

Recovery Equipment for Contaminated Refrigerant from Mobile Automotive Air Conditioning Systems

RATIONALE

This standard is required to facilitate service of contaminated MAC refrigerant systems. Due to the concern for contaminated refrigerant with R-1234yf systems, it has been changed from a Recovery only equipment standard to one that covers the recovery of contaminated refrigerant from any MAC system. .

1. SCOPE

This standard is equipment used to remove contaminated refrigerant from Mobile Air Conditioning (MAC) systems.

1.1 Purpose

1.2 The purpose of this SAE Standard is to provide minimum performance and operating requirements for equipment used to recover contaminated refrigerant or to recover refrigerant at facilities which do not service MAC systems. Any refrigerant recovered with this equipment is to be returned to an EPA approved refrigerant reclamation facility that will process it appropriately as per AHRI 700 standard or dispose of it. Refrigerant recovered with this equipment cannot be recycled. Refrigerant recovery equipment is required to ensure adequate refrigerant recovery and to reduce emissions during the removal of refrigerant from mobile air conditioning systems.

1.3 Equipment shall be certified to meet all performance requirements outlined in this document and international and regional construction and safety requirements as outlined in Section 8 of this document.

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 724-776-4970 (outside USA), www.sae.org.

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on this Technical Report, please visit
http://www.sae.org/technical/standards/J2851_201202**

2.1.1.1 System Design Guidelines

SAE J639 Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems

SAE J2844 R-1234yf New Refrigerant Purity and Container Requirements Used 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

2.1.1.3 Technician Service Procedures

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

2.1.1.4 Service Equipment

SAE J2099 Standard of Purity for Recycled HFC-134a (R-134a) and HFO-1234yf (R-1234yf) or Use in Mobile Air-conditioning Systems

SAE J2296 Retest of Refrigerant Cylinder

SAE J2927 R-1234yf Refrigerant Identifier Installed in Recovery and Recycling Equipment for Use in Mobile Air Conditioning

2.1.1.5 Reference Documents

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), and Potential Failure Mode and Effects Analysis for Machinery (Machinery FMEA) Automotive Quality and Process Improvement Committee

SAE J2911 Certification Requirements for Mobile Air Conditioning System Components, Service Equipment, and Service Technicians to Meet SAE J Standards

2.1.2 AHRI Publication

Available from Air Conditioning and Refrigeration Institute, 1501 Wilson Boulevard, Sixth Floor, Arlington, VA 22209.

AHRI 700 Specifications for Fluorocarbon Refrigerants

2.1.3 CGA Publication

Available from CGA, Crystal Gateway #1, Suite 501, 1235 Jefferson Davis Highway, Arlington, VA 22202.

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

2.1.4 DOT Specification

Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

DOT Standard CFR 49, Section 173.304 Shippers - General Requirements for Shipments and Packaging.

2.1.5 UL Publications

UL is currently in the process of updating UL 1963 to comprehend the use with A2L fluids. All references to UL 1963 within this document shall be to UL1963 (version 4). The following are exceptions to UL1963:

1. A hazardous location plug shall not be required.
2. A hose assembly inside the machine shall not exceed 0.91 meters (3 feet) in length.
3. The hose tensile pull requirement shall be 113 Kg (250 lbs) minimum.
4. The required hose permeation shall be 4.9 Kg/m² (1 Lb/Ft²) /yr. maximum.

Available from Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 600622096.

UL 1769 Cylinder Valves

UL 1963 Refrigerant Recovery/charge Equipment

2.1.6 Other Publications

ANSI/ISA 12.12.01 Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III Divisions 1 and 2 Hazardous (Classified) Locations (these standards reference NFPA-70 and NFPA497)

3. SPECIFICATIONS AND GENERAL DESCRIPTION

- 3.1 The equipment must be able to recover (extract) contaminated refrigerant from a MAC system as per the test procedure of Section 7.
- 3.2 The equipment shall be suitable for use in an automotive service garage environment as defined in 6.1.1.
- 3.3 The equipment must be certified that it meets 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 "Procedure for Certification That Requirements for Mobile Air Conditioning System Components, Service Equipment and Service Technicians Training Meet SAE J Standards". (See Appendix B for additional information.)
 - 3.3.2 Certification of compliance to the requirements of 3.3 shall be made by an independent testing organization that has received approval by the EPA Administrator to certify equipment as meeting the standard requirements identified under US EPA 40 CFR Ch. I (7-1-08 Edition) 82.38.

