The Engineering Society For Advancing Mobility Land Sea Air and Space®
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HIGHWAY VEHICLE RECOMMENDED PRACTICE

Submitted for recognition as an American National Standard

SAE J1990

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EXTRACTION AND RECYCLE EQUIPMENT FOR MOBILE AUTOMOTIVE AIR-CONDITIONING SYSTEMS

FOREWORD: Due to the CFC's damaging effect on the ozone layer, recycle of CFC-12 (R-12) used in mobile air-conditioning systems is required to replace system venting during normal service operations. Establishing recycle specifications for R-12 will assure that system operation with recycled R-12 will provide the same level of performance as new refrigerant.

Extensive field testing with the EPA and the auto industry indicates that R-12 can be reused, provided that it is cleaned to specifications in SAE J1991. The purpose of this document is to establish the specific minimum equipment specifications required for recycle of R-12 that has been directly removed from mobile systems for reuse in mobile automotive air-conditioning systems.

1. SCOPE:

The purpose of this document is to provide equipment specifications for CFC-12 (R-12) recycling and/or recovery, and recharging systems. This information applies to equipment used to service automobiles, light trucks, and other vehicles with similar CFC-12 systems. Systems used on mobile vehicles for refrigerated cargo that have hermetically sealed systems are not covered in this document.

2. REFERENCES:

SAE J51, Automotive Air-Conditioning Hose

SAE J1991, Standard of Purity for Use in Mobile Air-Conditioning Systems

UL 1963 Section 40 Tests Service Hoses for Refrigerant-12 (Underwriters Laboratories)

Pressure Relief Device Standard Part 1 - Cylinders for Compressed Gases, LGA Pamphlet S-1.1

3. SPECIFICATION AND GENERAL DESCRIPTION:

3.1 The equipment must be able to extract and process R-12 from mobile air-conditioning systems to purity levels specified in SAE J1991.

3.2 The equipment shall be suitable for use in an automotive service garage environment as defined in 7.8.

3.3 The equipment must be certified by Underwriters Laboratories or an equivalent certifying laboratory.

4. REFRIGERATION RECYCLE EQUIPMENT REQUIREMENTS:

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

4.1.1 The equipment shall be provided with a moisture detection means that will reliably indicate when moisture in the R-12 exceeds the allowable level and requires the filter/dryer replacement.

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

4.3 Noncondensable Gas:

4.3.1 If the equipment has a self-contained recovery tank, a device is required to alert the operator that the noncondensable level has been exceeded.

4.3.2 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 the handling of R-12 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. OPERATING INSTRUCTIONS:

6.1 The equipment manufacturer must provide operating instructions, necessary maintenance procedures, and source information for replacement parts and repair.

6.2 The equipment must prominently display the manufacturer's name, address 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.

7. FUNCTIONAL DESCRIPTION:

7.1 The equipment must be capable of ensuring recovery of the R-12 from the system being serviced, by reducing the system to a vacuum.

7.2 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 Portable refillable tanks or containers used in conjunction with this equipment must meet applicable Department of Transportation (DOT) or Underwriters Laboratories (UL) Standards and be adaptable to existing refrigerant service and charging equipment.

7.4 During the recovery and/or recycle, the equipment must provide overfill protection to assure that during filling or transfer, the tank or storage container cannot exceed 80% of volume at 70°F (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.

7.4.1 Additional Storage Tank Requirements:

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

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

7.4.1.3 The tank assembly shall be marked to indicate the first retest date, which shall be 5 years after date of manufacture. The marking shall indicate that retest must be performed every subsequent 5 years. The marking shall be in letters at least 1/4 in high.

7.5 All flexible hoses must meet SAE J51 or UL 1963 Section 40.

7.6 Service hoses must have shutoff devices located within 12 in (30 cm) of the connection point to the system being serviced to minimize introduction of noncondensable gases into the recovery equipment and the release of the refrigerant when being disconnected.

