



SURFACE VEHICLE STANDARD

J2843™

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

RATIONALE

Updates for Five-Year Review include removing old test system references.

1. SCOPE

This SAE Standard applies to equipment to be used with R-1234yf refrigerant only. It establishes requirements for equipment used to recharge R-1234yf to an accuracy level that meets Section 9 of this document and purity levels defined in SAE J2099. Refrigerant service equipment is required to ensure adequate refrigerant recovery to reduce emissions and provide for accurate recharging of mobile air-conditioning systems. Equipment shall be certified to meet all performance requirements outlined in this document and international/regional construction and safety requirements as outlined in this document.

1.1 Purpose

The purpose of this SAE Standard is to establish the specific minimum equipment requirements for the recovery/recycle/recharge of HFO-1234yf (R-1234yf) refrigerant that has been directly removed from, and is intended for reuse in, mobile air-conditioning systems and system recharging of recycled or virgin R-1234yf. Establishing such specifications will ensure that system operation with recycled R-1234yf will provide the same level of performance and durability as the new refrigerant.

NOTE: R-1234yf is mildly flammable (refrigerants called “mildly flammable” have a maximum burning velocity of ≤ 0.10 m/s when tested at 23 °C and 101.3 kPa; ASHRAE 34 and ISO 817 Class 2L).

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.

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Documents

Standard, visit Sharing Hub

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.

2.1.1.1 System Design Guidelines

SAE J639	Safety and Design Standards for Motor Vehicle Refrigerant Vapor Compression Systems
SAE J2844	R-1234yf (HFO-1234yf) New Refrigerant Purity and Container Requirements for Use in Mobile Air-Conditioning Systems

2.1.1.2 Service Activities

SAE J2888	R-1234yf Service Hose, Fittings, and Couplers for Mobile Refrigerant Systems Service Equipment
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2.1.1.3 Service Equipment

SAE J2099	Standard of Purity for Recycled R-134a (HFC-134a) and R-1234yf (HFO-1234yf) for Use in Mobile Air-conditioning Systems
SAE J2296	Retest of Refrigerant Container
SAE J2912	Performance Requirements for R-134a and R-1234yf Refrigerant Diagnostic Identifiers (RDI) for Use with Mobile Air Conditioning Systems
SAE J2913	R-1234yf [HFO-1234yf] Refrigerant Electronic Leak Detectors, Minimum Performance Criteria
SAE J2927	Integrated R-1234yf Refrigerant Identifier for Recovery and Recycling Equipment Used in Mobile A/C System Servicing

2.1.1.4 Reference Documents

SAE J2911	Procedure for Certification that Requirements for Mobile Air Conditioning System Components, Service Equipment, and Service Technician Training Meet SAE J Standards
SAE J3030	Automotive Refrigerant Recovery/Recycling/Recharging Equipment Intended for use with Both R-1234yf and R-134a

2.1.2 ASME Publications

Available from ASME, P.O. Box 2900, 22 Law Drive, Fairfield, NJ 07007-2900, Tel: 800-843-2763 (U.S./Canada), 001-800-843-2763 (Mexico), 973-882-1170 (outside North America), www.asme.org.

ASME Boiler and Pressure Vessel Code

2.1.3 CGA Publications

Available from Compressed Gas Association, 8484 Westpark Drive, Suite 220, McLean, VA 22102, Tel: +1 703-788-2700, www.cganet.com.

CGA Pamphlet S-1.1 Pressure Relief Device Standard Part 1 - Cylinders for Compressed Gases

2.1.4 Code of Federal Regulations (CFR) Publications

Copies of these documents are available online at <https://www.ecfr.gov>.

40 CFR § 82.38 Approved independent standards testing organizations

49 CFR § 173.304 Filling of cylinders with liquefied compressed gases

2.1.5 UL Publications

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

UL 1769 Cylinder Valves

UL 1963 (version 4) Refrigerant Recovery/Charge Equipment

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

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

SAE J2845 R-12 (CFC-12), R-134a (HFC-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

2.2.2 UL Publications

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

UL 121201 Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations (these standards refer to NFPA 70 and NFPA 497)

3. SPECIFICATION AND GENERAL DESCRIPTION

3.1 The equipment shall be able to remove, recover, recycle, and recharge R-1234yf refrigerant on-site from MAC systems per the test procedures in Sections 8, 9, and 10.

3.2 The equipment shall be suitable for use in an automotive service garage environment and be capable of continuous operation in ambient temperatures from 10 to 50 °C (50 to 120 °F) and meet the accuracy defined in this standard.

