SAE INTERNATIONAL

SURFACE VEHICLE STANDARD

J1527™ JAN2022

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Superseding J1527 FEB2011

Marine Fuel Hoses

RATIONALE

Document open for periodic review including added notes of clarity to scope and tolerances and units.

1. SCOPE

This SAE Standard specifies requirements for two types, three classes, and four styles of reinforced hose and non-reinforced tubing for conveying gasoline or diesel fuel aboard small craft including pleasure craft whose fuel systems are regulated under 33 CFR 183 Subpart J. SAE J1527 contains requirements for a Type A fire test of 2.5 minutes and defines a type B hose that is not fire resistant.

Refer to SAE J1942 for commercial marine non-metallic flexible hose or hose assemblies used in systems on board commercial vessels inspected and certified by the U.S. Coast Guard. SAE J1942 defines a type A fire resistance test of 2.5 minutes and a type B test of 30 minutes.

Refer to SAE J2046 for fuel hose used on personal watercraft.

1.1 Hose Types

Two types of hose meeting 33 CFR 183 Subpart J requirements with respect to fire resistance are covered by this document.

1.1.1 USCG Type A

This hose must provide a minimum 2-1/2 minutes of fire resistivity with no evidence of leakage when subjected to the fire test in Section 5.

1.1.2 USCG Type B

This hose need not be subjected to the 2-1/2 minute fire test.

1.2 Hose Classifications

Fuel resistance and rate of permeation.

1.2.1 Hose intended for applications such as fuel feed lines where liquid fuel is normally continuously in the hose.

1.2.1.1 Class 1

1.2.1.2 Class 1-15

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For more information on this standard, visit
https://www.sae.org/standards/content/J1527_202201/

1.2.2 Hose intended for applications such as fuel tank vent and fill hoses, where liquid fuel is not normally continuously in contact with the hose.

1.2.2.1 Class 2

1.3 Hose or Tubing Construction Styles

1.3.1 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 1 and Class 1-15 service, covers or sleeves having a lower permeation rate than the tube shall be pinpricked.

1.3.2 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. Plies of fabric or cord may be applied between the tube or cover and the helical wire. The helical wire must not be exposed after the cover is subjected to the abrasion test in Section 6.

1.3.3 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 SAE J516-100R5.

1.3.4 Style R4

The construction of this non-reinforced multi-laminate hose/tubing embodies a smooth bore fuel and oil-resistant tube and finished with a suitable oil, ozone, and heat-resistant cover.

1.4 For identification and ordering purposes, the following should be listed in order:

USCG Type, Fuel Resistance/Permeation, Construction Style.

Example of Hose Identification: USCG Type A1-15 Style R2 means the hose meets USCG Type A requirements for fire resistance, Class 1-15 requirements for fuel resistance/permeation, and Style R2 for a helical wire embedded hose.

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 +1 724-776-4970 (outside USA), www.sae.org.

SAE J516	Hydraulic Hose Fittings
SAE J517	Hydraulic Hose
SAE J1942	Hose and Hose Assemblies for Marine Applications
SAE J2046	Personal Watercraft Fuel Systems

2.1.2 ASTM Publications

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 D380 Test Methods for Rubber Hose

ASTM D413 Test Methods for Rubber Property - Adhesion to Flexible Substrate

ASTM D471 Test Method for Rubber Property - Effect of Liquids

ASTM D573 Test Method for Rubber - Deterioration in an Air Oven

ASTM D1149 Test Method for Rubber Deterioration - Cracking in an Ozone Controlled Environment

ASTM D4806-06a Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel

2.1.3 Code of Federal Regulations (CFR) Publications

Available from the United States Government Printing Office, 732 North Capitol Street, NW, Washington, DC 20401, Tel: 202-512-1800, www.gpo.gov.

33 CFR 183 Code of Federal Regulations: Navigation and Navigable Waters

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J2006 Marine Exhaust Hose

2.2.2 ISO Publications

Available from International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, Tel: +41 22 749 01 11, www.iso.org.

