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# SURFACE VEHICLE STANDARD

SAE J2064 | REV. AUG1998

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Submitted for recognition as an American National Standard

## (R) R134a Refrigerant Automotive Air-Conditioning Hose

1. ***Scope***—This SAE Standard covers hose and hose assemblies intended for conducting liquid and gaseous R134a refrigerant in automotive air-conditioning systems. The hose shall be designed to minimize permeation of R134a refrigerant, contamination of the system, and to be functional over a temperature range of –30 to 125 °C. Specific construction details are to be agreed upon between user and supplier. A hose marked "J2064" signifies that it has been coupled, tested, and has met the requirements of SAE J2064. It is the hose assembly manufacturer's responsibility to see that the assemblies meet the specified acceptance criteria for this specification.

2. ***References***

**2.1 Applicable Publication**—The following publication forms a part of this specification to the extent specified herein.

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

ASTM D 380—Methods of Testing Rubber Hose

3. ***Manufacture***

**3.1 Size**—Standard dimensions are given in the first column of Table 1.

**3.2 Types**—Including, but not limited to the following:

3.2.1 TYPE A—ELASTOMERIC, TEXTILE REINFORCED—The hose shall be built having a suitable seamless synthetic elastomeric tube. The reinforcement shall consist of textile yarn, cord, or fabric adhered to the tube and cover. The outer cover shall be heat- and ozone-resistant synthetic elastomer.

3.2.2 TYPE B—ELASTOMERIC, WIRE REINFORCED—The hose shall be built having a suitable seamless synthetic elastomeric tube. The reinforcement shall consist of steel wire adhered to the elastomeric tube. The cover shall consist of a heat-resistant textile yarn impregnated with a synthetic elastomeric cement.

3.2.3 TYPE C—BARRIER, TEXTILE REINFORCED—The hose shall have a suitable thermoplastic barrier between elastomeric layers. The reinforcement shall consist of suitable textile yarn, cord, or fabric adhered to the tube and cover. The outer cover shall be heat- and ozone-resistant synthetic elastomer.





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3.2.4 TYPE D—THERMOPLASTIC, TEXTILE REINFORCED, ELASTOMERIC COVER—The hose shall have a suitable thermoplastic tube. The reinforcement shall consist of a suitable textile yarn, cord, or fabric adhered to the tube and cover. The outer cover shall be heat- and ozone-resistant synthetic elastomer.

**TABLE 1—CONVERSION FACTORS**

| Fractional Hose Size mm (in) | Mean Hose ID mm (in) | Multiply g/day by Factor Shown to Obtain kg/m$^2$/year | Multiply g/day to Obtain lb/ft$^2$/year |
|---|---|---|---|
| 8 (5/16) | 8.1 (0.320) | 13.452 | 2.746 |
| 10 (13/32) | 10.6 (0.418) | 10.280 | 2.102 |
| 13 (1/2) | 13.0 (0.510) | 8.382 | 1.723 |
| 16 (5/8) | 16.1 (0.635) | 6.768 | 1.384 |
| 19 (3/4) | 19.4 (0.765) | 5.617 | 1.149 |

3.2.5 TYPE E—VENEER, TEXTILE REINFORCED—The hose shall have a suitable thermoplastic veneer lining the inside diameter with an elastomeric tube outer layer. The reinforcement shall consist of a textile yarn, cord, or fabric adhered to the tube and cover. The cover shall be heat- and ozone-resistant synthetic elastomer.

3.2.6 TYPE F—VENEER, BARRIER, THERMOPLASTIC LINER—The hose shall have a suitable thermoplastic veneer liner with a thermoplastic barrier between elastomeric layers. The reinforcement shall consist of a suitable textile yarn, cord, or fabric adhered to the tube and cover. The cover shall be heat- and ozone-resistant elastomer.

