OVERVIEW OF THE CLEAN AIR ACT AMENDMENTS OF 1990

In response to increase scientific evidence of significant ozone depletion, the land mark international environmental agreement, the Montreal Protocol on Substances that Delete the Ozone Layer, was signed in September 1987. The original Protocol called for 50 percent reduction in CFC's by the year 1998. The discovery of seasonal "ozone hole" over Antarctica highlighted the need for more stringent measures. In June 1990, the Protocol was amended to comply phaseout production CFC's halons (used in fire extinguisher by the year 2000. In November 1992, in response to scientific findings indicted that ozone depletion was more severe than anticipated, the parties to the Montreal Protocol voted to accelerate the phaseout to the end of 1995. Currently, 132 nations, representing over 95 percent of the worlds consumption of CFC's are parties to the Protocol.

In addition to the phase out of ozone-depleting substances, title VI includes provisions to reduce emissions of all ozone-depleting substances. Section 608 contains requirements for a "lowest achievable level" of emissions of the controlled substances during use and disposal of appliances and industrial process refrigeration and bans on intentional venting at services and disposal. The requirements for auto technicians and the regulations they must follow when servicing an A/C unit are in Section 609 of the Act.

Section 609 of the Clean Air Act of 1990 establishes an important new statutory structure to control the release of refrigerants from motor vehicle air conditioners into the atmosphere. After January 1, 1992, any person repairing or servicing motor vehicle air conditioners for consideration must properly use refrigerant recycling equipment that has been approved by the EPA. All such persons must be properly trained and certified.

To obtain your certification, you must read and study the following booklet, including completing the test at the end of the booklet. The test will consist of 25 questions, and will be on the material covered in the booklet. You cannot miss more than five questions to pass. Should you have questions about the booklet, please call the Greater Cleveland Automobile Dealers' Association (328-1500).

WHAT IS THE OZONE

Ozone is formed when ultraviolet radiation from the sun reacts with oxygen molecules which causes them to split apart into two oxygen atoms. These separated atoms then combine with other oxygen molecules (O2) to form ozone (O3), which contains a total of three oxygen atoms. Ozone is a pungent gas that has a close chemical relationship to molecular oxygen. About 90 percent of the earth's ozone is located in a layer far above the earth's surface in a region known as the stratosphere. This natural layer acts as a shield against ultraviolet radiation. Concern about possible depletion of the ozone layer from CFC's was first raised in 1974 with publication of research which theorized that chlorine released from CFC's could migrate to the stratosphere and destroy ozone molecules. (Molina and Rowland, 1974). Some of the CFC's have an atmospheric lifetime of more than 120 years and as a result, they rise slowly to the stratosphere where the Suns radiation strikes them, releasing chlorine. Once freed, the chlorine acts as a catalyst repeatedly combining with and breaking apart ozone molecules. If ozone depletion occurs, more UV radiation penetrates the earth's surface. Moreover, because of the long atmospheric lifetimes of CFC's, it would take many decades for the ozone layer to return to past concentrations.

HOW IT EFFECTS THE ENVIRONMENT

The ozone layer shielding the earth from much of the damaging part of the sun's radiation and is a critical resource safeguarding life on this planet. Should the ozone layer be depleted, more of the sun's damaging rays would penetrate to the earth's surface. It is believed that for each one percent depletion exposure to damaging ultraviolet radiation would increase by 1.5 to 2 percent. The Environmental Protection Agency's (EPA) assessment of the risks from ozone depletion focused on the following areas:

***Increases in skin cancers**
***Suppression of the human immune response system**
***Increases in cataracts**
***Damage to crops**
***Damage to aquatic organisms**
***Increases in ground level ozone**
***Increased global warming**

HOW IT EFFECTS THE HUMAN HEALTH

Under current atmospheric conditions, the greater the distance from the equator, the greater the effectiveness of the ozone layer as a shield. As a result, people who live further north are exposed to less damaging UV radiation than those residing closer to the equator. Not surprisingly, the chances of getting skin cancer follow the same gradient; the closer to the equator, the greater the risk. Three distinct types of the skin cancer would increase if the ozone layer is depleted. Basal and squamous cell skin cancers, the two most common types, affect about 500,000 people annually in the United States alone. If detected early, these cancers are treatable. Even so, approximately 1 percent of cases result in premature deaths. Malignant melanoma is far less common but substantially more harmful. About 25,000 cases now occur annually resulting in 5,000 deaths. Cataracts cloud the lens of the eye, thus limiting vision. Although cataracts develop for a variety of reasons, scientific evidence supports the conclusion that increased exposure to UV radiation would increase the number of people experiencing this eye disorder. Based on epidemiological studies, if current trends in the use of ozone depleting gases continued, the number of

cataract cases would increase by 16 million (for the population alive today or born before 2075). Suppression of the immune system is another possible threat to human health resulting from ozone depletion.

HOW IT EFFECTS PLANT & MARINE LIFE

Crop and other land based ecosystems could also be adversely affected by increased exposure to UV radiation. In studies of the greenhouse effect, approximately 65 percent of the crops exposed to elevated levels of UV radiation proved sensitive. Certain marine organisms, particularly phytoplankton, may be sensitive to increased exposure to UV radiation because they spend much their existence near the surface of the water.

Other Considerations:

Ground Level Ozone - Ozone depletion in the stratosphere would increase the rate of formation of ground level (tropospheric) ozone, due to higher levels of UV radiation, a major component of what is commonly called smog.

Degradation of Polymers - Ozone depletion would accelerate the breakdown (i.e. chalking, yellowing, and cracking) of plastics used in outdoor applications.

Climatic Changes - CFC's are greenhouse gases and thus would contribute to global warming and rising sea levels.

THE GLOBAL CONCERN ON THE OZONE

Unlike other environmental issues, stratospheric ozone protection is a global concern. CFC's and halons are used by most industrialized nations, and, given their long atmospheric lifetimes, they become widely distributed over time. As a result, the release of these chemicals in one country could adversely affect the stratosphere and therefore the health and welfare of other countries. Many developed and developing countries produce CFC's and halons. Most use the chemicals in a variety of different products. The United States is one of the largest consumers of the world's CFC's. Other nations are also significant users. Therefore, to protect the ozone layer from the damages that may be caused by CFC's and halons, an international solution is critical.

OPTIONS OF TOPPING OFF LEAKING SYSTEM

Since Section 609 of the Federal Clean Air Act of 1990 came into affect, their has been some confusion on whether it is legal to top of a leaking air conditioning system. Although the EPA encourages, but does not mandate, leak detection and repair of air conditioners systems, it is essential that consumers realize that, in most states and localities, they have the option to top off their air conditioning systems with freon.