ISO 7840 Fire Resistant Fuel Hoses

ISO 8469 Non-Fire Resistant Fuel Hoses

3. DIMENSIONS AND TOLERANCES

The applicable dimensions and tolerances for style R1, R2, and R4 are shown in Table 1. The dimensions and tolerances for style R3 shall comply with the SAE J517-100R5 specification.

Table 1 - Dimensions and tolerances

Nominal Size	Inside Diameter mm	Inside Diameter Inches
3/16	4.75 ± 0.40	0.187 ± 0.016
1/4	6.35 ± 0.40	0.250 ± 0.016
5/16	7.94 ± 0.40	0.312 ± 0.016
3/8	9.53 ± 0.40	0.375 ± 0.016
7/16	11.11 ± 0.58	0.438 ± 0.023
1/2	12.70 ± 0.58	0.500 ± 0.023
9/16	14.28 ± 0.58	0.562 ± 0.023
5/8	15.88 ± 0.79	0.625 ± 0.031
3/4	19.05 ± 0.79	0.750 ± 0.031
1	25.40 ± 1.59	1.000 ± 0.062
1-1/4	31.75 ± 1.59	1.250 ± 0.062
1-1/2	38.10 ± 1.59	1.500 ± 0.062
1-3/4	44.45 ± 1.59	1.750 ± 0.062
1-7/8	47.62 ± 1.59	1.875 ± 0.062
2	50.80 ± 1.59	2.000 ± 0.062
2-1/4	57.35 ± 1.59	2.250 ± 0.062
2-3/8	60.32 ± 1.59	2.375 ± 0.062

4. 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 inch) 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 seconds. The average time of at least six determinations shall be used. The test shall be conducted in a draft-free atmosphere.

5. FIRE RESISTANCE-TYPE A ONLY

5.1 Principle

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

5.2 Sampling

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

5.3 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 inch) from the surface of the hose and 25.4 mm (1 inch) from the end of the hose. The fuel pan shall be a straight-sided container with minimum width, length, and depth dimensions of 355 x 355 x 40 mm (14 x 14 x 1.5 inches).

5.4 Test Procedure

The following test procedure or an equivalent test procedure may be utilized to perform this test. If the hose is intended to be delivered with couplings, at least one of the couplings shall be located directly above the fuel pan. Fill the hose with fuel by opening the fuel valve; ensure that no air is left in the hose. Check that the air velocity outside the device does not exceed 0.5 m/s. Pour heptane into the fuel pan and ignite it. Ensure that at least one coupling is exposed to the flame. Allow the heptane to burn for 150 seconds and record temperatures. At the end of the period of 150 seconds, extinguish the flame. 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 inches) of fuel. Note any sign of leakage.