**3.3 Moisture Vapor Ingression Hose Classes**

Class I—Not greater than 0.039 g/cm$^2$/year
Class II— Not greater than 0.111 g/m$^2$/year

***4.*** ***Hose Identification***—The hose shall be identified with the SAE number, type, class, and size of inside diameter in fraction of inches or metric millimeter equivalents, or both, and hose manufacturer's code marking. This marking shall appear on the outer cover of the hose at intervals not greater than 380 mm.

**4.1 Hose Assemblies**—Hose Assemblies may be fabricated by the manufacturer, an agent for or customer of the manufacturer, or by the user. Fabrication of permanently attached fittings to refrigerant hose requires specialized assembly equipment. Refrigerant hose from one manufacturer may not be compatible with fittings supplied by another manufacturer. Similarly, assembly equipment from one manufacturer may not be interchangeable with that of another manufacturer.

***5.*** ***Testing***—The test procedures described in the current issue of ASTM D 380, shall be followed whenever applicable.

**5.1 Test Conditions**—The temperature of the testing room shall be maintained at 23 °C ± 2 °C. The temperature of the test hose or hose assemblies shall be stabilized for 24 h at the testing room temperature prior to testing.

**5.2 Permeation Test**

5.2.1 TEST SPECIMENS—107 CM SAMPLES—The test specimens are to consist of four coupled hose assemblies that have 107 cm ± 1.2 cm of exposed hose between couplings. Three of the coupled hose assemblies are to be used for determining the permeation rate through the hose at a specific temperature. The fourth coupled and plugged hose assembly is to be used for a control hose.

One end of each hose assembly is to be fitted with a capped charge fitting. The other end is to be attached to a canister (optional) or plugged with a fitting. If a canister is used, the coupled hose assemblies are to be connected to canisters each having an internal volume of 510 $cm^3$ ± 25 $cm^3$ and having a minimum burst strength of 8.6 MPa.

5.2.2 CHARGING PROCEDURE AND INITIAL WEIGHTS—The coupled hose assemblies are to be weighed and recorded to 0.01 g to establish an initial weight prior to charging. The test samples (control sample not charged) are to be charged with refrigerant to 70% ± 3% of the internal volume of the assembly and then reweighed. Evacuation and cooling of samples is recommended for ease of charging.

5.2.3 TEMPERATURE EXPOSURE—The test temperature is 80 °C ± 2 °C.

5.2.4 ESTABLISH CONSTANT LOSS RATE—Weigh the samples at the end of the first 24 h temperature exposures and weighing at periodic intervals (minimum period must be 24 h). The weighings should be taken in net loss of grams, charged sample weight loss minus control sample weight loss. The net weight loss versus time should continue to be recorded until steady-state is reached. Steady-state is reached when the last four readings are within 10% of the lowest reading or after 25 days, whichever comes first.

This is not to be a lot release test. The lot release test is to be agreed upon between the vendor and consumer.

5.2.5 LOSS RATE DETERMINATION—No charged specimen may lose more than 40 g during the first 24 h period. The permeation rate for each specimen may be determined as follows:

a. For Samples that Meet the 10% Rule—Establish the slope of steady-state net loss in grams per day for the 107 cm length specimen and multiply by factors in Table 1 to obtain permeation rate.
b. For Samples that Run for 25 Days—The final weighing period, in which the data recorded will be used to determine the permeation rate, shall be the last 5 days or 7 days of the test period. The samples during the final period shall be weighed 5 times at least 24 h apart. The total net weight loss for the final period, divided by the number of days in the period are multiplied by the factors in Table 1 to obtain the permeation rate.

At the end of the temperature exposure period, the refrigerant charge remaining should be 50% of the original charge minimum. At the conclusion of the test, the refrigerant charge in each specimen should be exhausted to a suitable reclamation container.

5.2.6 ACCEPTANCE DETERMINATION—The coupled hose assembly shall not be permeable to a refrigerant loss at a rate greater than 29 $kg/m^2$/year for type A and B or a rate greater than 9.7 $kg/m^2$/year for types C, D, E, and F.

