By Authority Of
THE UNITED STATES OF AMERICA
Legally Binding Document

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Part 1 of the Code of Regulations § 51 the attached document has been duly
INCORPORATED BY REFERENCE and shall be considered legally
binding upon all citizens and residents of the United States of America.

HEED THIS NOTICE: Criminal penalties may apply for noncompliance.

Official Incorporator:
The Executive Director
Office of the Federal Register
Washington, D.C.
**MARINE FUEL HOSES**

**SAE J1527 JAN93**


1. Scope—This SAE Standard covers three styles of reinforced hose for conveying gasoline or diesel fuel aboard small craft including pleasure craft whose fuel systems are regulated under 33 CFR 183 Subpart J.

2. References

2.1 Applicable Documents—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

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

SAE JS16—Hydraulic Hose Fittings
SAE JS17—Hydraulic Hose

2.1.2 ASTM PUBLICATIONS—Available from ASTM, 1916 Race Street, Philadelphia, PA 19103.

ASTM D 380—Methods of Testing Rubber Hose
ASTM D 413—Test Methods for Rubber Property—Adhesion to Flexible Substrate
ASTM D 471—Test Method for Rubber Property—Effect of Liquids
ASTM D 573—Test Method for Rubber—Deterioration in an Air Oven
ASTM D 1149—Test Method for Rubber Deterioration—Surface Ozone Cracking in a Chamber (Plat Specimen)


3. Hose Construction

3.1 Style R1—The construction of this hose embodies a smooth bore fuel and oil resistant tube, reinforced with one or more plies of textile fiber yarn, cord or fabric, and finished with a suitable oil, ozone, and heat-resistant cover. For Class I service, covers or sleeves having a lower permeation rate than the tube shall be pin-pricked.

3.2 Style R2—The construction of this hose embodies a smooth bore fuel and oil resistant tube, a helical wire imbedded in the hose, and finished with a suitable oil, ozone, and heat-resistant cover. Pllies of fabric or cord may be applied between the tube or cover and the helical wire.

3.3 Style R3—The construction of this hose embodies a smooth bore fuel and oil resistant tube, reinforced with one or more braids of wire, and finished with a suitable oil, ozone, and heat-resistant cover. These hoses shall be used with end fittings complying with SAE specification JS16-100R5.

4. Dimensions and Tolerances—The applicable dimensions and tolerances for style R1 and R2 are shown in Table 1. The dimensions and tolerances for style R3 shall comply with the SAE JS17-100R5 specification.

5. Flammability—Quarter-inch-wide strips cut longitudinal from the cover, which have been removed from the hose, shall be used for this test. A bunsen burner shall be used to start burning of the strips until approximately 12.7 mm (1/2 in) of the strip is burning vigorously. Remove the burning strip from the flame and hold it horizontally with the outside facing upward. The flame shall be self-extinguishing within 60 s. The average time of at least six determinations shall be used. The test shall be conducted in a draft-free atmosphere.

6. Fire Resistance—Two types of hose with respect to fire resistance are covered by this document. 33 CFR 183 Subpart J requires certain fuel hoses to provide a minimum 2-1/2 min of fire resistivity. Hose exhibiting no leakage after the following test procedure is designated USCG Type A. Hose not subjected to the following test is designated USCG Type B.

6.1 Principle—The hose, including its couplings if applicable, filled with N Heptane, is subjected to a flame for 2-1/2 min, then to a hydraulic pressure test, after which it shall show no leakage.

6.2 Sampling—Three hose samples shall be tested in turn without showing leakage.

6.3 Equipment—Test equipment shall be utilized as shown in Figure 1. Thermocouples shall be located in the same horizontal plane as the sample, at a distance of 12 mm (0.5 in) from the surface of the hose and 25.4 mm (1 in) from the end of the hose.

The fuel pan shall be a straight-sided container with minimum width, length, and depth dimensions of 355 mm (14 in) × 355 mm (14 in) × 40 mm (1.5 in).

6.4 Test Procedure—If the hose is intended to be delivered with couplings, at least one of the couplings shall be located directly above the fuel pan.

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**TABLE 1—DIMENSIONS AND TOLERANCES**

