SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J2888 JAN2013

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Superseding J2888 JAN2012

R-1234yf Service Hose, Fittings and Couplers for Mobile Refrigerant Systems Service Equipment

RATIONALE

Updated Figures for service hose fittings, clarify fitting requirements and revise the appendix for SAE J2911.

1. SCOPE

This SAE Standard covers fittings, couplers, and hoses intended for connecting service hoses from mobile air-conditioning Systems to service equipment such as charging, recovery and recycling equipment. (Figure 1) This specification covers service hose fittings and couplers for MAC service equipment service hoses, per SAE J2843 and SAE J2851, from mobile air-conditioning systems to service equipment such as manifold gauges, vacuum pumps, and air-conditioning charging, recovery and recycling equipment.

1.1 Purpose

The purpose of this SAE Standard is to establish specific but unique fittings, couplers, and hoses for service equipment used in maintaining R-1234yf systems. This is necessary to avoid cross mixing of refrigerant and lubricants from other refrigerant systems. This standard applies only to systems specifically designed to use R-1234yf. Hermetically sealed appliances and refrigerated cargo systems are not covered by this document.

2. REFERENCES

2.1 Applicable Documents

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

2.1.1 SAE Publications

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

2.1.1.1 System Design Guidelines

SAE J639 Safety Standards for Motor Vehicle Refrigerant Vapor Compressions Systems

2.1.1.2 Technician Service Procedures

SAE J2845 R-1234yf [HFO-1234yf] and R-744 Technician Training for Service and Containment of Refrigerants Used in Mobile A/C Systems

2.1.1.3 Service Equipment

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/J2888_201301

SAE J2843 R-1234yf [HFO-1234yf] Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems

SAE J2844 R-1234yf (HFO-1234yf) New Refrigerant Purity and Container Requirements for use in Mobile Air-Conditioning Systems

SAE J2851 Recovery Equipment for Contaminated Refrigerant from Mobile Automotive Air Conditioning Systems

2.1.2 Reference Documents

SAE J1739 Potential Failure Mode and Effects Analysis in Design (Design FMEA), Potential Failure Mode and Effects Analysis in Manufacturing and Assembly Processes (Process FMEA)

SAE J2911 Procedure for Certification that Requirements for Mobile Air Conditioning System Components, Service Equipment, and Service Technician Training Meet SAE J Standards. This Standard provides manufacturers, testing facilities and technician knowledge requirement providers with a procedure of certifying compliance with the appropriate SAE standard.

2.1.3 ARI Publication

Available from Air Conditioning and Refrigeration Institute, 1501 Wilson Boulevard, Sixth Floor, Arlington, VA 22209.