4. SAFETY REQUIREMENTS

4.1 Construction

4.1.1 Electrical requirements for contaminated refrigerant removal Equipment

See Section 8 listing international and regional construction and safety requirements.

4.1.2 Ventilation of Equipment Enclosure

If equipment stores refrigerant inside an enclosure or cabinet the equipment shall provide [6 air exchanges per hour] ventilation 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. Fan placement shall direct flow out of the cabinet so it is not pressurized. At least (2) Intake grills each of sufficient area to maintain 6 air change per hour flow shall be located on different surfaces and oriented to maximize cross flow within the cabinet.

4.2 The equipment must comply with applicable federal, state, and local requirements on equipment related to handling contaminated refrigerant material. Safety precautions or notices related to safe operation of the equipment shall be prominently displayed on the equipment and shall also state "CAUTION—SHALL BE OPERATED BY QUALIFIED PERSONNEL."

4.3 Under NO CIRCUMSTANCES shall any equipment be pressure tested or leak tested with air/ or air/refrigerant mixtures. Do not use compressed air (shop air) for leak detection in systems.

5. OPERATING INSTRUCTIONS

5.1 The equipment manufacturer shall provide operating instructions that include information required by SAE J639, necessary maintenance procedures, and source information for replacement parts and repair.

5.2 The equipment must prominently display the manufacturer's name, address, a service telephone number, and any items that require maintenance or replacement that affect the proper operation of the equipment. Operation manuals must cover information for complete maintenance of the equipment to assure proper operation.

5.3 The equipment manufacturer shall provide a warning in the instruction manual regarding the possibility of refrigerant contamination from hydrocarbons, and leak sealants.

6. FUNCTIONAL DESCRIPTION

6.1 Equipment Performance Requirements

6.1.1 The equipment must be capable of continuous operation in ambient temperatures of 10 °C (50 °F) to 50 °C (120 °F). Continuous is defined as completing recover operation with no more than a brief reset between servicing 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).

6.1.2 The equipment shall demonstrate ability to recover a minimum of 95.0% of the refrigerant from the test vehicle in 30 min or less, without prior engine operation (for previous 8 h minimum), external heating or use of any device (such as shields, reflectors, special lights, etc.), which could heat components of the system. The recovery procedure shall be based on a test at 21 to 24 °C (70 to 75 °F) ambient temperature. The test system for qualifying shall be a 1.4 kg (3 lb.) capacity orifice tube/accumulator system in a 2005 to 2009 Chevrolet Suburban with front and rear A/C or the test option described in Section 7.

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

6.1.3 The equipment shall demonstrate ability to recover a minimum of 85% of the refrigerant from the test vehicle or system as per 6.1.2. in 30 min or less, at an ambient temperature of 10 to 13 °C (50 to 55 °F), subject to the same restrictions regarding engine operation and external heating.

6.2 Fittings and Flexible Hoses

6.2.1 All flexible hoses must meet the applicable sections of SAE J2888 for service hoses.

6.2.2 Service hoses must have shutoff devices located at the connection points to the system being serviced to minimize emissions while connecting/disconnecting from the system being serviced.

7. RECOVERY EQUIPMENT VALIDATION TEST REQUIREMENTS

7.1 Use of a test vehicle (2005 to 2009 Chevrolet Suburban) with rear A/C and a charge of 1.4 kg/3 lb or a laboratory fixture per Section 7.6 shall be used to validate the recovery efficiency of this equipment.

For test validation, the equipment is to be operated to the manufacturer's instructions.

7.2 Testing shall be done at a temperature of 21 to 24 °C (70 to 75 °F). Test vehicle shall be "overnight cold" (not run for at least 8 h).

7.3 You shall start with an empty system, using this method: (a) Recover refrigerant from system, per equipment manufacturer's instructions. (b) Evacuate the system to a minimum of -710 mm Hg (-27.9 in Hg). (c) Monitor vacuum for decay, checking every 20 min. If decay exceeds 75 mm Hg (3.0 in Hg), evacuate the system again. When system holds 710 mm Hg plus 75 mm Hg, vacuum for three more hours, it is considered empty.

7.4 Using a machine certified to SAE J2843 and with machine on a platform scale with accuracy to within plus/minus 3g at the weight of the machine, charge the system to 1.4kg/3 lb. The actual charge amount per the reading on the platform scale (hoses disconnected from the system after charge and draped over the machine) shall be used as the basis for the recovery efficiency of the recovery only machine being tested to this standard.

