SAE International™

SURFACE VEHICLE STANDARD

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Superseding J30 JUN1998

(R) Fuel and Oil Hoses

RATIONALE

This specification was revised to add Type 14 low permeation, low pressure hose for small engines to the sections and Tables.

TABLE OF CONTENTS

1. SCOPE

This SAE standard covers fuel, oil, or emission hose for use in coupled and uncoupled applications, for use with gasoline, oil, diesel fuel, lubrication oil, or the vapors present in either the fuel system or in the crankcase of internal combustion engines in mobile or stationary applications. This standard covers the hose portion only. If assembly / coupling is required, that is to be agreed to between the customer and assembler, along with the specific requirements.

2. REFERENCES

2.1 Applicable Publications

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

2.1.1 SAE Publication

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 J1737 Test Procedure to Determine the Hydrocarbon Losses from Fuel Tubes, Hoses, Fittings, and Fuel Line Assemblies by Recirculation

2.1.2 ASTM Publications

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

ASTM B 117 Method of Salt Spray (Fog) Testing

ASTM D 380 Methods of Testing Rubber Hose

ASTM D 413 Test Methods for Rubber Property—Adhesion to Flexible Substrate

ASTM D 471 Test for Rubber Property—Effect of Liquids

ASTM D 573 Test for Rubber—Deterioration in an Air Oven

ASTM D 975 Specification for Diesel Fuel Oils

ASTM D 1149 Test Method for Rubber Deterioration—Surface Ozone Cracking in a Chamber (Flat Specimens)

2.1.3 Military Specification

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, http://assist.daps.dla.mil/quicksearch/.

MIL-HDBK-695 Rubber Products: Recommended Shelf Life

2.1.4 Rubber Manufacturers Association (RMA) Publication

Available from RMA, 1400 K Street, NW, Suite 900, Washington, DC 20005, Tel: 202-682-4800, www.rma.org.

IP-2 Hose Handbook

3. APPLICATION SELECTION GUIDE

SAE J30R2 covers Coupled and Uncoupled Synthetic Rubber Tube and Cover Hose.
SAE J30R3 covers Lightweight Braided Reinforced Lacquer, Cement, or Rubber Covered Hose.
SAE J30R5 covers Wire Inserted Synthetic Rubber Tube and Cover Hose.
SAE J30R6, 7, and 8 covers Low Pressure Coupled and Uncoupled Synthetic Rubber Tube and Cover Hose.
SAE J30R9 covers Fuel Injection, Medium Pressure Coupled and Uncoupled Synthetic Rubber Tube and Cover Hose.
SAE J30R10 covers In-Tank, Low Pressure, and Uncoupled Fuel Hose.
SAE J30R11 covers Low Permeation Fuel Fill and Vent Hose.
SAE J30R12 covers Low Permeation Fuel Feed and Return Hose.
SAE J30R13 covers Diesel or Biodiesel Fuel Feed and Return Hose (currently under development).
SAE J30R14 covers Low Permeation, Low Pressure Coupled and Uncoupled Synthetic Rubber Tube and Cover Hose for Small Engines.

See Application Selection Guide Table 1, and construction guide paragraph 4.

SAE has included an application table “Table1” to assist purchasers selecting fuel hose. We recommend any purchaser to discuss hose requirements with the manufacturer to confirm that the selected fuel hose is suitable for an intended application. The table is arranged by SAE specification, sizes by inside diameter of the hose, maximum external temperature the hose is exposed too, type of fuel testing, burst pressure, permeation in grams/square meter/day, and low temperature bend capability.

TABLE 1 - APPLICATION SELECTION GUIDE

SAE Spec	ID Sizes (mm)	Rated External Temperature	ASTM Reference Test Fuel	Burst Press ID (mm)	Burst Press (MPa)	Permeation $g/m^2/day$	Low Temp
30R2	3 to >30	100 °C	48 h @ RT Fuel B	Type 1 - 3.5 to 4.8 Type 2 - 1.7 to 4.8 Type 3 - 8.3 to 13.8		None	5 h @ -40 °C Fuel B Aged
30R3	4 to 11	100 °C	48 h @ RT Fuel B		6.2 to 13.8	None	5 h @ -40 °C Fuel B Aged
30R5 (Filler with wire)	19 to 65	100 °C	48 h @ RT Fuel B		0.6	None	5 h @ -40 °C Fuel B Aged
30R6	3 to >64	100 °C	48 h @ RT Fuel C 70 h @ RT Fuel G	< = 9.53 >9.53 to 25.4 > 25.4	1.72 1.20 0.5	600 Fuel C @ RT	5 h @ -40 °C Fuel C Aged
30R7	3 to >64	125 °C	48 h @ RT Fuel C 70 h @ RT Fuel G 14 day @ 40 C Sour Gas # 1	< = 9.53 > 9.53 to 25.4	1.72 1.20	550 Fuel C @ RT	5 h @ -40 °C Fuel C Aged
30R8	3 to >64	135 °C, intermittent to 150 °C	48 h @ RT Fuel C 70 h @ RT Fuel G	< = 9.53 > 9.53 to 25.4	1.72 1.20	200 Fuel C @ RT	5 h @ -40 °C Fuel C Aged
30R9 (Fuel Injected)	6 to 13	135 °C intermittent to 150 °C	48 h @ RT Fuel C 70 h @ RT Fuel G 14 day @ 40 C Sour Gas # 1	< = 9.53 > 9.53	6.2 3.4	15 Fuel C @ RT	24 h @ -40 °C Fuel C Aged
30R10 (In Tank, uncoupled)	6 to 13	100 °C, intermittent to 125 °C	48 h @ RT Fuel C 70 h @ RT Fuel I	3.4 to 2.8 MPa as size increases		Not Required	24 h @ -40 °C Fuel C Aged
30R11	3 to >64	100 °C T1 125 °C T2 (Can be selected)	48 h @ RT Fuel C Fuel I Extended Test		1.2	100 to 25 max Fuel I @ 40°C	24 h @ -40 °C after Fuel C Aging
30R12	6 to 13	100 °C T1 125 °C T2 135 °C T3 150 °C T4 (Can be selected)	48 h @ RT Fuel C 168 h @ RT Fuel I 168 h @ RT Fuel K Fuel I Extended Test		8	100 to 25 max Fuel I @ 60°C	24 h @ -40 °C after Conditioning with Fuel C
30R13 (Under Development)							
30R14	3 to >64	T1 = 100 °C T2 = 125 °C	48 h @ RT Fuel C 70 h @ RT Fuel G 14 day @ 40 C Sour Gas # 1 (T2 only)	< = 9.53 > 9.53 to 25.4	1.72 1.20	15 max, Fuel CE10 @ RT, 21 day, after 28 day presoak	5 h @ -40 °C Fuel C Aged

NOTE: This guide is intended to be a quick reference guide to assist the user in selection of the proper type of hose for the application. There are more requirements than are shown on this page. Please see the appropriate sections of this specification for the detailed complete requirements for that type of hose.

4. HOSE CONSTRUCTION

4.1 Coupled and Uncoupled Synthetic Rubber Tube and Cover (SAE 30R2)

4.1.1 Type 1

The construction of this hose embodies a smooth bore tube of suitable synthetic rubber material, reinforced with one ply of braided, knit, spiral, or woven fabric, and finished with a suitable oil- and ozone-resisting synthetic rubber cover.

4.1.2 Type 2

The construction of this hose embodies a smooth bore tube of suitable synthetic rubber material, reinforced with two braided plies or multiples of woven fabric, and finished with a suitable oil- and ozone-resisting synthetic rubber cover.

4.1.3 Type 3

The construction of this hose embodies a smooth bore tube of suitable synthetic rubber material, a single braided ply of textile reinforcement, and finished with a suitable oil- and ozone-resisting synthetic rubber cover.

4.2 Lightweight Braided Reinforced Lacquer, Cement, or Rubber Covered Hose (SAE 30R3)

The construction of this hose embodies a smooth bore tube of suitable synthetic rubber material, reinforced with one braided ply of cotton or other suitable material and finished with a gasoline-, oil-, and water-resistant flexible coating of lacquer, cement, or synthetic rubber.

4.3 Wire Inserted Synthetic Rubber Tube and Cover (SAE 30R5)

A wire inserted hose for fuel and oil filler and vent use in mobile, stationary, or marine applications. The hose is furnished uncoupled in specific lengths and is secured in application by the use of suitable clamps. The hose is particularly useful in applications where it must be installed in a curved configuration and where resistance to collapse is desirable.

The construction of this hose embodies a fuel- and oil-resistant tube, a helical high-carbon steel wire embedded in the convoluted section of this hose and running out into the plain 1 ends and an ozone- and oil-resistant cover. A ply of fabric or cord may be applied between the tube or cover and the helical wire. A ply of fabric must be used to reinforce the ends.

4.4 Low-Pressure Coupled and Uncoupled Synthetic Rubber Tube and Cover (SAE 30R6), (SAE 30R7), (SAE 30R8)

Hose which may be supplied either coupled or uncoupled for use with gasoline, diesel fuel, lubrication oil, or the vapor present in either the fuel system or in the crankcase of internal combustion engines in mobile, stationary, and marine applications. Exposure of these hoses to gasoline or diesel fuel which contain high levels, greater than 5% by volume, of oxygenates, i.e., ethanol, methanol, or MTBE (methyl tertiary butyl ether), may result in significantly higher permeation rates than those listed for 30R6, 7, or 8. This hose is for maximum working pressures of 0.34 MPa (50 psi) up to and including 9.53 mm (3/8 in) ID and 0.24 MPa (35 psi) for over 9.53 mm (3/8 in). For 30R6 hose in excess of 25.40 mm (1 in), the working pressure is 0.11 MPa (16 psi). The hose may be furnished in long lengths, specific cut lengths, or as a part preformed to a specific configuration. This hose is suitable for use in temperatures up to 100 °C (212 °F) for 30R6, 125 °C (257 °F) for 30R7, 150 °C (302 °F) intermittently and 135 °C (275 °F) continuously for 30R8.

The construction of this hose embodies a smooth bore tube of fuel- and oil-resistant synthetic rubber compound, suitably reinforced with textile fiber yarn, cord, or fabric, and a cover of suitable oil-, ozone-, and heat-resistant synthetic rubber compound.

4.5 Fuel Injection Hose Medium-Pressure Coupled and Uncoupled Synthetic Rubber Tube and Cover (SAE 30R9)

Hose primarily intended to meet the demands of fuel injection systems. These would include, for example, electronic fuel metering (EFM), electronic fuel injection (EFI), throttle body injection (TBI), and the like. Other areas of utility are those applications requiring fuel permeation resistance exceeding 30R8 and ones which require fuel resistance greater than that obtainable with 30R6, 7, and 8. Exposure of this hose to gasoline or diesel fuel that contains high levels, greater than 5% by volume, of oxygenates, i.e., ethanol, methanol, or MTBE may result in significantly higher permeation rates than realized with ASTM Fuel C. This hose may be supplied in either a coupled or uncoupled form, and is useful in the transportation of gasoline, ethanol extended gasoline, diesel fuel, lubrication oil, or the vapor present in either the fuel system or the crankcase of internal combustion engines in mobile, stationary, and marine applications. This hose has a maximum working pressure of 0.69 MPa (100 psi) up to and including 12.70 mm (1/2 in) ID. This hose may be furnished in long lengths, specific cut lengths, or as a part preformed to a specific configuration. This hose is suitable for use in normal operating temperatures of 34 to 135 °C (29 to 275 °F) and intermittent use at 150°C (302 °F).

