



**POLYAMIDE (PA) 66, HEAT STABILIZED, 40% GLASS
FIBER/MINERAL REINFORCED MOLDING COMPOUND**

WSS-M4D1029-A1

**POLYAMIDE (PA) 66, HEAT STABILIZED, 40% GLASS
FIBER/MINERAL REINFORCED MOLDING COMPOUND,
60% RECYCLED MATERIAL BY WEIGHT**

WRS-M4D1029-A2

1. SCOPE

The material defined by this specification is a thermoplastic heat stabilized 25% mineral and 15% glass fiber reinforced molding compound based on Nylon 66. Material with recycled content should be used whenever feasible.

WRS-M4D1029-A2	% of Material by Weight
Recycled Resin PCR/PIR	60
Glass Fiber	15
Mineral	25
Minimum % Recycled Material	60

2. APPLICATION

WSS-M4D1029-A1 This specification was released originally for material used for cooling fan and shroud.

WRS-M4D1029-A2 This specification was released originally for material 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 does not contain UV stabilizers, long term exposure to direct sunlight will cause chalking and loss of gloss.

This material is not suitable to direct long term exposure to engine coolant, or direct exposure to strong acids or bases. It is not suitable to use above 150 °C.

3. REQUIREMENTS

3.1 APPROVED SOURCES

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.

Approval of new sources requires the completion of the latest version of the FMD template. Data should be submitted at the same 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.

Date	Action	Revisions	Rev. 00
2016 10 26	Released		G Kowalski, C Obermaier, NHA

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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.

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 (*), 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-M4D1029-A1 is based on virgin materials.

3.4.3 WRS-M4D1029-A2 must contain minimum 60% Sustainable Material (Post Consumer Recycled (PCR) and/or Post Industrial Recycled (PIR) content, as defined by WRS-M99P42-A1). Actual % 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 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 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 3.2) (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.

3.4.6 Material must be processed per Global Manufacturing Standard W-IMMS - Control of Plastic Injection Molding Processes, located on the Ford Supplier Portal, STA Global Technical Services, Plastic Molding, https://web.gpr.ford.com/sta/Ford_GTS.html.

3.4.7 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.

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

3.4.9 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:

Filler Content
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 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.

3.6 MATERIAL PROPERTIES

3.6.1	Melt Temperature (ISO 11357, 10 °C/min heating rate)	A1/A2 251-263 °C
3.6.2	Mineral Filler and Glass Fiber Content	
3.6.2.1	Determination of Ash (Mineral Filler+Glass Fiber) (ISO 3451-1, Method A, or ISO 3451-2, 1 h at 650 +/- 25 °C)	37.5 – 42.5%
3.6.2.2	Glass Fiber Content (ISO 3451-1, Method B,	14.5 – 17.5 %

1 h at 650 +/- 25 °C, except use 5% by volume hydrochloric acid solution for 15 minutes. Rinse the glass fibers several times with distilled water before drying in an oven for 2 h at 120 +/- 2 °C. After cooling, weigh the crucibles and calculate the percent glass fibers.)