SAE INTERNATIONAL

SURFACE VEHICLE STANDARD

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HFC-134a (R-134a) Recovery/Recycle/Recharging Equipment for Mobile Air-Conditioning Systems

RATIONALE

SAE J2788 is the result of a Five-Year Review and update of the specification.

1. SCOPE

The purpose of this SAE Standard is to establish the specific minimum equipment performance requirements for recovery and recycling of HFC-134a that has been directly removed from, and is intended for reuse in, mobile air-conditioning (A/C) systems. It also is intended to establish requirements for equipment used to recharge HFC-134a to an accuracy level that meets Section 9 of this document and SAE J2099. The requirements apply to the following types of service equipment and their specific applications:

a. Recovery/recycling equipment

b. Recovery/recycling - refrigerant charging

c. Refrigerant recharging equipment only

1.1 Improved refrigerant recovery equipment is required to ensure adequate refrigerant recovery to reduce emissions and provide for accurate recharging of mobile air-conditioning systems.

1.2 Equipment shall be certified to meet all performance requirements outlined in this document and international/regional construction and safety requirements as outlined in Section 11 of this document.

1.3 This standard supersedes the requirements of SAE J2210.

1.4 Purpose

This SAE Standard is to establish the specific minimum equipment requirements for the recovery/recycling of HFC-134a that has been directly removed from, and is intended for reuse in, mobile air-conditioning systems and recovery/recycling and system recharging of recycled or virgin HFC-134a. Establishing such specifications will ensure that system operation with recycled HFC-134a will provide the same level of performance and durability as new refrigerant.

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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 (U.S. and Canada only) or +1 724-776-4970 (Outside U.S. and Canada), www.sae.org.

SAE J1771	Criteria for Refrigerant Identification Equipment for Use with Mobile Air-Conditioning Systems
SAE J2099	Standard of Purity for Recycled R-134a (HFC-134a) and R-1234yf (HFO-1234yf) for Use in Mobile Air-conditioning Systems
SAE J2196	Service Hose for Automotive Air Conditioning
SAE J2197	Hfc-134a (R-134a) Service Hose Fittings for Automotive Air-Conditioning Service Equipment
SAE J2296	Retest of Refrigerant Container
SAE J2911	Procedure for Certification that Requirements for Mobile Air Conditioning System Components, Service Equipment, and Service Technician Training Meet SAE J Standards
SAE J2912	Performance Requirements for R-134a and R-1234yf Refrigerant Diagnostic Identifiers (RDI) for Use with Mobile Air Conditioning Systems

2.1.2 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

2.1.3 Code of Federal Regulations (CFR) Publications

Copies of these documents are available online at www.ecfr.gov.

40 CFR § 82.38	Approved independent standards testing organizations
49 CFR § 173.304	Filling of cylinders with liquefied compressed gases

2.1.4 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 Refrigerant Recovery/Recycling Equipment
UL 1963	Refrigerant Recovery/Recycling Equipment

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3. SPECIFICATION AND GENERAL DESCRIPTION

3.1 The equipment shall be able to remove and process HFC-134a (R-134a) from mobile A/C systems to the purity level specified in SAE J2099.

3.2 The equipment shall be suitable for use in an automotive service garage environment and be capable of continuous operation in ambient from 10 to 49 °C (50 to 120 °F). If it is designed to recharge a system, and it uses a scale for this purpose, the scale shall demonstrate the ability to maintain accuracy per the test in 10.2.

3.3 The equipment shall be certified that it meets 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 § 82.38 shall provide certification of compliance in meeting the requirements in 3.3.

3.4 The equipment shall have a label which states “Certified by (Certifying Agent) to Meet SAE J2788” in bold-type letters a minimum of 3 mm (1/8 inch) in height.

3.5 Equipment meeting high voltage compressor requirements in 8.10 shall also be marked below the SAE J2788 marking of 3.4 “Certified for High Voltage Compressor Service” in bold-type letters a minimum of 3 mm (1/8 inch) in height and shall incorporate the ISO high voltage symbol.

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.

4.1.1 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 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.

4.1.2 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 or greater.

4.3 Scale (If Used)

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

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4.4 Purging Non-Condensable Gases

4.4.1 The equipment shall automatically purge non-condensable gases (NCG), which are primarily air, if the acceptable level is exceeded. NCG removal shall be part of the normal operation of the equipment, and instructions shall 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 Refrigerant loss from NCG purging during the testing described in Section 8 shall be minimized by a method that initiates a purge when the machine has not been in use for a period long enough for air-refrigerant separation in the tank to have occurred.

4.4.3 Refrigerant loss from NCG purging during the testing described in Section 8 shall not exceed 5% by weight of the total contaminated refrigerant removed from the test system.

