

Submitted for recognition as an American National Standard

(R) WINDSHIELD WASHER TUBING

Foreword—This Document has also changed to comply with the new SAE Technical Standards Board format.

1. Scope—This SAE Standard covers nonreinforced, extruded, flexible tubing intended primarily for use as fluid lines for automotive windshield washer systems conforming to the requirements of SAE J942.

2. References

2.1 Applicable Publications—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J942—Passenger Car Windshield Washer Systems
SAE J962 MAY86—Formed Tube Ends for Hose Connections

2.1.2 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 380—Methods of Testing Rubber Hose
ASTM D 573—Test Method for Rubber—Deterioration in an Air Oven
ASTM D 925—Test Methods for Rubber Property—Staining of Surfaces (Contact, Migration, and Diffusion)
ASTM D 1149—Test Method for Rubber Deterioration—Surface Ozone Cracking in a Chamber (Flat Specimens)
ASTM D 2240—Test Method for Rubber Property—Durometer Hardness

3. Dimensions—Typical available sizes are noted below:

I.D.	
mm	in
2.29 – 2.79	0.090 – 0.110
3.56 – 4.37	0.140 – 0.172
5.16 – 5.97	0.203 – 0.235

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4. Requirements—The following tests shall be conducted on full sections of tubing, except when noted otherwise. All test values indicated herein are based on samples conditioned in a controlled atmosphere of $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ ($73\text{ }^{\circ}\text{F} \pm 3.6\text{ }^{\circ}\text{F}$) and $50\% \pm 5\%$ relative humidity for not less than 24 h prior to testing and tested under the same conditions unless otherwise specified.

4.1 Hardness, Durometer A (ASTM D 2240) - 70 ± 5 points.

4.2 Tensile Strength - 7.0 MPa, minimum (1015 lbf/in², minimum).

Elongation - 200%, minimum

4.2.1 TEST METHOD—Tubing 250 mm (10 in) long is fastened to the jaws of a tensile tester by means of knots tied in both ends with two washers located between the knots and the washers fastened in the jaws. The jaw separation rate shall be $500\text{ mm} \pm 25\text{ mm}$ ($20\text{ in} \pm 1\text{ in}$) per minute until failure occurs. If the tubing fails in the knots or within 25 mm (1 in) of the knots, then the tests should be rerun until failure occurs in the section between the knots. To obtain the cross-sectional area of tubing, an optical comparator or similar instrument may be used.

4.3 Burst Pressure—(ASTM D 380) - 0.70 MPa, minimum (101 lbf/in², minimum).

4.4 Formed Tube End or Connector Pull-Off Force

Tubing I.D.	Formed Tube End	Pull Off-Force
	Nominal Tube O.D.	
mm (in)	mm (in)	N (lbf)
2.29 – 2.79 (0.090 - 0.110)		22.2 (5)
3.56 – 4.37 (0.140 - 0.172)	4.76 (0.188)	44.5 (10)
5.16 – 5.97 (0.203 - 0.235)	6.35 (0.250)	66.7 (15)

4.4.1 TEST METHOD—150 mm (5.9 in) specimen lengths of tubing shall be installed on the respective size formed tube end or plastic connector fitting as described in SAE J962 MAY86 (Type A or B). The formed tube ends or plastic connectors used shall be clean and dry. The tubing specimens shall be as received with no preparation of the bore. If a lubricant is required to facilitate installation, only isooctane or similar evaporative petroleum derivative may be used. After installation, the specimens shall be allowed to stabilize at standard laboratory test temperature for 48 hours. Using a suitable tensioning device, the rubber tubing shall not be pulled from the formed tube end with less than the specified force at a pull rate of $500\text{ h} \pm 25\text{ mm}$ ($20\text{ in} \pm 1\text{ in}$).

4.5 Vacuum Collapse Test—30%, maximum.

The collapse of the OD of the tubing under internal vacuum of 610 mm (24 in) of mercury for 5 min shall be 30% max. The test shall be made with the tubing curved to a radius equal to five times the maximum OD.

4.6 Wax Bloom—There shall be no visible evidence of wax or any other contaminants exuding from the inside or outside diameter of the tubing.