3.2.1 Length of Service Coupling Hoses

If the manufacturer/marketer offers more than one length of service coupling hoses for a recovery/recycling/recharge machine, the following applies: The shortest and longest lengths must be tested in accordance with Sections 9 and 10. The manufacturer/marketer shall indicate the range of hose lengths for which the SAE J2843 certification applies.

- 3.3 The equipment shall be certified that it meets the requirements of this document and the requirements of SAE J2911.
- 3.3.1 The manufacturer can state certification of compliance with this standard only after meeting the requirements in SAE J2911 (see Appendix A for additional information).
- 3.3.2 Any independent testing organization that has received approval by the Administrator to certify equipment as meeting the standard requirements identified under U.S. EPA 40 CFR Ch. I (7-1-08 edition) 82.38 shall provide certification of compliance in meeting the requirements in 3.3.

4. REFRIGERANT RECYCLING EQUIPMENT REQUIREMENTS

4.1 Moisture and Acid

The equipment shall incorporate a desiccant package that shall be replaced before saturation with moisture and whose mineral acid capacity is at least 5% by weight of the dry desiccant. Oil separation operation shall occur before the desiccant filter in the recovery circuit flow path to promote maximum desiccant life.

The equipment shall be provided with a means of indicating when the filter desiccant moisture capacity has reached the allowable limit and desiccant replacement is required. This may include a reliable means of detecting moisture level or an algorithm based on the amount of refrigerant recovered. The user shall be clearly alerted to replace the filter prior to the full saturation. Warnings shall be displayed on screens and printed on printouts where applicable. The warnings shall explain that the machine is approaching the end of filter life. The manufacturer shall incorporate a lockout when the end of filter life is reached.

- 4.1.1 The manufacturer shall use an identification system to ensure that a new filter has been installed to reset the machine for operation.

4.2 Filter

The equipment shall incorporate an in-line filter rated by the filter manufacturer to trap particulates of 0.015 mm spherical diameter and greater.

4.3 Scale (If Used)

The scale shall maintain accuracy when moved, as per the test in Section 10.

4.4 Requirements for Non-Condensable Gases (NCGs)

- 4.4.1 The equipment shall automatically purge NCGs if the acceptable level is exceeded or incorporate a device to alert the operator that NCGs level has been exceeded. NCG removal must be part of normal operation of the equipment and instructions must be provided to enable the task to be accomplished within 30 minutes (to reach the refrigerant purity level specified in SAE J2099).
- 4.4.2 Equipment that uses the manual NCG purge process shall provide a method to determine the temperature of the refrigerant in the container being purged. This is required for determining the container refrigerant pressure/temperature relationship as the container lowers in temperature during the purge process. This is required to alert the operator if they have properly operated the purge cycle and determined the amount of NCGs remaining in the container that has been purged. The procedure shall be identified in the instruction manual provided with the recycling equipment.
- 4.4.3 Pressure-indicating devices that are used to identify the NCGs level shall have readable divisions of 7 kPa values in order to identify the level of excess NCGs in the refrigerant.
- 4.4.3.1 Refrigerant loss from NCG purging shall not exceed 5% by weight of the total refrigerant removed from the test system.

4.5 The tank shall be tested on each charge cycle for NCGs and a purge performed, if required.

4.6 Recharging and Transfer of Recycled Refrigerant

4.6.1 Refrigerant for recharging and transfer shall be taken from the liquid phase only.

5. SAFETY REQUIREMENTS

5.1 Construction

5.1.1 Electrical Requirements for R-1234yf Equipment

5.1.1.1 See Section 11 listing international/regional construction and safety requirements.

5.1.2 Release of R-1234yf in Normal Operation of the Equipment

Any component that normally releases small amounts of R-1234yf vapor into the cabinet shall have the vapor directed away from any potential ignition sources to be dispersed from the cabinet by the ventilation system.

Any user maintenance procedure (such as filter change or tank evacuation) shall assure that procedures are in place to collect and/or safely vent any residual refrigerant before the system is opened.

5.1.3 Service Couplers

To avoid cross connection with non-R-1234yf vehicle ports, the equipment shall only use service couplers designed to SAE J2888 specifications and shall be marked R-1234yf, as required in SAE J2888.

