Material Name	Specification Number
THERMOPLASTIC POLYOLEFIN ELASTOMER (TPO) HIGH IMPACT, GENERAL PURPOSE	WSK-M4D777-A1
THERMOPLASTIC POLYOLEFIN ELASTOMER (TPO) HIGH IMPACT, COLOR PIGMENTED, EXTERIOR	WSK-M4D777-A2

1. SCOPE

The materials defined by these specifications are rigid thermoplastic polyolefin elastomer (TPO) injection molding compounds with high impact. WSK-M4D777-A2 material is color pigmented and has added UV stabilization for exterior use. This material is also suitable for painting provided that qualified surface pretreatments (e.g. flaming) are used.

2. APPLICATION

These specifications were released originally for materials used for general purpose use such as covers and bezels (WSK-M4D777-A1) and for exterior parts, pigmented and/or painted, which are exposed to sunlight such as bumper shells, body side mouldings etc. (WSK-M4D777-A2).

3. REQUIREMENTS

3.1 STATISTICAL PROCESS

Suppliers must conform to the requirements of Ford Quality System Standard Q-101. A mutually acceptable Control Plan as described therein is required for material/source approval. Appropriate statistical tools must be used to analyze process/product data so that variation in the final product is continuously reduced.

3.1.1 All requirements of this specification, identified by symbol (s), shall be met with data representing 3 sigma values.

3.2 INFRARED SPECTROPHOTOMETRY AND/OR THERMAL ANALYSIS

Ford Motor Company, at its option, may conduct infrared and/or thermal analysis of material/parts supplied to this specification. The IR spectra and thermograms established for initial approval shall constitute the reference standard and shall be kept on file at the designated material laboratory. All samples shall produce IR spectra and thermograms that correspond to the reference standard when tested under the same conditions.

Date	Release No.	Released	
1994 06 01	C10348592	Completely revised	L. Rodigas
1991 05 02	EP00E01089484000	Released	L. Rodigas

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3.3 CONDITIONING AND TEST CONDITIONS

All test values indicated herein are based on material conditioned in a controlled atmosphere of 23 +/- 2 C and 50 +/- 5 % relative humidity for not less than 24 h prior to testing and tested under the same conditions unless otherwise specified.

3.4 MOLDING COMPOUND

(s)	3.4.1	Melt Flow Rate (ISO 1133, 230 C, 2.16 kg)	1.5 - 5.0 g/10 minutes

3.5 MOLDED TEST SPECIMEN (A1 & A2)

3.5.1 Preparation of Test Specimens

Unless otherwise specified all tests shall be carried out on injection molded one-end gated test specimens.

The following dimensions are required:

A. 150 min x 10 x 4.0 +/- 0.2 mm (Tensile Bar, ISO 3167)
B. 120 x 10 x 4.0 +/- 0.2 mm

Specimens with shorter dimensions shall be cut from the center portion of the test specimen A and/or B. The specimens shall be prepared according to ISO 294. No annealing allowed.

	3.5.2	Density (ISO 1183, Method A)	0.895 - 0.93 g/cm3
	3.5.3	Hardness, Durometer D (ISO 868, 15 s dwell)	53 - 63
(s)	3.5.4	Tensile Strength at Yield, min (ISO R 527, 150 minimum x 10 x 4.0 +/- 0.2 mm specimen, 50 mm/min test speed)	17 MPa
	(s) 3.5.4.1	Elongation at Yield, min (Test Method according to para 3.5.4)	10 %
(s)	3.5.5	Flexural Modulus, min (ISO 178, 80 x 10 x 4.0 +/- 0.2 mm specimen, 2 mm/min test speed, 64 mm support span)	850 MPa

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	3.5.6	Shear Modulus at 23 C (ASTM D 4065, forced constant amplitude, fixed frequency of 1 Hz +/- 15 %, strain level below 1 %. Specimen approx. 60 x 10 x 4.0 +/- 0.2 mm cut from the center of specimen A. Specimen length between clamps 35-40 mm. Soak time at each temperature interval - 3 minutes minimum)	300 - 450 MPa

Additionally, a Shear Modulus versus Temperature curve shall be plotted for - 50 to + 150 C temperature range, at 5 C minimum intervals. The plotted curve must be within tolerance range shown on page 8.

(s)	3.5.7	Impact Strength, Izod, min (ISO 180/1A, 80 x 10 x 4.0 +/- 0.2 mm specimen, 10 specimens for each test)	
	3.5.7.1	At 23 +/- 2 C	43 kJ/m2
	3.5.7.2	At - 40 +/- 1 C	3.5 kJ/m2
	3.5.7.3	At 0 +/- 2 C	25 kJ/m2

The test specimens must be conditioned for minimum of 6 h at the above specified temperature prior to impact test. Low temperature testing shall be done within the cold box.

(s)	3.5.8	Heat Deflection Temperature, min (ISO 75, 120 x 10 x 4.0 +/- 0.2 mm specimen, 0.32 +/- 0.01 mm deflection)	
	3.5.8.1	At 1.80 MPa	45 C
	3.5.8.2	At 0.45 MPa	70 C
	3.5.9	Heat Aging Performance (ISO 188, except 150 +/- 50 air changes/h, 1000 h at 130 +/- 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 3.5.4)	+/- 25 %

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