ARI 720 Refrigerant Access Valves and Hose Connectors

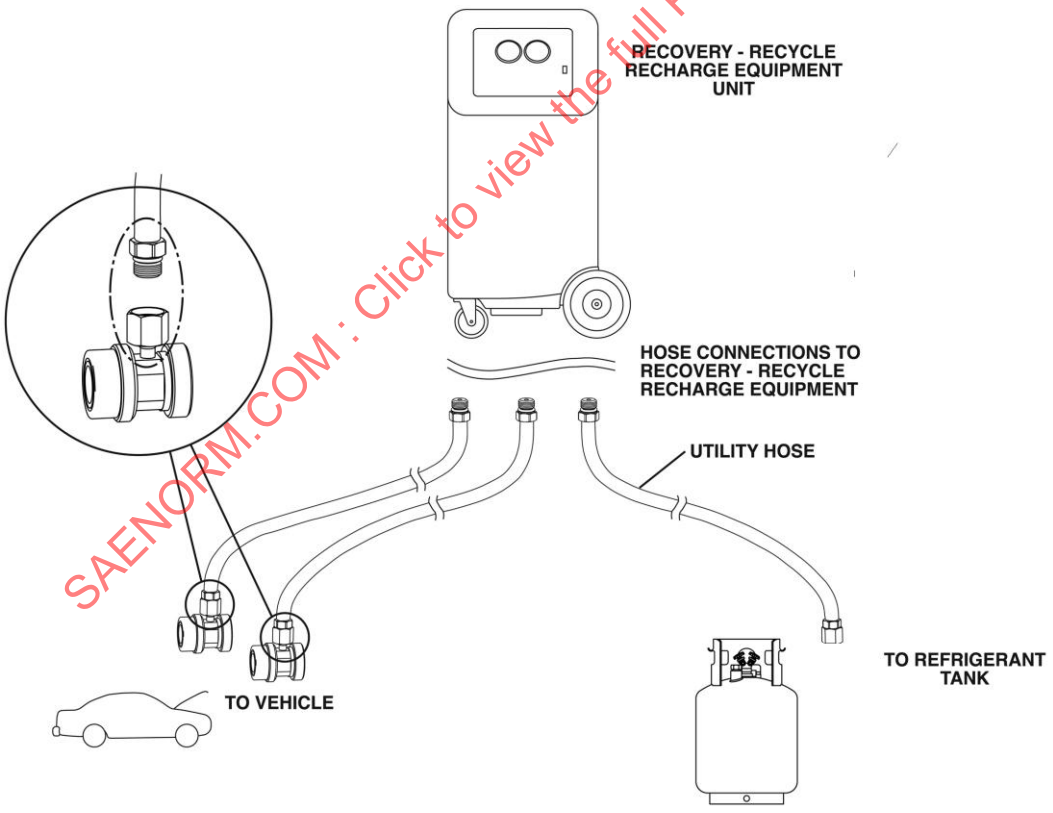

FIGURE 1 - R-1234yf SERVICE EQUIPMENT

3. DEFINITIONS

3.1 HIGH SIDE SERVICE HOSE

A hose connected between the MAC high-side service fitting and the recovery equipment. It includes a high-side coupling, as defined in SAE J639, and at the shutoff device of the connection to the serviced system or equipment, an M12 x 1.5-6g male thread on both ends.

3.2 LOW SIDE SERVICE HOSE

A hose connected between the MAC low-side service fitting and the recovery equipment. It includes a low-side coupling, as defined in SAE J639, and at shutoff device of the connection to the serviced system or equipment, an M12 x 1.5-6g male thread on both ends.

3.3 SUPPLY HOSE (utility)

A hose connected between the R-1234yf supply cylinder and the service equipment (recovery/recycling recovery/recycle/charging unit). On one end, the supply hose shall have a compatible coupling per SAE J2844 to connect to the refrigerant supply cylinder. See Figure 2 and Table 1 The other end of the supply hose, if connected externally to the service equipment, shall contain an M12 x 1.5-6g male threaded connection.

3.3.1 The supply hose at the refrigerant cylinder connection shall have a left hand female thread, ½ inch, 16 TPI ACME fitting.

