40 °C Six Meter Drop Test (GMW14853) (Development and Quality Control). The drop test shall be conducted in accordance with GMW14853. Acceptance criteria shall be as defined on the engineering drawing. Testing to this section shall be done during development and a specified frequency shall be agreed upon within the control plan.

3.3.2 Pressure Burst Test (GMW15449). The tank shell must meet a minimum of 345 kPa without bursting, splitting or leaking.

3.3.3 Internal Stress Crack Resistance Test.

3.3.3.1 Type 1. The tank shall be run in accordance with GMW16787 using fluid A for a minimum of 120 hours. There shall be no bursting, leaking, or evidence of stress cracking.

3.3.3.2 Type 2. The tank shall be run in accordance with GMW16787 using fluid B for a minimum of 80 hours. There shall be no bursting, leaking, or evidence of stress cracking.

3.3.4 Wall Thickness.

3.3.4.1 The minimum wall thickness shall be 3.0 mm. If the minimum wall thickness occurs in an area of the weld:

a. Measures shall be taken to ensure the wall integrity post weld.
b. Studies shall be performed to ensure that during the weld process, the tank wall does not deflect resulting in weld quality concerns.

3.3.4.2 Flash shall not exceed 3.0 mm in height from the normal surface.

3.3.5 Barrier Thickness. (Type 1 Only). Barrier thickness testing applies to Type 1 only. Type 1 tanks must meet both the average and absolute minimum.

3.3.5.1 Average Minimum. The average minimum thickness of the barrier layer is 3% of the total wall thickness and shall be 90 µm. If an alternate barrier layer percentage is specified, then the average minimum thickness shall be calculated by the following formula:

Thickness = Barrier percent/100% × 3000 µm

Where: 3000 µm is the minimum wall thickness specified in 3.3.4.

Example:

For barrier layer intended to be 1.7% of wall:

- Thickness = 1.7%/100% × 3000 µm = 51 µm

3.3.5.2 Average Minimum Procedure. Cut a band section from the tank shell perpendicular to the parasin through the flattest location. The band should be a minimum of 25 mm wide. Divide the band into 25 mm+10 mm,-0 mm sections. Record the minimum thickness of the barrier layer through each divided section.

3.3.5.2.1 Absolute Minimum. The barrier layer shall be greater than 25 µm throughout the entire tank. GM Engineering shall determine the highest stretch areas of the tank and document them for ongoing quality control checks.

3.3.6 Peel Strength Test (Type 1 Tanks Only). Fill the tank to 40% of volume capacity with either CE10 per SAE J1681 or 10% Bioethanol in Gasoline according to ISO 1817 Liquid 1, and soak at 40 °C for 20 weeks. Upon completion of soak, take peel strength samples from body side of tank. The test method for peel strength requires a 127 × 12.7 mm sample. Peel the coupon back approximately 18 to 26 mm to make a T. Place the piece in tensile test equipment and pull at a rate of 50 mm/minute. Ninety percent (90%) retention of the original non-soaked value is required.

3.4 Part Performance. Non-material related part performance requirements shall be met as part of GMW14106. The part performance requirements include, but are not limited to:

- GMW14800 Fuel Tank Assembly: Cold Roll Test.
- GMW15450 Internal Cleanliness.

3.5 ECE/EEC Requirements. Tanks to be sold in Europe or regions that have adopted Economic Commission Europe/European Union (ECE/EEC) requirements in whole or part must meet the requirements as spelled out in ECE R34.01, Annex 5 and EEC 70/221. Further instructions can be found in GMW14106. The following lists GM procedures for assistance in meeting those requirements.

- GMW14846: Fuel Permeability
- GMW14847: Impact Resistance
- GMW14848: Mechanical Strength
- GMW14849: Fire Resistance
- GMW14850: Resistance to High Temperature
- GMW14853: -40 °C Meter Drop
- GMW14860: Fuel Tank Markings Export

3.6 List of Items Required on Engineering Assembly Drawings. Required notes on engineering drawing include, but are not limited to the following:

- Part weight.
- High stretch areas where thin walls could be encountered shall be identified on the drawing and absolute minimum barrier layer testing shall be performed in those areas.

4 Manufacturing Process

Not applicable.

