SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE STANDARD

SAE J1770

ISSUED OCT95

Issued 1995-10

Submitted for recognition as an American National Standard

AUTOMOTIVE REFRIGERANT RECOVERY/RECYCLING EQUIPMENT INTENDED FOR USE WITH BOTH R12 AND R134A

***Foreword*—**The purpose of this document is to establish specific minimum equipment requirements for automotive refrigerant recovery/recycling equipment intended for use with both R12 and R134a in a common refrigerant circuit. Establishing such specifications will assure that this equipment does not cross contaminate refrigerant above specified limits when used under normal operating conditions.

***1. Scope*—**The purpose of this SAE Standard is to establish the specific minimum equipment requirements for recovery/recycling equipment intended for use with both R12 and R134a in a common refrigerant circuit that has been directly removed from, and is intended for reuse in, mobile air-conditioning (A/C) systems. This document does not apply to equipment used for R12 and R134a having a common enclosure with separate circuits for each refrigerant.

2. References

2.1 Applicable Publications—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1991—Standard of Purity for Use in Mobile Air-Conditioning Systems
SAE J2099—Standard of Purity for Recycled HFC-134a for Use in Mobile Air-Conditioning Systems
SAE J2196—Service Hoses for Automotive Air-Conditioning
SAE J2197—HFC-134a Service Hose Fittings for Automotive Air-Conditioning

2.1.2 COMPRESSED GAS ASSOCIATION (CGA) PUBLICATION—Available from CGA, 1235 Jefferson Davis Highway, Arlington, VA 22202.

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

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

CFR 49, Section 173.304—Shippers—General Requirements for Shipments and Packagings

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-8512 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER; (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS http://www.sae.org

2.1.4 UL PUBLICATIONS—Available from Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 991—Standard for Tests for Safety Related Controls in Employing Solid-State Devices
UL 1769—Cylinder Valves
UL 1963—Refrigerant Recovery/Recycling Equipment

2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1990—Extraction and Recycling Equipment for Mobile A/C Systems
SAE J2210—HFC-134a (R134a) Recycling Equipment for Mobile A/C Systems

3. Specification and General Description

3.1 The equipment shall be suitable for use in an automotive service garage environment and be capable of continuous operation in ambients from 10 to 49 °C.

3.2 The equipment must be certified that it meets this specification by Underwriters Laboratories Inc. (UL), or by an equivalent certifying Laboratory.

3.3 The equipment shall have a label which states "Design Certified by (Certifying Laboratory) to meet SAE J1770 for recycling R12 and R134a using common refrigerant circuits," in bold-type letters a minimum of 3 mm in height.

4. Equipment Requirements

4.1 General

4.1.1 The equipment shall have a lockout to prevent cross contamination to the level required by 9.2.1g to assure the clearing process has been completed before an operation involving recovery of a different refrigerant can begin. Following initiation of the clearing process no further technician action shall be required. The equipment shall prevent initiation of the recovery operation if hoses, storage tanks, internal refrigerant circuits, etc., are not connected properly.

4.1.2 If an operator action is required to clear the unit prior to reconnecting for a different refrigerant, the equipment shall be provided with a means which indicates which refrigerant was last processed.

4.1.3 Means shall be provided to prevent recovery from both an R12 and R134a mobile air conditioning system concurrently.

4.1.4 TRANSFER OF RECYCLED REFRIGERANT—Recycled refrigerant for recharging and transfer shall be taken from the liquid phase only.

4.2 Seat Leakage Test

4.2.1 Valves, including electrically operated solenoid valves, that are used to isolate R12 and R134a refrigerant circuits, shall have a seat leakage rate not exceeding 15 g/year (1/2 oz/year) before and after 100 000 cycles of operation. This Endurance Test shall be conducted with R134a at maximum operating pressure as determined by 8.1 and 8.2. The Seat Leakage Test shall be performed at 1.5 times this pressure at an ambient of 24 °C.

4.3 Interlocks

4.3.1 Electrical interlock devices used to prevent cross contamination of refrigerant shall be operated for 100 000 cycles and there shall be no failure that would permit cross contamination of refrigerant. Solid state interlock devices shall comply with the Transient Overvoltage Test and the Fast Transient (Electric Noise) Test contained in the Standard for Tests for Safety Related Controls Employing Solid-State Devices, UL 991.

4.4 Noncondensable Gases

4.4.1 The equipment shall either automatically purge noncondensables (NCGs) if the acceptable level is exceeded or incorporate a device that indicates to the operator the NCG level has been exceeded. A pressure gauge used to indicate an NCG level shall be readable in 1 psig increments. NCG removal must be part of the normal operation of the equipment and instructions must be provided to enable the task to be accomplished within 30 min.