3.3.2 The R-1234yf refrigerant cylinder has the following fitting.

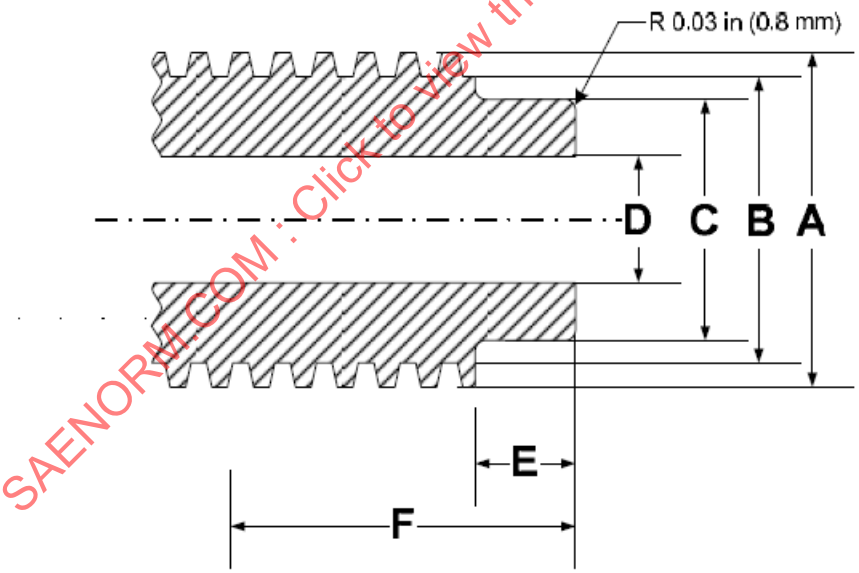

FIGURE 2 - R-1234YF REFRIGERANT CYLINDER

TABLE 1 - SUMMARY OF R-1234YF REFRIGERANT CYLINDER

0.500-16 ACME-2G-LH-EXT	SI units	English units
Major Diameter (A)	12.700 – 12.573 mm	0.5000 – 0.4950 in
Minor Diameter (B)	10.858 – 10.707 mm	0.4275 – 0.4215 in
Relief Diameter (C)	9.14 ± 0.25 mm	0.360 ± 0.010 in
Bore Diameter (D)	4.78 ± 0.05 mm	0.188 ± 0.002 in
Cutback (E)	4.1 ± 0.25 mm	0.16 ± 0.01 in
Full Thread (F)	13.51 mm (min.)	0.532 in (min.)

3.4 INTERNAL HOSE

A hose connected between components within or as part of service equipment. If the connection is made external to the unit, it shall be a wrench tight connection different than those described for the high-side, low-side service hose and supply hose as previously defined.

3.5 CHARGE SERVICE COUPLING

The female connector intended to be used with the MAC service fittings (ports) as identified in SAE J639.

4. TECHNICAL REQUIREMENTS

4.1 Charge Service Coupling

4.1.1 Charge Service couplings for high and low side shall meet the requirements and be compatible as defined in SAE J639. The charge service coupling shall be constructed to prevent discharge when decoupled and shall have a manual valve to actuate flow, this valve shall have a lock out feature that prevents actuation until the coupler is securely locked into place on the charge port.

4.1.2 The charge service coupling must be designed for sealing on the outer diameter of the charge port to prevent leakage due to variation in the charge port end configuration.

4.1.3 The charge service coupling must remain sealed and be able to hold pressures from 3.4 MPa to 759.5 mm of Hg (500 psi to 29.9 Hg) when decoupled from service fitting regardless of the valve position.

4.1.4 The valve core pin depressor feature of the charge service coupling shall provide a minimum of 0.25 mm to the top of the valve core pin when fully retracted allowing it to be coupled and de-coupled from the service fitting without a significant release of refrigerant.

4.1.5 The charge service coupling handle shall be permanently color coded red for high side, blue for low side.

4.1.6 Charge service couplings shall have M12 x 1.5-6g female thread.

4.1.7 For clearance during installation, the service fitting [port] access coupler shall have a minimum clearance to the OD of the service port fitting as defined in Table 1 of SAE J639.

4.1.8 Charge service couplings shall be permanently marked with “J639-R-1234yf” with 3 mm minimum text height indicating that the coupler is designed to connect and actuate only R-1234yf fittings as described in SAE J639 and no other designated refrigerant fitting designs.

4.2 Hose Assembly Construction

4.2.1 Hose and hose assemblies shall be designed to minimize permeation of refrigerant and contamination of refrigerant passing through and to be serviceable over a temperature range of -30 to 95 °C. Hose working pressure shall be at least 3.4 MPa and the minimum burst pressure shall be at least 17.2 MPa.

4.2.2 No color, fitting restrictions, or shutoff device requirements shall apply to internal hoses. Hoses, which use internal wrench tight connections, shall be exempt from fitting requirements pertaining to the end of the hose so connected.

4.2.3 High-side service hose and low-side service hose shall be constructed with the charge service coupling on one end, an M12 x 1.5-6g male thread on the other end

4.2.4 As an option to the charge service coupling being integral [mechanically attached] to the hose assembly or an M12-1.5 threaded connection may be used for serviceability. The hose end shall be a hose barb per Figure 3 and the charge service coupling shall contain a female threaded connection.

