



POLYAMIDE (PA) 66 HEAT STABILIZED MOLDING COMPOUND

WSS-M4D648-B1

POLYAMIDE (PA) 66 HEAT STABILIZED MOLDING COMPOUND, MOLDED IN COLOR, INTERIOR

WSS-M4D648-B2

1. SCOPE

The material defined by this specification is a heat stabilized polyamide 66 molding compound.

2. APPLICATION

WSS-M4D648-B1 material is being released for non-visible applications(interior, body and underhood).
WSS-M4D648-B2 material is being released for molded in color interior 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.
- B1 suffix only: This material typically does not contain UV stabilizers, long term exposure to direct sunlight will cause chalking and loss of gloss without suitable additives.
- This material is not suitable for long term exposure to engine coolant, or direct exposure to strong acids or bases. It is not suitable for use above 155 °C.
- For B2 only. Must be tested to WSS-M99P2222 D1/Latest, *Performance, Vehicle Interior Environment Quality Material/Component Requirements* if the part exceeds 100 cm² or 100 g.

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 Note: 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 values. 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 post industrial 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 regrind is permitted, for economic / environmental reasons, with compliance as indicated in Ford Engineering CAD and Drafting Standard E-4.

Date	Action	Revisions	Rev 2
2015 07 28	Editorial	See Summary of Revisions	R. Harris, NA
2014 04 10	Editorial	See Summary of Revisions	R. Harris, NA
2014 02 27	Released		R. Harris, NA



- 3.1.4 Performance Criteria:
Parts using this specification shall meet the appropriate performance specification, WSS-M15P4-F/Latest.
- 3.1.5 For B2 suffix only: Must be tested to WSS-M99P2222 D1/Latest, *Performance, Vehicle Interior Environment Quality Material/Component Requirements*, if part exceeds 100 cm² or 100 g.
- 3.1.6 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:

Viscosity
Moisture Content

- 3.1.7 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).

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.

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 1874-2. No annealing is allowed. See Tables 1 and 2 for the number of samples 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 APPEARANCE – WSS-M4D648-B2 only

- 3.3.1 Weathering Resistance Rating 4 min
(FLTM BO 116-01, 977.6 kJ/m² exposure
Specimen C from smooth polished mold,
ISO 105-A02 / AATCC Evaluation Procedure 1)

At 601.6 kJ/m², remove the samples from the weatherometer and allow them to cool for one hour. Conduct a tactile evaluation on



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and report any tackiness. Visually evaluate and report any spewing or other exudation.

After exposure the material shall show no fading or color change in excess of the specified AATCC rating. In addition, there shall be no cracking, crazing or other deterioration.

Use regional choice for initial approval and report the color house used. See Table 2 for additional color durability submission requirements.

**3.3.2 Resistance to Scratch and Mar
(FLTM BO 162-01, Specimen I)**

Hard Trim

Scratch 2 N,

Whitening/Color Change 7 N,

Marring 2 N,

Rating 2 max

Rating 1 max

Rating 2 max

These values are derived from colored and grained samples in agreement with Materials Engineering. Details regarding color house, let down ratio, colors, grain, etc can be found in the approval package.

3.4 MATERIAL PROPERTIES

3.4.1	Melt Temperature (ISO 11357, 10 °C/min heating rate)	250 - 265° C
3.4.2	Density (ISO 1183, Method A)	1.12 – 1.16 g/cm ³
3.4.3	Tensile Strength at Yield (ISO 527-1 and ISO 527-2, Specimen A, 50 mm/minute test speed)	60 MPa min
3.4.4	Elongation at Yield (ISO 527-1 and ISO 527-2, Specimen A, 50 mm/minute test speed)	3.5 % min
3.4.5	Tensile Modulus (ISO 527-1 and ISO 527-2, Specimen A, 1 mm/minute test speed)	2.5 GPa min
3.4.6	Flexural Modulus (ISO 178, Specimen D, 64 mm support span, 2 mm/minute test speed)	2.5 GPa min
3.4.7	Impact Strength, Notched Charpy (ISO 179-1/1eA, Specimen D)	Report Break Type
3.4.7.1	At 23 +/- 2 °C	3.5 kJ/m ² min
3.4.7.2	At -40 +/- 2 °C	2.0 kJ/m ² min

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.