4.5 Recharging and transfer of recycled refrigerant shall be taken from the liquid phase only.

5. SAFETY REQUIREMENTS

See Section 11 for international/regional construction and safety requirements.

5.1 The equipment shall comply with applicable federal, state, and local requirements on equipment related to handling HFC-134a material. Safety precautions or notices related to safe operation of the equipment shall be prominently displayed on the equipment and should also state “CAUTION - SHOULD BE OPERATED BY QUALIFIED PERSONNEL.”

5.2 Under NO CIRCUMSTANCES should any equipment be pressure tested or leak tested with air/HFC-134a mixtures. Do not use compressed air (shop air) for leak detection in systems containing HFC-134a. This should be clearly stated in the manual.

6. OPERATING INSTRUCTIONS

6.1 The equipment manufacturer shall provide a warning in the instruction manual regarding the possibility of refrigerant contamination in the mobile A/C system being serviced.

6.1.1 If recovery/recycle equipment has refrigerant identification equipment, the refrigerant identification equipment shall meet the requirements of SAE J1771 or SAE J2912.

6.1.2 Recovery/recycling equipment not having refrigerant identification capability shall have instructions in the equipment manual covering possible contamination problems to the equipment and the contamination of the existing recycled refrigerant in the container in the equipment.

6.2 The equipment manufacturer shall provide operating instructions, including proper attainment of vehicle system vacuum (i.e., when to stop the extraction process), filter/desiccant replacement, and purging of NCG (air). Also to be included are any other necessary maintenance procedures, source information for replacement parts, and repair and safety precautions.

6.2.1 The manual shall identify the proper maintaining of hose and seals to prevent the addition of excess air, due to leaks, during the recovery process, which would increase the NCG level in the recovered refrigerant.

6.3 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.

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7. FUNCTIONAL DESCRIPTION

The ability of the equipment to meet the refrigerant recovery and recharge specifications of this section shall be determined by the test procedures of Section 10.

7.1 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.

7.1.1 The equipment shall be capable of removing a minimum of 95% of the refrigerant from the test system in 30 minutes or less, without external heating or use of any device (such as shields, reflectors, special lights, etc.) which could heat components of the system. The recovery procedures shall be based on 21 to 24 °C (70 to 75 °F) ambient temperature. The test system for qualifying shall be a 1.4-kg (3-pound) 2020-2026 Ford Transit with front and rear A/C and shall be determined by accurately weighing the recovery machine with the resolution and accuracy of within 2.3 g (0.005 pound) in the range of the machine's weight. The laboratory shall maintain records of the vehicle, including its vehicle identification number (VIN).

7.1.2 The preceding shall not preclude a brief period of engine–A/C operation at fast idle (up to 15 minutes, up to 2000 rpm) to circulate refrigerant and oil, and provide some engine and A/C warm-up. The laboratory shall monitor coolant temperature per the vehicle engine coolant temperature sensor, and coolant temperature shall not be allowed to exceed 105 °C (221 °F). The time required shall not be included in the total time of 30 minutes set forth in 7.1.1.

7.1.3 The refrigerant that is recovered, following oil separation, shall be measured and the quantity displayed, accurate to within ±30 g (1.0 ounce). The equipment shall include a provision for checking the accuracy, per the requirements of 9.1.

7.2 Storage Vessel and Tank Overfill Protection

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

7.3 If the machine is designed for recharging, and the marketer permits use of a non-refillable refrigerant tank, the machine shall include a way to ensure virgin refrigerant remaining in the tank (called the "heel") to no more than 1% of tank rated capacity when the tank is indicated to be empty and shall be held at a minimum vacuum level of -15 in Hg for a minimum of 30 seconds. This shall be done by the machine marketer as follows:

The machine marketer shall specify a non-venting procedure to minimize the amount of unused virgin refrigerant remaining in the tank. The machine shall include any devices required for the procedure, other than ordinary service shop tools and supplies, and include in the operator's manual and any instructions.

The machine marketer shall provide an automatic or (with instructions in the operator's manual) semi-automatic non-venting procedure with the machine.

The laboratory shall test for the 1% capability. For testing purposes, it may use a refillable tank, minimum 6.8 kg (15 pounds) capacity containing a minimum of 3.4 kg (7.5 pounds) of refrigerant.

The test procedure is as follows:

7.3.1 Weigh the tank at the start of the test, on a scale accurate to ±3 g, to ensure it contains sufficient refrigerant.

7.3.2 Operate the machine to remove refrigerant from the tank, charging into a holding container until the tank is indicated to be empty. Continue with the marketer's recommended procedure for the 1% capability. Measure vacuum level in the refrigerant tank to ensure that a vacuum level of -15 in Hg is held for a minimum of 30 seconds prior to the process completing.

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