The construction of this hose typically consists of a smooth bore tube or laminated tube(s) of a synthetic rubber compound(s) resistant to chemical attack, swelling, and permeation by gasoline, oxidized ("sour") gasoline, ethanol extended gasoline, diesel fuel, and oil or lubricants. It shall be suitably reinforced with a textile fiber, yarn, cord, or fabric, and a cover of a suitable oil-, ozone-, and heat-resistant elastomer.

4.6 In-Tank, Low-Pressure, Uncoupled Fuel Hoses (SAE 30R10)

Hose intended primarily for use in fuel injection systems where the hose may be submerged in the fuel tank. The hose is capable of handling gasoline, alcohol-extended gasoline or diesel fuel used in mobile, stationary, and marine applications.

This hose has a maximum working pressure of 0.69 MPa (100 psi) up to and including 12.7 mm ID. This hose may be furnished in long lengths, specific cut lengths, or as a part preformed to a specific configuration. This hose is suitable for use in normal operating temperatures of 34 to 100 °C and intermittent use at 125 °C

The construction of this hose consists of a smooth bore tube and cover based on synthetic rubber compound(s) which are resistant to chemical attack or swelling by gasoline, oxidized ("sour") gasoline, alcohol extended gasoline, and diesel fuel. The hose shall be suitably reinforced with a textile fiber, yarn, cord, or fabric which is resistant to the same fuels as the tube and cover.

4.7 Low Permeation Fuel Fill, Vent, and Vapor Hose (SAE 30R11)

Low permeation hose (100 g/m^2/day or less) for use as a low pressure (14.5 kPa) liquid or vapor carrying component for use in gasoline or diesel fuel filler, vent, and vapor systems. The construction shall be designed to be functional over a temperature range of –40 °C to 100 °C for T1 designation, or –40 °C to 125 °C for the T2 designation.

The construction typically consists of a smooth bore or laminated tube of one or more synthetic rubber compound(s) and/or thermoplastic material(s) resistant to chemical attack, swelling, and permeation by gasoline, alcohol extended gasoline, or diesel fuel. It will be suitably reinforced with a textile fiber, yarn, cord, or fabric. It will also be covered with a suitable oil, ozone, and heat-resistant synthetic rubber compound and/or thermoplastic. The specific construction details are to be agreed between the supplier and the original purchaser.

4.8 Low Permeation Fuel Feed and Return Hose (SAE 30R12)

Low permeation reinforced hose suitable for use in fuel supply systems including fuel injection systems. Applies to hose with an elastomeric inner layer. Hose with a thermoplastic inner layer is specifically excluded.

Low permeation hose, for the purpose of SAE 30R12, is defined as hose having a permeation rate less than 100 g/m^2/day by method SAE J1737 when tested with CM15 fuel at 60 °C.

This hose is intended for use as fuel feed and return hose in applications where low levels of evaporative emissions are required. This hose is useful in this and other applications for the transportation of gasoline, ethanol or methanol extended gasoline, reformulated gasoline (RFG), alcohol fuel, diesel fuel, lubrication oil, or the vapor present in either the fuel system or the crankcase of internal combustion engines in mobile, stationary, and marine applications. This hose has a maximum working pressure of 1.0 MPa (145 psi). Hose is suitable for use in four categories of operating temperature ranges. Category T1 hose is suitable for use in a normal operating temperature range from –40 °C to 100 °C; Category T2 hose is suitable for use in a normal operating temperature range from –40 °C to 125 °C; Category T3 hose is suitable for use in a normal operating temperature range from –40 °C to 135 °C; and Category T4 hose is suitable for use in a normal operating temperature range from –40 °C to 150 °C. This hose may be furnished in long lengths, specific cut lengths, or as a part preformed to a specific configuration.

The construction of this hose typically consists of a smooth bore tube with an internal diameter below 13 mm which is resistant to chemical attack, swelling and permeation by gasoline, oxidized ("sour") gasoline, alcohol extended gasoline, reformulated gasoline (RFG), alcohol fuels, diesel fuel and oil or lubricants. The tube may be composed of a single elastomeric material or be a laminated construction of two or more synthetic rubber compounds and/or thermoplastic materials provided the innermost layer is an elastomeric layer. The tube shall be suitably reinforced with a textile fiber, yarn, cord or fabric and covered with an oil, ozone, and heat-resistant elastomer.

4.9 Diesel and Biodiesel Fuel Feed and Return Hose (SAE 30R13) Under Development

4.10 Low Permeation, Low Pressure Coupled and Uncoupled Synthetic Rubber Tube and Cover Hose for Small Engines (SAE 30R14)

Hose which may be supplied either coupled or uncoupled for use with gasoline, diesel fuel, lubrication oil, or the vapor present in either the fuel system or in the crankcase of internal combustion engines in small engine applications. Exposure of these hoses to gasoline or diesel fuel which contain high levels, greater than 5% by volume, of oxygenates, i.e., ethanol, methanol, or MTBE (methyl tertiary butyl ether), may result in significantly higher permeation rates than those listed for 30R14. This hose is for maximum working pressures of 0.34 MPa (50 psi) up to and including 9.53 mm (3/8 in) ID and for hose in excess of 25.40 mm (1 in), the working pressure is 0.11 MPa (16 psi). The hose may be furnished in long lengths, specific cut lengths, or as a part preformed to a specific configuration. This hose is suitable for use in temperatures up to 100 °C (212 °F) for 30R14 T1, 125 °C (257 °F) for 30R14 T2. The construction of this hose embodies a smooth bore tube of fuel- and oil-resistant synthetic rubber compound, suitably reinforced with textile fiber yarn, cord, or fabric, and a cover of suitable oil-, ozone-, and heat-resistant synthetic rubber compound. A permeation resistant elastomeric or thermoplastic layer may be used if needed to reduce the permeation through the hose wall, provided the innermost layer is an elastomeric layer. The specific construction details are to be agreed between the supplier and the original purchaser.

5. QUALIFICATION TESTS AND LOT ACCEPTANCE INSPECTION TESTS

5.1 Retests and Rejection

Any hose or assembly that fails in one or more tests shall be resampled and retested. Twice the number of specimens shall be selected from the lot in question for any retests, and failure of any of the retested samples shall be cause for rejection.

5.1.1 For SAE J30R2 and R3

5.1.1.1 Qualification Tests

For qualification tests, one 7.6 m length of bulk hose or 10 assemblies of each size to be qualified shall be furnished. In order to qualify under this standard, hose and hose assemblies must meet the requirements of the following tests: (a) change-in-length followed by (b) burst, (c) vacuum collapse, (d) cold flexibility, (e) tensile strength and elongation, tube and cover (if present), (f) dry heat resistance, (g) fuel resistance, (h) oil resistance, (i) ozone resistance, and (j) adhesion (if cover present).

In addition to the above, hose assemblies shall be subjected to qualification tests as follows: (k) proof, (l) tensile test of assembly, (m) leakage, (n) corrosion, and (o) visual inspection.

5.1.1.2 Frequency of Testing for Inspection

On uncoupled hose, tests shall be conducted on samples representing each lot of 152 to 3048 m. Where a lot is 152 m or less, no tests shall be conducted, but materials and workmanship shall be the same on such lots as on hose previously qualified under this specification.

On coupled hose lots from 100 to 10 000 pieces, not less than two assemblies shall be subjected to all inspection tests except the visual test, which shall apply to 100% of the assemblies.

5.1.1.3 Inspection Tests

On uncoupled hose, these inspection tests shall apply: (a) change-in-length, (b) burst, (c) vacuum collapse, (d) cold flexibility, and (e) adhesion (if cover present).

On coupled hose assemblies, these tests shall apply: (f) burst, (g) proof, (h) tension test of assembly (unaged), and (i) visual inspection (100%).

5.1.1.4 Visual Inspection

All assemblies shall be inspected to see that the correct fittings are properly applied.

5.1.2 For SAE J30R5

5.1.2.1 Qualification and Inspection Testing

For qualifications, 10 lengths of each size to be qualified shall be furnished and shall be subjected to burst, cold flexibility, vacuum collapse, ozone, and property testing as shown in Table 2.

For inspection testing, not less than two samples shall be selected from each lot which shall not exceed 10 000 pieces and shall be subjected to the burst, vacuum collapse, and low-temperature flexibility tests described above.

5.1.3 For SAE J30R6, 7, 8, 9, and 10

5.1.3.1 Qualification Tests

For the qualification tests, one 7.5 m length of bulk hose, 10 preformed parts, or 10 assemblies of each size to be qualified shall be furnished. In order to qualify under this specification, hose and hose assemblies must meet all the test requirements of Sections 1, 2, and 3.

5.1.3.2 Frequency of Testing for Inspection

As agreed upon between supplier and user.

5.1.3.3 Inspection Test

On hose and/or hose assemblies the following inspection tests shall apply: burst, vacuum collapse*, cold flexibility, adhesion, kink resistance (if specified). The kink resistance test shall not normally be required on preformed hose, but may be specified for straight sections of at least 300 mm length.

*NOTE: No vacuum testing is required for SAE J30R10.

5.1.4 For SAE J30R11

5.1.4.1 Qualification Testing

In order to qualify under this specification, hose or the assembly must meet all the applicable test requirements of sections 1, 2, and 3. Hose for testing will be 12.7 mm ID or as agreed upon between supplier and user. The construction must be representative of construction of all other sizes. The impermeable layer thickness cannot be reduced with other data.

5.1.4.2 Frequency of Testing for Qualification

Qualification testing to be performed once annually except for permeation testing which only needs to be tested initially.

5.1.4.3 Inspection Testing

On hose or the assembly, the following inspection shall apply: burst, vacuum collapse, original adhesion, kink resistance, and electrical conductivity (if required).

5.1.4.4 Frequency of Testing for Inspection and Quality Acceptance Standards

Quality acceptance standards to be agreed upon between supplier and the original purchaser.

5.1.5 For SAE J30R12

5.1.5.1 Tests

ASTM test slabs are permissible for testing tube or cover when thickness does not meet ASTM D 412 minimum 1.5 mm.

5.1.5.2 Qualification Tests

In order to qualify under this specification, hose and/or hose assemblies must meet all the applicable test requirements. Qualification testing is to be performed on samples of the largest ID size to be supplied, or on 13 mm ID hose, whichever is smaller. The hose used for qualification tests must be representative of the construction of all other sizes. The impermeable layer thickness of the qualification sample cannot be greater than that of the other sizes.

5.1.5.3 Frequency of Testing for Qualification

Qualification testing is to be performed once per year, with the exception of permeation testing which is to be performed on original qualification only.