5 Rules and Regulations

5.1 Legal Regulations. All materials must satisfy applicable laws, rules, regulations and recommendations valid in the country of usage.

5.2 Language. In the event of conflict between the English and domestic language, the English language shall take precedence.

5.3 Inspection and Rejection. Samples of components or materials released to a GM material specification shall be tested for conformity with the requirements of this material specification and approved by the responsible Engineering department prior to commencement of delivery of bulk supplies.

A new approval must be received for any changes, e.g., properties, manufacturing process, location of manufacture, etc. If not otherwise agreed, all testing and documentation normally required for initial release must be completed.

It is the responsibility of the supplier to inform the customer in a timely manner, without solicitation, and to include documentation of all modifications of materials and/or processes and to apply for a new release.

If not otherwise agreed, all release tests shall be repeated and documented by the supplier prior to commencement of delivery of non-conforming bulk supplies. In individual cases, a shorter test can be agreed to between the responsible Engineering department and the supplier.

5.4 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.

5.5 Material Safety Data Sheets/Safety Data Sheets (MSDS/SDS). For new product submissions, or when a change in chemical composition of an existing product has occurred, a complete copy of the Material Safety Data Sheet/Safety Data Sheet must be submitted in compliance with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) requirements or other country-specific MSDS/SDS requirements. In addition, product MSDS/SDS submissions must be in compliance with specific country General Motors TMC003 Material Safety Data Sheet/Safety Data Sheet guidance documents where available.

5.6 All materials supplied to this standard must comply with the requirements of GMW3059**, Restricted and Reportable Substances for Parts.**

6 Approved Sources

Not applicable

7 Notes

7.1 Glossary.

MATSPC: Global repository of GM approved materials for corresponding GM Engineering Standards.

7.2 Acronyms, Abbreviations, and Symbols.

ECE	Economic Commission Europe
EEC	European Union
EVOH	Ethylene Vinyl Alcohol
GHS	Globally Harmonized System of Classification and Labeling of Chemicals
HDPE	High Density Polyethylene
MSDS	Material Safety Data Sheet
PE	Polyethylene
PPAP	Production Parts Approval Process
SDS	Safety Data Sheet

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Material per GMW3086 Type X

Where: X is 1 for Multilayer and 2 for Monolayer.

Alternate barrier layer thickness applications for Type 1 only shall be specified as follows:

GMW3086 Type X (Barrier Y%)

Where: Y is the alternate barrier layer thickness.

9 Release and Revisions

This standard was originated in February 2000. It was first approved by the Global Plastics Team in October 2000. It was first published in December 2000.

Issue	Publication Date	Description (Organization)
1	DEC 2000	Initial publication.
2	SEP 2010	5 Year refresh of document - updated to current template. Added Alternate Type. (Plastics Subsystem Leadership Team)
3	MAY 2012	Updated Internal Stress Cracking Resistance Section. (Plastics Global Subsystem Leadership Team)

Cross Reference of Replaced Specifications

Standard No.	Replaced Specifications
GMW3086 Type 1	GM7473M (GMNA)
GMW3086 Type 2	GMI08010V (GME)