THE RECYCLING CONCEPT

FIELD STUDY:

Due to the serious nature of the ozone depletion issue, industry efforts were immediately directed toward determining if CFC's used in the mobile air conditioning service industry could be recycled.
During the summer of 1988, the EPA, with the support of the Mobile Air Conditioning Society (MACS) initiated a sampling program of used refrigerant from 227 vehicles from 4 regions of the country. These vehicles included properly operating systems, failed compressors, low mileage vehicles, and vehicles with over 100,000 miles. The chemical analysis of the removed refrigerant indicated a low amount of contamination. From the field study results, the task force established specifications for recycled refrigerant and requested the world auto manufacturers to approve the level of purity in December, 1988. Many automobile and truck manufacturers have accepted recycled CFC-12 for service and warranty repairs.

SYSTEM CONTAMINANTS:

Data gleaned from the field study of CFC-12 from mobile air conditioning systems identified moisture, refrigerant oil and non-condensable gases (air) as contaminants in used refrigerant that could affect system performance and life. A consensus was achieved establishing the standard of purity for recycled R-12 refrigerant. Recycled refrigerant may not contain impurities that exceed the level specified by SAE J1991:

*Moisture: 15 PPM by weight,
*Refrigerant oil: 4000 PPM by weight,
*Non-condensable gases (air): 330 PPM by weight.

STANDARDS DEVELOPED:

Based on the field study, the Society of Automotive Engineer's R-12 task force published three documents to cover the mobile air conditioning industry use of CFC's.
The documents include:

*SAE J1989: Service Procedures. (On Page 9)
*SAE J1990: Specifications for Recycling Equipment. (On Page 12)
*SAE J1991: Purity Requirement of Recycled Refrigerant. (On Page 15)

WHY WE MUST RECYCLE:

With over 65.8% of the CFC-12 used in the mobile air conditioning industry being used for service, current practices that involve venting to atmosphere can no longer be considered acceptable. This includes the addition of CFC's to systems that have leaks and are not repaired prior to recharge, and charging equipment that requires venting to fill the measuring device. Proper procedures for containment of CFC's during service and proper disposal of residual from containers prior to disposal are covered in SAE J1989. From limited information presently available, service facilities that have used recycling equipment during the summer of 1989 have realized approximately a 50% reduction in CFC-12 usage. If the sale of CFC's were limited to facilities that have trained personnel and certified recycling equipment, a major reduction of CFC usage could be attained. It is important that CFC-12 be available beyond the year 2000 to assure that vehicles produced with CFC-12 can be serviced for the life expectancy of the vehicle. Without CFC-12 for service in the time period, conversion or obsolescence of vehicles will result in a major economic impact for the owners. Although the mobile air conditioning industry is scheduled to phase in HFC-134a in the mid-1990's, CFC-12 systems will still be produced before then. With a 5 to 10 year vehicle life expectancy, CFC-12 will be required for service well beyond the year 2000. If CFC-12 is not available for service, the consumer will have to choose whether to convert to a new refrigerant, to

purchase a new vehicle with HFC-134a, or to do without air conditioning. Controlled sale of CFC's, proper repair of leaking systems, and recycling of existing CFC's are required to assure consumers the use of their air conditioning systems beyond the year 2000. With elective controls of CFC supplies and mandatory recycling at all servicing levels, the auto industry can effect a major reduction of new CFC-12 production requirements in the mid-1990's.

SAE J1989

Issued October 1989

RECOMMENDED SERVICE PROCEDURE FOR THE CONTAINMENT OF R-12

A. SCOPE: During service of mobile air-conditioning systems, containment of the refrigerant is important. This procedure provides service guidelines for technicians when repairing vehicles and operating equipment defined in SAE J1990.

B. REFERENCES: SAE J1990, Extraction and Recycle Equipment for Mobile Automotive Air-Conditioning Systems

C. REFRIGERANT RECOVERY PROCEDURE:

a- Connect the recovery unit service hoses, which shall have shut off valves within 12 inches (30 cm) of the service ends, to the vehicle air-conditioning system service ports.

b- Operate the recovery equipment as covered by the equipment manufacturers
recommended procedure.

1- Start the recovery process and remove the refrigerant from the vehicle AC system. Operate the recovery unit until the vehicle system has been reduced from a pressure to a vacuum. With the recovery unit shut off for at least 5 minutes, determine that there is no refrigerant remaining in the vehicle AC system. If the vehicle system has pressure, additional recovery operation is required to remove the remaining refrigerant. Repeat the operation until the vehicle AC system vacuum level remains stable for 2 minutes.

c- Close the valves in the service lines and then remove the service lines from the vehicle system. Proceed with the repair/service. If the recovery equipment has automatic closing valves, be sure they are properly operating.

D. SERVICE WITH MANIFOLD GAGE SET:

a- Service hoses must have shut off valves in the high, low, and center service hoses within 12 inches (30 cm) of the service ends. Valves must be closed prior to hose removal from the air-conditioning system. This will reduce the volume of refrigerant contained in the service hose that would otherwise be vented to atmosphere.

b- During all service operations, the valves should be closed until connected to the vehicle air conditioning system or the charging source to avoid introduction of air and to contain the refrigerant rather than vent open to atmosphere.

c- When the manifold gage set is disconnected from the air conditioning system, or when the center hose is moved to another device which cannot accept refrigerant pressure, the gage set hoses should first be attached to the reclaim equipment to recover the refrigerant from the hoses.

TABLE 1

TEMP F	PSIG	TEMP F	PSIG	TEMP F	PSIG	TEMP F	PSIG	TEMP F PSIG
65	74	75	87	85	102	95	118	105
	136							
66	75	76	88	86	103	96	120	106
	138							
67	76	77	90	87	105	97	122	107
	140							
68	78	78	92	88	107	98	124	108
	142							
69	79	79	94	89	108	99	125	109
	144							
70	80	80	96	90	110	100	127	110
	146							
71	82	81	98	91	111	101	129	111
	148							
72	83	82	99	92	113	102	130	112
	150							
73	84	83	100	93	115	103	132	113
	152							
74	86	84	101	94	116	104	134	114
	154							

TABLE 1 (Metric)

