



SURFACE VEHICLE STANDARD	J2851™	SEP2022
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Superseding J2851 FEB2015		
Recovery Equipment for Contaminated R-134a or R-1234yf Refrigerant from Mobile Automotive Air Conditioning Systems		

RATIONALE

This standard has been updated to reflect the use of the Pacifica hybrid for recovery testing and to capture changes in previously cited ANSI 12.12.01 to UL 12.12.01 reference.

1. SCOPE

This SAE Standard covers equipment used to remove contaminated R-134a and/or R-1234yf 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 contaminated 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 +1 724-776-4970 (outside USA), www.sae.org.

2.1.1.1 System Design Guidelines

SAE J639 Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems

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For more information on this standard, visit
https://www.sae.org/standards/content/J2851_202209/

2.1.1.2 Service Activities

- SAE J2197 HFC-134a (R-134a) Service Hose Fittings for Automotive Air-Conditioning Service Equipment
- SAE J2888 R-1234yf Service Hose, Fittings, and Couplers for Mobile Refrigerant Systems Service Equipment

2.1.1.3 Technician Service Procedures

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

2.1.1.4 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 J2788 HFC-134a (R-134a) Recovery/Recycle/Recharging Equipment for Mobile Air-Conditioning Systems
- SAE J2810 HFC-134a (R-134a) Refrigerant Recovery Equipment for Mobile Automotive Air-Conditioning Systems
- SAE J2843 R-1234yf (HFO-1234yf) Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air-Conditioning Systems
- SAE J2912 Performance Requirements for R-134a and R-1234yf Refrigerant Diagnostic Identifiers (RDI) for Use with Mobile Air Conditioning Systems
- 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 R-1234yf and R-134a

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 J2296 Retest of Refrigerant Container
- SAE J2776 Refrigerant Purity and Container Requirements for New HFC-134a 1,1,1,2 - Tetrafluoroethane Refrigerant Used in Mobile Air-Conditioning Systems
- SAE J2844 R-1234yf (HFO-1234yf) New Refrigerant Purity and Container Requirements for Use in Mobile 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

2.2.2 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

- ISO 7010:201 Graphical Symbols - Safety Colours and Safety Signs - Registered Safety Signs

2.2.3 AHRI Publications

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

AHRI 700 Specifications for Fluorocarbon Refrigerants

2.2.4 CGA Publications

Available from CGA, 14501 George Carter Way, Suite 103, Chantilly, VA 20151, Tel: 703-788-2700, www.cganet.com.

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

2.2.5 Specification for Cylinders

It is the responsibility of the equipment manufacturer and/or equipment user to be compliant with the most recent cylinder standards that apply in the region where the equipment is used for recovery. For reference, examples of cylinder specifications are shown below.

NOTE: This list is not exhaustive and local/regional standards may change recovery cylinder requirements.

EU Cylinders ADR Standard and TPED Standard

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

2.2.6 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 (Revision 4) Refrigerant Recovery/Recycling Equipment Standard for Safety for Refrigerant Recovery/Recycling Equipment

2.2.7 ANSI Accredited Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

UL12.12.01/CSA C22.2#213:2017(or newer) 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 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. (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 U.S. 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 (six 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: (1) operate continuously while the equipment is powered, (2) have a means to detect loss of ventilation airflow, and (3) 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 two intake grills, each of sufficient area to maintain six 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 The Chrysler Pacifica hybrid and associated procedural changes can be used immediately, use of the Suburban or test fixture shall be allowed through July 31, 2023, after this date only the Pacifica shall be used, the Suburban or test fixture shall not be allowed.

6.2 Equipment Performance Requirements

6.2.1 The equipment must be capable of continuous operation in ambient temperatures of 10 to 50 °C (50 to 120 °F). Continuous is defined as completing recovery 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).

6.2.2 The equipment shall demonstrate ability to recover a minimum of 95.0% of the refrigerant from the test vehicle in 30 minutes or less, without prior engine operation (for previous 8 hours 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 pound) capacity orifice tube/accumulator system in a 2005 to 2009 Chevrolet Suburban or 2017 or later Chrysler Pacifica plug in hybrid 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.

6.2.3 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 minutes 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.

6.3 Fittings, Flexible Hoses, and Couplings

6.3.1 All flexible hoses must meet the applicable sections of SAE J2197 and/or SAE J2888 for service hoses.

6.3.2 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

The Chrysler Pacifica hybrid and associated procedural changes can be used immediately, use of the Suburban or test fixture shall be allowed through July 31, 2023, after this date only the Pacifica shall be used, the Suburban or test fixture shall not be allowed.