**5.3 Coupling Integrity**—It is the assembly manufacturer's responsibility to verify that the combination of coupling Type A and specific Hose Manufacturer's Hose Material will meet the following acceptance criteria at all possible. Option 1 or Test Option 2 may be used.

5.3.1 TEST SPECIMENS—Six production coupled assemblies shall have 76 mm ± 3 mm of exposed hose and 56 mm ± 8 mm of straight tubing between the couplings with suitable connector and sealed at the other (pinch-welding permitted). Each assembly is attached to a canister having an internal volume of 1260 $cm^3$ ± 25 $cm^3$ and equipped with a charging fitting.

5.3.2 TEST PROCEDURE

*5.3.2.1* *Charging*—Charge the canister assembly with an amount of R134a compatible lubricant equivalent to half of the internal volume of the hose assembly. Evaluate and add 103 g ± 1 g of R134a and record original weight. Check all fittings to insure against extraneous R134a leakage. This weighing and all subsequent weighings are to be made at 18 to 29 °C to the nearest 0.01 g. For a canister size other than previously mentioned, the internal volume of the assembly must be determined and the R134a charge in grams shall equal system volume (cubic centimeters) x 0.0783 g/cm$^3$ (the density) constant for R134a gas at 125 °C and 2.07 MPa. After charging, agitate the assembly to insure mixing with the lubricant and wetting of all internal surfaces.

*5.3.2.2* *Test Exposure*—The assembly shall be oriented so that the canister axis is 4 degrees ± 2 degress above the horizontal, insuring that the liquid phase will always drain into the test coupling assembly. The test shall include four exposure intervals with Test Option 1 or six exposure intervals with Test Option 2, each followed by a leakage evaluation and possible recharging before the next exposure.

Test Option 1—The four exposure intervals in sequential order are as follows:

a. Exposure 1—96 h at 125 °C ± 2 °C with canister pressure at 2.07 MPa.
b. Exposure 2—48 h thermal cycling from –30 to 125 °C in a timer-controlled chamber. The chamber temperature shall change every 4 h and canisters shall reach the desired temperature within 3 h after a temperature change.
c. Exposure 3—96 h at 125 °C ± 2 °C with canister pressure at 2.07 MPa.
d. Exposure 4—48 h thermal cycling from –30 to 125 °C in a timer-controlled chamber. The chamber temperature shall change every 4 h and canisters shall reach the desired temperature within 3 h after a temperature change.

Test Option 2—The six exposure intervals in sequential order are as follows:

a. Exposure 1—96 h at 121 °C ± 2 °C with canister pressure at 2.0 MPa.
b. Exposure 2—48 h at –29 to 121 °C in a timer-controlled chamber. The chamber temperature shall change every 4 h and canisters shall reach the desired temperature within 3 h after a temperature change.
c. Exposure 3—96 h at 121 °C ± 2 °C with canister pressure at 2.0 MPa.
d. Exposure 4—48 h at –29 to 121 °C in a timer-controlled chamber. The chamber temperature shall change every 4 h and canisters shall reach the desired temperature within 3 h after a temperature change.
e. Exposure 5—96 h at 121°C ± 2°C with canister pressure at 2.0 MPa.
f. Exposure 6—48 h at –29 to 121 °C in a timer-controlled chamber. The chamber temperature shall change every 4 h and canisters shall reach the desired temperature within 3 h after a temperature change.

*5.3.2.3* *Leakage Evaluation*—At the end of each exposure interval, as soon as a canister assembly reaches room temperature of 18 to 29 °C, it shall be evaluated as follows:

a. Weigh and record the loss in grams for the interval.
b. If the loss is greater than 7 g, terminate the test.
c. Flex test the coupled assembly on the canister to ±15 degrees. Make 10 flex cycles in approximately 10 s in each of two perpendicular planes on a coupling assembly. Immediately evaluate the leakage at each coupling as follows:

   1. Listen for hissing (charge loss).
   2. Look for fluid leakage.

d. Reweigh after flex testing and continue with the next exposure interval if the weight is within 4 g of original weight. If not, recharge to original weight before continuing. Maintaining the weight within 4 g of original weight insures that the canister assembly R134a restarting pressure is no less than 2.0 MPa at 125°C.