TEMP C	PRES	TEMP C	PRES	TEMP C	PRES	TEMP C	PRES	TEMP C PRES
18.3	5.20	23.9	6.11	29.4	7.17	35.0	8.29	40.5
	9.56							
18.8	5.27	24.4	6.18	30.0	7.24	35.5	8.43	41.1
	9.70							
19.4	5.34	25.0	6.32	30.5	7.38	36.1	8.57	41.6
	9.84							
20.0	5.48	25.5	6.46	31.1	7.52	36.6	8.71	42.2
	9.98							
20.5	5.55	26.1	6.60	31.6	7.59	37.2	8.78	42.7
	10.12							
21.1	5.62	26.6	6.74	32.2	7.73	37.7	8.92	43.3
	10.26							
21.6	5.76	27.2	6.88	32.7	7.80	38.3	9.06	43.9
	10.40							
22.2	5.83	27.7	6.95	33.3	7.94	38.8	9.13	44.4
	10.54							
22.7	5.90	28.3	7.03	33.9	8.08	39.4	9.27	45.0
	10.68							
23.3	6.04	28.9	7.10	34.4	8.15	40.0	9.42	45.5
	10.82							

PRES kg/sq cm

e- If the container pressure is less than the Table 1 values and has been recycled, limits of noncondensable gases (air) have not been exceeded and the refrigerant may be used.

f- If the pressure is greater than the range and the container contains recycled material, 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 on Table 1.

g- If the container still exceeds the pressure shown on Table 1, the entire contents of the container shall be recycled.

F. CONTAINERS FOR STORAGE OF RECYCLED REFRIGERANT:

a- Recycled refrigerant should not be salvaged or stored in disposable refrigerant containers. This is the type of container in which virgin refrigerant is sold. Use only DOT CFR Title 49 or UL approved storage containers for recycled refrigerant.

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

G. TRANSFER OF RECYCLED REFRIGERANT:

a- When external portable containers are used for transfer, the container must be evacuated to at least 27 inches of vacuum (75 mm Hg absolute pressure) prior to transfer of the recycled refrigerant. External portable containers must meet DOT and UL standards.

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

H. DISPOSAL OF EMPTY/NEAR EMPTY CONTAINERS:

a- Since all the refrigerant may not be removed from disposable refrigerant containers during normal system charging procedures, empty/near empty container contents should be reclaimed prior to disposal of the container.

b- Attach the container to the recovery unit and remove the remaining refrigerant. When the container has been reduced from a pressure to a vacuum, the container valve can be closed. The container should be marked empty and is ready for disposal.

APPLICATION:

During service of mobile air-conditioning systems, containment of the refrigerant is important. This procedure provides service guidelines for technicians when repairing vehicles and operating equipment defined in SAE J1990.

Overview of SAE J1990

EXTRACTION AND RECYCLE EQUIPMENT FOR MOBILE AUTOMOTIVE AIR-CONDITIONING SYSTEMS

A. 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.

B. 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

C. SPECIFICATION AND GENERAL DESCRIPTION

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

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

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

D. REFRIGERATION RECYCLE EQUIPMENT REQUIREMENTS:

a- 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.

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.

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

c- Noncondensable Gas:

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.

2- Transfer of Recycled Refrigerant: Recycled refrigerant, for recharging and transfer shall be taken from the liquid phase only.

E. SAFETY REQUIREMENTS:

a- 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”.

F. OPERATING INSTRUCTIONS:

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

b- 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.

G. FUNCTIONAL DESCRIPTION:

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

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

c- 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.

d- During the recovery and/or recycle, the equipment must provide over fill 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.

1- Additional Storage Tank Requirements:

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

b- The pressure relief device shall comply with the Pressure Relief Device Standard Part

c- 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.

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

f- Service hoses must have shut off devices located within 12 inches (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.

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

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

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

H. TESTING

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

a- 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:

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

c- The equipment must be preconditioned.

d- Contaminated R-12 Samples:

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).

2- High moisture contaminated sample shall consist of R-12 vapor with 1,000 ppm (by weight) moisture.

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

e- Test Cycle:

1- After preconditioning as stated in H.c, the test cycle is started, processing the following contaminated samples through the equipment:

f- Equipment Operating Ambient:

g- Sample Analysis:

h- Quantitative Determination of Moisture:

j- Determination of Percent Oil:

k- Noncondensable Gas:

l- Sample Requirements:

J. DATE OF EFFECTIVENESS:

This recommended practice will become a standard after one year.

APPLICATION:

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 which have hermetically sealed systems are not covered in this document.

Overview of SAE J1991

STANDARD OF PURITY FOR USE IN MOBILE AIR-CONDITIONING SYSTEMS

A. SCOPE: This information applies to refrigerant 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, rigid pipe are not covered in this document.

B. REFERENCES:

SAE J1989, Recommended Service procedure for the Containment of R-12

SAE J1990, Extraction and Recycle Equipment for Mobile Automotive Air-Conditioning Systems

ARI Standard 700-88

C. PURITY SPECIFICATION: The refrigerant in this document shall have been directly removed from, and intended to be returned to, a mobile air-conditioning system. The contaminants in this recycled refrigerant 12 shall be limited to moisture, refrigerant oil, and noncondensable gases, which shall not exceed the following level:

a- Moisture: 15 ppm by weight.

b- Refrigerant Oil: 4000 ppm by weight.

c- Noncondensable Gases (Air): 330 ppm by weight.

D. REFRIGERATION RECYCLE EQUIPMENT USED IN DIRECT MOBILE AIR-CONDITIONING SERVICE OPERATIONS REQUIREMENT:

a- The equipment shall meet SAE J1990, which covers additional moisture, acid, and filter requirements.

b- The equipment shall have a label indicating that it is certified to meet this document.

E. PURITY SPECIFICATION OF RECYCLED R-12 REFRIGERANT SUPPLIED IN CONTAINERS FROM OTHER RECYCLE SOURCES: Purity specification of recycled R-12 refrigerant supplied in container from other recycle sources, for service of mobile air-conditioning systems, shall meet ARI Standard 700-88 (Air Conditioning and Refrigeration Institute).

F. OPERATION OF THE RECYCLE EQUIPMENT:

This shall be done in accordance with SAE J1989.

APPLICATION:
This information applies to refrigerant 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, rigid pipe are not covered in this document.

HFC-134a (R-134a) SERVICE HOSE FITTINGS FOR AUTOMOTIVE AIR-CONDITIONING SERVICE EQUIPMENT

Foreword-The purpose of this SAE Standard is to establish specific but unique fittings for service equipment used in maintaining HFC-134a (R-134a) systems. This is necessary to avoid cross mixing of refrigerant and lubricants from CFC based systems. This applies only to systems specifically designed for or retrofitted to R-134a. Hermetically sealed appliances and refrigerated cargo systems are not covered by this document.