5.1.5.4 Inspection Testing

On hose and/or hose assemblies, the following inspection tests shall apply: burst, vacuum collapse, original adhesion, kink resistance and electrical conductivity (if specified). The kink resistance test shall not normally be required on preformed hose, but may be specified for straight sections of at least 300 mm length.

5.1.5.5 Frequency of Testing for Inspection and Quality Acceptance Standards

As agreed upon between supplier and user.

5.1.6 For SAE J30R13 Under Development

5.1.7 For SAE J30R14

5.1.7.1 Qualification Tests

For the qualification tests, one 7.5 m length of bulk hose, 10 preformed parts, or 10 assemblies of each size to be qualified shall be furnished. In order to qualify under this specification, hose and hose assemblies must meet all the test requirements of Tables 1, 2, and 3.

5.1.7.2 Frequency of Testing for Inspection

As agreed upon between supplier and user.

5.1.7.3 Inspection Test

On hose and/or hose assemblies the following inspection tests shall apply: burst, vacuum collapse*, cold flexibility, adhesion, kink resistance (if specified). The kink resistance test shall not normally be required on preformed hose, but may be specified for straight sections of at least 300 mm length.

5.2 SAE J30R11 and 12 Testing Requirements

Test	R11	R12
Burst	Inspection test – all sizes	Inspection test – all sizes
Vacuum Collapse	Inspection test – all sizes	Inspection test – all sizes
Electrical Conductivity	Inspection test – all sizes	Inspection test – all sizes
Original Adhesion	Inspection test – all sizes	Inspection test – all sizes
Kink	Inspection test – all sizes	Inspection test – all sizes
Permeation	Initial Qualification Only	Initial Qualification Only
ID for Permeation test	12.7 mm, 13 mm nominal	
Low Temperature Flexibility	Qualification Test	Qualification Test (Annually*)
Original Material Properties	Qualification Test	Qualification Test (Annually**)
Heat Resistance	Qualification Test	Qualification Test (Annually*)
Oil Resistance	Qualification Test	Qualification Test (Annually*)
Fuel Resistance	Qualification Test	Qualification Test (Annually**)
Oxidized Fuel Resistance	Not Required	Qualification Test (Annually**)
Extractables	Qualification Test	Qualification Test (Annually*)
Aged Adhesion	Qualification Test	Qualification Test (Annually*)
Recirculation		

* = To be tested on nominal 13 mm ID hose.
** = To be tested on nominal 13 mm ID hose or on ASTM test slabs.

For Dimensions and Tolerances for all hose types see Tables 1A through 1F.

TABLE 1A - DIMENSIONS AND TOLERANCES FOR SAE 30R2

Nominal Size, mm	Inside Diameter Tolerance, mm	Nominal Wall Thickness, mm Type 1 and 3	Outside Diameter[1] Tolerance, mm Type 1 and 3	Nominal Wall Thickness, mm Type 2	Outside Diameter[1] Tolerance, mm Type 2
3.0 to 4.0	± 0.25	2.88	± 0.60	4.36	± 0.79
>4.0 to 10.0	± 0.40	2.88	± 0.60	4.36	± 0.79
>10.0 to 16.0	± 0.58	3.17	± 0.79	4.36	± 0.79
>16.0 to 25.0	± 0.58	4.35	± 0.79	4.36	± 0.79
>25.0 to 26.0	± 0.79	4.17	± 1.20	4.16	± 1.20
>26.0 to 30.0	± 0.79		----	5.56	± 1.59
>30.0	± 0.99		----	5.56	± 1.59

1. Concentricity based on total indicator reading between the inside bore of the hose and the outer surface of the hose shall not exceed the values given below:
   Sizes 7 mm and under : 0.76 mm
   Sizes over 7 mm up to 23 mm: 1.02 mm
   Sizes over 23 mm: 1.27 mm

TABLE 1B - DIMENSIONS AND TOLERANCES FOR SAE 30R3

Nominal Size, mm	Inside Diameter Tolerance, mm	Outside Diameter[1] Tolerance, mm	Nominal Wall Thickness, mm
4.0 to 7.0	± 0.40	± 0.40	2.18
>7.0 to 9.0	± 0.40	± 0.40	2.58
>9.0 to 11.0	± 0.40	± 0.60	2.88

1. Concentricity based on total indicator reading between the inside bore of the hose and the outer surface of the hose shall not exceed the following values:
   Size 7 mm and under: 0.762 mm
   Size over 7 mm: 1.016 mm

TABLE 1C - DIMENSIONS AND TOLERANCES FOR SAE 30R5

ID, mm	ID Tolerance, mm	Wall Thickness, mm
19.0 to 26.0	+0.76 -1.52	3.05/5.89
>26.0 to 65.0	+0.76 -2.28	3.05/5.89

NOTE: The minimum tube gage for all sizes shall be 1.57 mm.

TABLE 1D - LENGTH TOLERANCES FOR SAE 30R2, R3, AND R5

Length, mm	Tolerance, mm
0 - 305	±6.35
305 - 610	±12.70
610 - 915	±19.05
>915	±2%

TABLE 1E - DIMENSIONS AND TOLERANCES FOR SAE 30R6, R7, R8, R9, R10, R11, R12, AND R14

Nominal Size, mm	Inside Diameter Tolerance, mm	Outside Diameter Tolerance, mm	Nominal Wall Thickness, mm
3.0 to 4.0	± 0.40	± 0.58	2.58
>4.0 to 6.0	± 0.40	± 0.58	2.78
>6.0 to 10.0	± 0.40	± 0.58	3.17
>10.0 to 13.0	± 0.58	± 0.79	3.57
>13.0 to 16.0	± 0.79	± 0.79	3.97
>16.0 to 26.0	± 0.79	± 1.59	4.77
>26.0 to 56.0	± 0.99	----	4.32 to 5.89
>56.0 to 64.0	± 0.99	----	4.32 to 6.35
>64.0	± 0.99	----	----

TABLE 1F - CUT OR LONG LENGTH TOLERANCES FOR SAE 30R6, R7, R8, R9, R10, R11, R12 AND R14

Length m	Precision mm	Commercial mm	Maximum End Out-of-Squareness Angle, Deg[2]
0-0.3	± 3.0	+ 9.5 - 3.0	
Over 0.31-0.6	± 4.8	+ 9.5 - 4.8	
Over 0.61-0.9	± 6.3	+12.7 - 6.3	Use equation below
Over 0.91-1.2	± 9.5	+12.7 - 9.5	
Over 1.21-1.8	±12.7	+19.0 -12.7	
Over 1.81	1%	2%	

1. Concentricity based on total indicator reading between the inside bore of the hose and the outer surface of the hose shall not exceed the values given below:
   Sizes 7 mm and under: 0.762 mm
   Sizes over 7 mm up to 13 mm: 1.016 mm
   Sizes over 13 mm: 1.270 mm
2. These values were determined by the equation:
   A = 15 degrees - (K X D)
   where:
   A = Maximum out-of-squareness angle
   K = 0.12 degree per mm of diameter (a slope factor derived from linear best-fit previous squareness requirement)
   D = Nominal inside diameter in millimeters

NOTE: Other dimensions and sizes are acceptable if agreed upon between buyer and seller.

5.3 Preformed Hose Dimensions and Tolerances

When a hose is supplied as a preformed item, the tolerance shall be as follows:

5.3.1 Squareness of Ends

The tolerance on squareness of ends of preformed parts shall be a maximum of: 15% of the nominal hose OD on all sizes though 25.4 mm ID, 6.3 mm for sizes over 25.4 mm ID through 50.8 mm ID and 9.5 mm for sizes over 50.8 mm ID.

5.3.2 Arm Lengths

Measured from end to intersection of nearest centerline. Each end shall be as described in Table 1F. These tolerances apply also to the length of an expanded end.

5.3.3 General Layout

Dimensions locating bend intersections are to establish the theoretical centerline of the hose. Actual outside contour of the hose must be held within 4.8 mm in all planes with respect to the theoretical outside contour. To check contour, hose ends should first be placed in nominal position (it may have to be flexed to correct any distortion caused by handling after vulcanization in the producing plant or in shipment) in a checking fixture made in accordance with user requirements from which contour deviation can be measured. Allowance shall be provided in the end mounting area of the fixture for the arm length tolerances that are applicable.

When the ID of an end of the hose is enlarged, the wall gauge of the enlarged end normally changes. Allowable change should be +0.8 –0.5 mm. The wall gauge within bends of a preformed hose may differ from the gauge in straight portions. The difference shall not exceed 33%

Property requirements for all hose types covered in this standard can be found in Table 2.

TABLE 2 - ELASTOMER SPECIFICATION REQUIREMENTS

Specification		Original Property	Dry Heat Resistance	Fuel Resistance	Oil Resistance	Oxygenated Fuel Resistance	Oxidized Fuel Resistance	Ozone Resistance	Sequential Fuel & Heat Resistance	Cold Flex Condition	Cold Flex Test
SAE 30R2											
Aging Time			70 h	48 h	70 h			70 h			
Aging Temperature			100 °C	23 °C	100 °C			40 °C			
Medium				ASTM Ref Fuel B	IRM 903			100 mPa			
Tube											
	Tensile (MPa) min	8	- - -	- - -	- - -						
	Tensile Change % max	- - -	-20	-30	-40						
	Elongation (%) min	200	- - -	- - -	- - -						
	Elongation Change % max	- - -	-50	-30	-40						
	Volume Change	- - -		-5 to +25	-5 to +25						
Cover											
	Tensile (MPa) min	7	- - -	- - -	- - -						
	Tensile Change % max	- - -	-20	- - -	- - -						
	Elongation (%) min	200	- - -	- - -	- - -						
	Elongation Change % max	- - -	-50	- - -	- - -						
	Volume Change	- - -	- - -	- - -	0 to +100						
Hose								0 rating			
	Adhesion (N/mm) min, Type 1 & 3	1									
	Adhesion (N/mm) min, Type 2	2									
	Low Temperature Resistance										
	Fuel									Fuel B	- - -
	Time (hrs.)									48	5
	Temperature (°C)									23 °C	-40 °C
											pass

TABLE 2 - ELASTOMER SPECIFICATION REQUIREMENTS (CONTINUED)

