POLYAMIDE (PA) 6, HEAT STABILIZED 30% GLASS FIBER REINFORCED MOLDING COMPOUND — **WSS-M4D993-B1**

POLYAMIDE (PA) 6, HEAT STABILIZED 30% GLASS FIBER REINFORCED MOLDING COMPOUND, 25% PCR AND/OR PIR RESIN CONTENT, 18% RECYCLED MATERIAL BY WEIGHT — **WRS-M4D993-B2**

POLYAMIDE (PA) 6, HEAT STABILIZED 30% GLASS FIBER REINFORCED MOLDING COMPOUND, 100% PCR AND/OR PIR RESIN CONTENT 70% RECYCLED MATERIAL BY WEIGHT — **WRS-M4D993-B3**

1. SCOPE

The materials defined by this specification are a thermoplastic 30% glass fiber reinforced, heat stabilized molding compound based on polyamide 6. Material with recycled content should be used whenever feasible.

2. APPLICATION

WSS-M4D993-B1 — This specification was released originally for material used for intake manifolds and GOR/FEM. This material is formulated to have enhanced welding properties.

WRS-M4D993-B2/B3 — This specification was released originally for materials containing post consumer or post industrial recycled resin content. This material is used for intake manifolds.

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 and loss of gloss.
- This material is not suitable for direct long term exposure to engine coolant, or direct exposure to strong acids or bases. It is not sutable for use above 150 °C.

3. REQUIREMENTS

3.1 APPROVED SOURCES

3.1.1 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.

Date	Action	Revisions	Rev. 04
2015 11 23	Revised	Combined B1, B2, and B3 into one specification	G. Kowalski, FNA
2011 10 05	Revised	Editorial updates to 3.1.3	
2011 01 07	Released	B1 (2011-01-07), B2 (2011 03 14) B3 (2014 08 01)	V Cerato, FOE

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3.1.2 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):

North American and European Programs:

WSS-M4D993-B1	BASF Ultramid B3WG6 Lanxess Durethan BKV 30 H2.0 DuPont Zytel 73G30HSL
WRS-M4D993-B2	BASF Nypel RC6030F
WRS-M4D993-B3	Wellman Ecolon GF3030

Molders not on the CMB program or regions without CMB are encouraged to use the CMB sources listed above.

3.2 STANDARD REQUIREMENTS FOR PRODUCTION MATERIALS

3.2.1 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.

3.2.2 The use of regrind is permitted, for economic / environmental reasons. Part manufacturers using this specification must complete DV and PV testing with the 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).

3.2.3 WSS-M4D993-B1 is based on virgin materials.

3.2.4 WRS-M4D993-B2 must contain 25% Post Consumer Recycled (PCR) and/or Post Industrial Recycled (PIR) resin content as defined by WRS-M99P42-A1. The remaining portion of the material can come from virgin sources.

3.2.5 WRS-M4D993-B3 must contain 100% Post Consumer Recycled (PCR) and/or Post Industrial Recycled (PIR) resin content as defined by WRS-M99P42-A1.

3.2.6 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, see paragraph 3.7.9) (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.

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3.2.7 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.

3.2.8 Performance Criteria: Parts using this specification shall meet the appropriate performance specifications, WSS-M15P50-B/Latest

3.2.9 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:

Melt Flow Rate (not for filled materials)
Filler Content
Impact Strength, Notched Charpy at 23 °C
Flexural Modulus

3.3 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. See Table 1 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.

3.4 MATERIAL PROPERTIES

		B1	B2 / B3
3.4.1	Melt Temperature (ISO 11357, 10 °C/min heating rate)	215 - 225 °C	218 - 224 °C
3.4.2	Glass Fiber Content (ISO 3451-4, test temperature 600 +/- 25°C, test portion 2 to 2.5 g)	28 – 32	28 - 32
3.4.3	Density (ISO 1183, Method A)	1.32 – 1.39 g/cm^3	1.33 – 1.42 g/cm^3

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