5.3.3 ACCEPTANCE DETERMINATION

a. Applies to six canister assemblies (12 couplings).
b. Maximum weight loss per canister (2 couplings) per Test Option 1 or Test Option 2 shall not exceed 10 g.
c. All post-interval flexing evaluations shall not produce hissing or visible oil loss at any location in the coupling assembly.

**5.4 Aging Test**—The hose shall show no cracks or other disintegration when tested as specified after aging at 125 °C ± 2 °C for 168 h. The mandrel used shall have a diameter eight times the nominal OD of the hose. The test unit shall have a free hose length not less than 300 mm or more than 1000 mm.

5.4.1 PROCEDURE—Capped hose assembly shall be evacuated and charged with one atmosphere of refrigerant or nitrogen before coiling around the mandrel of the designated size. Place in a circulating air oven for the time and at the temperature specified. Allow the hose assembly to cool to room temperature, after removal from the oven. Open the hose assembly to a straight length and examine the hose for internal and external cracks visible to the naked eye for exposed hose only.

**5.5 Cold Test**—The hose shall show no evidence of cracking or breaking when tested as specified. The mandrel used for the hose shall have a diameter eight times the nominal OD of the hose. The test hose assembly shall have a free hose length not less than 600 mm or more than 1000 mm.

5.5.1 PROCEDURE—Load the test hose assembly to 70% of capacity with R134a refrigerant at room temperature. For convenience, the hose assembly and R134a refrigerant may be chilled below the boiling point of the R134a refrigerant in order that the R134a refrigerant may be handled in the liquid state. Place the loaded hose assembly in an air oven at 70 °C ± 2 °C for 48 h. Remove hose assembly from the air oven and allow to cool to room temperature.

Place the hose assembly in a straight position along with designated size mandrel in a cold chamber at –30 °C for 24 h. The cold chamber shall be capable of maintaining a uniform atmosphere of cold dry or a mixture of air and carbon dioxide at the specified temperature with a tolerance of ±2 °C. Without removing the hose assembly from the cold chamber, bend it through 180 degrees over the mandrel of the designated size at a uniform rate within a time period of 4 to 8 s. The refrigerant charge in each specimen shall be exhausted into a suitable reclamation container. Examine the hose for internal or external cracks or disintegration.

**5.6 Vacuum Flattening**

5.6.1 SCOPE—Flattening of a hose restricts internal fluid flow. This test evaluates the hose construction at room temperature condition for its ability to resist internal area reduction under vacuum conditions.

5.6.2 The coupled hose assembly shall be bent (with the natural curvature of the hose) at room temperature into a "U" shape, with the inside radius of the "U" equal to five times (six times for 0.765 nominal ID) the normal outside diameter of the hose. Measure the minimum outside diameter of the hose in any plane at the base of the "U" (hose OD shall not be less than 80% of original OD). Evacuate the hose to an absolute pressure of 10 mm Hg ± 5 mm Hg. Maintain this pressure in the bent hose specimen for 2 min. At the end of this period, while the hose is still under vacuum, measure the minimum outside diameter in any place at the base of the "U".

5.6.3 ACCEPTANCE CRITERIA

a. The minimum diameter dimension shall not be less than 80% of the minimum hose outside diameter as measured in 5.6.2 in the "U" shape prior to the application of the vacuum.
b. Examine the hose externally for cracks or loose cover. If these imperfections exist, the hose fails.
c. If the hose passes (5.6.3.a and b) cut the hose off at the coupling and section longitudinally. Check the hose internally for blisters, delamination, cracks, or other surface imperfections. Any such imperfections result in hose failure.