Hose Assembly Construction

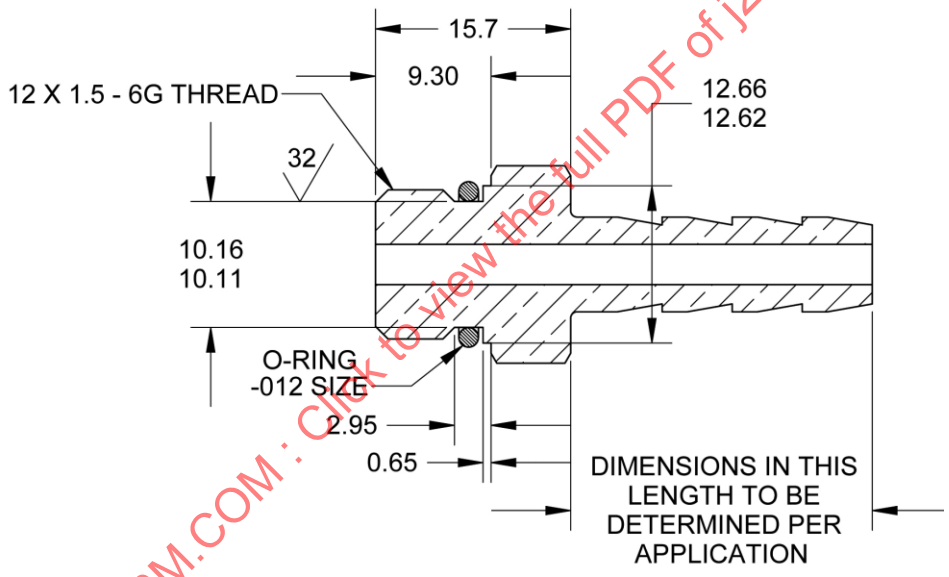

FIGURE 3 - BARB AND THREAD

4.2.5 If service hoses are connected to service equipment externally, the connection shall be made with an M12 x 1.5 threaded connection. The hose shall contain the barb with a male thread. All dimensions are in mm. Figures 3 and 4

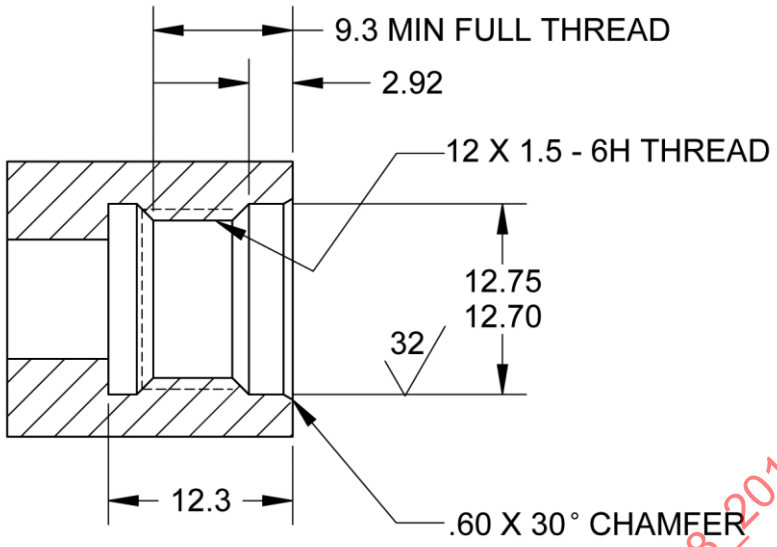

FIGURE 4 - FEMALE FITTING

4.2.6 Hose Marking

4.2.6.1 Hose shall be identified with “SAE J2888” marking.

4.2.6.2 Manufacturer’s and assembler identification (code or actual name) shall be located on the external surface of the hose 180 degrees from the SAE marking as identified in Figure 5.