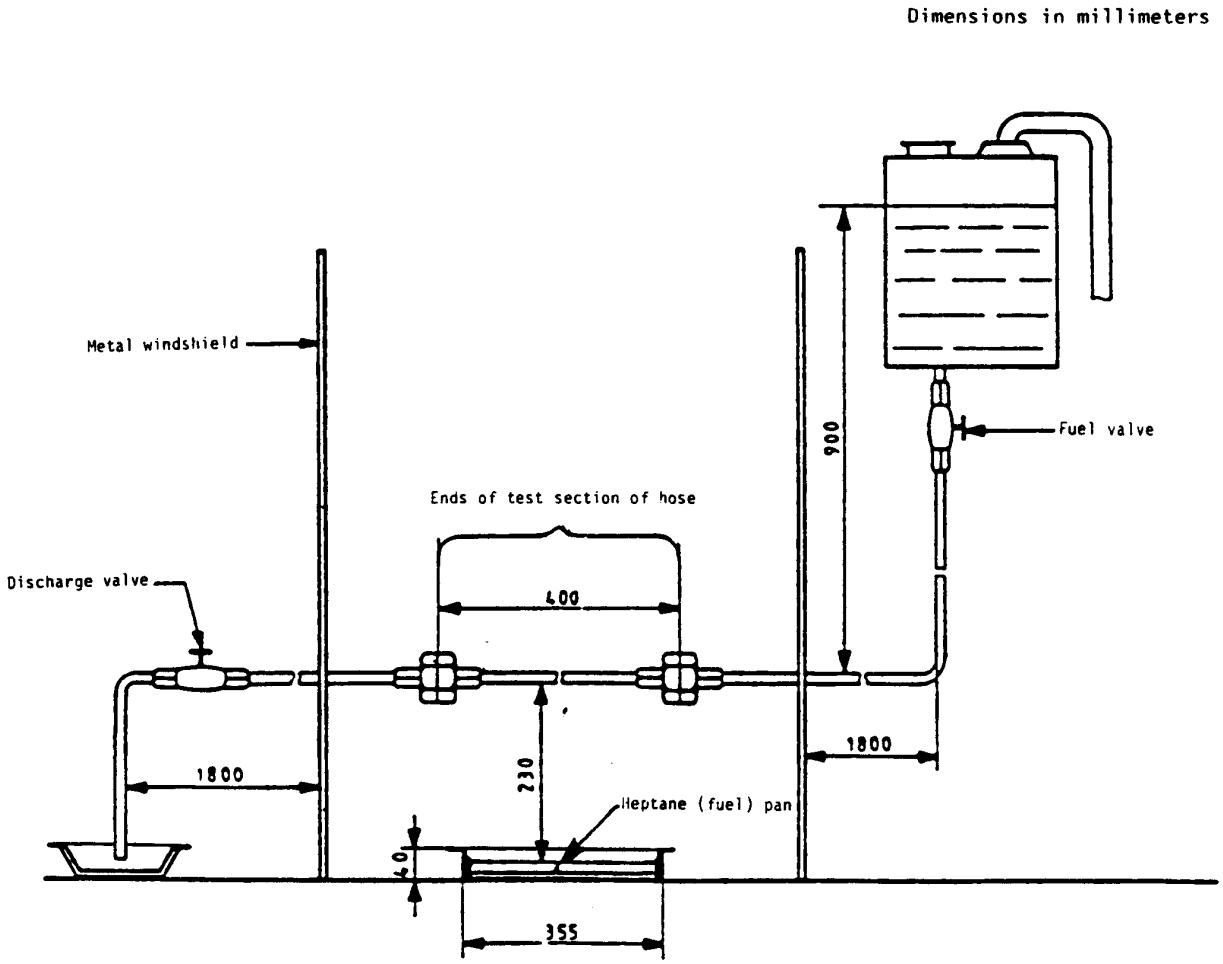

Figure 1 - Fire test equipment

6. ABRASION TEST-STYLE R2 ONLY

6.1 Principle

Three individual production 38 mm (1-1/2 inch) 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.

6.2 Procedure

The test hoses shall be preconditioned for at least 24 hours 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 (80 grit, coarse, Al_2O_3 emery cloth) parallel to the longitudinal axis of the test hose. The abrasive surface shall be 25 x 75 mm ± 5 mm (1 x 3 inches ± 0.25 inch) firmly affixed to a hard surface which will cycle back and forth 75 mm ± 5 mm (3 inches ± 0.25 inch) in each direction.

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

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.