**5.7 Length Change**—All hose types shall not contract in length more than 4% or elongate more than 2% when subjected to a pressure of 2.4 MPa for suction hose and 2.7 MPa for liquid and discharge hose. Test in accordance with ASTM D 380.

**5.8 Bursting Strength**—The minimum bursting strength for hose and hose assemblies shall be 13.7 MPa for discharge and liquid line, 12 MPa for suction hose. Test in accordance with ASTM D 380.

**5.9 Proof Test**—All hose shall satisfactorily withstand a hydrostatic proof test with a minimum hydrostatic pressure equal to 50% of the minimum required burst strength for a period not less than 30 s or more than 5 min.

**5.10 Extraction Test**—The extractables of the inside surface of the hose tube shall not exceed 118 g/m$^2$ and any extractables shall be oily or soft/greasy in nature. The test hose assembly shall have a free hose length not less than 450 mm or more than 1000 mm.

5.10.1 PROCEDURE—Fill the hose assembly to capacity with suitable solvent and then empty it immediately to remove any surface material. Load the hose assembly to approximately 70% capacity with R134a refrigerant at room temperature. For convenience, the hose assembly and R134a refrigerant may be chilled below the boiling point of R134a refrigerant in order that the R134a refrigerant may be handled in the liquid state. Place the loaded hose assembly in the air oven at 70 °C ± 2 °C for 24 h. At the end of the aging period, chill the hose assembly to –30 °C or colder and pour the liquid R134a refrigerant into a weighed vacuum flask, chilled to –30 °C or colder, then attach the flask to an R134a recovery unit and recover all R134a. After the R134a refrigerant has evaporated, condition the beaker at approximately 70 °C for 1 h to remove condensed moisture, then weigh the beaker again. Report the extract in terms of grams per square meter (milligrams per square inch) of the hose inner surface based on the nominal inside diameter of the hose.

**5.11 Ozone Test**—When the hose is bent around a mandrel with a diameter 8 times the nominal diameter of the hose and exposed for 70 h to ozone air atmosphere in which the ozone partial pressure is 50 MPa ± 5 MPa at 40 °C ± 2 °C, the outer cover of the hose shall show no cracks when examined under 7X magnification. The test hose shall be about 250 mm longer than the mandrel circumference. Test in accordance with ASTM D 380.

