



POLYAMIDE 6 (PA 6), HEAT STABILIZED 40% GLASS FIBER/MINERAL REINFORCED MOLDING COMPOUND, PAINTED, EXTERIOR

WSS-M4D822-B3

1. SCOPE

The material defined by this specification is a heat stabilized molding compound with approximately 15% glass fiber and 25% mineral reinforcement, based on polyamide 6 resin.

2. APPLICATION

This specification was released originally for material used in painted applications.

2.1 LIMITATIONS

- This material absorbs and retains moisture. Part design and tolerances must accommodate changes in part dimensions and physical properties due to moisture absorption or loss in the service/assembly environment.
- This material does not contain UV stabilizers, long term exposure to direct sunlight will cause chalking or loss of gloss and must be painted for exterior visible applications.

3. REQUIREMENTS

3.1 STANDARD REQUIREMENTS FOR PRODUCTION MATERIALS

Material suppliers and part producers must conform to the Company's Standard Requirements for Production Materials (WSS-M99P1111-A).

- 3.1.1 Many 4D resin specifications prior to 2011, identified certain requirements with the symbol (s), which indicated that the mean and +/- 3 sigma values were to be reported. The specification minimum, maximum or range was established using 3 sigma data. For 2011 and beyond, refer to Table 1 for number of samples required for each test.
- 3.1.2 This specification is based on virgin materials, however materials with recycled content as defined by WRS-M99P42-A1 (post-consumer and/or postindustrial recyclates and repolymerised recycled materials) should be used whenever technically feasible and following all materials and PV testing required by Ford Materials Engineering.
- 3.1.3 The use of recycled materials is encouraged per [Ford Corporate ESOW Supplement 3](#). Materials containing recycled content (PIR/PCR) must be specified with a Ford WRS material specification as defined by WRS-M99P42-A1. These materials cannot replace a virgin material without prior Ford approval and addition of the WRS specification to the engineering drawing.
- 3.1.4 Dry as molded:
All test values indicated herein are based on material and specimens with moisture content not exceeding 0.2% except where noted (Moisture Conditioned) (test according to ISO 15512 Method B/ASTM D 6869).

Date	Action	Revisions	Rev 01
2016 04 26	Revised	3.3.1 Melt Temp was 210-219 °C	
2015 11 11	Released		



All test materials have to be sealed in moisture-proof containers and stored at 23 +/- 2 °C for at least 24 h immediately after processing. If the moisture content exceeds 0.2%, conditioning the material for a minimum of 16 h at 40 – 50 °C at a reduced pressure below 133 kPa.

Conduct tests in a controlled atmosphere of 23 +/- 2 °C and 50 +/- 5% relative humidity. Individual specimens shall not be removed from closed containers until immediately before testing

Moisture conditions results for Tensile Strength, Tensile Modulus, Charpy Impact, and Flexural Modulus can be found in the Ford Material Database.

3.1.5 Moisture Conditioned:

The specimens shall be conditioned to a moisture content of 1.0 to 2.0 wt% moisture then place the specimens in standard atmosphere of 23 +/- 2 °C and 50 +/- 5% relative humidity for at least 1 h before testing (according to ISO 1110). Moisture content shall be reported to verify the moisture level.

3.1.6 Performance Criteria:

Exterior painted substrates approved to WSS-M4D822-B3 must comply with all the requirements of WSS-M2P180-D/Latest (exterior). Parts must fulfill applicable SDS/CDS requirements.

3.1.7 As specified in WSS-M99P1111-A, paragraph 3.2, Ford Materials Engineering may request a Control Plan and Certificate of Analysis (CoA) containing lot testing requirements which must include, but are not limited to:

Filler Content
Impact Strength, Notched Charpy at 23 °C
Tensile Modulus

3.2 SAMPLE PREPARATION

Unless otherwise specified all tests shall be carried out on injection molded, one-end gated test specimens. The test specimens A and D shall be molded using molding conditions defined in ISO 1874-02. See Table 1 for the number of specimens required.

Specimens shall be as follows:

Specimen A	150 minimum x 10 x 4.0 +/- 0.2 mm (ISO 527-2, Specimen Type 1A)
Specimen B	355 x 100 x 1.0 +/- 0.1 mm (ISO 3795)
Specimen C	145 x 60 x 3.2 +/- 0.2 mm
Specimen D	Center of Specimen A. 80 x 10 x 4.0 +/- 0.2 mm
Specimen E	100 mm diameter x 3.2 mm
Specimen F	80 mm diameter x 3.2 mm
Specimen G	90 mm x 200 mm
Specimen H	50 +/- 1 mm diameter x 3.2 +/- 0.2 mm
Specimen I	100 mm x 150 mm, min

3.3 MATERIAL PROPERTIES

3.3.1 Melt Temperature 210 - 225 °C
(ISO 11357, 10 °C/min heating rate)

3.3.2 Determination of Ash
(ISO 3451-4, test temperature 600
+/- 25 °C, test portion 2.0 to 2.5 g)

Glass: 13 - 17%

Mineral: 23 - 27%



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3.3.3	Density (ISO 1183, Method A)	1.42 – 1.50 g/cm ³
3.3.4	Tensile Strength at Break (ISO 527-1 and ISO 527-2, Specimen A, 5 mm/minute test speed)	100 MPa min
3.3.5	Tensile Modulus (ISO 527-1 and ISO 527-2, Specimen A, 1 mm/minute test speed)	6 GPa min
3.3.6	Impact Strength, Notched Charpy (ISO 179-1/2, Specimen D)	
	3.3.6.1 At 23 +/- 2 °C	3.0 kJ/m ² min Report Break Type
	3.3.6.2 At -40 +/- 2 °C	2.0 kJ/m ² min Report Break Type

The test specimen must be conditioned for minimum of 6 hours 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 seconds.

3.3.7	Heat Deflection Temperature (ISO 75-1 and ISO 75-2, Specimen D, flatwise, 0.34 +/- 0.1 mm deflection. At 1.80 MPa)	187 °C min
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All specimens dry as molded. If not tested immediately after molding, specimens must be stored in a sealed, moisture-proof container filled with silica gel.

3.3.8	Heat Aging Performance (ISO 188, except 150 +/- 50 air changes/h, 1000 h at 140 +/- 2 °C. After heat aging test specimens are to be conditioned in a desiccator for 3 - 5 h at 23 +/- 2 °C. Unaged property values shall be determined at the time of the aged properties determination)	
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3.3.8.1	Impact Strength, Notched Charpy, Change (Test Method per para 3.3.6.1, specimens to be notched before Heat Aging)	+/- 25% max
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3.3.9	Flammability (ISO 3795/SAE J369, Specimen B, smooth surface)	
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Burn Rate	100 mm/minute max
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3.4 MATERIAL PROPERTIES – REPORT ONLY

Values are retained in Ford Materials Database www.fmd.ford.com.

3.4.1	Molding Shrinkage (Report method used, sample size and value)	
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After 48 h at 23 +/- 2 °C	
Flow	
Cross Flow	