7.7 The equipment must be able to separate the lubricant from recovered refrigerant and accurately indicate in 1 oz units (28 grams).

7.8 The equipment must be capable of continuous operation in ambient of 50 to 120°F (10 to 49°C).

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

8. TESTING:

This test procedure and the requirements are used for evaluation of the equipment for its ability to clean the contaminated R-12 refrigerant.

8.1 The equipment shall clean the contaminated R-12 refrigerant to the minimum purity level as defined in SAE J1991, when tested in accordance with the following conditions:

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

8.3 The equipment must be preconditioned with 30 lb (13.6 kg) of the standard contaminated R-12 at an ambient of 70°F (21°C) before starting the test cycle. Sample amounts are not to exceed 2.5 lb (1.13 kg) with sample amounts to be repeated every 5 min. The sample method fixture, defined in Fig. 1, shall be operated at 75°F (24°C).

8.4 Contaminated R-12 Samples:

8.4.1 Standard contaminated R-12 refrigerant shall consist of liquid R-12 with 100 ppm (by weight) moisture at 70°F and 45 000 ppm (by weight) mineral oil 525 suspension viscosity nominal and 770 ppm by weight of noncondensable gases (air).

8.4.2 High moisture contaminated sample shall consist of R-12 vapor with 1000 ppm (by weight) moisture.

8.4.3 High oil contaminated sample shall consist of R-12 with 200 000 ppm (by weight) mineral oil 525 suspension viscosity nominal.

8.5 Test Cycle:

8.5.1 After preconditioning as stated in 8.3, the test cycle is started, processing the following contaminated samples through the equipment:

8.5.1.1 30 lb (13.6 kg) of standard contaminated R-12.

8.5.1.2 2.2 lb (1 kg) of high oil contaminated R-12.

8.5.1.3 10 lb (4.5 kg) of standard contaminated R-12.

8.5.1.4 2.2 lb (1 kg) of high moisture contaminated R-12.

8.6 Equipment Operating Ambient:

8.6.1 The R-12 is to be cleaned to the minimum purity level, as defined in SAE J1991, with the equipment operating in a stable ambient of 50, 70, and 120°F (10, 21, and 49°C) and processing the samples as defined in 8.5.

8.7 Sample Analysis:

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

8.8 Quantitative Determination of Moisture:

8.8.1 The cleaned sample of R-12 is to be subjected to a quantitative determination of the moisture content by Karl Fischer titration.

8.8.2 The apparatus employed is a Karl Fischer coulometer, an automated instrument for precise determination of small amounts of water. The weighed sample of liquid R-12 is introduced directly into the analyte of the Karl Fischer coulometer. A coulometric titration by the instrument is conducted and the results are calculated and displayed as parts per million moisture weight.

8.9 Determination of Percent Oil:

8.9.1 The amount of oil in the cleaned sample of R-12 is to be determined by gravimetric analysis.

8.9.2 A weighed 100 mL sample of the liquid R-12 is placed in a preweighted graduated Goetz phosphorous tube of 100 mL nominal capacity. The sample and containing tube are maintained in ambient air at a minimum temperature of 90°F (32°C) above the expected boiling point of the refrigerant. When 85 mL of the sample has evaporated, the tube is then immersed in a refrigerated brine bath at a temperature of 50°F (10°C) above the boiling point of the sample for 30 min. The residual sample, if any, is allowed to reach room temperature. The tube is reweighed and the percent of oil is calculated.

8.10 Noncondensable Gas:

8.10.1 The sample is to be analyzed using gas chromatography to determine the noncondensable gas content. The cleaned refrigerant is to be sampled in the liquid phase through a closed loop or by an airtight syringe into the injector.

8.11 Sample Requirements:

8.11.1 The sample shall be tested as defined in 8.7, 8.8, 8.9, and 8.10 at ambient temperatures of 50, 70, and 120°F (10, 21, and 49°C) as defined in 8.6.1.

9. DATE OF EFFECTIVENESS:

This recommended practice will become a standard after one year.