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Inside Diameter mm</th>
<th>Inside Diameter in</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4</td>
<td>8.58 ± 0.40</td>
<td>0.260 ± 0.016</td>
</tr>
<tr>
<td>5/16</td>
<td>7.04 ± 0.40</td>
<td>0.280 ± 0.016</td>
</tr>
<tr>
<td>3/8</td>
<td>5.53 ± 0.40</td>
<td>0.217 ± 0.016</td>
</tr>
<tr>
<td>7/16</td>
<td>11.11 ± 0.58</td>
<td>0.438 ± 0.023</td>
</tr>
<tr>
<td>1/2</td>
<td>12.70 ± 0.58</td>
<td>0.500 ± 0.023</td>
</tr>
<tr>
<td>9/16</td>
<td>14.28 ± 0.58</td>
<td>0.562 ± 0.023</td>
</tr>
<tr>
<td>5/8</td>
<td>15.88 ± 0.79</td>
<td>0.625 ± 0.031</td>
</tr>
<tr>
<td>3/4</td>
<td>19.05 ± 0.79</td>
<td>0.750 ± 0.031</td>
</tr>
<tr>
<td>3</td>
<td>25.40 ± 1.59</td>
<td>1.00 ± 0.082</td>
</tr>
<tr>
<td>1-1/4</td>
<td>31.78 ± 1.59</td>
<td>1.250 ± 0.082</td>
</tr>
<tr>
<td>1-1/2</td>
<td>38.10 ± 1.59</td>
<td>1.500 ± 0.082</td>
</tr>
<tr>
<td>1-3/4</td>
<td>44.45 ± 1.59</td>
<td>1.750 ± 0.082</td>
</tr>
<tr>
<td>1-7/8</td>
<td>47.69 ± 1.59</td>
<td>1.875 ± 0.082</td>
</tr>
<tr>
<td>1</td>
<td>50.82 ± 1.59</td>
<td>2.000 ± 0.082</td>
</tr>
<tr>
<td>2-1/4</td>
<td>57.35 ± 1.59</td>
<td>2.250 ± 0.082</td>
</tr>
<tr>
<td>2-3/4</td>
<td>60.32 ± 1.59</td>
<td>2.375 ± 0.082</td>
</tr>
</tbody>
</table>
7. Abrasion Test—Style R2 Only

7.1 Principle—Three individual production 38 mm (1-1/2 in) ID hoses of identical construction shall be selected for a test lot. These hoses shall incorporate a cover compounded and constructed the same as for all other sizes to be qualified by this test lot. No hose to be qualified by this test lot shall have a cover thickness less than those of the test lot. After 1000 test cycles each hose of the test lot shall not have any rigid helix exposed at the point of contact with the abrasive surface.

7.2 Procedure—The test hoses shall be preconditioned for at least 24 h at 23 °C ± 2 °C (73 °F ± 3.6 °F) and 50% ± 5% relative humidity. Testing shall then be performed at the preconditioning temperature with an unused abrasive surface for each hose sample.

The test hose shall be mandrel supported and rotated at a constant speed of 80 rpm ± 2 rpm. The rotation hose shall be subjected to a laterally moving abrasive surface (0.34 grain size emery cloth) parallel to the longitudinal axis of the test hose.

The abrasive surface shall be 25 × 75 mm ± 5 mm (1 × 3 in ± 0.25 in) firmly affixed to a hard surface which will cycle back and forth 75 mm ± 5 mm (3 in ± 0.25 in) in each direction.

A constant normal force of 45 N ± 5 N (10 lb ± 1 oz) shall be applied to the abrasive surface.

The test shall be repeated on a new sample if the temperature has not reached 650 °C (1202 °F).

Open the valve so that fuel can flow through the hose under test. As soon as steady flow is achieved, close the valve and submit the hose to a hydrostatic pressure corresponding to 900 mm (35.4 in) of fuel. Note any sign of leakage.

Dimensions in millimeters

FIGURE 1—FIRE TEST EQUIPMENT

One test cycle equals 360 degrees rotation of the outside diameter and one back and forth movement of the abrasive surface.

See Figure 2 for a typical apparatus.

8. Burst Test—The minimum burst pressure per ASTM D 380 for hose sizes through 25.4 mm (1 in) shall be 1.20 MPa (175 psi) and for hose sizes over 25.4 mm (1 in) shall be 0.62 MPa (90 psi). These hoses have maximum working pressures of 0.24 MPa (35 psi) and 0.12 MPa (18 psi), respectively. Applications which exceed the working pressure values stated previously shall have burst pressures which equal or exceed four times the working pressure of the hose.

9. Vacuum Collapse Test—A 1 m (3.28 ft) length of hose or a hose assembly shall be held in a straight line, and no diameter shall decrease by more than 20% during application of a vacuum of 67.5 kPa (20 in Hg) for a minimum of 15 s and not more than 60 s. The vacuum collapse test on prefomed parts should be performed on the finished part. This requirement shall not apply to style R1 hose sizes larger than 25.4 mm (1 in).

10. Cold Flexibility—For styles R1 and R3 straight hose 19.05 mm (3/4 in) ID and under, the whole hose shall be used for this test. The test specimen shall be conditioned per ASTM D 380 at -20 °C ± 2 °C (-4 °F ± 3.6 °F) for 5 h and then flex in the cold chamber through 180 degrees from the centerline to a diameter of ten times the maximum OD of the hose. The flexing shall take place
within 4 s and the hose must not fracture or show any cracks, checks, or breaks in the tube or cover. Proof pressure of 0.68 MPa (95 psi) may be applied to determine tube damage.

