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INTERNATIONAL
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SURFACE VEHICLE STANDARD

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

Foreword—The purpose of this SAE Standard is to establish the specific minimum equipment requirements for the recycling of HFC-134a (R-134a) that has been directly removed from, and is intended for reuse in, mobile air-conditioning (A/C) systems. Establishing such specifications will assure that system operation with recycled HFC-134a (R-134a) will provide the same level of performance and durability as new refrigerant.

1. Scope—The purpose of this SAE Standard is to establish the specific minimum equipment requirements for recycling HFC-134a (R-134a) that has been directly removed from, and is intended for reuse in, mobile air-conditioning (A/C) systems.

2. References

2.1 Applicable Publications—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, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J639—Safety and Containment of Refrigerant for Mechanical Compression Systems Used for Mobile Air-Conditioning Systems
SAE J1771—Criteria for Refrigerant Identification Equipment for Use with Mobile Air-Conditioning Systems
SAE J2099—Standard of Purity for Recycled HFC-134a (R-134a) for Use in Mobile Air-Conditioning Systems
SAE J2196—Service Hoses for Automotive Air-Conditioning
SAE J2197—Service Hose Fittings for Automotive Air-Conditioning
SAE J2296—Retest of Refrigerant Container

2.1.2 CGA PUBLICATIONS—Available from CGA, Crystal Square #2, Jefferson Davis Highway, Arlington, VA 22202-4102.

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

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

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

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

UL 1769—Cylinder Valves
UL 1963—Refrigerant Recovery/Recycling Equipment

3. Specification and General Description

3.1 The equipment must 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 ambients from 10 to 49 °C.

3.3 The equipment must be certified that it meets this specification by Underwriters Laboratories (UL) or an equivalent EPA listed certifying laboratory.

3.4 The equipment shall have a label which states "Design Certified by (Certifying Agent) to Meet SAE J2210" in bold-type letters a minimum of 3 mm in height.

4. Refrigerant Recycling Equipment Requirements

4.1 Moisture and Acid—The equipment shall incorporate a desiccant package that must 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 moisture detection means that is reliable, visible, and indicates when moisture in the HFC-134a (R-134a) reaches the allowable limit and desiccant replacement is required.

4.2 Filter—The equipment shall incorporate an in-line filter that will trap particulates of 15 micron spherical diameter or greater.

4.3 Noncondensable Gases

4.3.1 The equipment shall either automatically purge noncondensables (NCGs) if the acceptable level is exceeded or incorporate a device that indicates to the operator that the NCG level has been exceeded. 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.

4.3.1.1 Pressure gauges that are used to identify NCG level shall have readable divisions of 7 kPa values in order to identify the level of excess NCGs in the refrigerant.

4.3.1.2 Equipment that use 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 NCG remaining in the container that has been purged. The procedure shall be identified in the instruction manual provided with the recycling equipment.

4.3.1.3 Equipment with automatic noncondensable (NCG) purge and manual purge shall not combine the refrigerant recycling operation with some other equipment operation (e.g., Recovery) unless a method to indicate that the recycled refrigerant has been processed and meets the specificaiton in SAE J2099 before it can be charged into the mobile A/C system.

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

4.4 Recharging and Transfer of Recycled Refrigerant—Recycled refrigerant for recharging and transfer shall be taken from the liquid phase only.

5. Safety Requirements

5.1 The equipment must comply with applicable federal, state, and local requirements on equipment related to handling HFC-134a (R-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 HFC-134a (R-134a) has been shown to be nonflammable at ambient temperature and atmospheric pressure. However, tests under controlled conditions have indicated that, at pressures above atmospheric and with air concentrations greater than 60% by volume, HFC-134a (R-134a) can form combustible mixtures. While it is recognized that an ignition source is also required for combustion to occur, the presence of combustible mixtures is a potentially dangerous situation and should be avoided.

5.3 Under NO CIRCUMSTANCES should any equipment be pressure tested or leak tested with air/HFC-134a (R-134a) mixtures. Do not use compressed air (shop air) or leak detection in HFC-134a (R-134a) systems.

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 Recovery/recycle equipment having refrigerant identification equipment shall meet the requirements of SAE J1771.

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 equipment's container.

6.2 The equipment manufacturer must provide operating instructions, including proper attainment of vehicle system vacuum (i.e., when to stop the extraction process), filter/desiccant replacement, and purging of noncondensable gases (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 preventing the addition of excess air, due to leaks, during the recovery process, increasing the NCG level in the recovered refrigerant.

6.3 The equipment must 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.

7. Functional Description

7.1 The equipment must be capable of ensuring removal of refrigerant from the system being serviced by reducing the system pressure to a minimum of 102 mm (4 in) of Mercury below atmospheric pressure (i.e., vacuum).

