



SURFACE VEHICLE STANDARD

SAE**J2927 FEB2011**

Issued

2011-02

R-1234yf Refrigerant Identifier Installed In Recovery and Recycling Equipment for Use With Mobile A/C Systems

RATIONALE

This standard was developed to establish requirements for refrigerant identification equipment to be installed on recovery and recycle equipment for use with R-1234yf

1. SCOPE

This SAE standard applies to refrigerant identification equipment to be used for identifying an acceptable level of R-1234yf purity in a refrigerant tank or vehicle MAC system labeled as containing R-1234yf, and not misidentify other refrigerants, per 5.7.

1.1 Purpose

The purpose of this SAE Standard is to establish minimum performance criteria for R-1234yf refrigeration identification equipment that is intended for integration with R-1234yf recovery/recycle/recharge machines. It is intended to prevent the technician from recovering R-1234yf that is contaminated with other refrigerants, including hydrocarbons.

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 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.

SAE J639	Safety and Containment of Refrigerant for Mechanical Vapor Compression Systems Used for Mobile Air-Conditioning Systems
SAE J1739	Potential Failure Mode and Effects Analysis in Design (Design FMEA) and Potential Failure Mode and Effects Analysis in Manufacturing and Assembly Processes (Process FMEA) and Effects Analysis for Machinery (Machinery FMEA)
SAE J2843	R-1234yf Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2011 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: <http://www.sae.org>

**SAE values your input. To provide feedback
on this Technical Report, please visit
http://www.sae.org/technical/standards/J2927_201102**

- SAE J2845 Technician Training for Safe Service and Containment of Refrigerants Used in Mobile A/C Systems (R-744, and R-1234yf)
- SAE J2851 R-1234yf Refrigerant Recovery Equipment for Mobile Automotive Air-Conditioning Systems
- SAE J2911 Certification Requirements for Mobile Air Conditioning System Components, Service Equipment, and Service Technicians to Meet SAE J Standards

2.1.2 UL Publication

Available from Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096, Tel: 847-272-8800, www.ul.com.

UL1963

3. TECHNICAL REQUIREMENTS

- 3.1 The detector evaluated under this document shall be suitable for use in safely identifying HFO-1234yf/R-1234yf, an A2 flammable refrigerant.
- 3.1.1 The detector shall be tested by an independent testing laboratory as defined in SAE J2911 and in order to claim certification (including use of any labeling) shall be tested and certified to this standard in accordance with the requirements set forth in SAE J2911.
- 3.2 The detector shall be design certified as an "R-1234yf Refrigerant Identifier for use with SAE J2843 or SAE J2851 Equipment."
- 3.3 The detector shall have an accuracy of $\pm 2\%$ point or better for R-1234yf and hydrocarbons or R-152a (the latter two which may be combined into a single output signal. This accuracy applies when R-1234yf is the primary refrigerant and is present at 95% or greater. Other percentages are subject to the accuracy tolerances as listed for the test mixtures of 5.7.
- 3.4 It shall provide an output signal of the percentage of R-1234yf, although because the recovery/recycle/recharge machine may display actual percentage, a digital display is optional. However, one of the two shall have such a display.
- 3.5 It shall provide an output signal and digital display of the percentage of hydrocarbons and/or R-152a, when the percentage (by weight) is in excess of 2%. However, it also shall be able to provide an alarm output signal at that percentage threshold, for an audible or visual alarm.
- 3.6 It shall provide an output signal for the percentage of air by volume, when the percentage by volume is in excess of 2%.
- 3.7 To prevent possible refrigerant contamination, the identifier either shall be directly connected (plumbed) to the recovery/recycle/recharge machine, or if an externally mounted, provided only with service hoses with fittings for R-1234yf, per SAE J639.
- 3.8 The identifier shall be certified that it meets this standard by SAE 2911 procedure for certification. If it passes, it may carry the label, with lettering 3 mm high, "Meets SAE J2927 for R-1234yf Refrigerant Identifiers for use with R-1234yf Recovery/Recycle/Recharge Machines." It shall be subject to all terms and limitations of SAE J2911.

4. OPERATING INSTRUCTIONS

- 4.1 The recovery/recycle/recharge equipment manufacturer shall include operating instructions, including warm-up time (if needed), calibration, parts replacement list, and use instructions. The instructions shall include any other necessary maintenance procedures, source information for replacement parts and repair, and safety precautions.
- 4.2 The instructions shall explain that the percent refrigerant purity indicated by this equipment includes the amount of air that may be in the refrigerant being tested, but the percentage of non-condensable gasses (such as air) is an independent number. For example, the identifier may indicate 95% refrigerant purity, but the refrigerant may contain 10% air, and both numbers would be displayed, the refrigerant by weight, the non-condensable gasses by volume. The method of determining volume may include an algorithm that uses weight of the same, however.
- 4.3 If the equipment requires special calibration gases, source information, and test facilities, this information shall be included with the operating instructions. Instructions shall clearly indicate calibration frequency intervals to ensure the analyzer maintains its accuracy and sensitivity.
- 4.4 The instructions shall indicate if the equipment is for use with vapor only, liquid only, or for vapor and liquid. Tests per 5.7 shall be conducted using the correct refrigerant phase as declared by the manufacturer.
- 4.5 If the accuracy of informational displayed percentages of R-134a or HFO-1234yf (R-12343yf) are outside of the designed certified purity value required by 3.3 and 5.7. Because the refrigerant sample is identified as contaminated, the following statement shall be published in the manual. "If the refrigerant being tested is identified as contaminated (as an example, less than 98% pure R-1234yf), any visual percentages displayed of HFO-1234yf (R-1234yf), outside the design certified value is informational and may not be accurate" or equivalent. Certification for other refrigerant identification in Section 1 shall also comply with this requirement.
- 4.6 An identifier that meets this standard and is externally mounted shall have a label, which states "R-1234yf Refrigerant Identifier for Recovery/Recycling/Recharge Equipment, Design Certified by (Certifying Agent) to Meet SAE J2927." If the identifier is internally mounted, such labeling shall be on the recovery/recycling/recharge machine itself. In addition, the supplier also is permitted to list separately any other refrigerants for which the RDI has similarly been tested and its performance verified to identify to accuracy levels equal to R-1234yf and hydrocarbons/R152a. However, such listings shall be referred to as informational, as no specific testing is required by this standard.

