SURFACE VEHICLE STANDARD

J2912™ SEP2020

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Superseding J2912 DEC2014

(R) Performance Requirements for R-134a and R-1234yf Refrigerant Diagnostic Identifiers (RDI) for Use with Mobile Air Conditioning Systems

RATIONALE

This standard is being updated to correct minor errors and clarify certain sections under the Five-Year Review process.

1. SCOPE

This SAE Standard applies to refrigerant identification equipment to be used for identifying refrigerant HFC-134a (R-134a) and HFO-1234yf (R-1234yf) refrigerant when servicing a mobile A/C system or for identifying refrigerant in a container to be used to charge a mobile A/C system. Identification of other refrigerants is the option of the equipment manufacturer, although it shall not misidentify refrigerants, per 3.2.

1.1 Purpose

Establishing such specifications will ensure equipment that meets this standard can identify relatively pure refrigerant HFC-134a (R-134a) and HFO-1234yf (R-1234yf) from mixtures of refrigerants (HFC, HCFC, CFC, hydrocarbons, etc.) in a refrigerant supply tank, or mobile system prior to recovering/recycling (R/R) the refrigerant, or prior to charging an A/C system from a refrigerant container. The identifier also shall identify and display weight of non-condensable gases, such as air. The displays shall be in percentages, per 3.1.3, and to the specified accuracies.

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 Standards for Motor Vehicle Refrigerant Vapor Compression Systems

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)

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

For more information on this standard, visit
https://www.sae.org/standards/content/J2912_202009

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

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

SAE J2911 Procedure for Certification that Requirements for Mobile Air Conditioning System Components, Service Equipment, and Service Technician Training Meet SAE J Standards

SAE J2927 R-1234yf Refrigerant Identifier Installed in Recovery and Recycling Equipment for Use with Mobile A/C Systems

SAE J3030 Automotive Refrigerant Recovery/Recycling/Recharging Equipment Intended for Use with Both R1234yf and R134a

2.1.2 UL Publications

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

UL 1963 Equipment evaluated under this document shall have the following specification and general description.

3. TECHNICAL REQUIREMENTS

3.1 The identifier shall be suitable for use in safely identifying HFO-1234yf (R-1234yf), an A2L classified flammable refrigerant.

3.1.1 The identifier shall be suitable for use in an automotive service garage environment and be capable of continuous operation in ambient temperatures from 10 to 49 °C.

3.1.2 The identifier shall be design certified as an “R-134a/R-1234yf Refrigerant Diagnostic Identifier” and shall carry this labeling and also the following: “Certified to meet SAE J2912.” Tools that do not meet this standard shall not be referred to by this name or carry this labeling. Within this standard, the term RDI shall be used to mean R-134a/R-1234yf refrigerant diagnostic identifier.

3.1.3 Refrigerant Diagnostic Identifier

The R-134a/R-1234yf refrigerant diagnostic identifier shall have a panel or an output to another external display (R/R/R, etc.) that displays the percentages of R-134a and R-1234yf in the refrigerant sample, with the following levels of accuracy, based on a percentage of non-condensable gasses that is 20% or less:

a. If the refrigerant in the sample contains 90% or more of either refrigerant, the displayed percentage shall be accurate to ±1% points or better.

b. If the refrigerant in the sample contains 70% to less than 90% of either refrigerant, the displayed percentage shall not display as greater than 92% pure.

c. If the refrigerant in the sample contains less than 70% of either refrigerant, but the percentage makes it the primary refrigerant, the displayed percentage shall not display as greater than 85% pure.

d. The percentages listed shall be for the refrigerants listed in 3.2, and pursuant to the testing in 5.7.

3.1.4 Non-condensable gases including air shall be displayed if in weight of 3% or greater of the sample, provided the refrigerant sample is identified as 95% or greater of R-134a or R-1234yf. The display then shall be accurate to ±2% points if NCG is in the range of 3 to 10% of the sample. The display shall be accurate to within ±3% points if NCG is in the range of 11 to 20%. If NCG content is in excess of 20%, up to 50%, the display shall be accurate to within ±10% points. If NCG content is in excess of 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.