Specification		Original Property	Dry Heat Resistance	Fuel Resistance	Oil Resistance	Oxygenated Fuel Resistance	Oxidized Fuel Resistance	Ozone Resistance	Sequential Fuel & Heat Resistance	Cold Flex Condition	Cold Flex Test
SAE 30R3											
Aging Time			70 h	48 h	70 h			70 h			
Aging Temperature			100 °C	23 °C	100 °C			40 °C			
Medium				ASTM Ref Fuel B	IRM 903			100 mPa			
Tube											
	Tensile (MPa) min	8	- - -	- - -	- - -						
	Tensile Change % max	- - -	-20	-30	-40						
	Elongation (%) min	200	- - -	- - -	- - -						
	Elongation Change % max	- - -	-50	-30	-40						
	Volume Change	- - -	- - -	-5 to +25	-5 to +25						
Hose								0 rating			
	Low Temperature Resistance										
	Fuel									Fuel B	- - -
	Time (hrs.)									48	5
	Temperature (°C)									23 °C	-40 °C
											pass
SAE 30R5											
Aging Time			100 h	48 h	70 h			70 h			
Aging Temperature			100 °C	23 °C	100 °C			40 °C			
Medium				ASTM Ref Fuel B	IRM 903 Oil			100 mPa			
Tube											
	Tensile (MPa) min	8	- - -	- - -	- - -						
	Tensile Change % max	- - -	-20	-30	-40						
	Elongation (%) min	200	- - -	- - -	- - -						
	Elongation Change % max	- - -	-30	-30	-40						
	Volume Change	- - -	- - -	-5 to +25	-5 to +25						
Cover											
	Tensile (MPa) min	7	- - -	- - -	- - -						
	Tensile Change % max	- - -	-20	- - -	- - -						
	Elongation (%) min	200	- - -	- - -	- - -						
	Elongation Change % max	- - -	-20	- - -	- - -						
	Volume Change	- - -	- - -	- - -	- - -						

TABLE 2 - ELASTOMER SPECIFICATION REQUIREMENTS (CONTINUED)

Specification		Original Property	Dry Heat Resistance	Fuel Resistance	Oil Resistance	Oxygenated Fuel Resistance	Oxidized Fuel Resistance	Ozone Resistance	Sequential Fuel & Heat Resistance	Cold Flex Condition	Cold Flex Test
SAE 30R5											
Hose								0 rating			
	Low Temperature Resistance										
	Fuel									Fuel B	- - -
	Time (hrs.)									48	5
	Temperature (°C)									23 °C	-40 °C
											pass
SAE 30R6											
Aging Time			70 h	48 h	70 h	70 h		70 h			
Aging Temperature			100 °C	23 °C	100 °C	23 °C		40 °C			
Medium				ASTM Ref Fuel C	IRM 903 Oil	ASTM Ref Fuel G		100 mPa			
Tube											
	Tensile (MPa) min	8	- - -	- - -	- - -	- - -					
	Tensile Change % max	- - -	-20	-45	-40	-45					
	Elongation (%) min	200	- - -	- - -	- - -	- - -					
	Elongation Change % max	- - -	-50	-45	-40	-45					
	Volume Change	- - -	- - -	0 to +50	-5 to +25	0 to +50					
Cover											
	Tensile (MPa) min	7	- - -	- - -	- - -	- - -					
	Tensile Change % max	- - -	-20	- - -	- - -	- - -					
	Elongation (%) min	200	- - -	- - -	- - -	- - -					
	Elongation Change % max	- - -	-50	- - -	- - -	- - -					
	Volume Change	- - -	- - -	- - -	0 to +100	- - -					
Hose								0 rating			
	Extractables gm/m^2	7.75									
	Permeation Resistance gm/m^2/day										
	Reservoir Method - Fuel C	600									
	Adhesion (N/mm) min	1									
	Low Temperature Resistance										
	Fuel									Fuel C	- - -
	Time (hrs.)									48	5
	Temperature (°C)									23 °C	-40 °C
											pass

TABLE 2 - ELASTOMER SPECIFICATION REQUIREMENTS (CONTINUED)

Specification		Original Property	Dry Heat Resistance	Fuel Resistance	Oil Resistance	Oxygenated Fuel Resistance	Oxidized Fuel Resistance	Ozone Resistance	Sequential Fuel & Heat Resistance	Cold Flex Condition	Cold Flex Test
SAE 30R7											
Aging Time			70 h	48 h	70 h	70 h	336 h	70 h			
Aging Temperature			125 °C	23°C	125 °C	23 °C	40 °C	40 °C			
Medium				ASTM Ref Fuel C	IRM 903 Oil	ASTM Ref Fuel G	Sour Gas #1	100 mPa			
Tube											
	Tensile (MPa) min	8	---	---	---	---	---				
	Tensile Change % max	---	-20	-45	-50	-45	-35				
	Elongation (%) min	200	---	---	---	---	---				
	Elongation Change % max	---	-60	-45	-50	-45	-40				
	Volume Change	---	---	0 to +50	-5 to +30	0 to +50	---				
Cover											
	Tensile (MPa) min	7	---	---	---	---	---				
	Tensile Change % max	---	-20	---	---	---	---				
	Elongation (%) min	200	---	---	---	---	---				
	Elongation Change % max	---	-60	---	---	---	---				
	Volume Change	---	---	---	0 to +75	---	---				
Hose								0 rating			
	Extractables gm/m^2	5									
	Permeation Resistance gm/m^2/day Reservoir Method - Fuel C	550									
	Adhesion (N/mm) min	1									
	Low Temperature Resistance Fuel									Fuel C	---
	Time (hrs.)									48	5
	Temperature (°C)									23 °C	-40 °C
											pass
SAE 30R8											
Aging Time			70 h	48 h	70 h	70 h		70 h			
Aging Temperature			150 °C	23 °C	150 °C	23 °C		40 °C			
Medium				ASTM Ref Fuel C	IRM 903 Oil	ASTM Ref Fuel G		100 mPa			
Tube											
	Tensile (MPa) min	8	---	---	---	---					
	Tensile Change % max	---	-25	-35	-20	-35					
	Elongation (%) min	200	---	---	---	---					
	Elongation Change % max	---	-50	-35	-50	-45					
	Volume Change	---	---	0 to +35	-5 to +15	0 to +40					

TABLE 2 - ELASTOMER SPECIFICATION REQUIREMENTS (CONTINUED)

Specification		Original Property	Dry Heat Resistance	Fuel Resistance	Oil Resistance	Oxygenated Fuel Resistance	Oxidized Fuel Resistance	Ozone Resistance	Sequential Fuel & Heat Resistance	Cold Flex Condition	Cold Flex Test
SAE 30R8											
Cover											
	Tensile (MPa) min	7	---	---	---	---					
	Tensile Change % max	---	-25	---	---	---					
	Elongation (%) min	200	---	---	---	---					
	Elongation Change % max	---	-50	---	---	---					
	Volume Change	---	---	---	0 to +15	---					
Hose								0 rating			
	Extractables gm/m^2	2.5									
	Permeation Resistance gm/m^2/day Reservoir Method-Fuel C	200									
	Adhesion (N/mm) min	1									
	Low Temperature Resistance Fuel									Fuel C	---
	Time (hrs.)									48	5
	Temperature (°C)									23 °C	-40 °C
											Pass
SAE 30R9											
Aging Time			168 h	48 h	70 h	70 h	336 h	70 h			
Aging Temperature			150 °C	23 °C	150 °C	23 °C	40 °C	40 °C			
Medium				ASTM Ref Fuel C	IRM 903 Oil	ASTM Ref Fuel G	Sour Gas #1	100 mPa			
Tube											
	Tensile (MPa) min	5	---	---	---	---	---				
	Tensile Change % max	---	---	---	---	-40	-30				
	Elongation (%) min	125	---	---	---	---	---				
	Elongation Change % max	---	---	---	---	-40	-20				
	Volume Change max	---	---	10	---	15	---				
Cover											
	Tensile (MPa) min	8	---	---	---	---	---				
	Tensile Change % max	---	---	---	---	---	---				
	Elongation (%) min	150	---	---	---	---	---				
	Elongation Change % max	---	---	---	---	---	---				
	Volume Change max	---	---	---	100	---	---				

TABLE 2 - ELASTOMER SPECIFICATION REQUIREMENTS (CONTINUED)

Specification		Original Property	Dry Heat Resistance	Fuel Resistance	Oil Resistance	Oxygenated Fuel Resistance	Oxidized Fuel Resistance	Ozone Resistance	Sequential Fuel & Heat Resistance	Cold Flex Condition	Cold Flex Test
SAE 30R9											
Hose			pass					0 rating			
	Extractables gm/m^2	2.5									
	Permeation Resistance gm/m^2/day Reservoir Method - Fuel C	15									
	Adhesion (N/mm) min	1.4									
	Low Temperature Resistance Fuel									Fuel C	---
	Time (hrs.)									168	24
	Temperature (°C)									23 °C	-40 °C
											pass
SAE 30R10											
Aging Time			168 h	48 h	70 h	70 h	To Be Determined Between User & Supplier		48 h 70 h		
Aging Temperature			125 °C	23 °C	150 °C	23 °C			23 °C, 125 C		
Medium				ASTM Ref Fuel C	IRM 903 Oil	ASTM Ref Fuel I			ASTM Ref Fuel C		---
Tube											
	Tensile (MPa) min	7	---	---	---	---	---				
	Tensile Change % max	---	---	---	---	-40	---				
	Elongation (%) min	200	---	---	---	---	---				
	Elongation Change % max	---	---	---	---	-40	---				
	Volume Change max	---	---	10	---	15	---				
Cover											
	Tensile (MPa) min	7	---	---	---	---	---				
	Tensile Change % max	---	---	---	---	---	---				
	Elongation (%) min	200	---	---	---	---	---				
	Elongation Change % max	---	---	---	---	---	---				
	Volume Change max	---	---	10	---	---	---				
Hose			pass						--- pass		
	Extractables gm/m^2	2.5									
	Adhesion (N/mm) min	1.4									
	Burst			pass		pass		---			
	Low Temperature Resistance Fuel									Fuel C	---
	Time (hrs.)									168	24
	Temperature (°C)									23 °C	-40 °C
											pass

TABLE 2 - ELASTOMER SPECIFICATION REQUIREMENTS (CONTINUED)

Specification		Original Property	Dry Heat Resistance	Fuel Resistance	Oil Resistance	Oxygenated Fuel Resistance	Oxidized Fuel Resistance	Ozone Resistance	Sequential Fuel & Heat Resistance	Cold Flex Condition	Cold Flex Test
SAE 30R11											
Aging Time			1000 h	48 h	70 h	1000 h	- - -	70 h			
Aging Temperature			T1 = 100 °C T2 = 125 °C	23 °C	125 °C	40°C	- - -	40 °C			
Medium				ASTM Ref Fuel C	IRM 903 Oil	ASTM Ref Fuel I	- - -	100 mPa			
Tube											
	Tensile (MPa) min	7	- - -	- - -	- - -	- - -	- - -				
	Tensile Change % max	- - -	- - -	-45	- - -	- - -	- - -				
	Elongation (%) min	150	- - -	- - -	- - -	- - -	- - -				
	Elongation Change % max	- - -	- - -	-45	- - -	- - -	- - -				
	Volume Change max	- - -	- - -	50	- - -	- - -	- - -				
Cover											
	Tensile (MPa) min	7	- - -	- - -	- - -	- - -	- - -				
	Elongation (%) min	150	- - -	- - -	- - -	- - -	- - -				
	Volume Change max	- - -	- - -	- - -	60	- - -	- - -				
Hose								0 rating			
	Extractables gm/m^2	2.5	pass								
	Electrical Conductivity (megaohms) max	E = 10 N = nonconductive									
	Permeation Resistance gm/m^2/day SAE J1737 method - Fuel I	A = 25 B = 50 C = 100									
	Adhesion (N/mm) min	1.4 or rubber tear				1.0 or rubber tear					
	Low Temperature Resistance Fuel									Fuel C	- - -
	Time (hrs.)									168	24
	Temperature (°C)									23 °C	-40 °C
											pass
SAE 30R12											
Aging Time			1000 h	48 h	70 h	168 h	168 h 168 h 168 h	70 h	- - -	- - -	
Aging Temperature			T1 = 100 °C T2 = 125 °C T3 = 135 °C T4 = 150 °C	23 °C	T1 = 100 °C T2 = 125 °C T3 = 135 °C T4 = 150 °C	23 °C	23 °C 23 °C 23 °C	40 °C	- - -	- - -	
Medium				ASTM Ref Fuel C	IRM 903 Oil	ASTM Ref Fuel I	ASTM Ref Fuel K Sour Gas #2 Sour Gas #3	100 mPa	- - -	- - -	