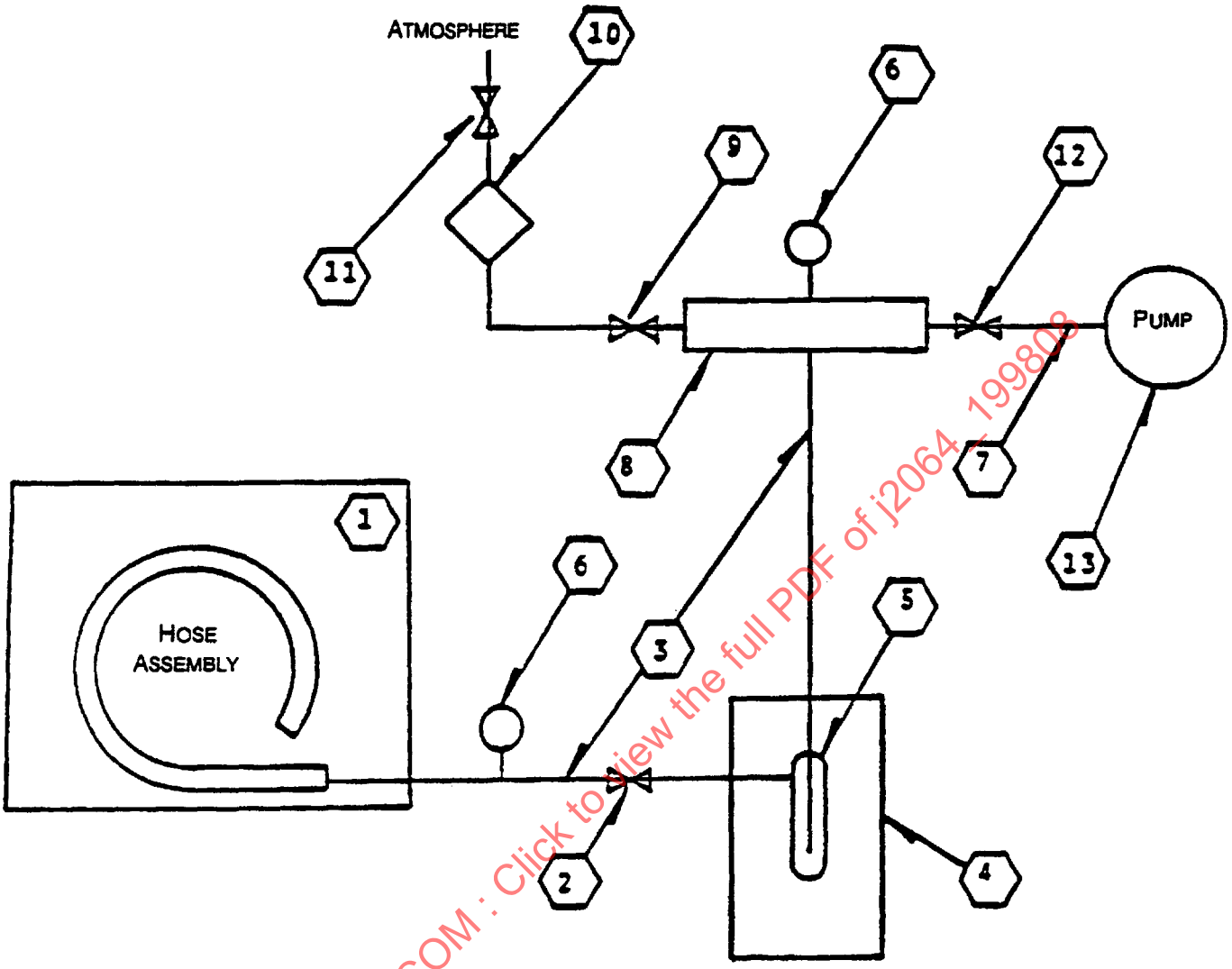
**5.12 Cleanliness Test**—The bore of all hose and hose assemblies shall be clean and dry. When subjected to this test, there shall not be more than 270 mg/m$^2$ of foreign material. The test hose shall not be less than 300 mm.

5.12.1 PROCEDURE—Bend the hose or hose assembly to a "U" shape, the legs of the "U" being of equal length. Position the hose in a vertical plane and fill the hose to capacity with suitable solvent. Then filter the suitable solvent through a prepared Gooch crucible, sintered glass crucible, or 0.8 µm filter of known weight. After dying at approximately 70 °C for 20 min, determine by weight difference the insoluble contamination.

**5.13 Moisture Ingression**—The purpose of the moisture ingression test is to measure the amount of moisture that permeates the hose samples when the hose samples are subjected to humid environment with vacuum being drawn on the ID of the hose samples.

5.13.1 TEST APPARATUS—See Figure 1.

a. Humidity chamber
b. Methanol cold bath maintained at –70 °C or lower (see Figure 1)
c. Vacuum/cold trap system
d. Vacuum pump
e. Nitrogen gas or dry air supply
f. Distilled water
g. Oven capable of 80 °C
h. Drying desiccator
i. Balance capable of 0.1 mg accuracy






LEGEND

Item Description

1 Humidity Chamber
2 Stainless Steel Valve
3 Copper or Stainless Tubing
4 Methanol/Dry Ice Bath
5 Glass Vacuum Traps
6 Vacuum Gauges
7 Vacuum Hose
8 Vacuum Manifold
9 Stainless Steel Valve
10 Desiccant Dryer (Indicating Silica Gel)
11 Quick Open Valve
12 Vacuum Valve
13 Vacuum Pump

FIGURE 1—MOISTURE INGRESSION TEST SCHEMATIC