1. Scope

   1.1 This SAE Standard covers fittings intended for connecting service hoses, per SAE J2196, from Mobile Air-Conditioning Systems to service equipment such as manifold gauges, vacuum pumps and air-conditioning charging, recovery and recycling equipment. (Figure 1)

   1.2 Due to similarities between English and metric thread sizes a single, unique ACME thread fitting is specified. This fitting was recommended by the Compressed Gas Association(CGA), Connection Standards Committee Task Force as one which could be qualified to meet their requirements for use and safety in a time frame consistent with the introduction of R-134a. It was selected because its unique design would reduce the likelihood of cross-treading services hoses on R-12/R-134a refrigerant storage containers and service equipment.

   1.3 The high and low pressure hose in J2196 requires the charge coupling (used to connect service hoses to vehicle access ports) to be an integral part of the hose assembly. To allow removal of the hose from the coupling for hose replacement only, a two-piece construction with a wrench tight connection is permitted. Specifications covering this fitting are provided.

2. References

   2.1 Applicable Documents-The following publications form a part of this specification to the extent specified herein. The latest issue of SAE Publications shall apply.

   2.1.1 SAE Publications-Available from SAE, 400 Cpmmpnwealth Drive, Warrendale, PA 15096-0001.
   SAE J639-Vehicle Service Coupling
   SAE J2196-Service Hose for Automotive Air Conditioning
   SAE J2210-HFC-134a Recycling Equipment fro Mobile Air-Conditioning Systems

2.1.2 ARI Publications-Available from Air Conditioning and Refrigeration Institute, 1501 Wilson Boulevard, Sixth Floor, Arlington, VA 22209 ARI 720-Refrigerant Access Valves and Hose Connectors

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SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

SAE J2197 Issued JUN92

3. Specification and Application Description

3.1 0.500 on x 16-2G ACME-Right Hand Thread Cylinder Valve Outlet Connection-Compressed Gas Association, Inc. Connection No. 167. (Figure 2)

3.1.1 The Connection shall be used on all R-134a refrigerant storage containers liquid and vapor outlet connections. It will also be used for all R-134a service equipment including manifold guage hose connections, utility hose connection to the vacuum pump, and charging, recovery and recycling equipment as defined in SAE J2210.

3.1.2 Aoolications which will require the use of valve cores should locate the valve core in accordance with ARI 720.

3.2 M14 x 1.5-6G right hand thread, SAE Hose Barb connection. (Figure 3)
Limited Standard Cylinder Valve Outlet Connection For Pressures Up To 500 PSIG (3450 kPa) For Tetrafluoroethane (R-134a) Automotive Use

Figure 2-0.500 in-16-ACME-2G-RH-EXT

3.2.1 This fitting may be used as an option to a nonserviceable connection of the charge coupling to the service hose assembly and will require a secure, wrench tight connection.

4. Functional Description

4.1 The high pressure hose assembly shall meet SAE J2196 requirements and will be terminated at one end with the 0.500 in x 16-ACME threaded nut. The other end will be permanently attached to the SAE J639 service charge coupling or terminated with the optional M14 x 1.5-6G external thread/male hose barb fitting.

Figure 3 -- SAE HOSE BARB R-134a SERVICE ADAPTER

4.2 The low pressure hose assembly shall meet SAE J2196 requirements and will be terminated at one end with the 0.500 in x 16 -- ACME threaded nut. The other end will be permanently attached to the SAE J639 service charge coupling or terminated with the optional M14 x 1.5-6G external thread/male hose barb fitting.

4.3 The utility hose shall meet SAE J2196 requirements and will be terminated at both ends using o.500 in x 16 -- ACME threaded nut.

4.4 Manifold Gauge Assembly shall require three or four 0.500 in x 16 -- ACME male threaded connections.

4.5 Containers disposable or refillable shall require 0.500 in x 16 -- ACME male threaded connections with shut off valves.

4.6 Refrigerant recovery, charging stations and stand-alone vacuum pumps shall require 0.500 in x 16 -- ACME male threaded connection unless an internal, nonserviceable connection is made by the equipment manufacturer.

4.7 High and low pressure charge couplings shall be constructed with an internal, M14 x 1.5-6H right hand thread connection as an option to attaching the hose assembly with a nonserviceable connection. (Figure 4)

5. Testing -- This test procedure is for the qualiSAE J2197 issued JUN92

Figure 4 -- SAE SPUD R-134a SERVICE ADAPTER

5.1 Determine the minimum torque necessary for a gas tight shutoff between the nippie and valve body at a gas pressure equal to the maximum rated working pressure per SAE J2196. For cycling purposes, twice this shutoff torque will be used to simulate normally applied field torque.

5.2 Cycling is to be conducted at atmospheric pressure, since that is the pressure at which connections are normally made.

5.3 Before and after cycling, measurements of the connection shall be recorded (Such as threaded elements, nipple bore diameters, and any other dimensions that may be subject to change) due to repeated tightenings.

5.4 Each connection is to be cycled 500 times with tightening to the torque determined in 5.1. Once cycle consists of tightening to the predetermined torque and then loosening to, at most, finger tight.

5.5 After each 100 cycles, the torque required to achieve gas tight shutoff at test pressure shall be recorded to determine if there is any abnormal torque buildup in shutoff requirements. The measurements indicated in 5.3 shall also be recorded at this interval to determine if there is any abnormal deformation of parts.

5.6 Each connection shall be subjected to a hydrostatic test and must withstand a pressure of at least 4 times the maximum rated working pressure per SAE J2196 without structure failure.

5.7 After completion of the previous tests, the results will be recorded on a suitable test report form which will be kept on file at the Compressed Gas Association office.

fication of new connection fir R-134a automotive air-conditioning system service equipment.

5.7.1 Testing of either a left hand or right hand connection of identical design (except for thread direction automatically qualifies the untested connection of the opposite thread direction. (The direction of the thread does not effect the structural integrity of the design.)

PREPARED BY THE SAE INTERIOR CLIMATE CONTROL STANDARDS COMMITTEE

J2197 JUN92

Rationale -- Not applicable.

Relationship of SAE Standard to ISO Standard -- No applicable.

Application -- This specification covers fittings intended for connection service hoses, per SAE J2196, from Mobile Air-Conditioning Systems to service equipment such as manifold gauges, vacuum pumps and air conditioning charging, recovering and recycling equipment.