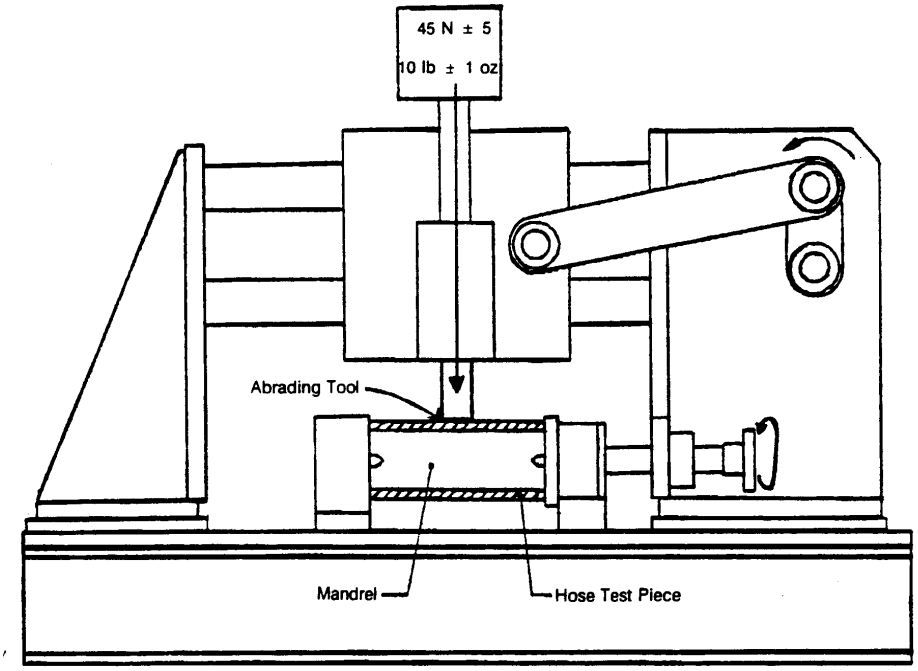

Figure 2 - Typical test apparatus

7. BURST TEST

The minimum burst pressure per ASTM D380 for hose sizes through 25.4 mm (1 inch) ID shall be 1.20 MPa (175 psi), and for hose sizes over 25.4 mm (1 inch) ID 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.

8. VACUUM COLLAPSE TEST

A 1 m (3.28 foot) 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 seconds and not more than 60 seconds. The vacuum collapse test on preformed parts should be performed on the finished part. This requirement shall not apply to style R1 hose sizes larger than 25.4 mm (1 inch).

9. COLD FLEXIBILITY

For styles R1, R3, and R4 straight hose 19.05 mm (3/4 inch) ID and under, the whole hose shall be used for this test. The test specimen shall be conditioned per ASTM D380 at -20 °C ± 2 °C (-4 °F ± 3.6 °F) for 5 hours, and then flex in the cold chamber through 180 degrees from the centerline to a diameter of 10 times the maximum OD of the hose. The flexing shall take place within 4 seconds and the hose must not fracture or show any cracks, checks, or breaks in the tube or cover. Proof pressure of 0.68 MPa (99 psi) may be applied to determine tube damage. For styles R1, R3, and R4 straight hose over 19.05 mm (3/4 inch) ID and all preformed hose, prepare three specimens 100 x 6 mm (4 x 0.25 inch) from the whole hose wall. These specimens shall be conditioned per ASTM D380 at -20 °C ± 2 °C (-4 °F ± 3.6 °F) for 5 hours in unrestrained loop positioned between two jaws 50.8 mm (2 inches) wide and 63.5 mm (2.5 inches) 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 inch) 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 D380 at -20 °C ± 2 °C (-4 °F ± 3.6 °F) for 5 hours 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 seconds. 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.

10. 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

11. DRY HEAT RESISTANCE

After heat aging per ASTM D573 for 70 hours 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%.

12. OIL RESISTANCE

After 70 hours immersion at 100 °C ± 2 °C (212 °F ± 6 °F) in IRM 903 per ASTM D471, 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%.

13. OZONE RESISTANCE

Test procedure and apparatus shall be in accordance with ASTM D1149, where applicable. For straight hose, 25.4 mm (1 inch) 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 hours 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 hours 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 "0" rating except for the area immediately adjacent to the wire, which shall be ignored. For hoses over 25.4 mm (1 inch) ID and preformed parts, prepare a specimen by cutting a strip of whole hose 12.7 mm wide x 100 m long (1/2 x 4 inches) and tie the specimen (cover out) around a 12.7 mm (1/2 inch) diameter mandrel. Condition 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.

