



ENGINEERING MATERIAL SPECIFICATION

Material Name

Specification Number

ACRYLIC (PMMA), HEAT RESISTANT, OPTICAL
GRADE MOLDING COMPOUND, EXTERIOR

WSK-M4D776-A2

1. SCOPE

The material defined by this specification is a thermoplastic acrylic molding compound based on polymethylmethacrylate (PMMA).

2. APPLICATION

This specification was released originally for material used for lenses of front and rear lamps.

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.

3.2 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.

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

3.4.1 Melt Flow Rate
(ISO 1133/ASTM D 1238
230 C, 3.8 kg)

1.7 - 5.0 g/10 minutes

The material shall be dried for 2 h minimum at 95 - 100 C in a mechanical convection oven immediately preceding the test.

Date	Release No.	Release/Revision
1991-06-03	EP00E01089485000	Released P. Kuntze

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3.5 MOLDED TEST SPECIMEN

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 1.17 - 1.19 g/cm³
(ISO 1183, Method A/ASTM D 792, Method A1)
- 3.5.3 Tensile Strength at Max Load, min 78 MPa
(ISO R 527/ASTM D 638M, 150 min x 10 x 4.0 +/- 0.2 mm specimen, 50 mm/min test speed)
 - 3.5.3.1 Elongation at Break, min 3.0 %
(Test Method according to para 3.5.3)
- 3.5.4 Flexural Modulus, min 3.1 GPa
(ISO 178/ASTM D 790M, Method I, Procedure A, 80 x 10 x 4.0 +/- 0.2 mm specimen, 64 mm support span)
- 3.5.5 Shear Modulus at 23 C 1.3 - 1.8 GPa
(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)

Additionally, a Shear Modulus vs. Temperature curve shall be plotted for - 50 to + 120 C temperature range, at 5 C minimum intervals. The plotted curve must be within tolerance range shown on page 6.



- 3.5.6 Impact Strength, Izod, min
(ISO 180, Method A/ASTM D 256, Method A,
80 x 10 x 4.0 +/- 0.2 mm specimen,
10 specimens for each test)

3.5.6.1 At 23 +/- 2 C 1.5 kJ/m2

3.5.6.2 At - 40 +/- 2 C 1.5 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, if not possible, test can be conducted outside, but within 5 s.

- 3.5.7 Heat Deflection Temperature, min
(ISO 75/ASTM D 648, 120 x
10 x 4.0 +/- 0.2 mm specimen)

3.5.7.1 At 1.82 MPa 97 C

3.5.7.2 At 0.45 MPa 105 C

Conditioning

Pre-treatment for 16 h at 80 C, followed by at least 1 h's cooling at 23 C in the dessiccator. Testing shall be performed immediately after the samples are removed from the dessiccator.

- 3.5.8 Vicat Softening Temperature, min 106 C
(ISO 306, 10 x 10 x 4.0 +/- 0.2 mm
specimens. Bath - silicone oil,
temp. raise 50 +/- 5 C/h. Dial gage
reset to '0' after addition of 5 kg
weight. At 49.0 N load)

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/ASTM D 573, 150 +/- 50 air
changes/h, 1000 h at 90 +/- 2 C.
Unaged property values shall be
determined at the time of the aged
properties determination)

3.5.9.1 Tensile Strength at Max
Load Change +/- 15 %
(Test Method per para 3.5.3)

3.5.9.2 Impact Strength, Izod Change +/- 15 %
(Test Method per para 3.5.6.1,
specimens to be notched before
heat aging)