TABLE 2 - ELASTOMER SPECIFICATION REQUIREMENTS (CONTINUED)

Specification		Original Property	Dry Heat Resistance	Fuel Resistance	Oil Resistance	Oxygenated Fuel Resistance		Oxidized Fuel Resistance		Ozone Resistance	Sequential Fuel & Heat Resistance	Cold Flex Condition	Cold Flex Test
SAE 30R12													
Tube													
	Tensile (MPa) min	7	---	---	---	---	---	---	---				
	Tensile Change % max	---	---	---	---	-40	-40	-40	-40				
	Elongation (%) min	150	---	---	---	---	---	---	---				
	Elongation Change % max	---	---	---	---	---	---	---	---				
	Volume Change max	---	---	---	60	25	25	25	25				
Cover													
	Tensile (MPa) min	7	---	---	---	---	---	---					
	Tensile Change % max	---	---	---	---	---	---	---					
	Elongation (%) min	150	---	---	---	---	---	---					
	Elongation Change % max	---	---	---	---	---	---	---					
	Volume Change max	---	---	---	---	---	---	---					
Hose			pass							0 rating			
	Extractables gm/m^2	2.5											
	Electrical Conductivity (megaohms) max	E = 10 N = nonconductive											
	Permeation Resistance $gm/m^2/day$ SAE J1737 method - Fuel I	A = 25 B = 50 C = 100											
	Adhesion (N/mm) min	1.4 or rubber tear				1.0 or rubber tear							
	Low Temperature Resistance Fuel											Fuel C	---
	Time (hrs.)											168	24
	Temperature (°C)											23 °C	-40 °C
													pass

TABLE 2 - ELASTOMER SPECIFICATION REQUIREMENTS (CONTINUED)

Specification		Original Property	Dry Heat Resistance	Fuel Resistance	Oil Resistance	Oxygenated Fuel Resistance	Oxidized Fuel Resistance	Ozone Resistance	Sequential Fuel and Heat Resistance	Cold Flex Condition	Cold Flex Test
							(for T2 only)				
SAE 30R14											
Aging Time			70 h	48 h	70 h	70 h	336 h	70 h			
Aging Temperature T1			100 C	23 C	100 C	23 C	40 C	40 C			
Aging Temperature T2			125 C	23 C	125 C	ASTM Ref Fuel G	Sour Gas #1	40 C			
Medium				ASTM Ref Fuel C	IRM 903 Oil			100 mPa			
Tube											
	Tensile (MPa) min	8	- - -	- - -	- - -	- - -	- - -				
	Tensile Change % max	- - -	-20	-45	-50	-45	-35				
	Elongation (%) min	200	- - -	- - -	- - -	- - -	- - -				
	Elongation Change % max	- - -	-60	-45	-50	-45	-40				
	Volume Change	- - -	- - -	0 to +50	-5 to +30	0 to +50	- - -				
Cover											
	Tensile (MPa) min	7	- - -	- - -	- - -	- - -					
	Tensile Change % max	- - -	-20	- - -	- - -	- - -					
	Elongation (%) min	200	- - -	- - -	- - -	- - -					
	Elongation Change % max	- - -	-60	- - -	- - -	- - -					
	Volume Change	- - -	- - -	- - -	0 to +100	- - -					
Hose								0 rating			
	Extractables gm/m^2	7.75									
	Permeation Resistance gm/m^2/day Reservoir Method - Fuel CE10	15									
	Adhesion (N/mm) min	1									
	Low Temperature Resistance Fuel									Fuel C	- - -
	Time (hrs.)									48	5
	Temperature (°C)									23 °C	-40 °C
											pass

– If a column shows more than one fluid in the heading for any individual column, all fluids shown in that column heading must be tested and meet the same specification limits shown in the column below the heading.
– Dynamic hose testing properties for all types of hose covered by this specification can be found in Table 3.

TABLE 3 - DYNAMIC HOSE PROPERTIES -
SAE J30 FUEL AND OIL HOSE
BURST, WORKING PRESSURE, AND CHANGE IN LENGTH

SAE 30R2 TYPE 1

Nominal Size mm	Burst min MPa	Proof Test Pressure Min MPa	Leak Test Pressure MPa	Length Change Test Pressure MPa	Length Change %	Vacuum Testing Nominal Size mm	Vacuum Testing Pressure kPa	Vacuum Testing OD Change % (max)
						<12.7	-67.5	20
3.0 through 12.7	4.82	2.41	3.37	0.79	+/- 5	= 12.7	-34	20
>12.7 through 26	3.45	1.73	2.42	0.59	+/- 5	> 12.7	NR	NR

SAE 30R2 TYPE 2

Nominal Size mm	Burst min MPa	Proof Test Pressure Min MPa	Leak Test Pressure MPa	Length Change Test Pressure MPa	Length Change %	Vacuum Testing Nominal Size mm	Vacuum Testing Pressure kPa	Vacuum Testing OD Change % (max)
3.0 through 12.7	4.82	2.41	3.37	0.79	0 to – 8	<15.8	-67.5	20
>12.7 through 25.4	3.45	1.73	2.42	0.59	0 to – 6	15.8 through 25.4	-34	20
>25.40 through 38.1	2.76	1.38	1.93	0.45	0 to – 6	>25.4	NR	NR
>38.1 through 51	1.73	0.87	1.21	0.28	0 to – 6			

SAE 30R2 TYPE 3

Nominal Size mm	Burst min MPa	Proof Test Pressure Min MPa	Leak Test Pressure %	Length Change Test Pressure MPa	Length Change %	Vacuum Testing Nominal Size mm	Vacuum Testing Pressure kPa	Vacuum Testing OD Change % (max)
3.0 through 4.8	13.80	6.9	6.9	3.45	+/- 5	<12.7	-67.5	20
>4.8 through 12.7	11.04	5.52	5.52	2.76	+/- 5	= 12.7	-34	20
>12.7 through 15.9	9.66	4.83	4.83	2.42	+/- 5	> 12.7	NR	NR
>15.9 through 20	8.27	4.13	4.13	2.07	+/- 5			

Coupled SAE 30R2 (All Types) must pass the Tensile Test of Assembly per procedure Section 6.14, and corrosion test per procedure Section 6.16, and a visual examination to see that the correct fittings are properly applied. Methods and limits are given in the procedure section referenced or in the tables for SAE 30R2.

TABLE 3 - DYNAMIC HOSE PROPERTIES -
SAE J30 FUEL AND OIL HOSE
BURST, WORKING PRESSURE, AND CHANGE IN LENGTH (CONTINUED)

SAE 30R3

Nominal Size mm	Burst min MPa	Length Change Test Pressure MPa	Length Change %	Hydrostatic Proof Pressure MPa	Vacuum Pressure kPa	Vacuum OD Change % (max)
4 through 5	13.80	3.45	+/- 5	6.9	-67.5	20
>5 through 7	11.04	2.76	+/- 5	5.52	-67.5	20
>7 through 9	8.27	2.07	+/- 5	4.14	-67.5	20
>9 through 10	6.20	1.53	+/- 5	3.1	-67.5	20

Coupled SAE 30R3 (All Types) must pass the Tensile Test of Assembly per procedure Section 6.14, and corrosion test per procedure Section 6.16, and a visual examination to see that the correct fittings are properly applied. Methods and limits are given in the procedure section referenced or in the tables for SAE 30R3.

SAE 30R5

Nominal Size mm	Burst min MPa	Vacuum, OD change at -67.5 kPa pressure % (max)
All Sizes	0.62	20

SAE 30R6, 7, 8 and 14

Nominal Size mm	Burst min MPa	Working Pressure max MPa	Vacuum Testing Nominal Size mm	Vacuum Testing Pressure kPa	Vacuum Testing OD Change % (max)
3 through 9.5	1.72	0.34	<12.7	-81	20
>9.5 through 25.4	1.20	0.24	12.7 through 25.4	-34	20
>25.4	0.55	0.11	>25.4	NR	NR

SAE 30R9

Nominal Size mm	Burst min MPa	Working Pressure max MPa	Vacuum, OD change at -81 kPa pressure % (max)
6 through 9.5	6.20	0.69	20
> 9.5	3.40	0.69	20

SAE 30R10

Nominal Size mm	Burst min MPa	Working Pressure max MPa
<= 9.5	3.40	0.69
> 9.5	2.80	0.69

SAE 30R11

Nominal Size mm	Burst Min MPa	Hose ID Size mm	Vacuum Pressure kPa	Vacuum, OD change limit % (max)
All Sizes	1.20	<12.7	-81	20
		12.7 to 25.4	-34	20
		>25.4 to 44.5	-14.3	20
		>44.5	Limit to be agreed upon between supplier and manufacturer.	

SAE 30R12

Nominal Size mm	Burst min MPa	Working Pressure max MPa	Vacuum Testing Pressure kPa	Vacuum Testing OD Change % (max)
All Sizes	8.00	1.00	-80	20

6. TEST METHODS

6.1 Test Requirements

NOTE 1: If a laminated tube is used, the inner tube must be separated and tested alone. If a satisfactory test specimen cannot be provided from inner tube, than a lab prepared test slab is acceptable. ASTM test slabs are permissible for testing tube or cover when thickness does not meet ASTM D 412 minimum 1.5 mm (0.060 in).

NOTE 2: Refer to Tables 2 and 3 to determine the tests required for each hose type.

6.2 Change-In-Length Tests

Tests for change in length shall be conducted in accordance with ASTM D 380, except that the original measurement shall be at 0 MPa gage pressure. The change in length shall be determined at the pressures specified in Table 3 (DYNAMIC HOSE PROPERTIES: BURST, WORKING PRESSURE, AND CHANGE-IN-LENGTH TESTS) for the specific sizes and types. The specified requirements are listed in the table.

6.3 Burst Test

Conducted per ASTM D 380, (The minimum bursting strength shall be as specified in Table 3 (DYNAMIC HOSE PROPERTIES: BURST, WORKING PRESSURE AND CHANGE-IN-LENGTH TESTS).

6.4 Vacuum Collapse Test

See Table 3 (DYNAMIC HOSE PROPERTIES: BURST, WORKING PRESSURE, AND CHANGE-IN-LENGTH TESTS) for the Type of hose, sizes, amount of vacuum to apply, and the requirements of the specification. During the vacuum test described, a 915 mm (3 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 vacuum for 15 s and not over 30 s.