Reference Section

SAE J639 -- Vehicle Service Coupling
SAE J2196 -- Service Hose for Automotive Air Conditioning
SAE J2210 -- HFC-134a Recycling Equipment for Mobile Air-Conditioning Systems
ARI 720 -- Refrigerant Access Valves and Hose Connectors

Committee Composition

Developed by the SAE Interior Climate Control Standards Committee
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RECOMMENDED SERVICE PROCEDURE FOR THE CONTAINMENT OF HFC-134a

1. Scope-Refrigerant containment is an important part of servicing mobile air-conditioning systems. This procedure provides guidelines for technicians for servicing mobile air-conditioning systems and operating refrigerant recycling equipment designed for HFC-134a (described in SAE J2210).

2. References

2.1 Applicable Documents-The following publications form a part of this specification to the extent specified herein, The latest issue of SAE publications shall apply.

2.1.1 SAE Publications-Available from SAE, 400 Commwealth Drive, Warrendale, PA 15096.

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 Mobile Air-Conditioning Systems

SAE J2219-Concerns to the Mobile Air-Conditioning Industry

2.2 Definitions

2.2.1 RECOVERY/RECYCLING (R/R) UNIT-Refers to a single piece of equipment that performs both functions of recovery and recycling of refrigerants per SAE J2210.

2.2.2 RECOVERY-Refers to that portion of the R/R unit operation that removes the refrigerant from the mobile air-conditioning system and places it in the R/R unit storage container.

2.2.3 RECYCLING-Refers to that portion of the R/R unit operation that processes the refrigerant for reuse on the same job site to the purity specifications of SAE J2099.

3. Service OProcedure

3.1 Connect the recycling unit service hoses, which shall have shutoff devices (e.g., valves) within 30 cm (12 in) of the service ends, to the vehicle air-conditioning (A/C) service ports. Hoses shall conform to SAE J2196 and fittings shall conform to SAE J2197.

3.2 Operate the recycling equipment per the equipment manufacturer's recommended procedure.

3.2.1 Verify that the vehicle A/C system has refrigerant pressure. Do not attempt to recycle refrigerant from a discharged system as this will introduce air (noncondensable gas) into the recycling equipment which must later be removed by purging.

3.2.2 Begin the recycling process by removing the 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 (4 in) 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

SAE review each technical report at least every five years atwhich time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

5 min. check A/C system pressure. If this pressure has risen above vacuum (0 psig), additional recycler operation is required to remove the remaining refrigerant. Repeat the operation until the system pressure remains stable at vaccuum for 2 min.

3.3 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, be sure they are operating properly. Proceed with the repair/service.

3.4 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.

4. Service with a Manifold Gauge Set

4.1 High-side, low-side, and center services hoses must have shutoff devices (e.g. valves) within 30cm (12 in) of the service ends. Valves must be closed prior to hose removal from the A/C
system to prevent refrigerant loss to the atmosphere.

4.2 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.

4.3 When the manifold gauge set is disconnected from the A/C system, or when the center 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.

5. Supplemental Refrigerant Checking Procedure for Stored Portable Containers

5.1 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, this procedure can be used to determine whether the recycled refrigerant container meets the specification for boncondensable gases (air).

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

5.2 The container must be stored at a temperature of 18.3 C (65 F) or above for at least 12 h, protected from direct sunlight.

5.3 Install a calibrated pressure gauge, with 6.9 kPa (1 psig) divisions, on the container and read container pressure.

5.4 With a calibrated thermometer, measure the air temperature within 10 cm (4 in) of the container surface.

5.5 Compare the onserved container pressure and air temperature to the values given in Tables 1 and 2 to determine whether the container pressure is below the pressure limit given in the Table. For example, at an air temperature of 21 C (70 F), the container pressure must not exceed 524 kPa (76 psig).

5.6 If the refrigerant in the container has been recycled and the container pressure is less than the limit in Tables 1 and 2, the refrigerant may be used.

5.7 If the refrigerant in the container has been recycled and the container pressure exceeds the limit in Tables 1 and 2, slowlyvent, 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 Tables 1 and 2.

CFC-12 (R-12) EXTRACTION EQUIPMENT FOR MOBILE AUTOMOTIVE AIR-CONDITIONING SYSTEMS
J2209

Foreword - CFC's deplete the stratospheric ozone layer that protects the earth against harmful ultraviolet radiation. To reduce the emissions of CFC's the 1990 Clean Air Act requires recycle of CFC-12 (R-12) used in mobile air-conditioning systems to eliminate system venting during service operations. SAE

provide service facilities with equipment to assure that venting of refrigerant will not occur.

1. *Scope* - The purpose of this SAE Recommended Practice is to provide equipment specifications for CFC-12 (R-12) recovery for return to a refrigerant reclamation facility that will process it to ARI standard 700-88 as a minimum (Air Conditioning and Refrigerant Institute). It is not acceptable that the refrigerant removed from a mobile air-conditioning system, with this equipment, be directly returned to a mobile air-conditioning system.

2. *References*

2.1 Applicable Documents - The following documents form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1 SAE Publications - Available from SAE, 400 Commonwealth Drive,
SAE J639 - Vehicle Service Coupling
SAE J1990 - Extraction and Recycle Equipment for Mobile Automotive Air-Conditioning System
SAE J2196 - Service Hose for Automotive Air Conditioning

2.1.2 ARI Publications - Available from Air Conditioning and Refrigeration Institute, 1501 Wilson Boulevard, Sixth Floor, Arlington, VA 22209.
ARI 700-88 - Specifications for Fluorocarbon Refrigerants

2.1.3 CGA Publications - Available from CGA, Crystal Gateway #1, Suite 501, 1235 Jefferson Davis Highway, Arlington, VA 22202.
CGA S-1.1 - Pressure Relief Device Standard Part 1 - Cylinders for Compressed Gases

2.1.4 DOT Specifications - Available from the Superintendent of Documents, U.S. Government Print ing Office, Washington, DC 20402.
CFR 49, Section 173.304 - Shippers - General Requirements for Shipments and Packaging

2.1.5 UL Publications - Available from Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062-2096.
UL 1769 - Cylinder Valves

3. *Specifications and General Description*

3.1 The equipment must be able to extract R-12 from a mobile airconditioning system.

3.2 The equipment discharge or transfer fitting shall be unique to prevent the unintentional use of ex- tracted R-12 to be used for recharging auto air conditioners.

3.3 The equipment shall be suitable for use in an automotive service garage environment as defined in figure 6.8.

3.4 Equipment Certification - The equipment must be certified by Underwriters Laboratories or an equivalent certifying laboratory to meet SAE J2209.