Appendix A

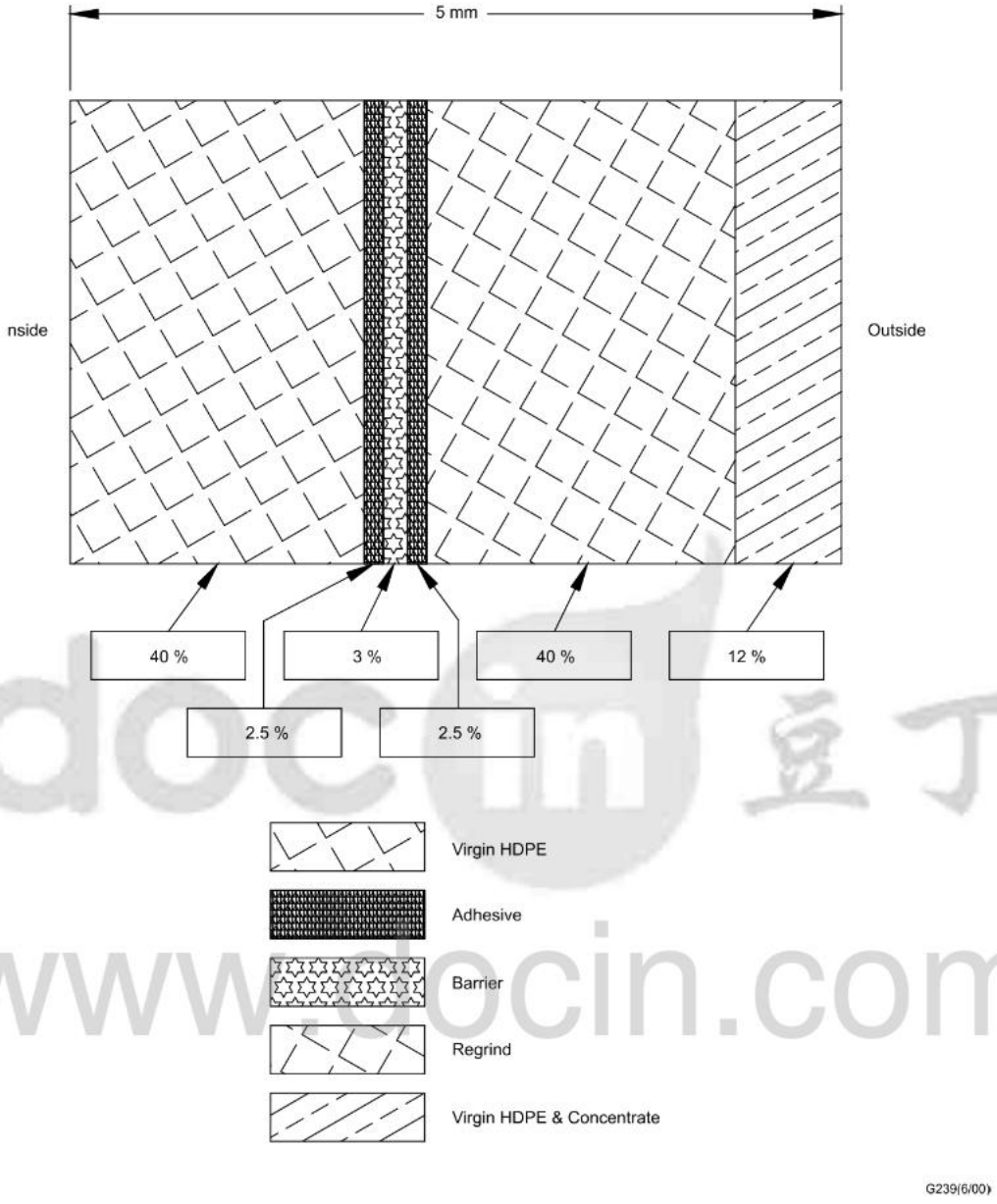

Figure A1: Typical Coextrusion Layer Structure

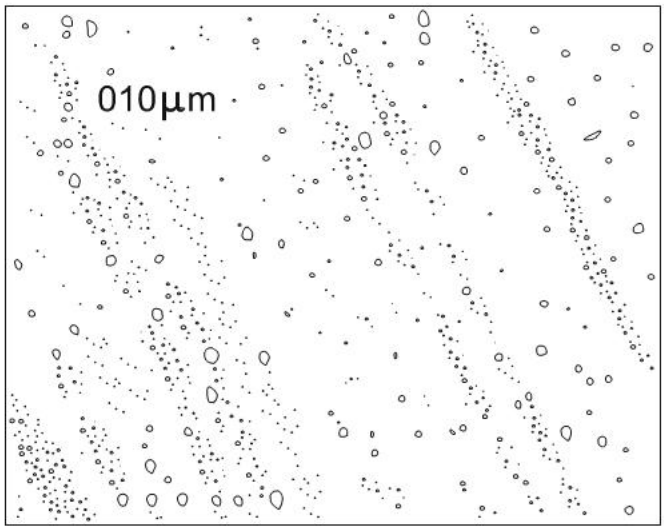

