

**TUBING, POLYAMIDE COVER, PTFE INNER
TUBE, NON-CONDUCTIVE, LOW PERMEATING
FUEL VAPOR LINE**

WSS-M98D33-A9

1. SCOPE

These specifications define multilayered fuel and vapor lines comprised of a heat, hydrocarbon, water, and chloride resistant outer cover of polyamide or alloyed polyamide or equivalent material. The cover is well adhered to a low fuel permeability and fuel/alcohol blend resistant inner tube such as conductive or non-conductive polytetrafluoroethylene (PTFE) or equivalent material. This construction is sufficiently flexible for ease of forming, assembly, and routing, and is resistant to kinking.

2. APPLICATIONS

These specifications were released originally for electrically non-conductive fuel vapor and electrically conductive supply and return liquid carrying fuel lines utilized in engine jumpers, crossover lines, and tank jumper fuel and vapor lines for passenger car and light truck applications where low permeation is required. This tubing is designed to be used through a temperature range of - 40 to + 140 degrees with a sustained half-life operation [defined as loss of 50% physical properties] of 120 °C for 1500 hours and intermittent temperature excursions up to 140 °C for 150 hours. This fuel line will meet the requirements for both reformulated and flexible fuels. Note: The construction and performance properties of the WSS-M98D33-A9 and A10 are essentially the same except for inner tube electrical conductivity in the A10. Liquid fuel carrying applications must use the A10. Certain applications may have elevated temperature excursions if the functionality of the part is not compromised by operation in an environment where there is a loss of more than 50 % of the physical properties.

2.1 LIMITATIONS

The requirements listed in this specification represent values based on vehicle operating conditions that do not exceed 0.6 MPa fuel pressure. If the fuel system is expected to exceed this pressure the construction is not appropriate for the application.

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 INFRARED SPECTROPHOTOMETRY AND/OR THERMAL ANALYSIS

Date	Action	Revisions	Rev 1
2016 01 26	Revised	See summary of revisions	A. Reaume/G. Kowalski, NA
2002 12 05	Activated		G. Gullen



IR spectra and thermograms from initial material approval shall constitute the reference standard and shall be kept on file at the designated material laboratory. The material supplier shall ensure that all future material supplied to the specification shall produce IR spectra and thermograms that correspond to the reference standard when tested under the same conditions.

3.4 INITIAL QUALIFICATION

Suppliers seeking approval to this specification must meet the initial qualification processes that include evaluating materials and constructions according to the applicable Fuel System Design Specification (SDS) and individual Design Verification Methods (DVM).

3.5 ADDITIONAL REQUIREMENTS

Requirements beyond those explicitly stated in this document and the material specification may be specified on the Engineering drawing, Engineering specification (ES), performance specification, System Design Specification (SDS) and/or Attribute Requirement List (ARL).

3.6 PERFORMANCE CRITERIA

Materials approved to this specification must also be approved to the fuel system polymeric materials performance standard: WSS-M98P14-A1

3.6.1 Burst Pressure

(SAE J2260, Room Temperature Burst, High Temperature Burst)

3.6.1.1 Room temperature burst
(As received)

3500 kPa min

3.6.1.2 High temperature burst
(Burst at 90°C)

1000 kPa min

3.6.2 Kink Resistance

(SAE J2260, Ovality Requirement)

Ball must pass freely

3.6.3 Dimensional Stability, length change

(Expose 300 mm of tubing in an air circulating oven
(ASTM D 573/ISO 188) for 168 h at 120 +/- 2 °C.,
measure at room temperature)

4 % max

3.6.4 Flammability Resistance, Cover Stock Only (ISO 3795)

Self- extinguishing
within 60 seconds

4. GENERAL INFORMATION

The information given below is provided for clarification and assistance in meeting the requirements of this specification. Contact gmfs@ford.com for questions concerning Engineering Material Specifications.

4.1 RECYCLING CODES

>PA/PTFE<

4.2 APPROVAL OF MATERIALS

Suppliers desiring approval of their materials shall first obtain an expression of interest from Purchasing, Design or Product Development, and Materials Engineering. The supplier shall submit a completed copy of their laboratory test reports, signed by a qualified and authorized representative of the test facility, demonstrating full compliance with all the requirements of the Material Specification. Tested material samples must be available for review upon request and kept for a minimum of one year. Upon request, the supplier will review the associated quality control