4.4.2 Refrigerant loss from noncondensable gas purging, oil removal, and refrigerant clearing shall not exceed more than 5% by weight of the total amount of refrigerant through the equipment as detailed in 8.1, 8.2, and 9.2.

4.5 Filter

4.5.1 A 15 µm filter, or other equivalent means, to remove particulates of 15 µm spherical diameter or greater shall be located before any manual or electrically operated valves that may cause cross contamination.

4.6 Moisture and Acid

4.6.1 The equipment shall incorporate a desiccant package that must be replaced before saturated with moisture and whole acid capacity is at least 5% by weight of total system dry desiccant.

4.6.2 The equipment shall be provided with a moisture detection means that will reliably indicate when moisture level exceeds 15 ppm in R12 or 50 ppm in R134a and requires the filter/dryer replacement.

5. Operating Instructions

5.1 The equipment manufacturer must provide operating instructions, including proper attainment of vehicle system vacuum (i.e., when to stop the extraction process and also to stop the extraction process if it is noticed that the A/C system being serviced has a leak), filter/desiccant replacement, and purging of noncondensable gases (air). The instructions shall indicate that the correct sequence of operation be followed so that the equipment can properly remove contaminates to the acceptable level. Also to be included are any other necessary maintenance procedures, source information for replacement parts and repair, and safety precautions.

5.2 The equipment must prominently display the manufacturer's name, address, the type of refrigerant—R12 and R134a, a service telephone number, and the part number for the replacement filter/drier. Operation manuals must cover information for complete maintenance of the equipment to assure proper operation.

6. Safety Requirements

6.1 The equipment must comply with applicable federal, state and local requirements on equipment related to the handling of R12 and R134a material. Safety precautions or notices related to the safe operation of the equipment shall be prominently displayed on the equipment and should also state "Caution—Should Be Operated By Qualified Personnel."

6.2 R134a has been shown to be nonflammable at ambient temperature and atmospheric pressure. The following statement shall be in the operating manual: "Caution: HFC-134a service equipment or vehicle A/C systems should not be pressure tested or leak tested with compressed air. Some mixtures of air and HFC-134a have been shown to be combustible at elevated pressures (when contained in a pipe or tank). These mixtures may be potentially dangerous, causing injury or property damage. Additional health and safety information may be obtained from refrigerant and lubricant manufacturers."

7. Functional Description

7.1 General

7.1.1 The equipment must be capable of ensuring recovery of the R12 and R134a from the system being serviced, by reducing the system to minimum of 102 mm of mercury below atmospheric pressure (i.e., vacuum).

7.1.2 The equipment must be compatible with leak detection material that may be present in the mobile AC system.

7.2 Shutoff Device

7.2.1 To prevent overcharge, the equipment must be equipped to protect the tank used to store the recycled refrigerant with a shutoff device and a mechanical pressure relief valve.

7.3 Storage Tanks

7.3.1 Portable refillable tanks or containers shall be supplied with this equipment and must be labeled "HFC-134a" or "CFC-12" as appropriate, meet applicable Department of Transportation (DOT) CFR, Section 173.304 or UL 1963 Standards, and be adaptable to existing refrigerant service and charging equipment.

7.3.2 The cylinder valve shall comply with the Standard for Cylinder Valves, UL 1769.

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

7.3.4 The tank assembly shall be marked to indicate the first retest date, which shall be 5 years after the date of manufacture. The marking shall indicate that retest must be performed every subsequent 5 years. The marking shall be in letters at least 6 mm high.

7.4 Overfill Protection

7.4.1 During operation, the equipment must provide overfill protection to assure that during filling or transfer, the tank or storage container cannot exceed 80% of volume at 21.1 °C of its maximum rating as defined by DOT standards, CFR Title 49 Part/Section 173.304 and American—Society of Mechanical Engineers.

7.5 Hoses and Connections

7.5.1 Separate inlet and outlet hoses with fittings and separate connections shall be provided for each refrigerant circuit.

7.5.2 All flexible hoses and fittings must meet SAE J2196 (for R12) and SAE J2197 (for R134a).

7.5.3 Service hoses must have shutoff devices located within 30 cm of the connection point to the system being serviced.

7.6 Lubricant Separation

7.6.1 The equipment must be able to separate the lubricant from the removed refrigerant and accurately indicate the amount of lubricant removed during the process, in 30 mL (1 fl oz) units. Refrigerant dissolves in lubricants and, as a result, increases the volume of the recovered lubricant sample. This creates the illusion that more lubricant has been recovered than actually has been. The equipment lubricant measuring system must take into account such dissolved refrigerant removed from the A/C system being serviced to prevent overcharging the vehicle system with lubricant.