For styles R1 and R3 straight hose over 19.05 mm (3/4 in) ID and all preformed hose, prepare three specimens 100 x 6 mm (4 x 0.25 in) from the whole hose wall. These specimens shall be conditioned per ASTM D 380 at -20 °C ± 2 °C (-4 °F ± 3.6 °F) for 5 h in unrestrained loop positioned between two jaws 50.8 mm (2 in) wide and 63.5 mm (2.5 in) apart. After conditioning and while still in the cold chamber, the jaws shall be brought together as rapidly as possible until they are 25.4 mm (1 in) apart. The specimens shall not fracture or show any cracks, checks, or breaks.

For style R2 hose, a test specimen of the whole hose shall be conditioned per ASTM D 380 at -20 °C ± 2 °C (-4 °F ± 3.6 °F) for 5 h and then, without removing it from the cold chamber, it shall be compressed to 50% of its original ID between parallel plates in 8 to 12 s. After removal and allowing it to come to room temperature, it shall be carefully examined visually. The specimen shall not show any cracks or breaks.

11. **Tensile Strength and Elongation**
   a. Original tensile strength of cover: 7 MPa (1020 psi) min
   b. Original tensile strength of tube: 8 MPa (1160 psi) min
   c. Original elongation of tube and cover: 200% min

12. **Dry Heat Resistance**—After heat aging per ASTM D 573 for 70 h at 100 °C ± 2 °C (212 °F ± 3.6 °F) specimens taken from the tube and cover shall not have a reduction in tensile strength of more than 20% or a reduction in elongation of more than 50%.

13. **Oil Resistance**—After 70 h immersion at 100 °C ± 2 °C (212 °F ± 6 °F) in ASTM Oil No. 3 per ASTM D 471, specimens taken from the tube shall not have a reduction in tensile strength or elongation of more than 40%, or a volumetric change exceeding -5% to +25%. Specimens taken from the cover shall not have a volumetric change exceeding 0% to +100%.

14. **Ozone Resistance**—Test procedure and apparatus shall be in accordance with ASTM D 1149, where applicable. For straight hose, 25.4 mm (1 in) ID and under, a specimen of hose of sufficient length shall be bent around a mandrel with OD eight times the nominal OD of the specimen. The two ends shall be tied at their crossing with enameled copper or aluminum wire. After mounting, the specimen shall be allowed to rest in an ozone-free atmosphere for 24 h at room temperature of 23 °C ± 2 °C (73 °F ± 3.6 °F). The mounted specimen shall be placed in a test chamber with ozone concentration of 100 mPa ± 5 mPa at a temperature of 40 °C ± 2 °C (104 °F ± 3.6 °F). After 70 h of exposure, the specimen shall be removed and allowed to cool to a temperature of 23 °C ± 2 °C (73 °F ± 3.6 °F) and then inspected. The specimen shall be visually inspected under 7X magnification and must meet a “O” rating except for the area immediately adjacent to the wire which shall be ignored. For hoses over 25.4 mm (1 in) ID and preformed parts, prepare a specimen by cutting a strip of whole hose 12.7 mm wide × 100 m long (1/2 x 4 in) and tie the specimen (cover out) around a 12.7 mm (1/2 in) diameter mandrel. Conditions the specimen in the same manner as for whole hose and apply same requirements. This test applies to the cover only and cracks in the exposed tube or cut edges of the cover shall be ignored.

15. **Adhesion Test**—The minimum load required to separate a 25.4 mm (1 in) width of tube and cover at 23 °C ± 2 °C (73 °F ± 3.6 °F) per ASTM D 413 shall be 27 N (6 lb).

16. **Fuel Resistance and Rate of Fuel Permeation**—Two classes of hoses have been established with respect to fuel resistance and rate of fuel permeation:

   - **Class 1** hose is intended for applications such as for fuel tank vent and fill hoses, where liquid fuel is not normally continuously in contact with the hose.
   - **Class 2** hose is recommended for applications such as for fuel tank vent and fill hoses, where liquid fuel is normally continuously in contact with the hose.

Separate samples from each class of hose are required to be tested as stated as follows with the following test fuels: 100% ASTM Fuel C and 85% ASTM Fuel C and 15% methanol by volume.

Those hoses tested in 100% ASTM Fuel C must me the specifications listed in Table 2; the hose samples tested in 85% ASTM Fuel C and 15% methanol must meet the specifications listed in Table 3.

Individual samples need not be tested in both test fluids to meet the requirements of this document.