3.1.5 Hydrocarbons and R-152a shall be identified if either or both are in the refrigerant sample at a percentage of 3 to 10%, accurate to ±2% points. For hydrocarbons or R152a quantities greater than 10%, the RDI shall display the percentage as greater than 10% so as to not impinge upon the prior stated accuracy. The display shall read HC/R-152a or an equivalent listed in the instruction manual.

3.2 This document provides the tests the equipment must pass and the feature content it is required to have, to certify the equipment to this standard, for identification of HFC-134a (R-134a), HFO-1234yf (R-1234yf), and hydrocarbons and/or R-152a. However, the equipment may identify as many refrigerants or substances as are in accordance with the manufacturer's design. The identifier shall not misidentify (i.e., incorrectly identify as pure R-134a or R-1234yf) any of the following: CFC-12, R-142b, R-22, R-32, R-124, R-404A, and R-410A.

3.2.1 If the equipment displays a percentage beyond the design certified percent purity level (i.e., to one or more decimal places) or identifies refrigerants other than R-1234yf, R-134a, and hydrocarbons/R-152a, the additional display is understood to be informational and may not be accurate. See 4.5.

3.2.2 To prevent possible refrigerant contamination the equipment shall comply with federal requirements that a unique separate hose assembly be used with a permanently attached service port fitting, for each primary refrigerant it will test/identify. The RDI shall be furnished with fittings for R-134a and R-1234yf unless said device is designed for integration into an R/R/R machine.

3.2.3 The equipment shall be certified that it meets this specification by SAE J2911.

3.3 As an example, for an RDI that meets this specification to identify R-134a and R-1234yf by ABC Company, to 98% purity and to detect weight of non-condensable gases 3% or greater, the label (with lettering at least 3 mm high) would read "Refrigerant Diagnostic Identifier Design Certified by (name, such as ABC Company or ABC Laboratories) to Meet SAE J2912 to Identify HFC-134a (R-134a) and HFO-1234yf (R-1234yf), to 98% purity." Also, "This equipment will detect 3% or greater by weight of non-condensable gases in HFC-134a (R-134a) and HFO-1234yf (R-1234yf)."

3.4 The supplier of an RDI that meets this standard also is permitted to list separately in the operating manual and/or on a separate label, any other refrigerants for which the RDI has similarly been tested and its performance verified to identify to accuracy levels equal to R-134a, R-1234yf, and hydrocarbons/R-152a. However, such listings shall be referred to as informational, as no specific testing is required by this standard. The label shall include the words "Informational only; not certified to SAE J2912."

3.4.1 The manufacturer can state certification of compliance with this standard, including use of any labeling per 3.3, only after meeting the requirements in SAE J2911. SAE J2911 also sets forth the definition of the independent testing laboratory that shall be used, laboratory test technician training requirements, and the test verification table (see Appendix A) that shall be completed.

3.5 The analyzer shall integrate with the SAE J2843 R-1234yf recovery/recycling/recharging equipment. The R-1234yf recovery/recycling/recharging equipment may be used as the digital display for the RDI or the RDI may have its own digital display. The required communication protocol is shown in Appendix B.

3.6 The communication of the gas test results between the analyzer and the SAE J2843 recovery machine shall be encrypted so as to avoid the use of non-SAE J2912 certified devices to simulate the test results. The required encryption method is the AES-256 algorithm.

4. OPERATING INSTRUCTIONS

4.1 The equipment manufacturer shall provide 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 weight. However, 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 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) is outside of the designed certified purity value required by 3.1.3 and 3.1.4 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 (i.e., less than 98% pure HFO-1234yf or HFC-134a), any visual percentages displayed of HFC-134a (R-134a) and/or 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.

5. EQUIPMENT REQUIREMENTS

5.1 The equipment shall be capable of identifying the specified refrigerants, HFC-134a (R-134a) and HFO-1234yf (R-1234yf), to the specified purity level when evaluated to the test criteria in 5.7. The indication shall be a digital display. No other type of indicator display is acceptable for an RDI certified under this standard. If the equipment has multiple modes of use based on the primary refrigerant being tested, all tests in 5.7 and 5.8 shall be conducted using the correct mode.

5.2 The equipment shall not use more than 7 g (0.25 ounce) of refrigerant per test cycle of the refrigerant being identified to perform its functions.

5.3 Electrical components shall meet ANSI/ISA and/or be enclosed/housed in a location within the identifier 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).

