

**THERMOPLASTIC POLYOLEFIN ELASTOMER (TEO), UNFILLED
MOLDING COMPOUND, 75% RECYCLED MATERIAL BY WEIGHT****WRS-M4D952-A4****1. SCOPE**

The material defined by this specification is a thermoplastic impact modified injection molding compound based on 75% recycled thermoplastic polyolefin elastomer, for general purpose and non-visible exterior use.

Type of Material	% of Material by Weight
Recycled Resin PCR/PIR	75
Virgin Resin	25
Minimum % Recycled Material	75

2. APPLICATION

This specification was released originally for materials used for underbody shields, wheel liners, and/or other non visible applications and containing post consumer or post industrial recycled resin content

2.1 LIMITATIONS

This material does not contain UV stabilizers, therefore long term exposure to direct sunlight could cause chalking and loss of gloss, and must not be used for visible (mold-in-color or painted) applications.

These materials should not be used for interior applications and have not been tested to meet Vehicle Interior Environment Quality Material/component Performance Requirements (WSS-M99P2222-D1).

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

All test values are based on material conditioned for not less than 24 h prior to testing in a controlled environment of 23 +/- 2 °C and 50 +/- 5% relative humidity. Testing of the material should occur in the conditioning environment or soon after removal.

3.3 STANDARD REQUIREMENTS FOR PRODUCTION MATERIALS

3.3.1 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.

3.3.2 The use of regrind is permitted, for economic / environmental reasons. Part manufacturers

Date	Action	Revisions	Rev. 0
2016 11 23	Released		

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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).

- 3.3.3 This material must contain a minimum of 75% 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.
- 3.3.4 Performance Criteria:
Parts using this specification shall meet the appropriate performance specifications, WSS-M15P50-B/Latest. Parts must fulfill applicable SDS/CDS requirements.
- 3.3.5 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
Impact Strength, Notched Charpy at 23°C
Flexural Modulus

3.4 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 1873-2. 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.

3.5 MATERIAL PROPERTIES

- 3.5.1 Density
(ISO 1183, Method A) 0.89 – 0.91 g/cm³
- 3.5.2 Hardness, Durometer D
(ISO 868, 15 s dwell) 53 - 57
- 3.5.3 Tensile Strength at Yield
(ISO 527-1 and ISO 527-2, Specimen A,
50 mm/minute test speed) 14 MPa min



3.5.4	Elongation at Yield (ISO 527-1 and ISO 527-2, Specimen A, 50 mm/minute test speed)	5% min
3.5.5	Tensile Modulus (ISO 527-1 and ISO 527-2, Specimen A, 1 mm/minute test speed)	800 MPa min
3.5.6	Flexural Modulus (ISO 178, Specimen D, 64 mm support span, 2 mm/minute test speed)	800 MPa min
3.5.7	Impact Strength, Notched Izod (ISO 180/1A, Specimen D)	
3.5.7.1	At 23 +/- 2 °C	32 kJ/m ² min 100% Partial Break
3.5.7.2	At 10 +/- 2 °C	100% Partial Break
3.5.7.3	At 0 +/- 2 °C	13 kJ/m ² min Report Break Type
3.5.7.4	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. Test specimens must be reviewed by Materials Engineering.

3.5.8	Heat Deflection Temperature (ISO 75-1 and ISO 75-2, Specimen D, flatwise, Bath – silicone oil, 0.34 +/- 0.1 mm deflection. At 1.80 MPa)	45 °C min
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All specimens dry as molded. If not tested immediately after molding, specimens must be stored in a sealed, moisture-proof container filled with silica gel.

3.5.9	Heat Aging Performance (ISO 188, 150 +/- 50 air changes/h, 1000 h at 120 +/- 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)	
3.5.9.1	Tensile Strength at Yield, Change (Test Method per para 3.5.3)	+/- 25% max
3.5.9.2	Impact Strength, Notched Izod, Change (Test Method per para 3.5.7.1, specimens to be notched before Heat Aging)	+/- 25% max