

Submitted for recognition as an American National Standard

Recommended Service Procedure for the Containment of HFC-134a (R-134a)

1. **Scope**—Refrigerant containment is an important part of servicing mobile air-conditioning (A/C) systems. This procedure provides guidelines for technicians for servicing mobile A/C systems and operating refrigerant recycling equipment designed for HFC-134a (R-134a) (described in SAE J2210).
2. **References HFC-134a (R-134a)**
 - 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 J639—Safety and Containment of Refrigerant for Mechanical Vapor Compression Systems Used for Mobile Air-Conditioning Systems
 - SAE J1732—HFC-134a (R-134a) Refrigerant Recovery Equipment for Mobile Automotive 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 Mobile Air-Conditioning Systems
 - SAE J2197—Service Hose Fittings for Automotive Air Conditioning
 - SAE J2210—Refrigerant Recycling Equipment for HFC-134a (R-134a) Mobile Air-Conditioning Systems
3. **Definitions**
 - 3.1 **Recovery/Recycling Unit**—Refers to a single piece of equipment that performs both functions of recovery and recycling of refrigerants per SAE J2210.
 - 3.2 **Recovery**—Refers to that portion of the recover unit operation that removes the refrigerant from the mobile A/C system and places it in the recover unit storage container per SAE J1732.
 - 3.3 **Recycling**—Refers to that portion of the recycling unit operation that processes the refrigerant for reuse on the same job site to the purity specifications of SAE J2099.

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4. Service Procedure

- 4.1** It is important that before attempting to remove refrigerant from the mobile A/C system that a determination be made to identify the refrigerant in the system. Since the A/C system may contain another refrigerant, a combination of refrigerants or excess noncondensables (NCG) to prevent contamination of the refrigerant in the recovery/recycle equipment shall be identified. Use of refrigerant identification equipment certified to SAE J1771 should be used to determine what refrigerant is in the mobile A/C system about to be recovered.
- 4.2** Connect the recovery/recycling or recovery unit services hoses, which shall have shutoff devices (e.g., valves, quick couples) within 50 cm of the services ends, to the vehicle A/C service port per SAE J639. Hoses shall conform to SAE J2196 and fittings shall conform to SAE J2197.
- 4.3** Operate the recovery/recycling or recovery equipment as recommended by the equipment manufacturer's procedure.
- 4.3.1** Verify that the vehicle A/C system has refrigerant pressure. Should the recovery equipment indicate that the A/C system does not have pressure, do not attempt to process the discharged system as this will introduce air (noncondensable gas) into the recovery/recycling equipment which must later be removed.
- 4.3.2** Begin the recycling process by removing the refrigerant from the vehicle A/C system. Continue the process until the system pressure has been reduced to a minimum of 102 mm of Mercury below atmospheric pressure (vacuum). If A/C components show evidence of icing, the component can be gently heated to facilitate refrigerant removal. With the recycling unit shut off for at least 5 min, unless the equipment has a device that assures there is no remaining refrigerant, check A/C system pressure. If this pressure has risen above vacuum (0 kPa), additional recovery operation is required to remove the remaining refrigerant. Repeat the operation until the system pressure remains stable at vacuum for 2 min.
- 4.3.3** Caution shall be taken to assure that the seal on all service hose connections be in good condition. Cut seals and leaking service hoses will cause the recovery equipment to draw air into the unit. These leaks, as well as, a leak in the mobile A/C system being serviced may result in the automatic shut off device in the recovery unit not to function properly. By allowing the recovery equipment to draw air from these leaks will result in excess noncondensables (NCG) air being mixed with the recovered refrigerant. The excess noncondensables (NCG) is difficult to remove from the refrigerant and will result in pressures higher than normal in the recovery/recycle equipment.
- 4.4** Close the valves in the service lines and then remove the service lines from the vehicle system. If the recovery equipment has automatic closing valves (quick couples), be sure they are operating properly. Proceed with the repair/service.
- 4.5** Upon completion of refrigerant removal from the A/C system, determine the amount of lubricant removed during the process and replenish the system with new lubricant, which is identified on the A/C system label. Used lubricant should be discarded per applicable federal, state, and local requirements.

5. Service with a Manifold Gauge Set

- 5.1** High-side, low-side, and center service hoses must have shutoff devices (e.g., valves) within 30 cm of the service ends. Valves must be closed prior to hose removal from the A/C system to prevent refrigerant loss to the atmosphere.
- 5.2** During all service operations, service hose valves should be closed until connected to the vehicle A/C system or to the charging source to exclude air and/or contain the refrigerant.

5.3 When the manifold gauge set is disconnected from the A/C system, or when the service hose is moved to another device that cannot accept refrigerant pressure, the gauge set hoses should be attached to the recycling equipment to recover the refrigerant from the hoses.

6. Supplemental Refrigerant Checking Procedure for Stored Portable Containers

6.1 Certified recycling equipment and the accompanying recycling procedure, when properly followed, will deliver use-ready refrigerant. In the event that the full recycling procedure was not followed or the technician is unsure about the noncondensable gas content of a given tank of refrigerant, a second complete recycling process must be performed.

6.1.1 Since refrigerant contamination can occur from many sources, it is important that the recycled HFC-134a (R-134a) refrigerant not be contaminated. HFC-134a (R-134a) refrigerant with contamination of over 2 to 3% by weight (7 to 8% by volume) can cause many different problems if reused in the mobile A/C system. Depending upon the type and amount of contamination, mobile A/C system cooling performance can be affected including improper refrigerant control calibration, higher operating pressures and chemical reactions.

6.1.2 To determine if a container of HFC-134a (R-134a) refrigerant is contaminated, it should be checked by using a SAE J1771 certified refrigerant identifier.