7.5 Recovery Test Procedure (using a vehicle)

1. Following a successful system charge, the system shall be run for 15 min at 2000 rpm to circulate oil and refrigerant, following which engine and system shall rest for 8 h. Then the laboratory may begin the recovery test. If the machine manufacturer specifies, operate the engine/system for up to 15 min, at up to 2000 rpm, then shut off engine/system.
2. Place the recovery machine being tested on the platform scale with the hoses draped over the unit and with recovery tank (if separate). Record the weight of the machine, hoses and the recovery tank (if separate) on the platform scale as (Weight a).
3. Start timer. Connect service hoses to system of test vehicle and perform recovery per the equipment manufacturer's instructions. The vehicle system service valves' cores shall remain in the fittings for this procedure.
4. When recovery is completed, including from service hoses if that is part of the recommended procedure, disconnect hoses and drape over machine (that is still on platform scale). Stop timer. The elapsed time shall be 30 min or less. If it is in excess of this time, the machine fails the test and no retest is allowed. The manufacturer shall document changes made to the machine to improve its performance before a new test is allowed, and furnish them to the laboratory.
5. If the recovery is completed in no more than the 30 min record the amount of refrigerant recovered by noting the weight of recovery unit, hoses and the recovery tank (if separate) on the platform scale (Weight b).
6. The platform scale shall indicate that a minimum of 95% of the amount charged into the system has been recovered. If the platform scale indicates a lower percentage has been recovered, the machine fails the recovery test. (Weight b – Weight a/ Charge Weight ≥ .95)

7.6 Optional Recovery Test Procedure (using a laboratory test fixture)

If an equipment manufacturer chooses, as an alternative to the actual vehicle, it may certify to SAE J2851 with a laboratory fixture that is composed entirely of all the original equipment parts of a single model year for the 3.0-lb capacity front/rear A/C system of R-1234yf designated vehicle system as defined in Appendix A of this document

The fixture system shall be powered by an electric motor, run at a speed not to exceed 2000 rpm, and for this test option, no system warm-up or equivalent procedure may be used. The certifying laboratory shall maintain records of all parts purchased, including invoices and payments. The assembly of the parts shall, as an outside-the-vehicle package, duplicate the OE system and its routing. [See Appendix A for detail system configuration.] Aside from the absence of engine operation and the limitations posed by the standard and the use of the electric motor, the test shall otherwise be the same as the vehicle test

The fixture systems for this standard shall not be powered by an electric motor during recovery, although a motor can be used, as part of the preparatory process, as outlined above, including installation of the charge.

8. INTERNATIONAL AND REGIONAL REQUIREMENTS

8.1 Equipment that is to be used in North America (where NFPA and NEC guidelines apply) shall comply with the following.

8.1.1 General Construction and Test Requirements

ANSI/ISA 12.12.01 shall apply to Recovery Recharge Equipment except that if the flammable refrigerant does not pose a hazard to certain parts of the Equipment, then the applicable requirements from UL 1963 may be applied.

8.1.2 Electrical Requirements for contaminated refrigerant.

Non-incendive equipment technique is required. The unit shall be constructed using electrical components deemed safe for this level of refrigerant flammability.

Guidelines for Electrical Equipment in a Class 1, Division 2 Hazardous Location shall be followed. Guidelines included, but not limited to the following areas for equipment used for contaminated refrigerant.

8.1.2.1 Electric motors shall comply with requirements outlined in ANSI/ISA 12.12.01

8.1.2.2 All other electrical components (such as but not limited to: switches, relays, circuit breakers, solenoids) shall comply with requirements as outlined in ANSI/ISA 12.12.01.

8.1.2.3 High-pressure Cutout Switch

Use sealed or located in explosion proof enclosure, per NEC article 501.115 (B) (1)

Labels need to indicate that proposed fasten connectors are not to be opened under load within classified location

Components used must limit surface temperature to not more than 400 °C

8.1.3 Labeling

8.1.3.1 The equipment shall have a label which states "Certified by (Certifying Agency) to meet SAE J2851 and UL1963" in bold-type letters a minimum of 3mm (1/8 in) in height.

8.1.3.2 In addition the following shall be included on the label:

- a. The applicable marking requirements of UL 1963
- b. Warning markings appropriate to describe refrigerant flammability (location, color, ISO symbols, text font and verbiage).
- c. The refrigerant for which the equipment is certified to service.