3.5 Label Requirements - The equipment shall have a label “Design Certified by (Company name) to meet SAE J2209 for use with R-12. The refrigerant from this equipment must be processed to ARI 700-88 specification before reuse in a mobile air-conditioning system.” The minimum letter size shall be bold type 3 mm in height.

4. *Safety Requirements*

4.1 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, label, related to the safe operation of the equipment shall also be prominently displayed on the equipment and should also state “CAUTION - SHOULD BE OPERATED BY CERTIFIED PERSONNEL.” The safety identification shall be located on the front near the controls.

4.2 The equipment must comply with applicable safety standards for electrical and mechanical require ments.

5. *Operating Instructions*

5.1 The equipment manufacturer must provide operating instructions, necessary maintenance proce- dures, and source information for replacement parts and repair.

5.2 The equipment must prominently display the manufacturer’s name, address, and any items that re- quire 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.

6. *Functional Description*

6.1 The equipment must be capable of ensuring recovery of the R-12 from the system being serviced, by reducing the system pressure to a minimum of 102 mm of mercury below atmospheric. To pre- vent system delayed outgassing, the unit must have a device that assures that the refrigerant has been recovered from the air-conditioning system.

6.1.1 Testing laboratory certification of the equipment capability is required which shall process con- taminated refrigerant samples at specific temperatures.

6.2 The equipment must be preconditioned with 13.6 kg of the standard R-12 at an ambient of 21 degrees Celsius before starting the test cycle. Sample amounts are not to exceed 1.13 kg with sample amounts to be repeated every 5 minutes. The sample method fixture defined in SAE J1990 (Figure 1) shall be operated at 24 degrees Celsius. Contaminated R-12 samples shall be processed at ambient temperatures of 10 and 49 degrees Celsius.

6.2.1 Contaminated R-12 sample

6.2.2 Standard contaminated R-12 refrigerant, 13.6 Kg sample size, shall consist of liquid R-12 with 100 ppm (by weight) mineral oil noncondensable gases (air).

6.3 Portable refillable containers used in conjunction with this equipment must meet appli- cable DOT standards.

6.3.1 The container color must be gray with yellow top to identify to identify that it contains used R- 12 refrigerant. It must be permanently marked on the outside surface in black print at least 20 mm high “DIRTY R-12 - DO NOT USE, MUST BE REPROCESSED”.

6.3.2 The portable refillable container shall have a SAE 3/8 in flare male thread connection as identified in SAE J639 CFC-12 High Pressure Charging Valve (Figure 2).

6.3.3 During operation the equipment shall provide overfill protection to assure that the storage container liquid fill does not exceed 80% of the tank’s rated volume at 21 degrees Celsius per DOT standard, CFR title 49, Section 173.304 and the American Society of Mechanical Engineers.

6.4 Additional Storage Tank Requirements

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

6.4.2 The pressure relief device shall comply with the pressure relief device standard part 1, CGA pamphlet S-1.1 .

6.4.3 The container 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 6 mm high.

6.5 All flexible hoses must meet SAE J2196 for service hoses.

6.6 Service hoses must have shutoff devices located within 30 cm of the connection point to the system being serviced to minimize introduction of noncondensable gases into the recovery equipment during connection and the release of the refrigerant during disconnection.

6.7 The equipment must be able to separate the lubricant from recovered refrigerant and accurately indicate the amount removed from the system during processing in 30 ml units.

6.7.1 The purpose of indicating the amount of lubricant removed is to ensure that a proper amount is returned to the mobile air-conditioning system for compressor lubrication.

6.7.2 Refrigerant dissolved in this lubricant must be accounted for to prevent system lubricant overcharge of the mobile air-conditioning system.

6.7.3 Only new lubricant, as identified by the system manufacturer, should be replaced in the mobile air-conditioning system.

6.7.4 Removed lubricant from the system and/or the equipment shall be disposed of in accordance with applicable federal, state, and local procedures and regulations.

6.8 The equipment must be capable of continuous operation in ambient of 10 degrees Celsius to 49 degrees Celsius and comply with 6.1 .

6.9 The equipment should be compatible with leak detection material that may be present in the mobile air-conditioning system.

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

8. This SAE Recommended Practice will become a SAE standard 1 year after first publication.

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

6. Containers for Storage of Recycled Refrigerant

6.1 Recycled refrigerant 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, for recycled refrigerant.

6.2 Any container of recycled refrigerant that has been stored or transferred must be checked prior to use as defined in Section 5.

6.3 Evacuate new tanks to at least 635 mm Hg (25 in Hg) below atmospheric pressure (vacuum) prior to first use.

7. Transfer of Recycled Refrigerant

7.1 When external portable containers are sued for transfer, the container must be evacuated to at least 635 mm (25 in Hg) below atmospheric pressure (vacuum) prior to transfer of the re cycled refrigerant to the container. External portable containers must meet DOT and UL standards.

7.2 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.

8. Safety Note for HFC-134a

8.1 HFC-134a has been shown to be nonflammable at ambient temperature and atmospheric pressure. However, recent tests under controlled conditions have indicated that, at pressures above atmospheric and with air concentrations greater than 60% by volume, HFC-134a can form combustible mixtures. White 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.

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

9. Disposal of Empty/Near Empty Containers

9.1 Since all refrigerant may not have been removed from disposable refrigerant containers during normal system charging procedures, empty/near empty container contents should be recycled prior to disposal of the container.

9.2 Attach the container to the recycling unit and remove the remaining refrigerant. When the container has been reduced from a pressure to a vacuum, the container valve can be closed and the container can be removed from the unit. The container should be marked “Empty” after which it is ready for disposal.

PREPARED BY THE SAE INTERIOR CLIMATE CONTROL STANDARDS COMMITTEE

J2211 DEC91

Rationale -- Not applicable.
Relationship of SAE Standard to ISO Standard -- No applicable.

Application -- Refrigerant containment is an important part of servicing mobile air-conditioning systems. This procedure provides guidelines for technicians for servicing mobile air-conditioning systems and operating refrigerant recycling equipment designed for HFC-134a (described in SAE J 2210).

Reference Section

SAE J2196 -- Service Hoses for Mobile Air-Conditioning

SAE J2197 -- Service Hose Fittings for Automotive Air-Conditioning

SAE J2210 -- Refrigerant Recycling Equipment for HFC-134a Mobile Air-Conditioning Systems

SAE J2219 -- Concerns to the Mobile Air-Conditioning Industry

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CONCERNS TO THE MOBILE AIR-CONDITIONING INDUSTRY (TAKEN FROM SAE J2219 COMMITTEE DRAFT)

6. HFC-134a--The New OEM Refrigerant -- The auto industry has selected HFC-134a, which is non-ozone depleting, for new vehicle production starting with 1992 models. The new HFC-1 34a system phase-in should be completed by 1996 models.

