



POLYAMIDE (PA) 6, 15% GLASS FIBER REINFORCED MOLDING COMPOUND, GENERAL PURPOSE

WSS-M4D665-B1

1. SCOPE

The material defined by this specification is 15% glass fiber reinforced, polyamide 6 molding compounds for general purpose use.

2. APPLICATION

This specification was released originally for material used for functional parts.

2.1 LIMITATIONS

- These materials absorb and retain 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. It is not suitable for use above 155 °C.
- Materials approved are not for Class A surface, color keyed applications as they do not contain UV stabilizers.

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.

3.2 CONDITIONING AND TEST CONDITIONS

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 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%, conditioning the material for a minimum of 16 h at 40 to 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

Date	Action	Revisions	Rev. 00
2016 03 22	Released		



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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 This specification is based on virgin material and does not allow the addition of recycled content (PIR/PCR).
- 3.4.3 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).
- 3.4.4 Materials used in interior applications must meet the requirements outlined in WSS-M99P2222-D1/Latest, Performance, Vehicle Interior Environment Quality Material/Component Requirements if collective parts exceeds 100 cm² or 100 g. Data must be included in material submission package.
- 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) (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%, conditioning the material for a minimum of 16 h at 40 to 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.

Moisture conditions results for Tensile Strength, Tensile Modulus, Charpy Impact, and Flexural Modulus can be found in the Ford Material Database.

- 3.4.6 Moisture Conditioned:
The specimens shall be conditioned to a moisture content of 1.0 to 2.0 wt% moisture then place the specimens in standard atmosphere of 23 +/- 2 °C and 50 +/- 5% relative humidity for at least 1 h before testing (according to ISO 1110). Moisture content shall be reported to verify the moisture level.
- 3.4.7 Performance Criteria:
Parts using these specifications must comply with all the requirements of WSS-M15P50-B/Latest (underhood, underbody) and WSS-M15P4-F/Latest (interior) and fulfill applicable SDS/CDS requirements.



- 3.4.8 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:

Filler Content
Impact Strength, Notched Charpy at 23 °C
Tensile Modulus

3.5 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 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

3.6 MATERIAL PROPERTIES

3.6.1	Determination of Ash (ISO 3451-4, test temperature 600 +/- 25 °C, test portion 1 g)	13 - 17 %
3.6.2	Melt Temperature (ISO 11357, 10 °C/min heating rate)	215 - 225 °C
3.6.3	Density (ISO 1183, Method A)	1.20 - 1.28 g/cm ³
3.6.4	Tensile Strength at Break (ISO 527-1 and ISO 527-2, Specimen A, 5 mm/minute test speed)	110 MPa min
3.6.5	Tensile Modulus (ISO 527-1 and ISO 527-2, Specimen A, 1 mm/minute test speed)	5.0 GPa min
3.6.6	Impact Strength, Notched Charpy (ISO 179-1eA, Specimen D)	
3.6.6.1	At 23 +/- 2 °C	3.5 kJ/m ² min Report Break Type
3.6.6.2	At -40 +/- 2 °C	3 kJ/m ² min Report Break Type

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.