14. ADHESION TEST

The minimum load required to separate a 25.4 mm (1 inch) width of tube and cover at 23 °C ± 2 °C (73 °F ± 3.6 °F) per ASTM D413 shall be 27 N (6 pounds).

15. FUEL RESISTANCE AND RATE OF FUEL PERMEATION

Separate samples of Class 1 and Class 2 hoses are required to be tested with 100% ASTM Fuel C.

Those hoses tested in 100% ASTM Fuel C must meet the specifications listed in Table 2.

Separate samples of Class 1-15 are required to be tested with CE-10, 90% ASTM Fuel C and 10% ASTM D4806 Denatured Fuel Ethanol by volume.

Hoses tested in CE-10, 90% ASTM Fuel C and 10% ASTM D 4806 Denatured Fuel Ethanol by volume must meet the specifications listed in Table 3.

15.1 Fuel Resistance Test

After 48 hours immersion at 23 °C ± 2 °C (73 °F ± 3.6 °F) per ASTM D471 in 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 Tables 2 or 3.

Table 2 - Requirements for ASTM Fuel C

	Class 1	Class 2
Tensile Change	-45%	-45%
Elongation Change	-45%	-45%
Volume Change	0 to +50%	0 to +50%
Permeation	100 g/m^2/24 hours	300 g/m^2/24 hours

Table 3 - Requirements for CE-10 fuel; 90% ASTM Fuel C and 10% ASTM D4806 ethanol by volume

	Class 1-15
Tensile Change	-60%
Elongation Change	-60%
Volume Change	0 to +60%
Permeation	15 g/m^2/24 hours

15.2 Rate of Fuel Permeation Test

Each class hose when tested with the fuel stated in Section 15, and the method shown as follows or an equivalent method shall not exceed the appropriate permeation values as listed in either Tables 2 or 3.

15.2.1 Reservoir Unit

A non-permeable container modified by the addition of a hose nipple (see Figure 3). The reservoir shall be filled with fuel, sealed weighed, and reweighed after 2 days to confirm its integrity.

15.2.2 Screw Caps

Cap to be lined with a non-permeating material such as a metal foil or fluoroelastomer to seal the reservoir unit.

15.2.3 Scale or Balance

A weighing device with a 4 kg minimum capacity and readable to 0.01 g.

15.2.4 Impermeable Plug

An impermeable plug of sufficient size to seal one end of the hose to a depth of 25.4 mm (1 inch).

15.2.5 Hose Clamps

Hose clamps of the correct size for hose being tested.

