POLYAMIDE (PA) 6, HEAT STABILIZED 30% GLASS FIBER/MINERAL REINFORCED — **WSS-M4D968-B1**

POLYAMIDE (PA) 6, HEAT STABILIZED 30% GLASS FIBER/MINERAL REINFORCED, 25% PCR AND/OR PIR RECYCLED CONTENT — **WRS-M4D968-B2**

POLYAMIDE (PA) 6, HEAT STABILIZED 30% GLASS FIBER/MINERAL REINFORCED, 50% PCR AND/OR PIR RECYCLED CONTENT — **WRS-M4D968-B3**
(The specifications for a recycled version of this resin are under development. Contact Materials Engineering (FoE) for status)

POLYAMIDE (PA) 6, HEAT STABILIZED 30% GLASS FIBER/MINERAL REINFORCED, 70% PCR AND/OR PIR RECYCLED CONTENT — **WRS-M4D968-B4**

1. SCOPE

The materials defined by these specifications are thermoplastic injection molding compound based on heat stabilized 10% glass fiber and 20% mineral reinforced polyamide 6.

2. APPLICATION

These specifications were released originally for material used for engine NVH and beauty covers.

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 suitable for use above 150℃.

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 values. For 2011 and beyond, refer to Table 1 for number of samples required for each test.

3.1.2 WSS-M4D968-B1 is based on virgin materials.

3.1.3 WRS-M4D968-B2 must contain 25% recycled content as defined by WRS-M99P42-A1 (post- consumer and/or post industrial recyclates and repolymerised recycled materials) The remaining portion of the material can come from virgin sources.

Date	Action	Revisions	Rev. 3
2013 07 19	Revised	See Summary of Revisions for Details	G. Kowalski, NA
2013 04 26	Revised	See Summary of Revisions for Details	V. Cerato, EU
2010 08 26	Activated	Activated B1	V.Cerato, EU & Global Materials Team

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3.1.4 **WRS-M4D968-B3/B4 must contain 50% and 70% recycled content as defined by WRS-M99P42-A (post-consumer and/or post industrial recyclates and repolymerised recycled materials). The remaining portion of the material can come from virgin sources.**

3.1.5 WRS-M4D968-B4 must contain 70% recycled content as defined by WRS-M99P42-A (post-consumer and/or post industrial recyclates and repolymerised recycled materials). The remaining portion of the material can come from virgin sources.

3.1.6 The use of regrind is permitted, for economic/environmental reasons, with compliance as indicated in Ford Engineering CAD and Drafting Standard E-4.

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.

3.1.8 Performance Criteria

Parts using this specification shall meet the appropriate performance specifications, WSS-M15P50-B.

3.1.9 As specified in WSS-M99P1111-A, paragraph 3.5, 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:

Melt Flow Rate
Filler Content
Impact Strength, Notched Charpy at 23°C
Flexural 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 1874-2. 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 (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

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Specimen I 100 mm x 150 mm, min

3.3 MATERIAL PROPERTIES

3.3.1	Melt Temperature (ISO 11357, 10 °C/min heating rate)	210 - 223 °C
3.3.2	Filler Content (ISO 3451-4, test temperature 600 +/- 25°C, Test portion 2-2.5g)	27 - 33 %
3.3.3	Density (ISO 1183, Method A)	1.32 - 1.45 g/cm^3
3.3.4	Tensile Strength at Break (ISO 527-1 and ISO 527-2, Specimen A, 50 mm/minute test speed)	80 MPa min
3.3.5	Tensile Modulus (ISO 527-1 and ISO 527-2, Specimen A, 1 mm/minute test speed)	5.0 GPa min
3.3.6	Impact Strength, Notched Charpy (ISO 179-1/1eA, Specimen D)	
	3.3.6.1 At 23 +/- 2 °C	0.5 kJ/m^2 min
	3.3.6.2 At -40 +/- 2 °C	0.5 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.

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)	168.5 °C min
3.3.8	Heat Aging Performance (ISO 188, 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)	
	3.3.8.1 Impact Strength, Notched Charpy, Change Test Method per para 3.3.6, specimens to be notched before Heat Aging)	+/- 25% max

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