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Figure A2: Good Dispersion

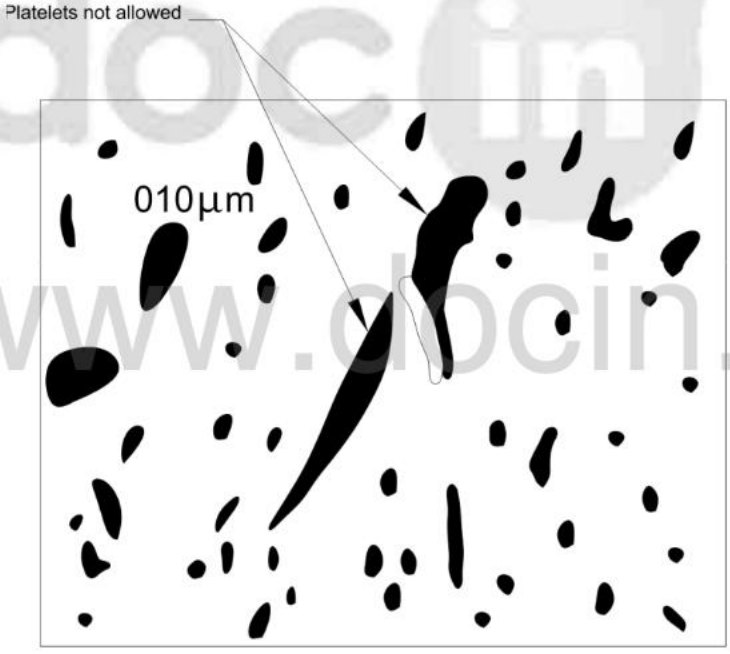

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Figure