



POLYAMIDE (PA) 66 HEAT STABILIZED MOLDING COMPOUND

WSS-M4D648-B1

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

WSS-M4D648-B2

POLYAMIDE (PA) 66 HEAT STABILIZED MOLDING COMPOUND,
100% RECYCLED MATERIAL BY WEIGHT

WRS-M4D648-B3

1. SCOPE

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

B3 - POLYAMIDE (PA) 66 HEAT STABILIZED MOLDING COMPOUND, 100% RECYCLED MATERIAL BY WEIGHT

Type of Material	% Material Type by Weight
Recycled Resin PCR/PIR	100
Virgin Resin	0
Minimum % Recycled Content	100

2. APPLICATION

- WSS-M4D648-B1 This specification was released originally for material used for non-visible applications (exterior and underhood/underbody).
- WSS-M4D648-B2 This specification was released originally for material used for molded in color interior applications.
- WRS-M4D648-B3 This specification was released originally for material used for non-visible applications (exterior and underhood/underbody) and containing post consumer or post industrial recycled resin content.

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 is not suitable for long term exposure to engine coolant, or direct exposure to strong acids or bases.
- For B1 and B3: This material typically does not contain UV stabilizers, long term exposure to direct sunlight will cause chalking and loss of gloss without suitable additives.
- For B3 only: This material has low impact resistance.

3. REQUIREMENTS

3.1 APPROVED SOURCES

Date	Action	Revisions	Rev. 3
2018 03 26	Released -B3	Revised B1,B2 See Summary of Revisions	C. Zhou, AP
2015 07 28	Editorial	See Summary of Revisions	R. Harris, NA
2014 02 27	Released		R. Harris, NA

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This specification is part of the Ford Co-Managed Buy (CMB) agreement. Tier 1 molders who are participating under the CMB agreement must use one the following approved sources (deviations require approval from Raw Materials Purchasing and Materials Engineering):

Specification	North American Programs	European Programs
WSS-M4D648-B1	BASF ULTRAMID A3W BASF ULTRAMID A3K DuPont ZYTEL 103HSL	BASF ULTRAMID A3W BASF ULTRAMID A3K DuPont ZYTEL 103HSL
WSS-M4D648-B2	BASF ULTRAMID A3W	BASF ULTRAMID A3W
WRS-M4D648-B3		

Molders not on the CMB program or regions without CMB are required to use materials listed on the Ford Approved Source List (ASL), and are encouraged to use the CMB sources listed above. Only the sources identified on the Approved Source List 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.

Approval of new sources requires the completion of the latest version of the FMD template. Data should be submitted at the time as the specification data package. Only one FMD package is required per trade name approved, FMD is not required for each manufacturing site. FMD is required for new site approvals that do not have an existing FMD record.

3.2 CONDITIONING AND TEST CONDITIONS

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 D6869).

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%, condition 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

3.3 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 STANDARD REQUIREMENTS FOR PRODUCTION MATERIALS

3.4.1 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.

3.4.2 WSS-M4D648-B1 and WSS-M4D648-B2 are based on virgin materials.

3.4.3 WRS -M4D648-B3 must contain 100% (Post Consumer Recycled (PCR) and/or Post Industrial Recycled (PIR) content and Renewable Bio-Based, as defined by WRS-M99P42-A1 and WNS-M99P42-A4). Actual percent to be reported as part of the data submission pack.



- 3.4.4 The use of regrind is permitted, for economic / environmental reasons. Part manufacturers using this specification must complete DV and PV testing with the maximum allowable amount of regrind and the maximum allowable regrind content must be specified on the engineering drawing. Any changes to what is specified on the drawing (no specific amount implies zero regrind) must be approved by Materials and PD Engineering through the formal Ford Motor Company process (SREA).
- 3.4.5 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.
- 3.4.6 Performance Criteria:
Parts using this specification shall meet the appropriate performance specifications, for the area of application (interior, exterior, underhood/underbody), such as WSS-M15P4-H/Latest (interior) or WSS-M15P50-C/Latest (underhood/underbody). The relevant performance specification shall be shown on the Engineering Drawing, along with the peak test temperature and with applicable or excepted sections identified (as required).
- 3.4.7 Ford Materials Engineering may request a Control Plan and Certificate of Analysis (C of A) containing lot testing requirements which must include, but are not limited to:

Impact Strength, Notched Charpy at 23°C
Flexural Modulus

3.5 SAMPLE PREPARATION

All tests shall be carried out on production materials manufactured from the production process unless correlation to a non-production process has been reviewed and approved by Ford Materials Engineering.

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
Specimen C	145 x 60 x 3.2 +/- 0.2 mm
Specimen D	80 x 10 x 4.0 +/- 0.2 mm (may be cut from the center of Specimen A)
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

For Appearance Testing: Use an ungrained, non-polished, tool to prepare specimens for C through N gloss surfaces. Use a smooth, polished tool to prepare specimens for A and B gloss surfaces.

3.6 APPEARANCE – WSS-M4D648-B2 only

- 3.6.1 Weathering Resistance
(FLTM BO 116-01, 977.6 kJ/m² exposure
Specimen C, ungrained, non-polished mold,

Rating 4 min



ISO 105-A02 / AATCC Evaluation Procedure 1)

Every week* remove the samples from the weatherometer and allow them to cool for one hour. Conduct a tactile evaluation 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.

*When setting machine for automatic shutoff, every 526.4 kJ/m² is recommended.

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

Scratch	Rating 2 at 2 N, max
Whitening/Color Change	Rating 1 at 7 N, max
Marring	Rating 2 at 2 N, 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.

3.7 MATERIAL PROPERTIES

3.7.1	Melt Temperature (ISO 11357, 10 °C/min heating rate)	250 - 265°C	
3.7.2	Density (ISO 1183, Method A)	1.12 – 1.16 g/cm³	
3.7.3	Tensile Strength at Yield (ISO 527-1 and ISO 527-2, Specimen A, 50 mm/minute test speed)	60 MPa min	
3.7.4	Elongation at Yield (ISO 527-1 and ISO 527-2, Specimen A, 50 mm/minute test speed)	<u>B1/2</u> 3.5 % min	<u>B3</u> Report Value, %
3.7.5	Tensile Modulus (ISO 527-1 and ISO 527-2, Specimen A, 1 mm/minute test speed)	2.5 GPa min	
3.7.6	Impact Strength, Notched Charpy (ISO 179-1/1eA, Specimen D)	<u>B1/B2</u>	<u>B3</u>
3.7.6.1	At 23 +/- 2 °C	3.5 kJ/m² min	2.5 kJ/m² min

Report Break Type



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