5. EQUIPMENT REQUIREMENTS

- 5.1 The identifier shall be capable of identifying the specified refrigerant, HFO-1234yf (R-1234yf), to the specified purity level when evaluated to the test criteria in 5.7. The indication may be an output for a digital display on the recovery/recycle/recharge machine or if a go-no electro-mechanical device to block refrigerant flow is used, also with a visual or audible indication to tell the technician that the machine not recovering because it has detected contaminated refrigerant. No other type of indicators is acceptable under this standard. A digital display on an externally mounted identifier itself is permitted although not required.
- 5.2 The identifier shall not use more than 7 g (0.25 oz) of refrigerant per test cycle of the refrigerant being identified to perform its functions. The recovery/recycle/recharge machine or recovery/only machine shall be designed to exhaust the sample in accordance SAE J2843, 5.1.4 and SAE J2851, 4.1.4.
- 5.3 The R-1234yf identifier shall meet a gas ignition test as follows. It is to be installed in a test chamber at a 49 °C ambient. The identifier is to be operated in the normal standby condition and the most easily ignitable mixture of propane and air is to be introduced into the identifier. The identifier is then to be operated in the signal condition and the input voltage for the test shall be increased to 110% of rated voltage.

There shall be no ignition of the gas-air mixture during 10 min of the sample standing in the identifier chamber followed by one operating cycle. . The identifier also shall indicate a refrigerant percentage of 100% for hydrocarbons when the operating cycle is completed.

- 5.4 Electrical components shall meet ANSI/SA 12.12.01 and/or be enclosed/housed in a location within the identifier and if internal, within the recovery/recycle/recharge or recovery-only machine that will, in case of separation at any connections within the refrigerant sampling flow route, prevent refrigerant from coming into contact with components that may arc/spark during operation and/or reach temperatures in excess of 400 °C (752 °F).
- 5.5 The R-1234yf identifier shall be capable of passing the following tests without effect on durability and performance, with any moisture and oil in the refrigerant sample:
- For moisture: The sensing probe shall be placed and held within 0.2 in (6 mm) of the liquid surface of a pot of vigorously boiling water for 5 min. Immediately following, it shall be tested for accurate identification on a system with 98% R-1234yf, 5% HC and 10% non-condensable gasses (i.e., primarily air).
 - For oil: Inject 2 cc PAG, POE oil or 50/50 mix of each into an R-1234yf hose coupler. Then perform a single identifier operating cycle with R-1234yf as described in 5.7. The manufacturer of the identifier may require replacement of any filtering device used for this test prior to testing according to 5.6 and 5.7. This test is required only once, and the laboratory may perform it as part of any of the tests in 5.7.

As part of the test setup, the hose couple shall be part of a hose that is 1.8 m in length (6 ft) shall be installed from the location of the sensing probe to the source of the refrigerant sample.

5.6 Test Equipment and Program

- 5.6.1 The test apparatus shall consist of 13.6 kg (30 lb) (or other appropriate size) test cylinders filled with an appropriate amount of the test mixtures detailed in 5.7.

CAUTION: Certain Mixtures of Refrigerants and Hydrocarbons and Certain Mixtures of HFO-1234yf (R-1234yf), and Air May be Combustible. Care shall be taken when conducting this test.

5.7 Test Mixtures

Prior to identifying each specific test mixture, the equipment shall be tested using pure HFO-1234yf and the test sequence shall be performed twice to assure proper operation of the equipment. All test mixtures not prepared by the certifying laboratory itself shall be verified by the laboratory using gas chromatography. This section consists of 10 tests per unit at 21 to 24 °C (70 to 75 °F), and three units shall be tested, for a total of 30 tests. An identifier shall pass all 30 tests to be certified to this standard. The refrigerant and air identifications shall be accurate per 3.3, 3.5 3.6, and 5.7.

In addition, to confirm the equipment operates properly at ambient temperatures of 10 to 49 °C, at least the three test points that follow the 10-test list (for each refrigerant) shall be repeated at 10 °C \pm 2/-0 °C and also at 49 °C \pm 2 °C. The three identifiers also shall pass all tests at each trio of tests at the 10 °C and 49 °C temperatures to be certified.

Except as noted, all R-1234yf samples shall be accurate to \pm 1% point. Test Nos. 2, 3, and 7 are the tests that shall be repeated at 10 °C and 49 °C.

- 100% HFO-1234yf, 2 ml oil, 3% air (accuracy of air ID \pm 2% points).
- 2% HFC-134a, 98% HFO-1234yf, 6% air (accuracy of air ID \pm 3% points).
- 4% HFC-134a, 90% HFO-1234yf, 6% hydrocarbons, 15% air (accuracy of air ID \pm 3% points).
- 90% HFO-1234yf, 10% hydrocarbons, 10% air (accuracy of air ID \pm 3% points).
- 90% HFO-1234yf, 10% R-152a, 10% air (accuracy of air ID \pm 3% points).
- 25% HFC-134a, 75% HFO-1234yf (accuracy of R-1234yf sample at \pm 5% points).