7.2 During 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 Department of Transportation (DOT) Standard, CFR Title 49, Section 173.304 and the American Society of Mechanical Engineers.

7.3 Portable refillable tanks or containers used in conjunction with this equipment must be labeled "HFC-134a (R-134a)," meet applicable Department of Transportation (DOT) or Underwriters Laboratories (UL) Standards, and shall incorporate fittings per SAE J2197.

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

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

7.3.3 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. SAE J2296 provides an inspection procedure. The marking shall be in letters at least 6 mm high.

7.4 All flexible hoses must comply with SAE J2196.

7.5 Service hoses must have shutoff devices located within 30 cm of the connection point to the system being serviced as identified in SAE J2196. All service fittings must comply with SAE J2197.

7.6 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 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 to prevent overcharging the vehicle system with lubricant.

7.6.1 This statement shall be predominately identified in the equipment service manual.

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.

8. ***Testing*****—**This test procedure and its requirements are to be used to determine the ability of the recycling equipment to adequately recycle contaminated refrigerant.

8.1 The equipment shall be able to clean the contaminated refrigerant in 8.3 to the purity level defined in SAE J2099.

8.2 The equipment shall be operated in accordance with the manufacturer's operating instructions.

8.3 Contaminated HFC-134a (R-134a) Sample

8.3.1 The standard contaminated refrigerant shall consist of liquid HFC-134a (R-134a) with 1300 ppm (by weight) moisture (equivalent to saturation at 38 °C), 45 000 ppm (by weight) HFC-134a (R-134a) compatible lubricant, and 1000 ppm (by weight) of noncondensable gases (air).

8.3.1.1 The HFC-134a compatible lubricant referred to in 8.3.1, shall be polyalkylenme glycol (PAG, ISO 100 vis), such as Union Carbide, or equivalent, which shall contain no more than 1000 ppm by weight of moisture.

8.4 Test Cycle

8.4.1 The equipment must be preconditioned by processing 13.6 kg of the standard contaminated HFC-134a (R-134a) 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, depicted in Figure 1, shall be operated at 24 °C.

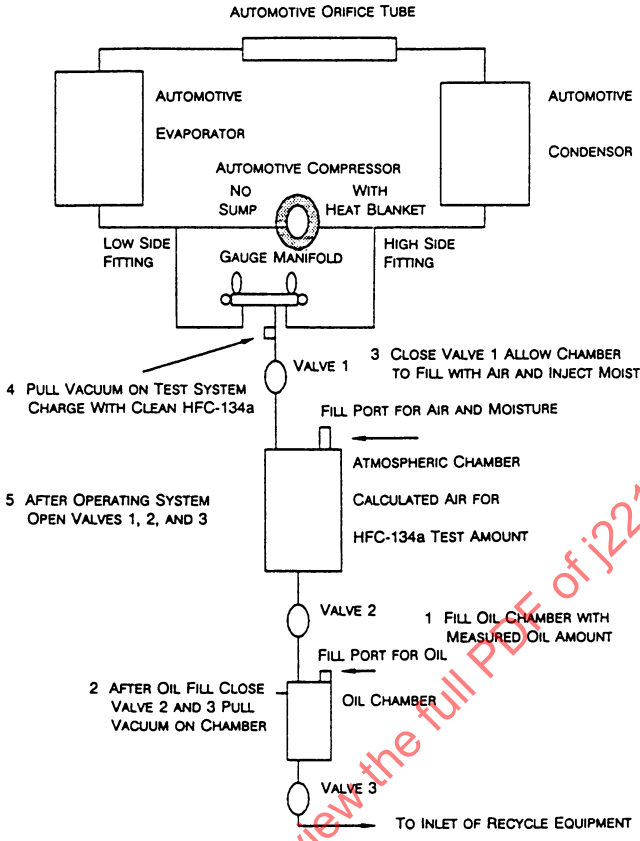

FIGURE 1—TEST FIXTURE

8.4.2 Following the preconditioning procedure per 8.4.1, 18.2 kg of standard contaminated HFC-134a (R-134a) are to be processed by the equipment.

8.5 Sample Requirements

8.5.1 Samples of the standard contaminated refrigerant from 8.3.1 shall be processed as required in 8.6 and shall be analyzed after said processing as defined in 8.7, 8.8, and 8.9. Note exception for noncondensable gas determination in 8.9.4.

8.6 Equipment Operating Ambient

8.6.1 The HFC-134a (R-134a) is to be cleaned to the purity level, as defined in SAE J2099, with the equipment operating in a stable ambient of 10, 21, and 49 °C while processing the samples as defined in 8.4.

8.7 Quantitative Determination of Moisture

8.7.1 The recycled liquid phase sample of HFC-134a (R-134a) shall be analyzed for moisture content via Karl Fischer coulometric 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.