8.1.4 Storage Vessel Requirements [unique labeling]

8.1.4.1 Cylinders used in conjunction with this equipment must meet applicable DOT cylinder regulations. It must be permanently marked on the outside surface in black print of at least 20 mm "CONTAMINATED REFRIGERANT—DO NOT USE, MUST BE RECLAIMED or DESTROYED by an EPA authorized facility.

8.1.4.2 Cylinder Valve

The cylinder valve shall comply with the standard for cylinder valves, UL 1769.

8.1.4.3 Tank Over-fill Protection

During recovery operation, the equipment shall provide overfill protection to assure that the liquid fill of the storage container (which may be integral or external) does not exceed 80% of the tank's rated volume at 21 °C per UL1963.

8.1.4.4 Pressure Relief Device

The pressure relief device shall comply with the Pressure Relief Device Standard Part 1 - Cylinders for Compressed Gases, CGA Pamphlet S-1.1.

8.2 Equipment that is to be sold in other regions shall comply with the following:

8.2.1 General construction and test requirements related to electrical systems and pressurized tanks shall be met for the region where the equipment will be sold.

8.2.2 All other performance requirements of this standard shall be met for all regions.

9. NOTES

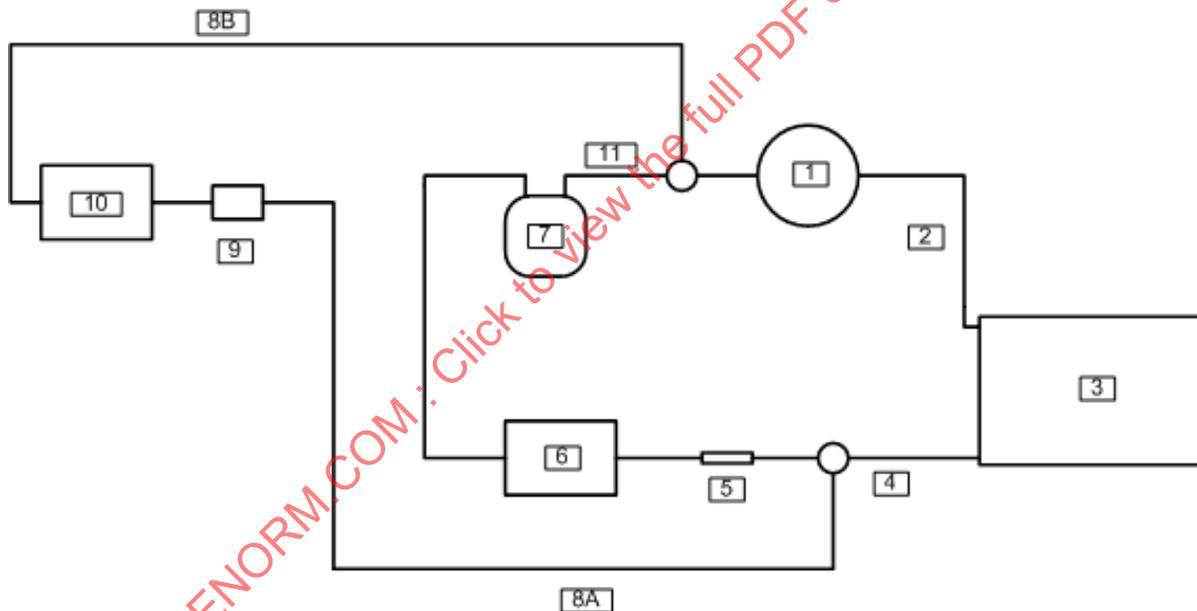
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APPENDIX A - DEFINITION OF TEST FIXTURE FOR RECOVERY EFFICIENCY TESTING.

(Only substitutions allowed are direct supersession or components these parts superseded which are functionally the same as identified by General Motors.)

Call Out	Part Description	Part Number
1	Compressor	89023461
2	Hose -AC Condenser	15785062
3	Condenser	25967386
4	Tube AC-Evaporator	15785057
5	Orifice	15784601
6	Front Evaporator	88986628
7	Accumulator	19130064
8a and 8b	Hose-Aux AC Evaporator	89024915
9	Aux (Rear) TXV Valve	52401710
10	Aux (Rear Evaporator	89019057
11	Hose-AC Accumulator	15200864



Alternate Rear Evaporator Lines:

8A Liquid line 7.0 mm inner diameter by 4.9 m long

8B Suction 13.0 mm inner diameter by 5.1 m long