



SURFACE VEHICLE STANDARD

J2927™

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Superseding J2927 AUG2017

Integrated R-1234yf Refrigerant Identifier
for Recovery and Recycling Equipment
Used in Mobile A/C System Servicing

RATIONALE

This SAE Standard is being updated as part of the standard SAE Five-Year Review. The major changes include updating of technical requirements to align with terminology used in SAE J2912 to avoid misinterpretations in 5.7, updating units of measure (which appeared to be previously updated on some of the measurements), removing Test Gas 10 and R-1234zf, updating sections for clarity of message, and grammatical updates.

1. SCOPE

This SAE Standard applies to refrigerant identification equipment 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 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 Documents

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

2.1.1 SAE Publications

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

SAE J639 Safety and Design Standards for Motor Vehicle Refrigerant Vapor Compression Systems

SAE J1739 Potential Failure Mode and Effects Analysis (FMEA) Including Design FMEA, Supplemental FMEA-MSR, and Process FMEA

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SAE J2843	R-1234yf (HFO-1234yf) Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems
SAE J2845	R-12 (CFC-12), R-134a (HRC-134a), R-1234yf (HFO-1234yf), R-744, and R-152a (HFC-152a) Technician Training for Service and Containment of Refrigerants Used in Mobile A/C Systems
SAE J2851	Recovery Equipment for Contaminated R-134a or R-1234yf Refrigerant from Mobile Automotive Air Conditioning Systems
SAE J2911	Procedure for Certification that Requirements for Mobile Air Conditioning System Components, Service Equipment, and Service Technician Training Meet SAE J Standards

2.1.2 UL Publications

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

UL1963 Refrigerant Recovery/Recycling Equipment

3. TECHNICAL REQUIREMENTS

- 3.1 The identifier evaluated under this document shall be suitable for use in safely identifying HFO-1234yf/R-1234yf, an A2L flammable refrigerant.
 - 3.1.1 The identifier shall be tested by an independent testing laboratory as defined in SAE J2911 to claim certification (including use of any labeling) to this standard, in accordance with the requirements set forth in SAE J2911.
- 3.2 The identifier shall be design certified as an “R-1234yf refrigerant identifier for use with SAE J2843 or SAE J2851 equipment.”
- 3.3 The identifier 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 90% or greater. If the sample contains 70% to less than 90% R-1234yf, the displayed percentage shall not display as greater than 92% pure. If the sample contains less than 70% R-1234yf, the display percentage shall not display greater than 85% pure.
- 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 weight, when the percentage by weight is more than 2%, provided the refrigerant sample is identified as 90% or greater R-1234yf. The display then shall be accurate to $\pm 2\%$ points if non-condensable gasses are in the range of 2 to 10% of the sample. The display shall be accurate to within $\pm 3\%$ points if non-condensable gasses are in the range of 11 to 20%. If non-condensable gasses are more than 20% up to 50%, the display shall be accurate to within $\pm 10\%$ points. If non-condensable gasses are more than 50%, the display shall indicate a numerical value that is greater than 50% or a message indicating the same as defined by the operating manual.
- 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 (0.11 inch) 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, 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 weight. The method of determining weight may include an algorithm that uses weight of the same.
- 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-1234yf) 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 shall have a label, which states "R-1234yf refrigerant identifier for recovery/recycling/recharge equipment, design certified by (certifying agent) to meet SAE J2927." The supplier also is permitted to list separately any other refrigerants for which the identifier 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 a go-no-go electro-mechanical device to block refrigerant flow. The go-no-go device will have a visual or audible indication to tell the technician that the machine is not recovering because it has detected contaminated refrigerant. No other type of indicators are 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 ounce) of refrigerant per test to perform its functions. The recovery/recycle/recharge machine or recovery/only machine shall be designed to exhaust the sample in accordance with 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 at the identifier to 110% of rated voltage.

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

- 5.4 Electrical components shall meet UL 121201/CSA C22.2 No. 213 and/or be enclosed/housed in the identifier and, if internal within the recovery/recycle/recharge or recovery-only machine, 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 moisture and oil laden refrigerant tests without effect on durability and performance:

- a. For moisture: The sensing probe shall be placed and held within $6\text{ mm} \pm 2\text{ mm}$ ($0.2\text{ inch} \pm 0.08\text{ inch}$) of the liquid surface of a pot of vigorously boiling water for 5 minutes. Immediately following, it shall be tested for accurate identification on a system with 95% R-1234yf, 5% HC and 10% non-condensable gasses (i.e., primarily air).
- b. For oil: Inject 2 cm^3 (0.12 cubic inch) PAG, POE oil, or 50/50 mix of each into a 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 coupler shall be part of a hose that is 1.8 m (6 feet) in length and 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 pounds) (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 nine tests per unit at $21\text{ to }24\text{ }^{\circ}\text{C}$ ($70\text{ to }75\text{ }^{\circ}\text{F}$), and three units shall be tested, for a total of 27 tests. An identifier shall pass all 27 tests to be certified to this standard. The refrigerant and air identifications shall be accurate per 3.3, 3.5, and 3.6.

In addition, to confirm the equipment operates properly at ambient temperatures of $10\text{ to }49\text{ }^{\circ}\text{C}$ ($50\text{ to }120\text{ }^{\circ}\text{F}$), three of the nine tests shall be repeated at $10\text{ }^{\circ}\text{C}$ ($50\text{ }^{\circ}\text{F}$) and also at $49\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ ($120\text{ }^{\circ}\text{F} \pm 2\text{ }^{\circ}\text{F}$). All three identifiers shall pass all three tests at $10\text{ }^{\circ}\text{C}$ ($50\text{ }^{\circ}\text{F}$) and $49\text{ }^{\circ}\text{C}$ ($120\text{ }^{\circ}\text{F}$) 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 $10\text{ }^{\circ}\text{C}$ ($50\text{ }^{\circ}\text{F}$) and $49\text{ }^{\circ}\text{C}$ ($120\text{ }^{\circ}\text{F}$).

1. 100% HFO-1234yf, 2 mL oil, 3% air.
2. 2% HFC-134a, 98% HFO-1234yf, 6% air.
3. 4% HFC-134a, 90% HFO-1234yf, 6% hydrocarbons, 15% air.
4. 90% HFO-1234yf, 10% hydrocarbons, 10% air
5. 90% HFO-1234yf, 10% R-152a, 10% air
6. 25% HFC-134a, 75% HFO-1234yf
7. 90% HFO-1234yf, 10% CFC-12 (should not misidentify as pure HFO-1234yf).
8. 90% HFO-1234yf, 10% R-404A (should not misidentify as pure HFO-1234yf).
9. 90% HFO-1234yf, 10% R-410A (should not misidentify as pure HFO-1234yf).

Connect the equipment to each cylinder tabulated in 5.7 and operate equipment following the manufacturer's instructions. The equipment will be tested with both liquid and vapor sample unless the manufacturer's instructions indicate the equipment for use with vapor only or liquid only.