For shaped parts the entire part shall be used (if required).

6.5 Cold Flexibility

6.5.1 Hose 19.0 mm ID and under, with or without couplings, shall be used for this test. Fill hose with ASTM Ref. Fuel C, condition hose for 70 hours at 23 °C ± 1 °C. Drain the fuel C from the hose. The conditioned samples shall then be subjected to a temperature of -40 °C ± 1 °C for a period of 5 hours, after which the hose shall be flexed in the cold chamber through 180 degrees from the centerline to a diameter of 10 times the maximum OD of the hose. This flexing shall be within 4 seconds. The hose shall not fracture and shall not show any cracks, checks, or breaks in the tube or cover. Cracking of the tube may be determined by application of the proof pressure specified in Table 3 (DYNAMIC HOSE PROPERTIES: BURST, WORKING PRESSURE AND CHANGE-IN-LENGTH TESTS).

6.5.2 Hose over 19.0 mm ID, and all shaped hoses shall be filled with fuel C, plugged and conditioned for 70 hours at 22 °C. Drain fuel from the hose and cut specimens 150 x 12 mm of the tube and cover (full hose wall thickness). The conditioned specimens shall then be subjected to a temperature as specified in Table 2 (± 1 °C) for a time as specified in Table 2. At the end of this time and while still in the cold chamber, the strip shall be bent around a 100 mm diameter cold conditioned mandrel. The specimen shall not fracture and shall not show any cracks, checks, or breaks.

6.5.3 Conduct cold flexibility after the recirculating test for R-13 hose.

6.6 Tensile Strength and Elongation Original Properties

Test per ASTM D 380, and D 412. See Table 2 for values of tensile and elongation.

6.7 Dry Heat Resistance

After oven aging per ASTM D 573, for time as specified in Table 2 at the required temperature from Table 2, the reductions in tensile strength and elongation of specimens taken from the tube and cover shall not exceed the values in Table 2.

6.8 Hose Flexibility After Heat Aging

The hose shall show no cracks, charring, or disintegration externally or internally when slowly straightened (taking 4 to 8 seconds) after being exposed as shown in Figure 1 for a period of 7 days at the required temperature shown in Table 2.

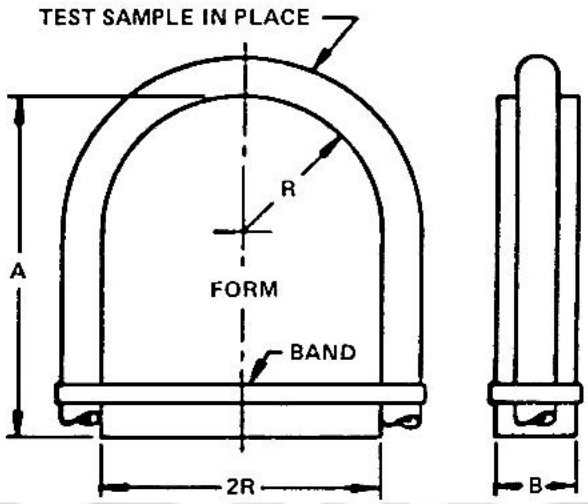

FIGURE 1 - TEST SAMPLE ON FORM FOR HEAT AGING TEST (SEE TABLE 2)

6.9 Fuel Resistance

Test per ASTM D 471 (See Table 2 for time, and fuel). Change in tensile, elongation and volume should not exceed those values listed in Table 2.

6.10 Oil Resistance

Test per ASTM D 471, in ASTM IRM 903 oil (See Table 2 for time and required temperature). Change in tensile, elongation and volume should not exceed those values listed in Table 2.

6.11 Ozone Resistance

Test procedure shall be in accordance with ASTM D 1149 where applicable. For hose 25.4 mm ID and under, a specimen of hose of sufficient length shall be bent around a mandrel with an outside diameter equal to eight times the nominal OD of the sample. 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. The mounted specimens shall be placed in a test chamber with ozone concentration per Table 2 at a temperature as specified in Table 2 (± 1°C). After exposure for the time specified in Table 2, the specimen shall be removed and allowed to cool to room temperature and then be inspected visually under 7X magnification. It must meet a rating of "0" except for the area immediately adjacent to the wire, which shall be ignored.

6.11.1 For hose over 25.40 mm ID, and all preformed hose, prepare a specimen by cutting a strip of the whole hose 12.70 x 100 mm and tie to a specimen (cover out) around a 12.70 mm diameter mandrel. Condition in the same manner as specified in the previous paragraphs for the whole hose and apply the same conditions and requirements. This test applied to the cover only and cracks in the exposed tube or cut edges of the cover shall be ignored.

6.12 Adhesion Test

6.12.1 Original Adhesion

Cut out 25 mm samples out of the hose in the transverse direction. The number of samples to be tested is dependent on the construction of the hose but should be enough to test the adhesion between all adjacent layers. When tested in accordance with ASTM D 413. Machine Method, Strip Specimen – Type A, 180° Peel, Table 2 for the minimum force required for the type of hose tested. Value must meet the limits shown in Table 2. Test method for 4 mm to 19 mm ID hose use ASTM D 413 ring specimen with approximately 90 degree peal.

OPTIONAL: For small Diameter hose (4 mm to 19 mm inside diameter) ring specimens, approximate 90 degree peal per ASTM D 413.

6.12.2 Aged Adhesion

6.12.2.1 Sample Conditioning

Use hose from the permeation test.

6.12.2.2 Alternate Method of Conditioning

Plug one end of the hose to be tested. Fill with test fuel CM15. Plug the other end of the tube in such a manner that it can be periodically removed. Expose the filled hose to a temperature of 40 °C for a 1000 h continuously. Change the fuel every 168 hours.

Cut 25 mm samples out of the hose in the transverse direction. The number of the samples to be tested is dependent on the construction but should be enough to test the adhesion between all adjacent layers.

6.12.2.3 Condition the test samples in a 70 °C oven for 24 h followed by 2 h at 23 °C. Test for adhesion in accordance with ASTM D 413, Machine Method, Strip Specimen-Type A, 180° Peel, the minimum force required to separate the two layers are listed in Table 2. Value must meet the limits shown in Table 2. For diameters 4 mm to 19 mm use ASTM D 413 ring specimen with approximately 90 degree peal.

6.13 Proof Test (if Required by Print or Table 3)

Before shipment by the vendor, a suitable number of assemblies from each lot shall be proof tested at 50% of the minimum burst pressure specified in Table 3 for a period of not less than 30 seconds or more than 60 seconds, to ensure an acceptable quality level.

6.14 Tensile Test of Assembly

The hose complete with fittings shall be dry-air aged at 100 °C ± 1 °C for 70 h and then permitted to rest at room temperature for 2 hours. The end fittings of the assembly shall be clamped in the jaws of a tensile testing machine so that a straight pull may be applied. The jaws of the test machine shall separate at a rate not greater than 25.4 mm minute. The hose assembly shall withstand, after the aging test, a minimum pull of 444 N on sizes up to, and including, the 6.35 mm. All sizes over 6.35 mm ID shall withstand a minimum pull of 667 N. For inspection tests, unaged samples may be used.

NOTE: For 30R3 assemblies only, the 6.35 through 7.94 mm ID hose assemblies shall withstand 556 N.

6.15 Leakage Test

For the required test parameters see Table 3. The hose assembly shall be aged for 70 h at 100 °C before beginning test. The pressure shall be held for a period of not less than 5 minutes or more than 7 minutes.

6.16 Corrosion Test

The assembly shall be tested in accordance with ASTM B 117. The period shall be 48 h. There shall be no evidence of corrosion or other deterioration at the expiration of this test.

6.17 Test for Extractible in Hose

6.17.1 Apparatus and Reagents

ASTM Fuel C (50 Toluene - 50 isooctane percent by volume)
Methanol, 99% minimum purity
Gooch crucible
Glass fiber filter, Grade 934AH
Beaker
Heating unit
Metal control rod and end plugs (see Figure 2 and Table 4)

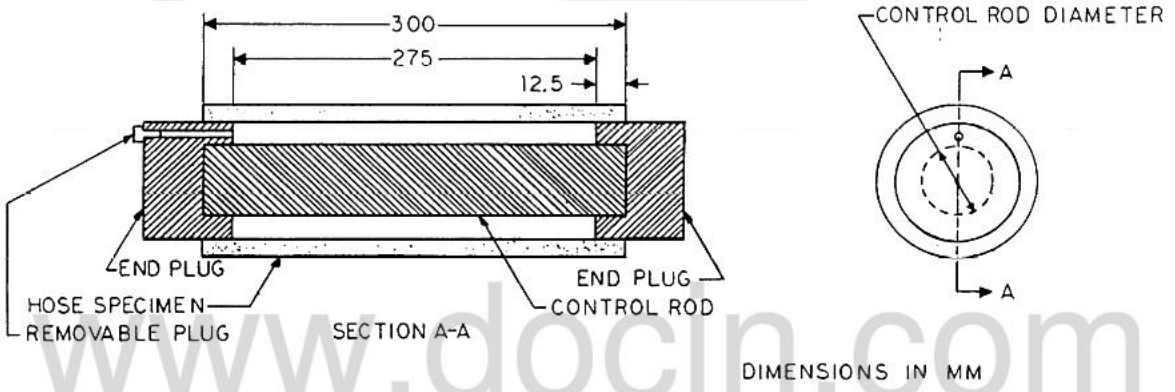

FIGURE 2 - TEST FIXTURE FOR EXTRACTABLES

TABLE 4 - CONTROL ROD DIMENSIONS

Hose Size (Nominal Inside Diameter) mm	Hose Size (Nominal Inside Diameter) in	Control Rod Diameter mm
Below 19.05	N/A	N/A
19.05	3/4	7.8
25.40	1	15.5
31.75	1 1/4	22.4
34.92	1 3/8	25.9
38.10	1 1/2	29.1
44.45	1 3/4	35.6
50.80	2	42.1
57.35	2 1/4	48.6
63.50	2 1/2	55.0

6.17.2 Specimens

Hose under tests shall be 300 mm long, plugged at both ends with metal (aluminum or steel) plugs to retain the fluid. Calculate inside surface area based on the actual inside diameter of the hose for its total effective length. Note (Total effective length of hose with end plugs inserted shall be 275 mm. Note (A round metal (aluminum or steel) control rod conforming to the dimensions shown in Table 4 for hose sizes 19.05 mm ID and larger shall be inserted into hose ID as shown in Figure 1. The rod shall be positioned in the end plugs such that it will not contact the hose ID.

6.17.3 Procedure

Record hose actual inside diameter, length, and inside surface area. Preferred method is with plug ID gauges to nearest 0.025 mm.

