SAE International

SURFACE VEHICLE STANDARD

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Superseding J2045 FEB1998

Performance Requirements for Fuel System Tubing Assemblies

RATIONALE

This revision is to encompass changes in fuel and emission technology and to clarify applicable test procedures.

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1. SCOPE

This SAE Standard encompasses the recommended minimum requirements for non-metallic tubing and/or combinations of metallic tubing to non-metallic tubing assemblies manufactured as liquid- and/or vapor-carrying systems designed for use in gasoline, alcohol blends with gasoline, or diesel fuel systems. This SAE Standard is intended to cover tubing assemblies for any portion of a fuel system which operates above –40 °C (–40 °F) and below 115 °C (239 °F), and up to a maximum working gage pressure of 690 kPa (100 psig). The peak intermittent temperature is 115 °C (239 °F). For long-term continuous usage, the temperature shall not exceed 90 °C (194 °F). It should be noted that temperature extremes can affect assemblies in various manners and every effort must be made to determine the operating temperature to which a specific fuel line assembly will be exposed, and design accordingly.

The applicable SAE standards should be referenced when designing liquid-carrying and/or vapor-carrying systems which are described in this document.

Wherever possible or unless stated otherwise, systems tested to this document shall be in the final design intent configuration.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J30 Fuel and Oil Hoses, Sections 10 and 11

SAE J517 Hydraulic Hose

SAE J526 Welded Low Carbon Steel Tubing

SAE J1645 Fuel System Electrostatic Charge

SAE J1681 Gasoline/Oxygenate Mixtures for Materials Testing

SAE J1737 Procedure/Fuel Permeation Losses

SAE J2027 Protective Covers for Non-metallic Gasoline Fuel Injection Tubing

SAE J2044 Quick Connect Coupling Specification for Liquid and Vapor/Emissions Systems

SAE J2260 Non-Metallic Fuel System Tubing with 1 or More Layers

SAE J2587 Optimized Fuel Sender Closure

2.1.2 ASTM Publication

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org

ASTM B117 Method of Salt Spray (Fog) Testing

2.1.3 Other Publications

Code of Federal Regulations (CFR) 40 (Protection of Environment), part 86 (Control of Emissions from New and In-Use Highway Vehicles and Engines).

FMVSS 301 (Fuel Systems Integrity).

California Code of Regulation Title 13, Division 3 (ARB), Chapter 1, Article 1, section 1976 (Standards and Test Procedures for Motor Vehicle Fuel Evaporative Emissions).

3. ROUTING RECOMMENDATIONS

Fuel tube/hose assemblies shall be routed and supported as to;

a. Prevent chafing, abrasion, kinking, or other mechanical damage.

b. Be protected against road hazards or provided with adequate shielding in locations that are vulnerable to physical and/or chemical hazards.

c. Be protected where temperatures may exceed the limits of –40 °C to +90 °C by the addition of adequate insulation and/or shielding.

d. To assure maintenance of design intent routings of liquid fuel and/or fuel vapor assemblies, appropriate retaining/mounting devices must be incorporated for proper assembly and subsequent vehicle service operation, maintaining interfaces for temperature and environmental control for durability.

e. Route tube assemblies in an environment which minimizes heat input to the assemblies and the liquid fuel and/or fuel vapor which they contain.

4. TECHNICAL REQUIREMENTS

4.1 Leak Tightness

In accordance with stringent emissions regulations, including CARB PZEV, and safety regulations, fuel line assemblies must be free of leaks and micro-leaks. Production leak testing is performed to assure conformance to the requirement. Compressed air leak testing is a proven technique which provides required leak sensitivity as well as a proof test for pressure resistance.

4.1.1 Testing Device

A device capable of applying the recommended internal pressure specified for both liquid fuel and fuel vapor line assemblies. Test is intended to be performed on liquid fuel/fuel vapor assemblies that duplicate the design intended for vehicle application, including applicable end fittings and/or connections (see Appendic A).

4.1.2 Sample Preparation

All test samples to be at room temperature.

4.1.3 Procedure

a. Leak tests are to be conducted at room temperature.

b. Attach tube assemblies to test fixture that simulates vehicle installation where at all possible.

c. Apply internal gas pressure (see Appendix A) at one end of the assembly, allowing sufficient time for system to stabilize before determining leak rate.

d. At test completion, test gas media should be exhausted through opposite end of assembly to which it was pressurized to insure obstruction and/or blockage was not present in the liquid fuel/fuel vapor line assembly, as well as blowout any potential residue which may have been present.

e. After test, remove assembly from test fixture.

4.1.4 Acceptance Criteria

No leak paths greater than 15µm X 3mm long for fuel lines and 20µm X 3mm long for vapor lines(see graphs figure A1 and A2). If otherwise required, final acceptance criteria to be jointly determined by producer and end user.

4.2 Fitting Pull-Off

(room temperature and elevated temperature)

4.2.1 Testing Device

A device suitable for applying a tensile load at a constant rate of 50 mm/min, elongating tube or hose assemblies up to 400% of their initial length, and measuring the maximum load achieved up to a load of 900 N minimum.

4.2.2 Sample Preparation

All tests are to be conducted at room temperature (room temperature fitting pull-off) and at 115 °C for high-temperature fitting pull-off.

4.2.3 Procedure

a. The test specimen shall consist of a direct connection coupling between the flexible tubing/hose and fitting or tube with enough length of hose and/or tube on either side of specimen to permit adequate gripping in the test apparatus. Specimens may be cut from the production intent part or made for this test utilizing production intent product and processes, such as component assembly devices and tube forming techniques.

b. Grip the test specimen in the tensile-loading device and apply a tensile load at a speed of 50 mm/min until one of the following events occur;

    1. The fitting or tube separates from the flexible tubing

    2. One of the test specimen components break, fracture, or rupture

    3. A maximum load is reached whereby the flexible tubing reaches its maximum tensile/elongation load capability

c. For elevated temperature pull-off tests, grip the test specimen in the tensile-loading device and heat test specimen to 115 °C (239 °F) for (15) minutes prior to applying the 50 mm/min tensile load. Test chamber should be instrumented with a thermocouple to insure test environment reaches 115 °C prior to applying the tensile load.

d. Measure and record the greatest load achieved before one of the events listed (2) occurs, and the type of event (failure mode).