5.4 The RDI shall be capable of withstanding without effect on durability and performance, any moisture and oil in the refrigerant sample, by passing the following tests: for moisture: the probe shall be placed and held within 6 mm (±2 mm) (0.24 inch ± 0.08 inch) of the liquid surface of a pot of 98 °C (±1 °C) (208.4 °F ± 1.8 °F) 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).

5.4.1 For Oil Exposure to RDI

Inject up to 2 cc PAG oil or POE oil into RDI hose coupler or until the oil is level with the maximum capacity of the hose coupler, and then perform an RDI operating cycle with R-134a or R-1234yf at ambient temperature and cylinder pressure. The manufacturer of the RDI may require replacement of any filtering device used prior to testing per 5.7. Following this test, the RDI shall not show damage from oil contamination by sucessfully completing the tests in 5.7.

5.5 The equipment shall be provided with connection fittings to the refrigerant storage container and to the mobile A/C system as identified by SAE J639.

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 HFC-134a (R-134a) and 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 HFC-134a (R-134a) and the test sequence shall be performed twice to assure proper operation of the equipment. All test mixtures not prepared by the certifying laboratory, shall be verified by the laboratory using gas chromatography. Three units shall be tested using each test mix. An RDI shall pass all tests to be certified to this standard. The refrigerant and air identifications shall be accurate per 3.1.3, 3.1.4, and 3.1.5, unless otherwise noted:

1. 100% HFC-134a, 2 mL oil, 3% air (per tolerances of 3.1.3a and 3.1.4).
2. 100% HFO-1234yf, 2 mL oil, 3% air (per tolerances of 3.1.3a and 3.1.4).
3. 98% HFC-134a, 2% HFO-1234yf, 6% air (per tolerances of 3.1.3a and 3.1.4).
4. 2% HFC-134a, 98% HFO-1234yf, 6% air (per tolerances of 3.1.3a and 3.1.4).
5. 90% HFC-134a, 4% HFO-1234yf, 6% hydrocarbons, 15% air (HFC-134a accuracy ±2% and per tolerances of 3.1.5).
6. 4% HFC-134a, 90% HFO-1234yf, 6% hydrocarbons, 15% air (HFO-1234yf accuracy ±2% and per tolerances of 3.1.5).
7. 90% HFC-134a, 10% hydrocarbons, 10% air (per tolerances of 3.1.3a and 3.1.5).
8. 80% HFC-134a, 20% R-152a, 10% air (per tolerances of 3.1.3b).
9. 90% HFO-1234yf, 10% hydrocarbons, 10% air (per tolerances of 3.1.3a and 3.1.5).
10. 90% HFO-1234yf, 10% R-152a, 10% air (per tolerances of 3.1.3a and 3.1.5).
11. 75% HFC-134a, 25% HFO-1234yf (per tolerances 3.1.3b)
12. 25% HFC-134a, 75% HFO-1234yf (per tolerances 3.1.3b)
13. 90% HFC-134a, 10% CFC-12 (shall not misidentify as pure HFC-134a).
14. 50% HFC-134a, 50% R-404A (shall not misidentify as pure HFC-134a).
15. 90% HFC-134a, 10% R-410a (shall not misidentify as pure HFC-134a).
16. 90% HFO-1234yf, 10% CFC-12 (shall not misidentify as pure HFO-1234yf).
17. 90% HFO-1234yf, 10% R-404a (shall not misidentify as pure HFO-1234yf).
18. 90% HFO-1234yf, 10% R-410A (shall not misidentify as pure HFO-1234yf).
19. 95% HFC-134a, 5% R40 (shall not misidentify as pure HFC-134a).

In tests 1 to 19, all components must be mixed to an accuracy of ±1% absolute. In tests 13 to 19, “pure” is defined as 98% or greater.

Connect the test equipment to each cylinder tabulated in 5.7 and operate equipment following the manufacturer’s/supplier’s instructions.

5.8 The test shall be conducted with the equipment and test cylinders in an ambient of 21 °C ± 2 °C. To confirm the equipment operates properly at ambient temperatures of 10 to 49 °C, at least the following four test points (for each refrigerant) shall be repeated (with the equipment only) at 10 °C ± 2 °C and also at 49 °C ± 2 °C.

1. 98% HFC-134a, 2% HFO-1234yf, 6% air (per tolerances of 3.1.3a and 3.1.4).