6.1.3 If a refrigerant identifier is not available, the use of a pressure gauge with readable divisions of 7 kPa can provide some guidance if the container of refrigerant is contaminated. This procedure cannot be used on a mobile A/C system since it is very difficult to be assured that all the A/C system refrigerant parts are at the same temperature. If the container pressure exceeds the recommended pressure/temperature indicated on Tables 1 and 2, it may not only contain excess air, but may contain a mixture of other refrigerants.

Since identification of contaminated refrigerant by the pressure/temperature procedure is not reliable, this procedure should be used with caution when determining if the recycled refrigerant container meets the specification for noncondensable gases (air).

NOTE—The use of refrigerant with excess air will result in higher system operating pressures and may cause A/C system damage.

6.2 The container must be stored at a temperature of 18 °C or above for at least 12 h, protected from direct sunlight.

6.3 Install a calibrated pressure gauge, with 7 kPa divisions, on the container and read container pressure.

6.4 Attach a temperature-measuring device to the lower one half of the refrigerant container surface so that an indication of the temperature inside can be identified. The use of only the air temperature surrounding the refrigerant container can result in incorrect refrigerant temperature information. For example, a container located on a concrete or other surface, the refrigerant can be colder than the air temperature, which can result in an incorrect reading.

6.5 Compare the observed container pressure and container surface temperature to the values given in Tables 1 (Metric) or 2 (English) to determine whether the container pressure is below the pressure limit. For example, at a container surface temperature of 21 °C or 70 °F, the container pressure must not exceed 524 kPa or 76 psig.

TABLE 1—HFC-134a (R-134a) REFRIGERANT—MAXIMUM ALLOWABLE CONTAINER PRESSURE (METRIC)

Temp, C	kPa						
18	476	26	621	34	793	42	1007
19	483	27	642	35	814	43	1027
20	503	28	655	36	841	44	1055
21	524	29	676	37	876	45	1089
22	545	30	703	38	889	46	1124
23	552	31	724	39	917	47	1158
24	572	32	752	40	945	48	1179
25	593	33	765	41	979	49	1214

TABLE 2—HFC-134a (R-134a) REFRIGERANT MAXIMUM ALLOWABLE CONTAINER PRESSURE (ENGLISH)

Temp, F	psig						
65	69	79	90	93	115	107	144
66	70	80	91	94	117	108	146
67	71	81	93	95	118	109	149
68	73	82	95	96	120	110	151
69	74	83	96	97	122	111	153
70	76	84	98	98	125	112	156
71	77	85	100	99	127	113	158
72	79	86	102	100	129	114	160
73	80	87	103	101	131	115	163
74	82	88	105	102	133	116	165
75	83	89	107	103	135	117	168
76	85	90	109	104	137	118	171
77	86	91	111	105	139	119	173
78	88	92	113	106	142	120	176

- 6.6** If the refrigerant in the container has been recycled and the container pressure is less than the limit in Table 1 or 2, the refrigerant may be used.
- 6.7** If the refrigerant in the container has been recycled and the container pressure exceeds the limit in Table 1 or 2, there may be a possibility that the refrigerant is contaminated and unusable.
- 6.8** The pressure/temperature relationships found in Table 3 compares different HFC-134a (R-134a) refrigerant contamination amounts due to air or CFC-12 (R-12) refrigerant.

**TABLE 3—(ENGLISH) HFC-134a (R-134a) REFRIGERANT PRESSURE (PSIG) WITH
CFC-12 (R-12) CONTAMINATION %
PERCENT BY WEIGHT
ESTIMATED CONTAMINATED PRESSURE ±2%**

Temp °F	Pure HFC-134a (R-134a) psig	Max NCG psig	2% CFC-12 (R-12) psig	5% CFC-12 (R-12) psig	10% CFC-12 (R-12) psig	25% CFC-12 (R-12) psig	50% CFC-12 (R-12) psig
65	64	69	67	70	73	78	84
70	71	76	74	77	81	87	93
75	79	83	83	85	89	96	102
80	87	91	92	95	98	105	111
85	95	100	100	103	106	114	120
90	104	109	109	112	116	125	131
95	114	118	119	122	126	135	142
100	124	129	130	133	136	145	151
105	135	139	141	144	149	159	166
110	146	151	152	157	161	173	177
115	158	163	163	168	175	184	193
120	171	176	176	181	187	196	205

6.8.1 If it has been determined that the container only contains HFC-134a (R-134a) refrigerant and excess air (NCG's) slowly vent, from the top of the container, a small amount of vapor into the recycle equipment until the pressure is less than the pressure shown in Table 1 or 2.

6.8.1.1 Caution should be taken to not vent the container too rapidly since the refrigerant in the container will become cooler during the venting process. This temperature change can be noted by observing the container surface temperature as required in 6.4.

6.9 If, after shaking the container and letting it stand for a few minutes, the container pressure still exceeds the pressure limit shown in Table 1 or 2, the entire contents of the container shall be recycled or reclaimed.

7. Containers for Storage of Recycled Refrigerant

7.1 Recycled refrigerant, for safety, should not be salvaged or stored in disposable containers (this is one common type of container in which new refrigerant is sold). Use only DOT CFR Title 49 or UL approved storage containers, specifically marked for HFC-134a (R-134a), for recycled refrigerant.

7.2 Any container of recycled refrigerant that has been stored or transferred must be checked prior to use as defined in Section 6.

8. Transfer of Recycled Refrigerant

8.1 When external portable containers are used for transfer of refrigerant, the container must be evacuated to at least 635 mm below atmospheric pressure (vacuum) prior to transfer of the recycled refrigerant to the container.

External portable containers must meet DOT and UL standards.

8.2 To prevent on-site overfilling when transferring to external containers, the safe filling level must be controlled by weight and must not exceed 60% of the container gross weight rating.