NOTE—Use only new lubricant to replace the amount removed during the recycling process. Used lubricant should be discarded per applicable federal, state, and local requirements.

7.6.2 The equipment must be provided with some means, such as a lockout device, which will prevent initiation of the recovery operation after switching to the other refrigerant, if the lubricant has not been drained from the oil separator.

8. ***Testing—***Equipment shall be tested in sequence as noted in 8.1, 8.2, and 9.2. The filter/dryer may be replaced only as noted by 4.6.2.

8.1 R12 Recycling Cycle

8.1.1 The maximum operating pressure of the equipment shall be determined when recycling R12 while conducting the following tests. This pressure is needed for the Seat Leakage Test, 4.2.

8.1.2 The equipment must be preconditioned with 13.6 kg of the standard contaminated R12 (see 8.1.2.1) at an ambient of 21 °C before starting the test cycle. Sample amounts shall be 1.13 kg with sample amounts to be repeated every 5 min. The sample method fixture, defined in Figure 1, shall be operated at 21 °C.

8.1.2.1 Standard contaminated R12 refrigerant shall consist of liquid R12 with 100 ppm (by weight) moisture at 21 °C and 45 000 ppm (by weight) mineral oil 525 suspension viscosity nominal and 770 ppm by weight of noncondensable gases (air).

8.1.3 The high moisture contaminated sample shall consist of R12 vapor with 1000 ppm (by weight) moisture.

8.1.4 The high oil contaminated sample shall consist of R12 with 200 000 ppm (by weight) mineral oil 525 suspension viscosity nominal.

8.1.5 After preconditioning as stated in 8.1.2, the test cycle is started, processing the following contaminated samples through the equipment.

a. 13.6 kg (1.13 kg per batch) of standard contaminated R12
b. 1 kg of high oil contaminated R12
c. 4.5 kg (1.13 kg per batch) of standard contaminated R12
d. 1 kg of high moisture contaminated R12

8.1.6 The R12 is to be cleaned to the minimum purity level, as defined in SAE J1991, with the equipment operating at each stable ambient of 10, 21, and 49 °C and processing the samples as defined in 8.1.5.