– Fill hose with ASTM Fuel C
– Allow to stand for 24 h at temperature of 23 °C ± 2 °C with both ends sealed. (Solubility of waxy hydrocarbons is affected by temperature).
– Drain fluid from hose into a tared beaker.
– Rinse inside of the specimen with an amount of fresh ASTM Fuel C approximately equal to the volume of the original filling and add to the original extraction.
– Remove solvent by evaporation by heating at 80 to 95 °C until no fuel odor is detectable and then store sample at room temperature of 23 °C ± 2 °C under a fume hood for a minimum of 16 h.
– Take up residue with 30 ml of room temperature, 23 °C ± 2 °C, methanol.
– Filter this solution on the tared crucible, rinsing beaker twice with 10 ml of room temperature, 23 °C ± 2 °C (73 °F ± 3.6 °F), methanol.
– Place crucible in beaker and dry in a 65 to 90 °C (149 to 194 °F) oven to insure complete evaporation of methanol.
– Weigh the gooch crucible and tared beaker and determine mass of extractables expressed as g/m^2 using surface area of hose in contact with ASTM Fuel C.
– Value for total g/m^2 shall be values shown in Table 2.

6.18 Oxidized Fuel Testing

6.18.1 Cut three tensile (Die C) specimens for immersion testing per ASTM D 471. No more than three tensile specimens may be immersed per test tube. Each test tube (38 mm diameter by 300 mm long) contains 200 ml of ASTM Fuel "BFEC5 which sufficient tertiarybutyl hydroperoxide has been added to provide a peroxide number, as determined by the method below, of 50. (A well-mixed mixture consisting of 3600 ml of ASTM Fuel "B" and 10 ml of 90% t-butyl hydroperoxide in water will produce a fuel mixture with 50 PN.) All specimen surfaces must be directly exposed to the test liquid. Water-cooled condensers should be attached to the test tubes by non-contaminating means. (Corks, ground glass joints, and foil wrapped rubber stoppers are acceptable.) Place the test tubes in a thermostated environment such that the temperature is maintained at 40 °C ± 2 °C. At 1-, 2-, 3-, and 7-day intervals, replace the test fluid with fresh fuel-hydroperoxide (50 PN) mixture. After 14 days of immersion, cool the samples in ASTM Fuel "B." Determine the reduction in tensile strength and elongation per ASTM D 412. The physical values of specimens from the tube shall not exceed the change in values listed in Table 2.

6.18.2 Peroxide Number Analytical Method

– The peroxide number here is defined as the number of milliequivalants of peroxide per liter of sample solution.
– A sample is refluxed 5 minutes with sodium iodide and acetic acid in dry isopropanol. The liberated iodine is titrated with standardized thiosulfate to disappearance of the yellow color. The titrant volume is corrected for any titratable substances in the reagents.

6.18.3 Apparatus

Flasks, Erlenmeyer, with ground joints, 250 ml capacity
Condensers, Allihn or Leibig water-cooled type, 300 mm jacket, with joints to fit above flasks

Optional (hot plate or equivalent. Equip with rod and clamps to hold condenser
Optional (reagent dispenser, 25 ml - Convenient for dispensing the acetic acid in isopropanol reagent
10 ml burette with 0.02 ml graduations
Optional - electrometric end point apparatus

6.18.4 Reagents

Acetic acid, glacial, ACS reagent grade, not over 0.5% water by the Karl Fischer method
Sodium iodide, ACS reagent grade, granular
Isopropyl alcohol, 99%
Sodium thiosulfate solution, 0.1 N accurately standardized
Sodium iodide, saturated solution in isopropanol. Reflux 22 g NaI in 100 ml isopropanol for a few minutes, cool to room temperature and filter through rapid filter paper. Store in the dark or in a brown reagent bottle. Replace if the solution gives an appreciable blank when titrated with thiosulfate.
Acetic acid in isopropanol. Mix 100 ml of glacial acetic acid and 1150 ml of isopropanol.

6.18.5 Procedure

Add, from an automatic dispenser, 25 ml of the acetic acid in isopropanol solution (Reagent 6) to a 250 ml Erlenmeyer flask.
Add 10 ml of the saturated NaI in isopropanol solution (Reagent 5) to the flask.
With a pipette, quantitatively transfer a 2 ml portion of sample to the Erlenmeyer flask.
Connect the flask to the condenser and heat to a gentle boil, reflux for 5 min. The solution should be dark yellow to brown in color.
Raise the flask from the hot plate and support it on an asbestos board to cool, or cool in a water bath.
Wash down the condenser with 5 ml of water.
Disconnect the flask, and titrate with standardized 0.1 N sodium thiosulfate solution to the disappearance of the yellow color, i.e., from a pale yellow to just colorless. (An electrometric end point apparatus may be used.)
Simultaneously run a reagent blank by following the above procedure omitting the sample addition in Step c. The titrant volume of the blank should be in the 0.02 to 0.06 ml range.

6.18.6 Calculate the peroxide number according to Equation 1.

$$(\text{Versus} - V_b)\ N \times 1000/(\text{ml sample}) = \text{Peroxide Number} \qquad \text{(Eq. 1)}$$

where:

Versus = volume of titrant consumed by sample, ml
V_b = volume of titrant consumed by blank, ml
N = normality of standardized sodium thiosulfate solution

NOTE: The 1000 = conversion ml to liter

6.18.7 Standard Sodium Thiosulfate Solution, 0.1 N (Reagent 4, See Above)

Sodium thiosulfate solutions decompose slowly with deposition of sulfur due to bacterial action unless cautions are taken to inhibit bacterial growth. Use of freshly boiled and cooled water in preparation of $Na_2S_2O_3$ solutions and maintaining the pH on the slightly alkaline side usually gives solutions whose factors will remain constant for two to four weeks. Other precautions that can be taken if bacterial growth persists include sterilization of the containers. Glass can be cleaned thoroughly with dichromate-sulfuric acid cleaning solution and rinsed with sterile water. Polyethylene can be washed thoroughly with chloroform and rinsed with sterile water. A few drops of chloroform added to the prepared solution will also aid in preventing bacteria growth.

6.18.8 Reagents

Sodium thiosulfate, $Na_2S_2O_3 \times 5H_2O$, ACS reagent grade
Potassium iodide solution, 10% (dissolve 10 g of ACS reagent grade KI in 100 ml of distilled water
Sulfuric acid solution, 40% (add 300 ml of concentrated H_2SO_4 slowly with stirring to 750 ml of distilled water
Potassium bromate $KBrO_3$, ACS reagent grade

6.18.8.1 Peparation of 0.1 N Solution

Dissolve 25 g of $Na_2S_2O_3 \times 5H_2O$ in freshly boiled and cooled distilled water and make up to 1 L.
Titrate a 100 ml portion of the solution with 0.1 N NaOH solution using phenolphthalein indicator.
Calculate the volume of alkali required to neutralize the remaining solution as follows:

$$\text{ml NaOH} \times N \times 9 = \text{ml 0.1 N NaOH required} \quad \text{(Eq. 2)}$$

Add the calculated volume of alkali to the remaining solution, mix thoroughly and withdraw 100 ml. Add two or three drops of phenolphthalein indicator solution. The solution should give a slight pink color. Store the solution in a brown bottle securely capped. Any precautions to protect the solution from air, e.g., sweeping with nitrogen or other inert gas, should be applied. The solution should be standardized at least monthly.

6.18.8.2 Standardization

Titration of Potassium Bromate—The reaction is as follows:

$KBrO_3 + 6KI + 3H_2SO_4 \text{ ----> } 3I_2 + KBr + 3H_2O + 3K_2SO_4$
$2Na_2S_2O_3 + I_2 \text{ ----> } Na_2S_4O_6 + 2NaI$

Grind a small amount of $KBrO_3$ to a fine powder and dry for 1 h at 180 °C. Weigh to the nearest 0.1 mg 0.015 to 0.25 g of the dried $KBrO_3$ into a 250 ml Erlenmeyer flask. Add 25 ml of distilled water and swirl to dissolve. Add 2 ml of 10% KI solution and 1 ml of 40% H_2SO_4 solution. Swirl to mix and allow to stand for 2 or 3 min. Titrate with the $Na_2S_2O_3$ solution, swirling continuously, until the brown color has changed to a pale yellow. Add titrant slowly, dropwise until the yellow color has disappeared and the solution is colorless.

6.18.8.3 Calculation

$$\text{Grams of } KBrO_3 \times 17.9/(\text{ml of } Na_2S_2O_3) = N \text{ of } Na_2S_2O_3 \text{ solution} \quad \text{(Eq. 3)}$$

Duplicate determination should agree within 0.0003. Report the average of the values found, to the nearest 0.0002, as the normality of the solution. A number of replicates are advised until the end point change is identified and suitable precision is established.

6.19 Reservoir Method for Fuel Hose Permeation

6.19.1 Rate of Fuel Permeation

Hose tested by the reservoir method shall meet the limits listed in Table 2. Exposure of these hoses to gasoline or diesel fuel which contain high levels, greater than 5% by volume, of oxygenates, i.e., ethanol, methanol, or MTBE (methyl tertiary butyl ether), may result in significantly higher permeation rates than those listed in Table 2.

6.19.2 Reservoir Units

See Table 5 for size of reservoir. A screw-top can may be modified by the addition of a standard hose nipple, or fitting, cold soldered into the base at the corner opposite its opening. See Figure 3 for typical equipment. Other types of reservoir units may be used. Examples are cylindrical aluminum and steel containers with appropriate standard hose nipples at one end, and a fill opening if required at the other end. The materials used for construction of the reservoirs should be compatible with the test fuel.

6.19.3 Screw Cap

A metal foil or fluoroelastomer -lined cap to seal the reservoir unit. Where the threaded fill opening is designed to seal with an O-ring, a fluoroelastomer O-ring shall be used. The threaded fill opening may be either a female or male thread and sealed with a threaded male plug or female cap.

TABLE 5 - TEST PIECE SIZE PARAMETERS

Inside Diameter of Test Hose mm	Active Length of Test Hose mm	Reservoir Size ml	Fuel Fill Amount ml
ID ≤ 16.0	300	460 – 490	300
16.0 <ID ≤ 25.0	300	940 – 1000	750
25.0 <ID ≤ 32.0	300	3750 – 4000	2500
32.0 ≤ ID	150	3750 – 4000	2500

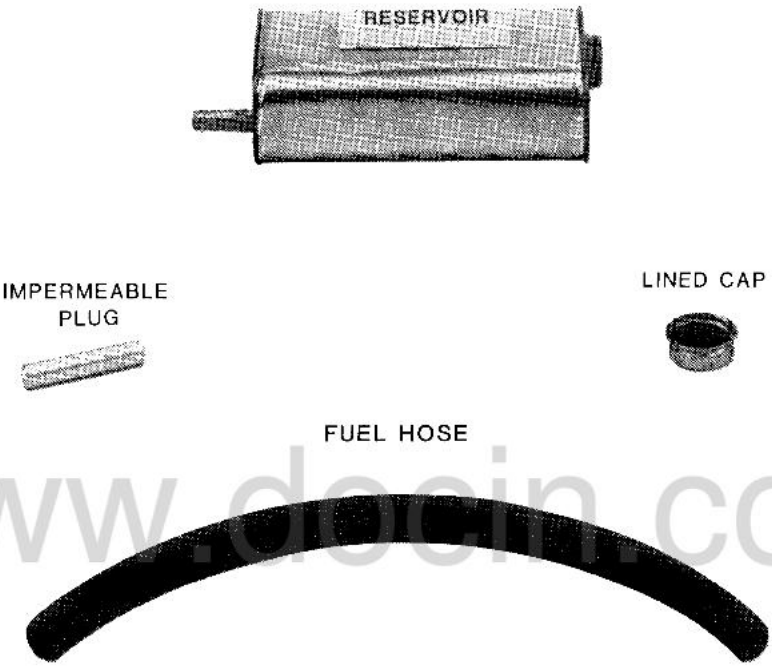

FIGURE 3 - FUEL PERMEATION TEST APPARATUS

6.19.4 Scale or Balance

A weighing unit with sufficient capacity to weigh the filled assemblies, and with a resolution of ±0.01 g.