### TABLE 2—REQUIREMENTS FOR ASTM FUEL C

<table>
<thead>
<tr>
<th></th>
<th>Class 1</th>
<th>Class 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Change</td>
<td>-45%</td>
<td>-45%</td>
</tr>
<tr>
<td>Elongation Change</td>
<td>-45%</td>
<td>-45%</td>
</tr>
<tr>
<td>Volume Change</td>
<td>0 to +50%</td>
<td>0 to +50%</td>
</tr>
<tr>
<td>Permeation</td>
<td>300 g/m²/24 h</td>
<td>300 g/m²/24 h</td>
</tr>
</tbody>
</table>

### TABLE 3—REQUIREMENTS FOR 85% ASTM FUEL C AND 15% METHANOL BY VOLUME

<table>
<thead>
<tr>
<th></th>
<th>Class 1</th>
<th>Class 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Change</td>
<td>-60%</td>
<td>-60%</td>
</tr>
<tr>
<td>Elongation Change</td>
<td>-60%</td>
<td>-60%</td>
</tr>
<tr>
<td>Volume Change</td>
<td>0 to +60%</td>
<td>0 to +60%</td>
</tr>
<tr>
<td>Permeation</td>
<td>600 g/m²/24 h</td>
<td>600 g/m²/24 h</td>
</tr>
</tbody>
</table>

16.1 **Fuel Resistance Test**—After 48h immersion at 23 °C ± 2 °C (73 °F ± 3.6 °F) per ASTM D 471, the test fuels stated in Section 15, degradation of the physical values of specimens taken from the tube shall not exceed the appropriate values as listed in Table 2 or Table 3.

16.2 **Rate of Fuel Permeation Test**—Each class hose when tested with the fuel stated in Section 15, and the method shown as follows, shall not exceed the appropriate permeation values as listed in either Table 2 or Table 3.

16.2.1 **Reservoir Unit**—A nonpermeable container modified by the addition of a hose nipple (see Figure 3). The reservoir shall be filled with fuel, sealed, weighed, and reweighed after two days to confirm its integrity.

16.2.2 **Screw Caps**—Cap to be lined with a nonpermeating material such as a metal foil or fluorocarbon to seal the reservoir unit.

16.2.3 **Scale or Balance**—A weighing device with a 4 kg minimum capacity and readable to 0.01 g.

16.2.4 **Impermeable Plug**—An impermeable plug of sufficient size to seal one end of the hose to a depth of 25.4 mm (1 in).

16.2.5 **Hose Clamps**—Hose clamps of the correct size for hose being tested.

16.2.6 **PROCEDURE**

16.2.6.1 Prepare three samples to proper length. Specimen lengths shall be 300 mm (11.8 in) for inside diameters 25.4 mm (1 in) and under, and 200 mm (7.9 in) for diameters over 25.4 mm (1 in).

16.2.6.2 Plug one end of each sample to a depth of 25.4 mm (1 in) using an impermeable plug and a hose clamp.

16.2.6.3 Measure the sample inside diameter (ID) to the nearest 0.3 mm (0.01 in).

16.2.6.4 Attach other end of sample to the hose nipple on the reservoir to a depth of 25.4 mm (1 in) using a hose clamp.

16.2.6.5 Measure the active length (L) between the end of the nipple and the end of the plug on the hose sample.
16.2.6.6 Fill the reservoir with the proper quantity of test fuel: 300 mL for sizes through 5/8 in; 800 mL for sizes under 25.4 mm (1 in); 2500 mL for sizes 25.4 mm (1 in) and over.

16.2.6.7 Seal reservoir unit.

16.2.6.8 To insure complete filling of hose, orient the test sample vertically and gently tap to loosen air bubbles.

16.2.6.9 Weigh reservoir assembly to nearest 0.01 g and record.

16.2.6.10 Place reservoir in a position to insure hose is filled throughout the test and not in contact with any surface. Storage location should be temperature controlled to 23 °C ± 2 °C (73 °F ± 3.6 °F) with free flowing air to prevent fume build-up.

16.2.6.11 Weigh the assembly each 24 h ± 1/2 h for 15 days or until a peak has been established, recording each weight reading. After each weighing invert the sealed assembly to drain the sample. Return to test position, taking care to refill the hose and remove any air.

16.2.6.12 Calculate the exposed tube surface area in m².

\[ L \times \pi \times 10^{-6} = A(m^2) \]  

(Eq.1)

16.2.6.13 Calculate the permeation rate (g/m²/24 h) for each day of exposure.

16.2.6.14 Report permeation rate as the highest 24 h weight loss in grams during the test period.

17. Marking—The outer cover shall be legibly and permanently marked with the following information reported at least every 305 mm (12 in) in block capitals and numericals at least 3 mm (0.12 in) high.

17.1 SAE J1527.

17.2 The fire resistance and fuel resistance classifications in the following format "USCG TYPE A1."

17.3 The year in which the hose was manufactured.

17.4 The manufacturer's name or registered trademark.