



COMPOSITE, FUEL TANK HIGH DENSITY POLYETHYLENE (PE-HD), LINEAR LOW DENSITY POLYETHYLENE (PE-LLD) TIE LAYERS, ETHYLENE VINYL ALCOHOL (EVOH) BARRIER

WSL-M98D29-A

1. SCOPE

The material defined by this specification is a thermoplastic blow molded composite based on high molecular weight PE-HD, EVOH and PE-LLD tie layers (Figure 1).

This specification defines a composite material used in manufacturing of blow molded fuel tanks and similar articles. The composite consists of a coextruded and blow molded high density polyethylene, barrier layer of ethylene/vinyl alcohol and tie layers of linear low density polyethylene, and has excellent chemical resistance and low fuel permeation characteristics.

2. APPLICATION

This specification was released originally for materials used for composite fuel tanks which meet CARB/EPA Clean Air Act Requirements in Passenger Car and Truck Applications.

3. REQUIREMENTS

3.1 APPROVED SOURCES

This specification requires the use of approved sources. Only the sources identified on the Ford Approved Source List (ASL) can be used when this specification is listed on the drawing, CAD file, or other documents. The list of approved sources is located within Ford at www.mats.ford.com or available externally through a Ford Materials Engineer.

3.2 CONDITIONING AND TEST CONDITIONS

All test values are based on material conditioned for not less than 24 h prior to testing in a controlled environment of 23 +/- 2 °C and 50 +/- 5% relative humidity. Testing of the material should occur in the conditioning environment or soon after removal.

3.3 INFRARED SPECTROPHOTOMETRY AND/OR THERMAL ANALYSIS

IR spectra and thermograms from initial material approval shall constitute the reference standard and shall be kept on file at the designated material laboratory. The material supplier shall ensure that all future material supplied to the specification shall produce IR spectra and thermograms that correspond to the reference standard when tested under the same conditions

3.4 MOLDED TEST SPECIMEN

3.4.1 Preparation of Test Specimens

The following tests shall be performed on test specimens cut (in accordance with the ISO methods specified) from blow molded fuel tanks. Specimens are tested with the as-molded thickness of the fuel tank and are not machined to meet the thickness

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2017 04 19	Revisions	See Symmary of Revisions	A. Reaume, NA
2016 05 10	Editorial	See Summary of Revisions	A. Reaume, NA
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requirements of the Standard Test Methods except where necessary for fixturing. Greater variation in test values can be anticipated when evaluating materials that are thinner than recommended by an applicable Industry Standard/Test Method.

The following dimensions are required:

- A. 150 min x 20/10 +/- 0.2 mm (Tensile Bar, ISO 527)
- B. 80 x 10 +/- 0.2 mm (Flexure Bar, ISO 178)
- C. 60 x 10/3, r = 15 mm (Tensile Impact Bar, ISO 8256)

Refer to Table 1 for number of samples required for each test to establish specification compliance.

3.4.2 Density (ISO 1183, Method A) 0.940 - 0.960 g/cm³

3.4.3 Tensile Properties (ISO 527, 50 mm/minute test speed, 150 min x 20/10 +/- 0.2 mm specimen)

3.4.3.1 Tensile Strength at Yield (Test Method according to para 3.4.3) 20 MPa min

3.4.3.2 Elongation at Yield (Test Method according to para 3.4.3) 8% min

3.4.3.3 Elongation at Break of EVOH Layer (Test Method according to para 3.4.3, noting that EVOH layer typically fractures before PE layers) 25% min

3.4.3.4 Elongation at Break of PE-HD Layer (Test Method according to para 3.4.3, reflecting first fracture of one of the PE-HD layers) 40% min

Note: Yield is defined as the first point on the engineering stress-strain curve at which the stress does not increase with increasing strain.

Break of PE-HD layer (para 3.4.3.4) is the first fracture of the regrind or PE-HD layers.

3.4.4 Heat Deflection Temperature (ISO 75, 120 x 10 +/- 0.2 mm specimen, 0.32 +/- 0.01 mm deflection)

3.4.4.1 At 1.82 MPa 35 °C min

3.4.5 Heat Aging Performance (ISO 188, except 150 +/- 50 air changes/ h, 1000 h at 120 +/- 2 °C. Unaged property values shall be determined at the time of the aged properties determination)

3.4.5.1 Tensile Strength at Yield (Test Method per para 3.4.3.1) +/- 25% change



3.4.6 Adhesion Strength 3 N/mm min
(FLTM BO 101-06, T-Peel test, 127 x
12.7 mm specimen, 50 mm/min)

3.4.7 Resistance to Fuel
(ISO 1817, complete immersion in fuel C +
15% Methanol at 40 +/- 2 °C for 1000 h)

Testing is to be completed within 30 minutes after the coupons have been removed from the fuel. Coupons should be wrapped in aluminum foil as long as practical between removal and testing to minimize drying.

3.4.7.1 Tensile Strength at Yield 16 MPa min
(Test Method per para 3.4.3.1)

3.4.7.2 Elongation at Yield 10% min
(Test Method per para 3.3.3.2)

3.4.7.3 Adhesion Strength 2 N/mm min
(Test Method per para 3.4.6)

In addition, there shall be no evidence of delamination after fuel soak.

3.4.8 Fuel Swell
(ASTM D471, 75 x 25 mm specimen,
immersed in Fuel C +15% Methanol at
40 +/- 2 °C for 1000 h)

3.4.8.1 Linear Swell 8% max
(average of length, width and thickness % change)

3.4.8.2 Weight Gain 15% max

3.5 FLAMMABILITY

(ISO 3795, Sample size per ISO 3795)

Burn Rate 100 mm/minute max

3.6 ENVIRONMENTAL STRESS CRACKING RESISTANCE

(ASTM D1693, Sample Type A F50, 10% Igepal at 50 +/- 0.5 °C) Across Flow 1000 h min

Specimen dimensions to be as specified in the ASTM procedure. Tank coupons which are thicker than this specification are to be milled or ground down on the inner HDPE surface to the proper thickness. Notch is to be applied to the exterior HDPE surface (see Figure 1).

3.7 EVOH BARRIER LAYER, % of total composite 1 - 5% Thickness
Or Specified on Engineering Drawing

3.8 TIE LAYER, % of total composite thickness 1.5 +/- 0.75%
(on each side of EVOH barrier layer)

3.9 REGRIND

Regrind material from production sources of WSL-M98D29-A fuel tank material.

The regrind material may only be used in the second-most exterior layer of the composite, on the exterior side of the outer tie layer (see Figure 1).