A3: Bad Dispersion

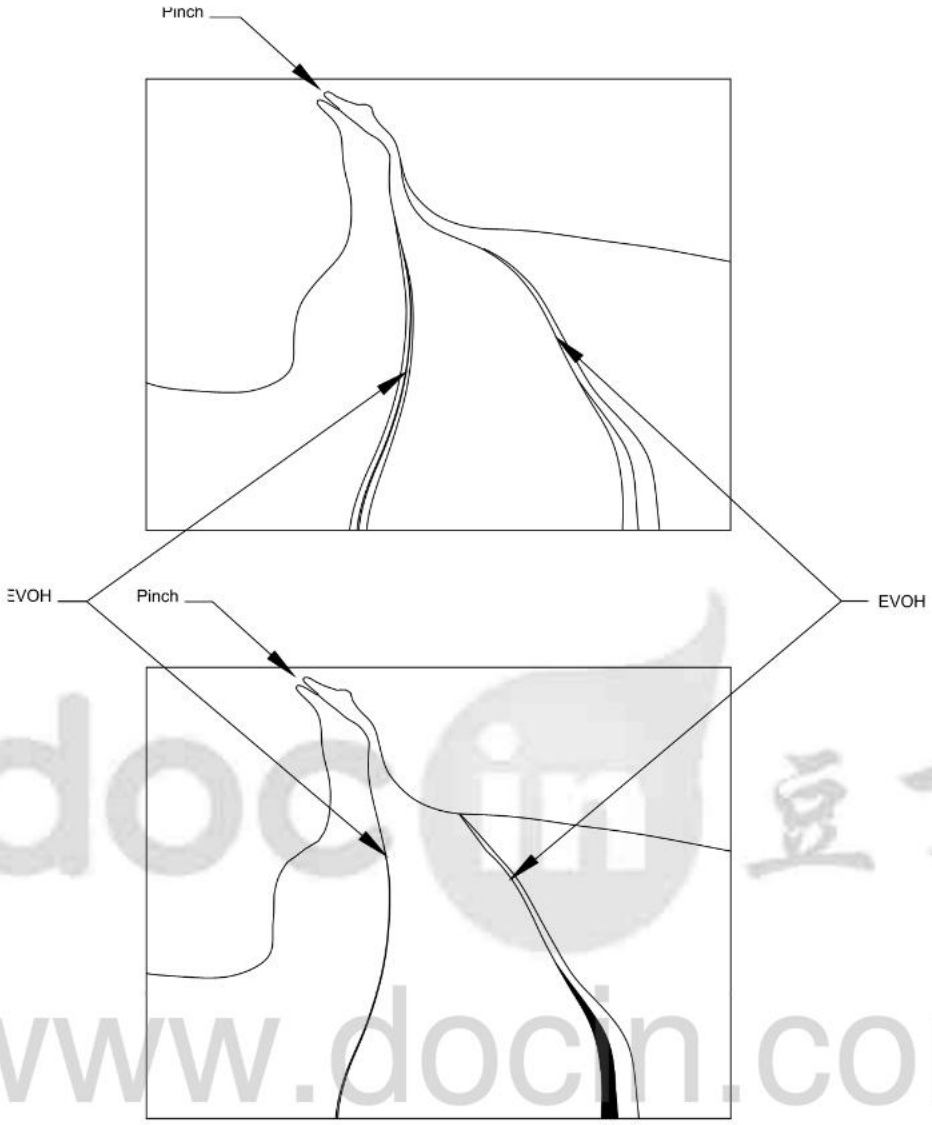

Figure A4: Bad Pinch Off

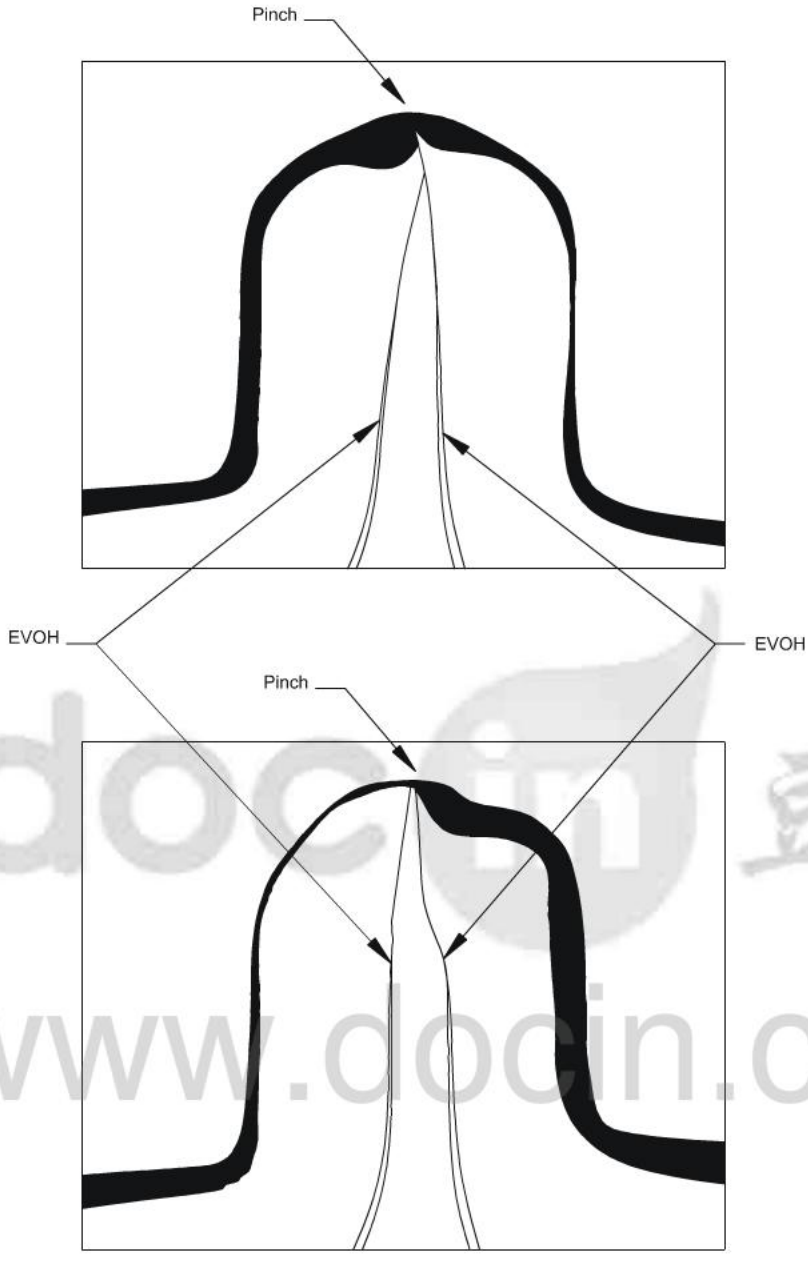

Figure A5: Good Pinch Off