SAE J1037 Revised DEC87

4.6.1 **TEST METHOD**—Condition a 150 mm (5.9 in) section of tubing for 45 min at -40°C (-40°F). Remove the specimen from the cold chamber and permit recovery to room temperature for 1 hour. The tubing shall then be twisted 360 deg for 10 successive cycles, after which the center 50 mm (1.96 in) section shall be compressed 10 successive cycles by finger pressure or utilization of a compression device to full closure of the I.D. The tubing shall then be sectioned longitudinally and examined for evidence of wax bloom or other contaminants.

4.7 **Tear Test**—The tubing shall not tear when expanded to a minimum internal diameter of two times the nominal I.D. by forcing the tubing over a 30 deg tapered, clean metal rod which has been lubricated with a silicone parting agent. The metal rod shall have a finish of rms 20 maximum.

4.8 Formed Tube End Pull-Off Force After Sequential Heat Aging/Ozone Exposure

4.8.1 **TEST METHOD**—150 mm (5.9 in) specimen lengths of tubing, installed on formed tube ends or plastic connector as described in Section 3.4 of SAE J962, shall be heat aged as described in 4.11. After 24 h stabilization period to and at standard laboratory test temperature, the installed specimens shall be exposed in an ozone test chamber as described in Section 4.10. At the end of the exposure, the specimens shall be allowed to cool to standard laboratory test temperature and to remain so for 16 h, minimum. Using the same suitable tensioning device and procedure as used in Section 4.4, the rubber tubing shall show a pull off force of not less than the following:

Tubing I.D.	Pull-Off Force
mm (in)	N (lbf)
2.29 – 2.79 (0.090 – 0.110)	17.8 (4)
3.56 – 4.37 (0.140 – 0.172)	35.6 (8)
5.16 – 5.97 (0.203 – 0.235)	53.4 (12)

4.9 **Cold Resistance**—Shall not show fractures, cracks, checks, or breaks.

4.9.1 **TEST METHOD**—The tubing shall be subjected to a temperature of -40°C (-40°F) for a period of 5 h, after which the tubing shall be flexed in the cold chamber through 180 deg from the centerline in each direction to a diameter 10 times the maximum OD of the tube at each extreme of the cycle for five cycles. The rate of cycling shall be approximately one cycle in four seconds.

4.10 Ozone Resistance (ASTM D 1149, Rating)—0.

4.10.1 **TEST METHOD**—Elongate the specimen around a wooden or aluminum mandrel of random selection to attain approximately 25% elongation. Condition the specimen on the mandrel 24 h at room temperature in an ozone-free atmosphere. Then hang the specimen(s) in an ozone box with an ozone partial pressure of 50 ± 5 mPa for 70 h at $40 \pm 1^{\circ}\text{C}$ ($104 \pm 2^{\circ}\text{F}$). Examine for rating using 7X power glass.

4.11 **Heat Aging**—After being subjected to dry air aging in accordance with ASTM D 573 method of testing for accelerated aging of vulcanized rubber by the oven method for 70 h at 125°C (257°F), the tubing must then meet the following test requirements:

Vacuum Collapse	30% maximum
Cold Resistance:	Shall not crack, etc.
Hardness, Durometer A Change:	+15 points, maximum
Tensile Change:	-20% maximum
Elongation Change:	-50% maximum
Tear Resistance	Must not tear
Ozone Resistance, ASTM Rating	0

4.12 Stain Test (Water Solution)—When tested as described below, slight staining of the paint is permitted, providing it can be removed by employing the usual cleaning materials.

4.12.1 TEST METHOD—Cut a 150 mm (5.9 in) length of tubing in to small pieces and place in 200 ml of a 50% aqueous solution of windshield washer solution and reflux for four hours. Cool the resulting liquid to room temperature. Pour out on a surface of a freshly prepared white paint panel, convertible and vinyl top materials of your production, covering about 645 mm² (1 in² surface of each specimen. Expose specimens to ultraviolet radiation (S-1 Sunlamp, ASTM D 925) for 24 hours. Cool and examine. Make a visual assessment of the degree of staining relative to a reference sample (protected from irradiation).

5. Notes

5.1 Marginal Indicia—The change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

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