



UNSATURATED POLYESTER (UP), LOW DENSITY, CLASS 'A', 40% GLASS FIBER REINFORCED, SHEET MOLDING COMPOUND

WSS-M3D188-B1

1. SCOPE

The material defined by this specification is 25 mm long glass fiber/bubble reinforced filled unsaturated polyester (UP) sheet molding compound.

2. APPLICATION

This specification was released originally for material used for painted class 'A' body components such as hoods or deck-lids to reduce weight.

- 2.1 Material is unlikely to contain UV stabilizers, therefore long term exposure to direct sunlight if left unpainted could cause chalking and loss of gloss.

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.

- 3.1.1 This specification is based on virgin material and does not allow the addition of recycled content (PIR/PCR).

- 3.1.2 Materials requiring high strain rate, creep or fiber oriented tensile modulus may be required to test to the requirements of WSS-M99D68-A1/Latest, *Thermoplastic Property Determination For CAE, High Strain Rate Tensile, Creep and Tensile Modulus*. Material suppliers should be prepared to submit data upon request.

- 3.1.3 Performance Criteria:

- Parts using this specification shall meet the appropriate performance specifications:
- Paint Performance: WSS-M2P180-D / Latest
- Adhesive Performance: ESB-M11P27-A / Latest or WSB-M11P27-B / Latest
- SMC Closure Adhesive Bonding: ESDA53-1B322-AA
- SMC Closure Adhesive Bonding using Plasma Surface Preparation: ES-EU5A-1B327-AA
- Parts must fulfill applicable SDS/CDS requirements.

- 3.1.4 Unless otherwise agreed to by Ford Materials Engineering, Control Plan and Certificate of Analysis (CoA) lot testing requirements must include, but are not limited to:

- Density
- Glass Fiber %
- Tensile Modulus
- Tensile Strength

- 3.1.5 Refer to Table 1 for the number of samples required for each test.

Date	Action	Revisions	Rev. 1
2018 02 09	Editorial	See Summary of Revisions	A. Meskovic, NA
2016 03 30	Released		K. Mueller, NA



3.1.6 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.

3.2 MOLDED TEST SPECIMEN

3.2.1 Preparation of Test Specimens

All test specimens shall be prepared from cross-ply molded plaques or equivalent. The plaques are to be manufactured from the same material and under equivalent conditions as production parts. The plaques shall have the following dimensions:
300 x 300 mm, min x 2.5 +/- 0.2 mm

Prepared specimens must show no evidence of fiber tear or loose strands protruding from the specimens. No additional annealing of specimens is allowed.

3.2.2	Density (ISO 1183, Method A)	1.15 – 1.36 g/cm ³
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3.2.3 Determination of Ash

3.2.3.1	Ash Content, by Weight (ISO 3451/1, Method A, 1 h at 650 +/- 25 °C)	57 - 65%
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3.2.3.2	Glass Fiber Content, by Weight	37 – 42%
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Test Method: ISO 3451/1, Method B, 1 h at 650 +/- 25 °C, except after bake oven boil in 5% by volume hydrochloric acid solution for 15 min. Rinse the glass fibers several times with distilled water before drying in an oven for 2 h at 120 +/- 2 °C. After cooling, weigh the crucibles and calculate the percent glass fibers.

3.2.3.3	Glass Fiber Length (Optical evaluation method)	25 mm min
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3.2.4	Tensile Strength at Break (ISO 527-4, 150 min x 10 x 2.5 +/- 0.2 mm specimen, 5 mm/min test speed)	64 MPa min
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3.2.5	Tensile Modulus at Break (ISO 527-4, 150 min x 10 x 2.5 +/- 0.2 mm specimen, 5 mm/min test speed)	7.4 GPa min
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3.2.6	Tensile Elongation (ISO 527-4, 150 min x 10 x 2.5 +/- 0.2 mm specimen, 5 mm/min test speed)	1.2% min
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3.2.7	Flexural Modulus (ISO 178, 60 x 10 x 2.5 +/- 0.2 mm specimen, 40 mm support span, 2 mm/ minute test speed)	6.5 GPa min
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3.2.8	Flexural Strength (ISO 178, 60 x 10 x 2.5 +/- 0.2 mm specimen, 40 mm support span, 2 mm/ minute test speed)	144 MPa min
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- 3.2.9 Impact Strength, Izod, notched
(ISO 180, Method A, 63.5 x 12.7 x 2.5 +/- 0.2 mm
specimen [use center section of specimen],
10 specimens for each test)

3.2.9.1 At 23 °C +/- 2 °C 72 kJ/m², min

3.2.9.2 At - 40 °C +/- 1 °C 73 kJ/m², min

The test specimen must be conditioned for minimum of 6 h at the above specified temperature prior to impact test. Low temperature testing shall be done within the cold chamber, if not possible, test may be conducted outside, but within 5 s.

- 3.2.10 Heat Deflection Temperature > 275 °C
(ISO 75, 120 x 10 x 2.5 +/- 0.2 mm
specimen [use center section of
specimen]. At 1.82 MPa)

- 3.2.11 Water Absorption 0.7 % max
no blisters

Test Method:

Include all processing steps, such as in-mold-coating, conductive primer, bakes, etc. that normally occurs just prior to shipping parts to the Ford Assembly Plant. If the bake conditions must deviate from those below, please contact Materials Engineering.

Panel size shall be approximately 30 x 30 cm.

Testing shall be performed in triplicate.

Dry panels for a minimum 2 hours at 75 +/- 2 °C. Allow panels to cool for 1 hour at 23 +/- 2 °C and 50 +/- 5 % relative humidity. Weigh panels to the nearest 0.1 g (Wi). Condition panels for 10 days at 95 +/- 2 % relative humidity and 35 +/- 1 °C. Blot away any excess water on the surfaces of the samples until no visually perceptible surface water remains. Allow panels to dry for 1 hour at 23 +/- 2 °C and 50 +/- 5% relative humidity and re-weigh panels (Wf).

Water absorption by weight (%) = $(Wf - Wi) / Wi \times 100$

Temperature-shock panels for 32 minutes: See Figures 1 and 2.

- Oven start temperature = 25 °C
- Place panels in IR oven, with both sides of panels exposed and thermocouple.
 - Other heat sources may be used
- Record temperatures of panels
- Bake oven ramp rate:
- Max oven temp = 205°C
- Review panels for blisters