15.2.6 Procedure

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

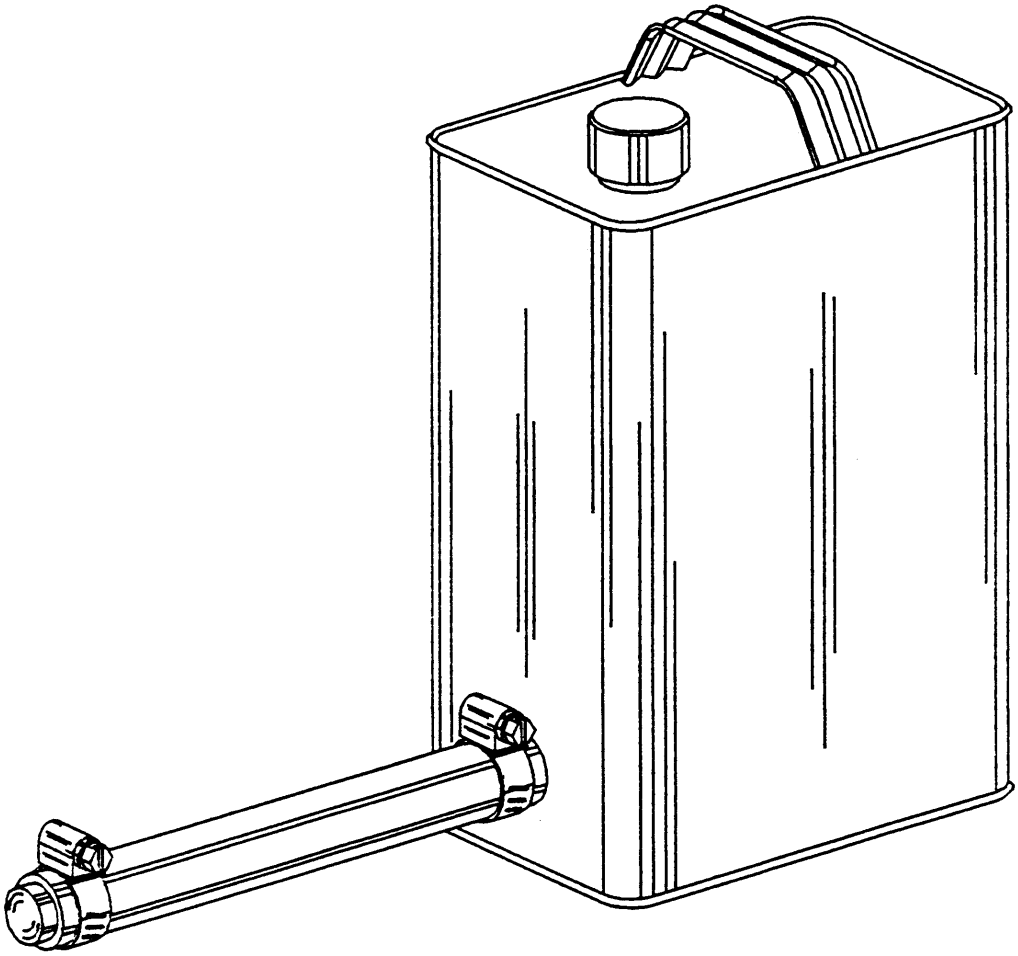

Figure 3 - Reservoir unit (storage position)

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

15.2.6.3 Measure the sample inside diameter (ID) to the nearest 0.3 mm (0.01 inch).

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

15.2.6.5 Measure the active length (L) between the ends of the nipple and the end of the plug on the hose sample.

15.2.6.6 Fill the reservoir with the proper quantity of test fuel: 300 mL for sizes through 15.6 mm (5/8 inch): 800 mL for sizes between 15.6 mm (5/8 inch) and 25.4 mm (1 inch): 2500 mL for sizes 25.4 mm (1 inch) and over.

15.2.6.7 Seal reservoir unit.

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

15.2.6.9 Weigh reservoir assembly to nearest 0.01 g and record.

15.2.6.10 Place reservoir in a position to ensure 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. (For Class 1 and Class 2 hoses, proceed to 15.2.6.14.)

15.2.6.11 Continue to soak the fuel hose in this configuration for 4 weeks at 40 °C ± 5 °C or 8 weeks at 23 °C ± 5 °C (for class 1-15 hose only).

15.2.6.12 Drain the reservoir and immediately refill with the proper quantity of fresh test fuel as specified in 15.2.6.6.

15.2.6.13 Repeat the steps specified in 15.2.6.7 through 15.2.6.10.

15.2.6.14 Weigh the assembly each 24 hours ± 1/2 hour 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.

15.2.6.15 Calculate the exposed tube surface area in m^2.

$$L\ (mm) \times ID\ (mm) \times \pi \times 10^{-6} = A(m^2) \qquad \text{(Eq. 1)}$$

15.2.6.16 Calculate the permeation rate (g/m^2/24 hours) for each day of exposure.

15.2.6.17 Report permeation rate as the highest 24 hour weight loss in grams during the test period.

16. MARKING

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

16.1 SAE J1527.

16.2 The hose type and class in the following format "USCG TYPE A1."

16.3 The year in which the hose was manufactured.

16.4 The manufacturer's name or registered trademark.

17. NOTES

17.1 Revision Indicator

A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

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