2. 2% HFC-134a, 98% HFO-1234yf, 6% air (per tolerances of 3.1.3a and 3.1.4).

3. 4% HFC-134a, 90% HFO-1234yf, 6% hydrocarbons, 15% air (HFO-1234yf accuracy ±2% and per tolerances of 3.1.5).

4. 90% HFC-134a, 4% HFO-1234yf, 6% hydrocarbons, 15% air (HFC-134a accuracy ±2% and per tolerances of 3.1.5).

5.9 Equipment shall meet a gas ignition test as follows. The identifier 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 a blend of 6% (±0.5%) R290 (99.5% pure or better) balance air is to be introduced into the identifier and not into the chamber. 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.

5.9.1 There shall be no ignition of the gas-air mixture during 2 minutes of the sample standing in the RDI chamber followed by one operating cycle. The RDI also shall indicate a refrigerant percentage of 100% +0/-2% for hydrocarbons when the operating cycle is completed.

The RDI shall pass all tests in 5.7, 5.8, and 5.9, as well as meet all other requirements of this standard, in order to be certified. No tests shall be repeated until the RDI manufacturer has documented changes made to correct the cause of failure, and furnished it to the testing laboratory per SAE J2911.

If the RDI is deemed to have passed, the certifying laboratory and the witness each shall produce a summary of all tests performed, the test results and a checklist showing that all requirements of the standard were met.

6. NOTES

6.1 Revision Indicator

A change bar (l) 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.

6.2 The PAG and POE oil shall be commercially available approved oil for mobile A/C compressor use.

6.3 The hydrocarbon shall be 1/3 each, by weight, of propane, N-butane, and iso-butane. Each hydrocarbon shall be 99% pure.

PREPARED BY THE INTERIOR CLIMATE CONTROL STANDARDS COMMITTEE

APPENDIX A - METHOD FOR CERTIFYING COMPLIANCE WITH SAE J2911

SAE J2911 provides manufacturers, testing facilities, and technician knowledge requirement providers with a procedure of certifying compliance with the appropriate SAE MAC standard. Only certifying to this SAE J Standard allows those verifying compliance to advertise their product as “Certified to SAE J2912.” Regulatory agencies will have access to SAE International public posting of the results in the official SAE database. The compliance information for this SAE Standard SAE J2912 shall be recorded, verified in Table A1, and supplied to SAE.

A separate chart shall be completed for each of the three units tested, and simply identified as Test Unit No. 1, Test Unit No. 2, and Test Unit No. 3.

Table A1 - Test verification table Sample

Requirement Paragraph #	Performance Requirement	Certification Test Observed Values	Test Organization	Person Verifying	Date of Test Results	Comments
5.4	Moisture test					
5.4.1	Oil test					
5.7	Test, Mixture No. 1					
5.7	Test, Mixture No. 2					
5.7	Test, Mixture No. 3					
5.7	Test, Mixture No. 4					
5.7	Test, Mixture No. 5					
5.7	Test, Mixture No. 6					
5.7	Test, Mixture No. 7					
5.7	Test, Mixture No. 8					
5.7	Test, Mixture No. 9					
5.7	Test, Mixture No. 10					
5.7	Test, Mixture No. 11					
5.7	Test, Mixture No. 12					
5.7	Test, Mixture No. 13					
5.7	Test, Mixture No. 14					
5.7	Test, Mixture No. 15					
5.7	Test, Mixture No. 16 (if performed)					
5.7	Test, Mixture No. 17					
5.7	Test, Mixture No. 18					
5.7	Test, Mixture No. 19					
5.8	Test, Mixture No. 1					
5.8	Text, Mixture No. 2					
5.8	Test, Mixture No. 3					
5.8	Test, Mixture No. 4					
5.9	Gas ignition test					
SAE J2911	Overall compliance					
Add columns as required						

Manufacturer name:	
Product make/model:	
Product S/Ns tested:	
Request for certification to the following SAE Standard:	
Date evaluated/tested:	
Name and address of certifying test facility:	
Required certificate attached: [Yes/No]	
Name of manufacturer's contact:	
Address:	
Phone number:	
Email:	

Approvals:

The manufacturer/supplier declares that the information in this report is representative of refrigerant of series production.

Name Title Date

I certify that that this claim meets all requirements of SAE J2911 **and** SAE J2912.