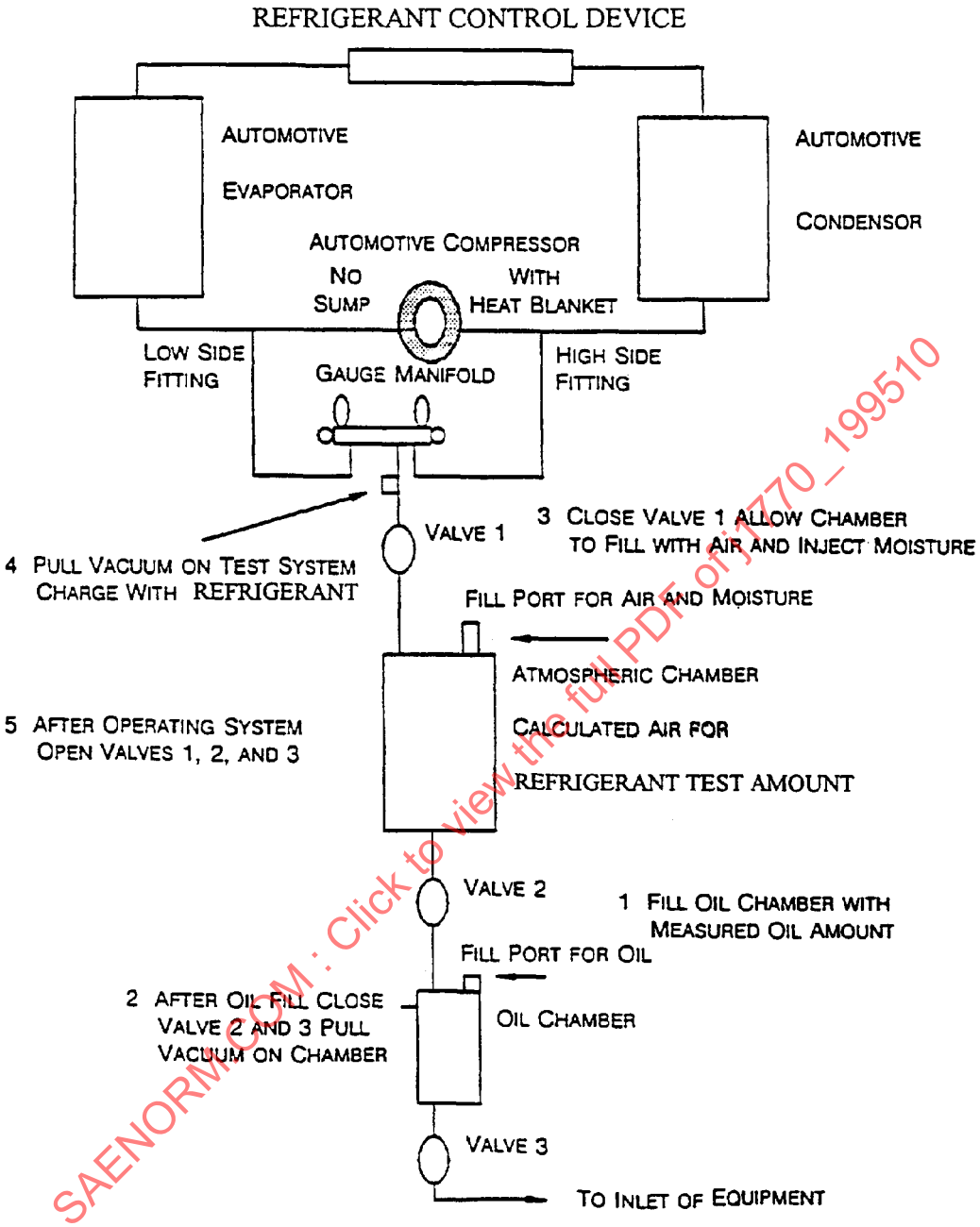

FIGURE 1—TEST FIXTURE

8.2 R134a Recycling Cycle

8.2.1 The maximum operating pressure of the equipment shall be determined when recycling R134a while conducting the following tests. This pressure is needed for the Seat Leakage Test, 4.2.

8.2.2 The equipment must be preconditioned by processing 13.6 kg of the standard contaminated R134a (see 8.2.2.1) at an ambient of 21 °C before starting the test cycle. 1.13 kg samples are to be processed at 5 min intervals. The test fixture shown in Figure 1 shall be operated at 21 °C.

8.2.2.1 The standard contaminated refrigerant shall consist of liquid R134a with 1300 ppm (by weight) moisture (equivalent to saturation at 38 °C [100 °F]), 45 000 ppm (by weight) R134a compatible lubricant, and 1000 ppm (by weight) of noncondensables gases (air).

8.2.2.2 The R134a compatible lubricant referred to in 8.2.2.1 shall be a polyalkylene glycol based synthetic lubricant or equivalent, which shall contain no more than 1000 ppm by weight of moisture.

8.2.3 Following the preconditioning procedure per 8.2.2, 18.2 kg of standard contaminated R134a are to be processed by the equipment at each stable ambient of 10, 21, and 49 °C.

8.2.4 The R134a is to be cleaned to the purity level, as defined in SAE J2099.

9. Refrigerant Cross Contamination Test

9.1 General

9.1.1 For test validation, the equipment is to be operated according to the manufacturer's instruction.

9.1.2 The equipment shall clean the contaminated R12 refrigerant to the minimum purity level as defined in SAE J1991, when tested in accordance with the requirements in 8.1.

9.1.3 The equipment shall clean the contaminated R134a refrigerant to the purity level defined in SAE J2099, when tested in accordance with the requirements in 8.2.

9.2 Test Cycle

9.2.1 The following method shall be used after the tests and requirements in 8.1 and 8.2, respectively, are completed. Following the manufacturer's instructions, the equipment shall be cleared of 134a, prior to beginning step a. The only refrigerant used for this is noted in steps a, c, and e. The test fixture shown in Figure 1 shall be used and the test shall be conducted at each stable ambient of 10, 21, and 49 °C.

a. A 1.13 kg standard contaminated sample of R12 shall be processed by the equipment.
b. Follow manufacturer's instructions to clear the equipment of R12 before processing R134a.
c. Process a 1.13 kg, standard contaminated sample of R134a through the equipment.
d. Follow manufacturer's instructions to clear the equipment of R134a before processing R12.
e. Process a 1.13 kg standard contaminated sample of R12 through the equipment.
f. Follow manufacturer's instructions to clear the equipment of R12.
g. The amount of cross contaminated refrigerant, as determined by gas chromatography, in samples processed during steps c and e shall not exceed 0.5% by weight.

10. Sample Analysis

10.1 General

10.1.1 The processed contaminated samples shall be analyzed according to the following procedure.

10.2 Quantitative Determination of Moisture

10.2.1 The recycled liquid phase sample of refrigerant shall be analyzed for moisture content via Karl Fischer coulometer titration or an equivalent method. The Karl Fischer apparatus is an instrument for precise determination of small amounts of water dissolved in liquid and/or gas samples.