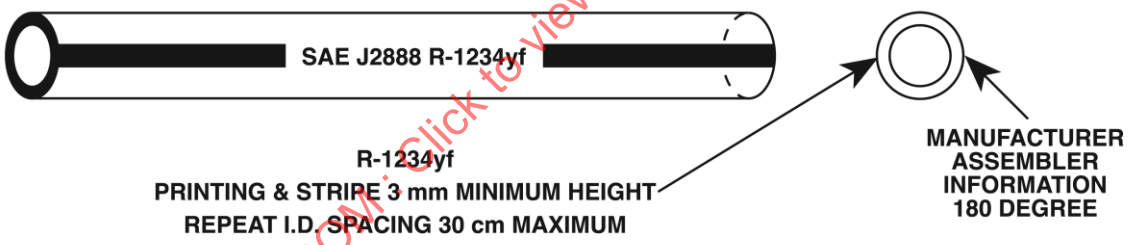

FIGURE 5 - HOSE MARKING CHANGE TO R-1234yf

4.2.6.3 The external hose identification shall be durable for the life of the hose.

4.2.6.4 The printed information and stripe as required shall be 3 mm minimum in height, and shall be repeated, not to exceed a distance of 30 cm between start and end of the identification.

4.2.6.5 High side hose shall be red, low side hose shall be blue, and supply hose shall be yellow in color.

5. TESTING

The test procedure described in the current ASTM D 380 shall be followed whenever applicable and hoses shall be certified as described in SAE J2911. The test hoses shall be from a random selection of production assembled coupled components and hose materials. Laboratory certification data, as required in this standard, shall be supplied to SAE International by the manufacturer of the product and posted on the SAE Web site certifying the hose(s) compliance.

5.1 Test Conditions

5.1.1 The temperature of the testing chamber shall be maintained at 23 °C ± 2 °C (73 °F ± 4 °F).

5.2 Refrigerant Containment

5.2.1 Test hose assemblies shall not permit refrigerant loss at a rate greater than 4.9 kg/m^2/year (1.0 lb/ft^2/year) when tested at 49 °C ± 2K (120 °F ± 4 °F).

5.2.2 The containment test is designed to measure, by loss of mass, the rate of refrigerant loss.

5.2.3 The apparatus required consists of canisters with internal volumes of 475 to 1000 cm^3 and a 21 MPa minimum burst pressure with appropriate fittings to connect to the hose assemblies, leak detector, circulating air oven capable of maintaining uniform test temperature throughout the test periods, and a weight scale capable of mass measurements to 0.1 g accuracy.

5.3 Test Sample Preparation

5.3.1 Sample length is to be measured in meters with resolution to mm, diameter is to be measured in mm with resolution to 0.1 mm, and weight is to be measured in grams with resolution to 0.1 g.

5.3.2 Four hose assemblies, having a free length of 1 m, are to be tested.

5.3.3 Three of the hose assemblies shall be used for determining the loss of refrigerant and the fourth assembly shall be run as an empty plugged blank to be used as the reference for determining the mass loss of the other hoses.

5.3.4 Measure the free length of the hose in each assembly at zero gauge pressure to the nearest 1mm. Connect each of the four hose assemblies to a canister and obtain the total mass of each test unit including end plugs to the nearest 0.1 g.

5.3.5 Load three of the test hose assemblies with 0.6 g of liquid R-1234yf per cm^3 of each test hose volume to a total variance of ±5 g.

5.3.6 Check the loaded test hose assembly with a refrigerant leak detector at a sensitivity of 10 g/year to be sure that they do not leak. Any suitable method for safely loading may be used.

5.4 Test Procedure

5.4.1 Weigh the test samples and record the mass (weight) of each sample.

5.4.2 Place the three loaded and one blank (uncharged) test units in the air oven at the specified temperature (50 °C) for a period of 30 min ± 5 min to drive off moisture.

5.4.3 Do not bend the test sample hose in a curve with a diameter smaller than 20 times the outside diameter of the hose while in the oven.

5.4.4 Remove the loaded test sample units from the oven and weigh.

5.4.5 Check the test samples for leakage and weigh all samples not less than 15 min or more than 30 min after removal from the oven.

5.4.6 Weigh the samples and compare the weight as recorded in 5.4.5 to the weight recorded in 5.4.1 to determine if the test samples have lost their refrigerant charge.

5.4.7 If the samples contain a refrigerant charge, use the mass weight recorded in 5.4.5 as the original mass for future weight loss comparison.

5.4.8 Place the test samples back in the air oven, within 1 h after completion of 5.4.5, at the specified temperature for 24 h.

5.4.9 At the end of the 24-h period, remove the test samples, weigh and record the data in the same manner as previously specified, and return the test samples to the oven.