The OEMs have established the necessary procedures and service information for the new HFC- 134a systems.

New SAE documents cover service, containment, and recycle requirements for HFC-134a systems.

7. Refrigerant Handling/Identification to Prevent Cross-Contamination

Note: There is no “drop in” refrigerant for retrofit of existing CFC-12 systems approved to date by the OEMs.

7.2 System Identification -- Today only two refrigerants, CFC-12 and HFC-134a, are approved for use in passenger and truck mobile air-conditioning systems that have been specifically designed for each refrigerant. To distinguish CFC-12 from HFC-134a, different system service fittings, labels and new refrigerant containers are provided. (Some bus systems use HCFC-22 for the refrigerant charge.)

New SAE standards in J639 have established service fittings for CFC-12 and HFC-134a mobile air-conditioning systems. current CFC-12 systems use screw threads and the new HFC-134a systems use a quick couple design.

Additional items include system label requirements that require listing the type and amount of refrigerant. New requirements also include type of lubricant required in the system.

Containers of new HFC-134a will have a unique fitting for hose connection and a light blue color (PMS 2975) for identification.

New fittings and markings will also identify HFC-134a service hoses, recycle equipment, and service gauge manifolds.

8. Consequences of Cross Contamination

8.1 Mixing of Refrigerants

Note: Under no circumstance should refrigerants be mixed either in a system or in recycle/ recovery equipment since it will affect recycle programs and may cause equipment and system damage.

Damage can include compressor failure, damage to recycle equipment, and transfer of the mixed refrigerant to other vehicles causing additional problems.

Note: With two refrigerants in the service sector it is important that CFC-12 and HFC-134a are not mixed in a system.

If CFC-12 and HFC-134a are mixed in the same system, increased pressures of up to 25% can occur resulting in loss of performance and system damage. It is essential that the service technician use only the OEM recommended refrigerant and service equipment to make sure refrigerant mixing does not occur. Use of the wrong refrigerant during “top off” service activi ties, which is not a recommended service procedure, will not improve system performance and may cause system damage.

8.2 Desiccant Failure-If a CFC-12 system is charged with the wrong refrigerant, desiccant break down may occur resulting in expensive system failure.

8.3 Lubricants

NOTE: Do not mix lubricants in systems. Use only the lubricant specified by the system manufacturer.

8.3.1 CFC-12 Systems-Current CFC-12 Systems use mineral-based lubricants.

8.3.2 HFC-134a Systems-New HFC-134a systems wikll use several types of PAG lubricants and proper type and amount is important. The system label will identify the type of lubricant required.

NOTE: Use only the lubricant specified by the manufacturer since mixing of PAG lubricants may also cause system problems.

8.4 Service Tools-Service equipment including recycle equipment, hoses, and gauge manifolds must be used with only one refrigerant. Use of equipment on systems with different refrigerants will result in contamination caused from refrigerant and lubricant residue in the lines being charged directly to the system and equipment.

9. Flushing of Systems-The past practice of open flushing systems with CFCs such as CFC-11 and CFC-12 can no longer be continued because Federal and local laws will prohibit venting of CFCs to the atmosphere.

Methylchoroform (1,1,1 trichloroethane) is also covered by the Montreal Protocol phase-out and should not be considered for flushing.

Use of recycle equipment with adapters for closed loop power flushing of the system can provide containment, remove lubricant, and clean the refrigerant. Verify equipment capability with the manufacturer.

NOTE: Use only specified equipment and refrigerant when servicing mobile air-conditioning systems to prevent contamination. Do not use CFC-11 or CFC-12 for flushing HFC-134a systems.

10. Recommendations for Retrofitting CFC-12 Systems to a Non-CFC Refrigerant-At this time no retrofit refrigerant (such as blends or HFC-134a) has been approved by any mobile air-conditioning manufacturer as a replacement for CFC-12.

NOTE: Mobile air-conditioning systems are specifically designed for one designated refrigerant only. The only source of information for use of replacement refrigerant is the original manufacturer of the mobile air-conditioning system. In compliance with SAE J639, the type of refrigerant, amount, and manufacturer of the system should be indicated on the vehicle air-conditioning system. When the industry has determined a suitable refrigerant to replace CFC-12, new service

identification and labels will be required to identify the retrofitted air-conditioning system.

10.1 Refrigerant Blend

NOTE: Do not use any refrigerant blend in any CFC-12 or HFC-134a system. Mixing of refrigerant blends with CFC-12 or HFC-134a may cause problems which could result in system failure. Refrigerant blends, which may contain HCFC, may be considered for servicing CFC-12 systems in the 90s if approved by the originalvehicle manufacturer.

Do not modify any CFC-12 system to use a refrigerant blend unless modification procedures are supplied by the original system manufacturer.The Clean Air Act requires that any refrigerant containing HCFC, must comply with Section 609 effective January 1, 1992, which includes containment and At this time no SAE standards have been established for service fittings and labels to identify future possible conversion of CFC-12 systems to blend refrigerants.

10.2 Conversion from CFC-12 to HFC-134a

NOTE: Do not directly use HFC-134a in CFC-12 systems.

Do not modify any CFC-12 system to use HFC-134a refrigerant unless modification procedures are supplied by the original system manufacturer.

Mixing of HFC-134a with CFC-12 without proper retrofit of system components may cause problems which could result in system failure.

The Clean Air Act requires that HFC-134a be recycled effective November 1995.

10.3 Modifications for Alternate Refrigerant-System modifications to retrofit CFC-12 systems may include hose, high pressure cut out device, seals, desiccant, lubricant, refrigerant control replacement, increased condenser capacity, and other modifications as determined by the equipment manufacturer. Not Following the “OEM” recommendation may result in system damage, loss of performance, and affect warranty.

Do not use any refrigerant other than the one specified for the system unless the manufacturer has supplied information for conversion.

If a conversion (retrofit) program is supplied by and only by the system manufacturer, per form the complete required conversion. Partial conversion may result in problems which can include loss of rperformance, system failure, and void warranty.

10.3.1 AREAS OF CONCERN-Use of improper refrigerant can result in many problems.

a. Leakage of hose and seals
b. Damage to desiccant material
c. Cause system refrigerant control problems
d. Cause compressor problems including failure
e. Compressor failure due to wrong lubricant
f. Loss of system performance due to evaporator control for freeze protection and expansion valve calibration
g. Higher system operating pressure resulting in lower performance and part failures.