7.1 A test vehicle (2005 to 2009 Chevrolet Suburban) with rear A/C and a charge of 1.36 kg (3 pounds) of R-134a or a laboratory fixture per 7.6 or 2017 or later Chrysler Pacifica plug in hybrid 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 hours).

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 minutes. 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 3 more hours; then it is considered empty.

7.4 Using a machine certified to SAE J2788 and with machine on a platform scale with accuracy to within ± 3 g at the weight of the machine, charge the system to 1.4 kg (3 pounds) of 134a. If testing using the Chrysler Pacifica, charge with a certified J2843 machine on a platform scale with accuracy within ± 3 g at the weight of the machine, charge the system with R-1234yf to the amount specified for the vehicle. 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)

If using the Chrysler Pacifica hybrid, charge vehicle battery pack to 100% and maintain the charging connection through the 8 hour rest period.

1. Following a successful system charge, the system shall be run for 15 minutes at 2000 rpm to circulate oil and refrigerant, following which engine and system shall rest for 8 hours. Then the laboratory may begin the recovery test. If the machine manufacturer specifies, operate the engine/system for up to 15 minutes, 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 minutes 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 minutes, 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 recovered \geq 95% of amount charged.)
- 7.5.1 Repeat 7.1 to 7.5 step 6 at 10 to 13 °C (50 to 55 °F) to comply with 6.1.3, which requires 85% recovery at that temperature.
- 7.6 Optional Recovery Test Procedure (Using a Laboratory Test Fixture)

The test fixture described below shall be allowed through July 31, 2023, after this date only the 2017 or later Chrysler Pacifica plug in hybrid (vehicle) shall be used.

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 pound capacity front/rear A/C system of R134a 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

UL12.12.01/CSA C22.2#213:2017(or newer) 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 are not limited to, the following areas for equipment used for contaminated refrigerant.

8.1.2.1 Electric motors shall comply with requirements outlined in UL12.12.01/CSA C22.2#213:2017(or newer).

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 UL12.12.01/CSA C22.2#213:2017(or newer).

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 UL 1963" in bold-type letters a minimum of 3 mm (1/8 inch) 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), if required.

ISO flammability symbols may be found at ISO 7010:2011.

c. The refrigerant system for which the equipment is certified to service.

Labeling should be permanently marked on the outside equipment surface in black print of at least 6 mm.

Depending on which refrigerant system the equipment is designed to service, one of the following labels should be applied: "For contaminated mobile A/C systems designed for R-134a and R-1234yf," "For contaminated mobile A/C systems designed for R-134a," or "For contaminated mobile A/C systems designed for R-1234yf."

8.1.4 Storage Vessel Requirements (Unique Labeling) for Contaminated Refrigerants

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 10 mm "CONTAMINATED REFRIGERANT—DO NOT USE, MUST BE RECLAIMED OR DESTROYED BY AN EPA AUTHORIZED FACILITY."

8.1.4.1.1 Furthermore, since the refrigerant is contaminated with an unknown refrigerant, it shall be assumed to be flammable. Therefore, cylinder labeling shall also meet requirements for flammable materials; i.e., they shall be marked with appropriate flammable pictogram per regional shipping requirements.

Options for types of cylinder labeling are as follows:

- Flammable labeling can be sticker attached to cylinder
- Flammable labeling can be tag attached to cylinder underneath valve
- Flammable labeling can be oversleeve attached to top of cylinder
- Flammable labeling can be shoulder sleeve cuff

8.1.4.2 Color

Recovery cylinders are typically gray with yellow shoulder/collar. Optional recovery cylinder markings to indicate flammable material can include, but are not required, gray body color with red shoulder/collar.

NOTE: There is no required PMS color for recovery cylinders in U.S. and/or EU. Therefore, either gray with yellow shoulder or gray with red shoulder are acceptable.

8.1.4.3 Cylinder Valve per Local Requirements

The cylinder valve shall comply with the local regional/country requirements. It is the responsibility of the equipment user to comply with local/regional valve requirements.

The following valves are listed for reference:

EU DIN 477-1

U.S. UL 1769

8.1.4.4 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 UL 1963.

8.1.4.5 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. ADDITIONAL REFRIGERANT RECOVERY INFORMATION

9.1 Recovery Process

While some MAC refrigerant systems may be contaminated such that they cannot be recycled on site, they may still have value at EPA approved recycling centers. Therefore, it is highly advisable that service shops frequently check with known recyclers on possible recycle streams and determine how to handle these waste streams.

For instance, the following streams may have potential reclaim value and it may be better not to add additional refrigerants (i.e., HCs to this recovery cylinder)

R-134a/R-1234yf

10. NOTES

10.1 Revision Indicator

A change bar (I) 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, or in documents that contain editorial changes only.