5.4.10 If a loss of 20 g or greater occurs, discontinue the test, check for leaks, take corrective action, and repeat the procedure as defined in 5.4.

5.4.11 The first 24-h period is considered the preconditioning period. If the test samples as checked in 5.4.9 have not leaked, consider this recorded mass as the initial value.

5.4.12 Return the samples to the oven for 72 h.

5.4.13 Remove the samples from the oven and weigh and record the mass in the same manner as previously described.

5.4.14 Calculate the 72-h mass loss and determine the effusion rate by subtracting the corresponding mass of the blank from that of the loaded test sample unit. Express the refrigerant loss rate in $kg/m^2/year$.

5.4.15 Calculate the rate of loss of refrigerant mass for the loaded test sample unit as follows:

$$R = K/D * ([(A-B)/L1] – [(C-E)/L2]) \quad \text{(Eq. 1)}$$

where:

A = Initial mass after preconditioning period of loaded test unit, g
B = Final mass after 72 h period test unit, g
C = Initial mass after preconditioning period of blank test unit, g
D = Nominal hose inside diameter, mm
E = Final mass after 72 h period of blank test unit, g
K = 38.7 constant
R = Rate of refrigerant mass loss, kilograms per square meter per year
L1 = Free length of loaded test unit, meters, to three decimal resolution
L2 = Free hose length of blank test unit, meters, to three decimal resolution

5.5 Refrigerant/Oil (Lubricant) Exposure

5.5.1 Three 457 mm long samples of the hose assembly are required for this test. The hose shall remain intact for this test.

5.5.2 The hose shall be filled to 70% capacity with a mixture of 95% refrigerant and 5% lubricant.

5.5.3 Testing for R-1234yf hoses shall use PAG lubricant compatible with R-1234yf.

5.5.4 The hose assemblies containing the refrigerant/lubricant mixture shall be immersed into ASTM Oil No.3 at 80 °C for 168 h. (Remove the refrigerant/lubricant mixture and proceed to step 5.5.5.)

5.5.5 Immediately following the exposure test, a sample shall be tested for tensile strength in accordance with Section 5.10, and a second sample tested for burst strength in accordance with Section 5.9 and must meet all requirements.

5.6 Vacuum Test

5.6.1 The test sample hose shall have a free length of 610 mm.

5.6.2 The collapse of the hose shall not exceed 20% of the original outside diameter when subjected to reduced vacuum pressure in microns of 1000 µm of Hg absolute for 2 min. Measure the outside diameter of the hose at the base of the “U” to determine the minimum diameter in any plane. Record this data for comparison to the measurement results in step 5.6.4.

5.6.3 Bend the test hose assembly to a “U” shape with the inside radius at the base of the “U” being 20 times the nominal size outside diameter of the hose.

5.6.4 Apply a reduced pressure (vacuum) of 1000 µm absolute to the bent hose assembly for 2 min. At the end of the 2-min period, while the hose is still under reduced pressure, measure the outside diameter of the hose at the base of the “U” to determine the minimum diameter in any plane.

5.7 Aging Test

5.7.1 The test sample hose shall show no cracks or other disintegration when tested as specified after aging at 95 °C ± 2 °C for 168 h.

5.7.2 The test sample hose, which had been used for vacuum testing in 5.6, shall have a length of 610 mm.

5.7.3 Fill the interior of the hose with nitrogen to atmospheric pressure and cap the open ends.

5.7.4 The hose assembly shall be wrapped around a mandrel (metal tube) having a diameter 20 times the nominal hose outside diameter.

5.7.5 Place the test sample in the air circulation oven for the time and temperature defined in 5.7.1.

5.7.6 After removal from the oven, allow the hose assembly to cool to room temperature, then remove it from the mandrel and lay in a straight length, and examine the hose for external cracks or other disintegration.

5.7.7 Pressurize the hose with R-1234yf to 2.4 MPa.

5.7.8 Leak check hose assembly at a sensitivity of 14 g/year to be sure that it does not leak.

5.8 Cold Test

5.8.1 The hose shall show no evidence of cracking or breaking when tested as specified.