



## TUBING, POLYOLEFIN, HEAT SHRINKABLE, DUAL WALL, ADHESIVELY LINED, SEMI-RIGID, FLAME RETARDANT

ESB-M99D56-A2

### 1. SCOPE

The material defined by this specification is a flame retardant, selectively crosslinked, dual wall polyolefin tubing whose diameter shall reduce to a predetermined size upon application of heat in excess of 135 °C. The tubing shall be fabricated from an irradiated, thermally stabilized, modified polyolefin composition, and shall be lined with a thermoplastic adhesive.

### 2. APPLICATION

These specifications were released originally for material used to seal electrical harness wire splices or electrical components such as fuselinks, diodes and resistors.

### 3. REQUIREMENTS

#### 3.1 STANDARD REQUIREMENTS FOR PRODUCTION MATERIALS

Material suppliers and part producers must conform to the Company's Standard Requirements For Production Materials (WSS-M99P1111-A).

#### 3.2 FORMED PARTS

The tubing shall be fabricated from thermally stabilized, modified polyolefin and shall be crosslinked by irradiation. It shall be homogeneous and essentially free from flaws, defects, pinholes, bubbles, seams, cracks, and inclusions.

3.2.1 Dimensions (ASTM D 2671) As specified on engineering drawing

Shall be specified before and after shrink.

3.2.2 Longitudinal Change (ASTM D 2671) +0%, -10%

3.3 SPECIFIC GRAVITY (ASTM D 2671, Outer Wall Only) 1.35 max

3.4 LOW TEMPERATURE FLEXIBILITY AT -30 °C (ASTM D 2671, Procedure C, Outer Wall Only) No cracking

Test Method: Specimens of tubing, as supplied (sizes as described in ASTM D 2671, Procedure C) and a mandrel (see Table 1 for size) shall be conditioned for 4 h at -30 +/- 2 °C. While at this temperature, the specimens shall be wrapped around the mandrel for at least 360° in approximately 2 s.

| Date       | Action      | Revisions                | Rev 04         |
|------------|-------------|--------------------------|----------------|
| 2015 02 27 | Re-Activate | See Summary of Revisions | M. Katz, NA    |
| 2013 07 04 | N-STATUS    |                          | A.Wedepohl, NA |
| 1987 11 17 | Released    | CAR1-PF183193            | M. Myers       |

Controlled document at [www.MATS.ford.com](http://www.MATS.ford.com)

Copyright © 2015, Ford Global Technologies, LLC



Documents  
Page 1 of 3  
Document Sharing Hub



- 3.5 HEAT SHOCK** 250 °C  
(ASTM D 2671, 150 mm specimen length)

Specimens of tubing shall be conditioned for 4 h in a 250 +/- 5 °C oven. The specimens shall be removed from the oven, cooled to 23 +/-2 °C, and then visually examined for evidence of dripping, flowing, or cracking in the polyolefin. Any side cracking caused by flattening of the specimen on the mandrel shall not constitute failure.

- 3.6 TENSILE STRENGTH AT MAX LOAD** 10 MPa min  
(ASTM D 2671, 25 mm benchmarks, 50 mm initial jaw separation, 150 mm specimen length, 500 +/-50 mm/min test speed, outer cross-section only)

- 3.6.1 Elongation at Break 200% min  
(Test according to para 3.6)

- 3.7 SECANT MODULUS** 225 MPa min  
(ASTM D 882, Procedure A at 2% strain, outer cross-section only, before shrink)

**3.8 CONCENTRICITY**

Six 150 mm specimens of tubing, as supplied, shall be measured for minimum and maximum wall thickness. Concentricity shall be calculated as follows:

$$C = \frac{W_{min}}{W_{max}} \times 100\%$$

Where:

Wmin = Minimum Wall Thickness  
Wmax = Maximum Wall Thickness

Concentricity as supplied 60% min

- 3.9 COPPER MIRROR CORROSION** No corrosion  
(ASTM D 2671, Procedure A, 16 h at 121 °C)

- 3.10 DIELECTRIC STRENGTH** 15 kV/mm min  
(ASTM D 2671, short time)

- 3.11 FLAMMABILITY** Shall not continue to burn for more than 60 s  
(SAE J1128, para 6.6 Resistance to Flame Propagation or ISO 6722-1, para 5.12 Resistance to Flame Propagation)

No dripping or flowing

- 3.12 COLOR** Black or as specified on Engineering Drawing

**4. GENERAL INFORMATION**

The information given below is provided for clarification and assistance in meeting the requirements of these specifications. Contact [gmfs@ford.com](mailto:gmfs@ford.com) for questions concerning Engineering Material Specifications.