**THERMOPLASTIC ELASTOMER (TEO) POLYOLEFIN, EPDM RUBBER MODIFIED ENGINE COOLANT AND MODERATE HEAT RESISTANT - 60 DUROMETER A HARDNESS** — **WSD-M2D378-A1**

**THERMOPLASTIC ELASTOMER (TEO) POLYOLEFIN, EPDM RUBBER MODIFIED ENGINE COOLANT AND MODERATE HEAT RESISTANT - 68 DUROMETER A HARDNESS** — **WSD-M2D379-A1**

**THERMOPLASTIC ELASTOMER (TEO) POLYOLEFIN, EPDM RUBBER MODIFIED ENGINE COOLANT AND MODERATE HEAT RESISTANT - 76 DUROMETER A HARDNESS** — **WSD-M2D380-A1**

**THERMOPLASTIC ELASTOMER (TEO) POLYOLEFIN, EPDM RUBBER MODIFIED ENGINE COOLANT AND MODERATE HEAT RESISTANT - 82 DUROMETER A HARDNESS** — **WSD-M2D381-A1**

**THERMOPLASTIC ELASTOMER (TEO) POLYOLEFIN, EPDM RUBBER MODIFIED ENGINE COOLANT AND MODERATE HEAT RESISTANT - 89 DUROMETER A HARDNESS** — **WSD-M2D382-A1**

## 1. SCOPE

The materials defined by these specifications are thermoplastic elastomers of nominal instantaneous Durometer 'A' hardnesses ranging from 60 to 89 having good long term resistance to heat and engine coolant at temperatures up to 125 °C. The harder materials also have moderate resistance to oil. Resistance to other fluids cannot be assumed without further testing. Being thermoplastic, the material will soften and creep at temperatures exceeding 165 °C.

## 2. APPLICATION

These specifications were released originally for materials used for general engine compartment components such as grommets, gaiters, seals, sleeving and tubing. The materials can be processed by conventional thermoplastics molding techniques such as injection molding, extrusion and blow-molding.

| Date | Action | Revisions | Rev 02 |
|---|---|---|---|
| 2017 06 14 | Revised | See Summary of Revisions | P.Addis, FoE |
| 2004 11 18 | Revised | Inserted 3.0; Deleted 3.1, 3.2, 3.4, 3.20 & 4 | |
| 1988 04 11 | | Released WSD-M2D378-A1 & 382-A1 SM/ER 3655 TC | |

Documents
Document Sharing Hub


Copyright © 2017, Ford Global Technologies, LLC


Copyright Ford Motor Company
Provided by IHS Markit under license with FORD
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: FORD WSD-M2D380-A1 2017

## 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 DYNAMIC MECHANICAL ANALYSIS

Ford Motor Company, at its option, may establish shear modulus/damping vs. temperature curves plotted for -50 to +150 °C temperature range for material/parts supplied to this specification. The shear modulus and damping curves established for initial approval shall constitute the reference standard and shall be kept on file at the designated material laboratory. All samples shall produce shear modulus and damping curves that correspond to the reference standard when tested under the same conditions.

### 3.5 PREPARATION OF TEST SPECIMENS

Unless otherwise specified, all test shall be conducted on specimens die cut from injection molded plaques 150 x 100 x 2.0 +/- 0.2 mm. The plaques shall be molded according to ISO 294 and film gated along the upper 100 mm edge, and preceded by a 0.8 mm diameter pin gate. No annealing allowed, unless specified otherwise.

| | | 378-A1 | 379-A1 | 380-A1 | 381-A1 | 382-A1 |
|---|---|---|---|---|---|---|
| 3.6 | **DENSITY, +/- 0.05 g/cm$^3$** (ISO 1183, Method /ASTM D 792, Method A1) | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| 3.7 | **HARDNESS, INTERNATIONAL** (ISO 48/ASTM D 1415) | 60 - 70 | 67 - 77 | 78 - 88 | 84 - 94 | --- |
| 3.8 | **HARDNESS, DUROMETER A** (ISO 868/ASTM D 2240, instantaneous, plied-up specimen) | 54 - 65 | 63 - 72 | 71 - 81 | 76 - 88 | 82 - 94 |
| 3.9 | **TENSILE STRENGTH, MPa, min.** (ISO R 527, type 2/ASTM D 412, Die C, 500 mm/min test speed. Measured Parallel to Flow) | 2.3 | 3.6 | 4.9 | 7.1 | 7.6 |
| 3.9.1 | Elongation at Break, % min (Test per para 3.9) | 100 | 100 | 110 | 250 | 250 |

Copyright © 2017, Ford Global Technologies, LLC



Documents
Document Sharing Hub
Copyright Ford Motor Company
Provided by IHS Markit under license with FORD
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: FORD WSD-M2D380-A1 2017

| | | 378-A1 | 379-A1 | 380-A1 | 381-A1 | 382-A1 |
|---|---|---|---|---|---|---|
| **3.10** | **MODULUS AT 100% ELONGATION, GPa, min** (Test per para 3.9) | 2.2 | 2.9 | 3.5 | 5.5 | 5.6 |
| **3.11** | **TEAR STRENGTH, kN/m, min** (ISO 34, Method B, procedure A/ ASTM D 624, Die C) | | | | | |
| 3.11.1 | Parallel to Flow | 6 | 15 | 18 | 20 | 45 |
| 3.11.2 | Perpendicular to Flow | 15 | 25 | 25 | 35 | 45 |
| **3.12** | **COMPRESSION SET, % max** (ISO 815, Large Type plied specimen/ASTM D 395, Method B, Type 1 plied specimen) | | | | | |
| 3.12.1 | 22 h at 70 +/- 1 °C | 35 | 40 | 45 | 45 | 65 |
| 3.12.2 | 70 h at 125 +/- 2 °C | 55 | 60 | 70 | 70 | 80 |
| **3.13** | **BRITTLENESS POINT, C max** (ISO 812, Type B specimen/ ASTM D 2137, Method A) | -60 | -60 | -55 | -50 | -50 |
| **3.14** | **OZONE RESISTANCE, Rating, max** (FLTM BP 101-01, at 20% elongation) | 0 | 0 | 0 | 0 | 0 |
| **3.15** | **HEAT AGING** (ISO 188/ASTM D 573, 150 +/- 50 air changes/h, 1000 h at 125 +/- 2 °C Unaged property values shall be determined at the time of the aged properties determination.) | | | | | |
| | Hardness Change , max | +5 | +5 | +5 | +5 | +5 |
| | Tensile Strength Change, % max | +/- 30 | +/- 30 | +/- 25 | +/- 25 | +/- 20 |
| | Elongation Change, % max | +/- 35 | +/- 35 | +/- 40 | +/- 40 | +/- 40 |
| **3.16** | **IMMERSION IN OIL NO. 1** (ISO 1817/ASTM D 471, 168 h at 125 +/- 2 °C) | | | | | |
| | Hardness Change, max | -25 | -25 | -25 | -30 | -30 |
| | Tensile Strength Change, % max | -40 | -35 | -35 | -30 | -25 |
| | Elongation Change, % max | -70 | -65 | -60 | -55 | -50 |
| | Volume Change, % max | +65 | +55 | +45 | +35 | 30 |

Copyright © 2017, Ford Global Technologies, LLC



Documents
Document Sharing Hub
Copyright Ford Motor Company
Provided by IHS Markit under license with FORD
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: FORD WSD-M2D380-A1 2017