5.1.4 Ventilation of Equipment Enclosure

5.1.4.1 Equipment shall be constructed with at least six air exchanges per hour to prevent buildup of concentrations of vapor in the enclosure or cabinet. At power up, the fan shall be operated long enough to perform one air change prior to any other operation and shall operate continuously while the equipment is powered and shall have a means to detect loss of ventilation airflow and shall lock out operation of the unit if flow is not detected. The exception to this is that the fan may be momentarily shut off for accurate scale reading, provided that the only component energized is the required control valve. To prevent buildup of vapor within the cabinet, the fan shall not be de-energized for more than 5 minutes while the recovery machine is powered. Fan placement shall direct flow out of the cabinet so it is not pressurized. At least two intake grills, each of sufficient area to maintain six air changes per hour flow, shall be located on different surfaces and shall be located to maximize cross flow within the cabinet.

5.2 The equipment shall comply with applicable federal, state, and local requirements on equipment related to handling R-1234yf material. Safety precautions or notices related to recommended operation of the equipment shall be prominently displayed on the equipment and shall also state "CAUTION — SHALL BE OPERATED BY QUALIFIED PERSONNEL."

5.3 Under NO CIRCUMSTANCES shall any equipment be pressure tested or leak tested with air or air/R-1234yf mixtures. Do not use compressed air (shop air) for leak detection in systems containing R-1234yf.

6. OPERATING INSTRUCTIONS

- 6.1 The equipment shall have an integrated refrigerant identifier that complies with SAE J2927 or shall be capable of receiving input from a non-integrated, SAE J2912-compliant identifier, via an integrated USB port.
 - 6.1.1 If not equipped with an integrated identifier, the equipment's integrated USB port designated to interface with the identifier shall comply with USB communication protocol: USB 2.0 or USB 3.0, CDC-ACM class (refer to SAE J2912, Appendix B).
 - 6.1.2 The communication between the recovery machine and the SAE J2912 analyzer must be encrypted so as to avoid the use of non-SAE J2912 certified devices to simulate the test results. The required encryption method is identified in SAE J2912.
 - 6.1.3 The equipment shall be required to receive an acceptable reading from an integrated (SAE J2927-compliant) or a non-integrated (SAE J2912-compliant) refrigerant identifier before allowing recovery.
- 6.2 If equipped with an independent refrigerant fill/source hose, the equipment shall be required to receive an acceptable reading from an integrated (SAE J2927-compliant) or a non-integrated (SAE J2912-compliant) refrigerant identifier before allowing refrigerant to be transferred from an external source. An acceptable reading is $\geq 98\% +2\%/-1\%$ R1234yf. Unacceptable readings shall prevent (lock out) the machine's ability to recover and/or transfer refrigerant until an acceptable identifier reading is received.
- 6.3 The equipment manufacturer shall provide operating instructions, including instructions for proper attainment of vehicle system vacuum (i.e., when to stop the extraction process) and filter/desiccant replacement. Also to be included are any other necessary maintenance procedures, source information for replacement parts, and repair and safety precautions.
 - 6.3.1 The manual shall identify how to properly maintain hoses and seals to prevent contamination of refrigerant in the tank due to ingress of air (NCG) during the recovery process.
- 6.4 The equipment shall prominently display the manufacturer's name, address, the type of refrigerant it is designed to recycle, a service telephone number, and the part number for the replacement filter/drier.
- 6.5 The operating instruction shall state: "Only new lubricant, as specified by the system manufacturer, shall be installed in the MAC system. Lubricant removed from the system and/or the equipment shall be disposed of in accordance with the applicable federal, state, and local procedures and regulations."

7. FUNCTIONAL DESCRIPTION OF THE EQUIPMENT

The equipment shall be capable of meeting the functional performance requirements defined in Section 10.

7.1 Equipment Operating Performance Expectations

- 7.1.1 As part of the charge cycle, the equipment shall incorporate a vacuum decay leak check, followed by a pressurized leak test. The charge cycle shall not progress to fully charge the vehicle without successfully completing both leak tests. The leak test parameters are defined in 9.3.
- 7.1.2 The equipment shall be capable of continuous operation in ambient temperatures of 10 to 50 °C (50 to 120 °F). Continuous is defined as completing recovery/recycle and recharge (if applicable) operations with no more than a brief reset period between vehicles and shall not include time delays for allowing a system to outgas (which shall be part of the recovery period provided by this standard). Continuous may include time out for an air purge, if necessary, although it is understood that extended equipment-off time is preferred to allow NCG and refrigerant separation in the supply tank for optimum results.

NOTE: Ensure that refrigerant does not come into contact with hot surfaces during this part of the process.