6.19.5 Impermeable Plug

An impermeable plug of sufficient size to seal one end of the hose to a depth of 25 mm.

6.19.6 Hose Clamps

Standard hose clamps of the correct size for the hose being tested.

6.19.7 Procedure

Cut hose to the required length (active length plus the fitting lengths). See Table 5.
Measure the inside diameter of the hose and record in mm.
Plug one end of hose to the required depth using an impermeable plug and hose clamp.
Attach the other end of hose to the fitting on the reservoir and clamp.
Measure the active or exposed length of the installed hose in mm and record.
Fill the reservoir with the specified amount (see Table 5) of desired fuel blend.
Seal reservoir with cap or plug.
Weigh reservoir assembly to the nearest 0.01 g and record.
To insure complete filling of the hose, orient assembly vertically and gently tap hose to eliminate the possibility of trapped air in the hose.
See Figure 4.

FIGURE 4 - FUEL PERMEATION TEST - AIR BUBBLE REMOVAL POSITION

FIGURE 5 - FUEL PERMEATION RESERVOIR TEST - ASSEMBLY STORAGE POSITION

Place assembly with the hose horizontal in its storage position for liquid permeation (Figure 5).
Weigh the assembly each 24 h ± 0.5 h for the required time interval and record each value.
After each weighing, invert assembly to drain hose, gently mix fuel, and refill hose as in step 1 and replace in storage position.
Calculate the exposed tube area (A) in m^2:

$$A = L\ (mm) \times ID\ (mm) \times 3.14 \times 10^{-6} \quad \text{(Eq. 4)}$$

Calculate the rate of fuel permeation in terms of $g/m^2/24$ h of exposed tube area on a daily basis.

If a pre-conditioning soak is required it must be specified in Table 2. If a pre-conditioning soak is specified, the assembly must be filled with fuel, and set in position with the hose down and maintained at the test temperature for the specified precondition time, per Table 2. Fuel is to be changed each week to fresh fuel as specified in Table 2, but no weighings are required until the end of the preconditioning period. After preconditioning is completed, the permeation test is followed as shown above (again with a fresh fuel change).

TWA = Time Weighted Average.

If TWA is specified in Table 2 then the permeation is calculated over the entire time specified (excluding any presoak), and averaged over the test days to obtain an average daily value or TWA. Results to be reported in grams per square meter of inside hose surface area per day of test (after preconditioning).

For R14, only, Permeation is to be per the above method and procedure, using a 28 day presoak with Reference Fuel CE10 at 23 C, followed by a 21 day permeation test at 23 C with Reference Fuel CE10. Results to be given as a TWA over this 21 day period.

6.20 Kink Resistance

When tested to the following procedure, a ball having a diameter equal to 1/2 the nominal inside diameter of the hose shall pass freely through the hose. Use fixture consisting of a 19 mm thick board or plate with holes and center distances shown in Table 6.

TABLE 6 - KINK RESISTANCE

Nominal Hose ID, mm	Hole Center Distance, mm	Hole Diameter, mm
< 6.35	12.7	12.7
6.35 through < 7.94	19	14.3
7.94 through < 9.53	25.4	5.9
9.53 through < 12.7	76.2	19
12.7	127	23
>12.7	Not Required	Not Required

6.20.1 Condition 300 mm long specimens of hose for 2 h at room temperature 23 °C ± 2 °C. Insert one end of hose into board with end flush with opposite side of the board. Carefully bend hose along its natural curvature and insert the other end carefully into the second hole until it projects 63 mm out the other side. After hose has been in this position for 5 min, insert a steel ball having a diameter equal to 1/2 the hose nominal ID.

6.20.2 The ball must pass freely from one end to the other.

6.21 Electrical Conductivity (Inspection Test on All Sizes)

The purpose is to provide a conductive pathway to dissipate any static electrical buildup. This test is required only for hose that will be designated as electrically conductive.

An entire hose (maximum length 610 mm) will be used for this test, unless its length exceeds 610 mm, at which time the length for test shall be 610 mm. Insert a brass, steel, or copper plug or fitting into each end.

Place clamps on each end of the hose and firmly tighten. Attach the ohmmeter electrodes to the plugs at each end. Measure the resistance between the plugs while applying 550 V DC (±50 V). The maximum resistance allowable is 10 M Ohm.

NOTE 1: The diameter of the plug or fitting should be close to the ID of the hose.

NOTE 2: The hose while under test should be placed on a nonconductive surface.

NOTE 3: Ohmmeter must have the capability of measuring resistance from 10^{-1} to 10^{+3} M Ohm at 550 V DC.

7. MARKING

Hoses shall be legibly marked on the outer cover as shown below:

7.1 SAE J30 R2 Through R10

The outer cover will be printed with the designation SAE 30RAA, along with any other identification agreed upon between user and manufacturer, repeated every 300 mm. The "AA" position shall indicate the hose type (R2 Type 1, 2, or 3, R3, R5, R6, R7, R8, R9, or R10).

EXAMPLE: SAE 30R7 would indicate a hose that meets all requirements for SAE J30 R7 shown in this specification.

NOTE: J30R2 has 3 types. The type must be specified after 30R2 (example SAE 30R2 Type 2) – This note applies to 30R2 only.

7.2 SAE J30 R11 and R12

The outer cover will be printed with the designation SAE J30RAAXYTz along with any other identification agreed upon between user and manufacturer, repeated every 300 mm.
The "AA" position shall indicate the hose type (R11 or R12).
The "X" position (Table 7) shall indicate the range that the permeation rate falls within.
The "Y" position will be either "E" for electrically conductive or "N" for non-conductive hose or tube.
The "Z" position will be either 1 for 100 °C heat resistance, 2 for 125 °C heat resistance, 3 for 135 °C heat resistance, or 4 for 150 °C heat resistance. (Table 7)

TABLE 7 - R11 AND R12 SUFFIX DEFINITIONS

The “X” position shall indicate the range that the permeation rate falls within.	
“X” Position	
A	0-25 g/m^2/day
B	26 to 50 g/m^2/day
C	51 to 100 g/m^2/day
The "Y" position is to be used to show if the hose meets the conductivity requirements of Section 6.21.	
"Y" Position	
N	Non Conductive (no conductivity requirement)
E	Conductivity less than 10 megaohms
The "T" position indicates that the hose meets the upper use temperature category given by "z" and meets the requirements of Section 6.7 and 6.8 when tested at the corresponding "z" temperature.	
“Tz” Position	Upper Use Temperature
T1	100 °C
T2	125 °C
T3	135 °C
T4	150 °C

NOTE: Some examples of the markings follow:

SAE 30R11ANT1 This hose is designed to meet the 0 to 25 g/m^2/day permeation range. It will meet the 100 °C heat requirement and is not electrically conductive

SAE 30R11ANT2 This hose or tube is designed to meet the 0 to 25 g/m^2/day permeation range. It will meet the 125 °C heat requirement and is not electrically conductive.

SAE 30R11AET2 This hose or tube is designed to meet the 0 to 25 g/m^2/day permeation range. It will meet the 125 °C heat requirement and is electrically conductive.

SAE 30R12ANT3 This hose would be a non-conductive hose with a permeation rate of 0 to 25 g/m^2/day and an upper use temperature of 135 °C.

7.3 SAE J30 R14

The outer cover will be printed with the designation SAE J30R14Tz along with any other identification agreed upon between user and manufacturer, repeated every 300 mm.
The "Z" position will be either 1 for 100 °C heat resistance, 2 for 125 °C heat resistance (Table 8)

TABLE 8 - R14 SUFFIX DEFINITIONS

The "T" position indicates that the hose meets the upper use temperature category given by "z" and meets the requirements of Section 6.7, 6.8 and 6.9 when tested at the corresponding "z" temperature.	
"Tz" Position	Upper Use Temperature
T1	100 °C
T2	125 °C

NOTE: Some examples of the markings follow:

SAE 30R14T1 This hose is designed to meet the 100 °C heat requirement and the EPA small engine permeation requirement.
SAE 30R14T2 This hose or tube is designed to meet the 125 °C heat requirement and the EPA small engine permeation requirement.

8. SHELF LIFE ORDERING NUMBER SUFFIX

8.1 Ordering Number Designation SAE 30 RAAYTzL

8.1.1 The "L" position is shelf life
"M" = military hose shelf life, 6 years - See USA Military Specification MIL-HDBK-695 for SAE J30 hose
"R" = industrial hose shelf life for expected hose functionality is 7 years - See Rubber Manufacturers Association Handbook IP-2.

8.1.2 Hose Storage Conditions

See Rubber Manufacturers Association Handbook IP-2.

9. NOTES

9.1 Marginal Indicia

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.

PREPARED BY THE SAE NON-HYDRAULIC HOSE COMMITTEE

APPENDIX A - LISTING OF ASTM REFERENCE FUELS

(See ASTM D 471 for complete list with references.)

Fuel Type	**Composition by Volume %**
Reference Fuel A	Isooctane 100%
Reference Fuel B	Isooctane 70% + Toluene 30%
Reference Fuel C	Isooctane 50% + Toluene 50%
Reference Fuel D	Isooctane 60% + Toluene 40%
Reference Fuel E	Toluene 100%
Reference Fuel F	Diesel Fuel, Grade No. 2 100%(See ASTM D 975 for specification)
Reference Fuel G	Fuel D 85% + anhydrous denatured ethanol 15%
Reference Fuel H	Fuel C 85% + anhydrous denatured ethanol 15%
Reference Fuel I	Fuel C 85% + anhydrous methanol 15%
Reference Fuel K	Fuel C 15% + anhydrous methanol 85%
Sour Gas #1	Fuel B + t-ButylHydroperoxide at PN=50
Sour Gas #2	Fuel I + t-ButylHydroperoxide at PN=50 + 0.01 mg CU+2 ion solution / liter of fuel
Sour Gas #3	Fuel K + t-ButylHydroperoxide at PN=50 + 0.01 mg CU+2 ion solution / liter of fuel
Reference Fuel CE10	90% Fuel C + 10% anhydrous denatured ethanol

(The peroxide number here is defined as the number of milliequivalants of peroxide per liter of sample solution. See Section 6.18.6 for method to manufacture.)