During early development of HFC-134a systems, use of copper material in the high temperature portion of the system resulted in material transfer causing system problems. Use of a copper condenser for service replacement in HFC-134a systems may result in system problems.

11. Leak Detection Devices-To assure that serviced systems are returned to original design intent leakage specification, leak detection devices should be used.

Proper use of leak detection equipment is important since leaks may occur in locations that are not directly visible.

11.1 Electronic Detectors-Some electronic leak detectors will only indicate when subjected to CFC-12 and will not indicate on HFC-134a. Newer design electronic detectors will provide leakage identification of both refrigerants. The detector manufacturer can verify the type of refrigerant that the unit will identify.

Proper use of the detector is important in determining the leak point.

11.2 Trace Dyes-The chemical composition and amount of trace(leak) dyes when injected in mobile air-conditioning systems may cause problems.

Leak dyes should not be added to any mobile air-conditioning system unless the specific product has been approved by the “OEM” system manufacturer.

12. HFC-134a Combustibility-It has been determmined that pressurized air-rich mixtures of HFC-134a and air can undergo combustion when exposed to an ignition source.

NOTE: HFC-134a should not be mixedd with air for leak testing. In general, it should not be used or allowed to be present with high concentrations of air above atmospheric pressure.

13. Purity of Recycled Refrigerant-SAE J1991 standard of purity states “the refrigerant in this document shall have been directly removed from, and intended to be returned to, a mobile air-conditioning system. Purity specification of recycled R-12 refrigerant supplied in containers from other recycle sources, for service of mobile air-conditioning systems, shall meet ARI Standard 700-88.”

13.1 With many other uses of CFC-12 it is important that the source of the refrigerant be known. Since CFC-12 is used in systems, such as refrigerators, water chillers, and central cooling systems, other contaminants and acids can be present.

13.2 Use of recycle equipment that meets SAE J1990 requirements will not purify the other used sources of CFC-12 to meet mobile air-conditioning purity requirements.

13.3 CFC-12 from any source, other than a mobile air-conditioning system, should not be used unless it has been returned to a recycle source that can return the purity to ARI 700-88 specification.

13.4 Use of refrigerant from other sources that contains acids and other contaminants, as well as a possible mixture of other refrigerants, will cause oriblkems in mobilke air-conditioning systems.

14. Notes

14.1 Comments on this Draft are welcome and should be submitted in writing to Secretary, Technical Standards Board, SAE Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

14.2 This document shall have a life span of no more than 3 years from approval which may not be renewed.

PREPARED BY THE SAE INTERIOR CLIMATE CONTROL STANDARDS COMMITTEE

RECORDKEEPING REQUIREMENTS

All persons who own approved recovery only refrigerant equipment certified under EPA regulations must maintain records of the name and address of the reclamation facility and the date the refrigerant is sent or delivered.

All persons who own approved refrigerant recycling equipment must maintain records demonstrating that all persons authorized to operate equipment are currently certified under EPA regulations.

All persons who sell or distribute any class I or class II substance that is suitable for use as a refrigerant in a motor vehicle air conditioner and is in a container of less than 20 pounds must verify that the purchaser is properly trained and certified under EPA regulations. The only exception to this requirement is if the purchaser is purchasing the small containers for resale and in this case, the seller must receive a written statement from the purchaser that the cans are for resale only. Records must be retained for a period of three years.

All persons who conduct any retail sale class I or class II substance that is suitable for use as a refrigerant in a motor vehicle air conditioner and is in a container of less than 20 pounds must
prominently display a sign which states: It is a violation of federal law to sell containers of Class I and Class II refrigerant of less than 20 pounds to anyone who is not properly trained and certified to operate approved refrigerant recycling equipment.

All records required to be maintained pursuant to this section must be kept for a minimum of three years unless otherwise indicated. Entities which service motor vehicle air conditioners for consideration must keep these records on-site.

All entities which service motor vehicle air conditioners for consideration must allow an authorized representative of the administrator entry onto their premises (upon presentation of his/her credentials) and give the authorized representative access to all records required to be maintained pursuant to this section.

EQUIPMENT CERTIFICATION

Equipment must be certified by an independent standards testing organization approved by the administration, Underwriters Laboratories (UL) is approved, under the regulations. To meet either one of the following standards:

Equipment that recovers and recycles refrigerant must meet the Standards of the Purity for Use in Mobile Air-Conditioning Systems (SAE J1990). and the procedures for the containments of R-12, Extraction and Recycle Equipment for Mobile Air Conditioning Systems (SAE J1991).

Equipment purchased before the proposal of regulations will be considered approved if the administration determines that the equipment is substantially identical to the equipment certified under the previous paragraph.

The administration (EPA) will maintain a list of approved equipment by manufacturer and model. Your Association will maintain a list of approved freon recovery /recycling equipment. Should you have any question about approved equipment, please contact your Association.

YOU HAVE NOW COMPLETED THE SELF-STUDY PORTION OF THE CERTIFICATION.

Its clear to most automotive service technicians by now that buying and handling A/C refrigerants is a lot more complicated than it used to be. Even when R-12 was the only refrigerant in town, many A/C techs discovered systems that had been contaminated with air, R-22 or hydrocarbons such as propane and butane. Today , with new vehicles using R-134a refrigerant, and with an abun dance of other R-12 substitutes reaching the market, the variety of refrigerants that techs may handle on the job is making A/C service more complicated than ever.

This document is designed to assist techs in determining how to identify, recover, and dispose of any contaminated refrigerants they may encounter. This document will also discuss what a tech should do with a substitute refrigerant that he has chosen not to work with or is unfamiliar to him. EPA intends to update this document whenever the Agency receives new information about potential solutions to the problems relating to contaminated or unfamiliar refrigerants.

IDENTIFYING REFRIGERANTS

EPA requires that when any vehicle is retrofitted from R-12, a label identifying the new refrigerant in the system must be placed under the hood, and new fittings that are unique to that refrigerant must be attached to the high-and-low-side service ports of the A/C systems. (For a complete discussion of these and other requirements, see the EPA fact sheet "Choosing and Using Alternative Refrigerants.") These EPA requirements obviously don’t solve the entire refrigerant identification problem. Your shop could encounter a vehicle that has been retrofitted to another refrigerant but has not been properly relabeled, or a vehicle that has the right label, but highly contaminated refrigerant.

Checking refrigerant pressures does not guarantee that you will recognize that refrigerant is contaminated or is a brand that is unfamiliar to you. Unusual head pressures may tip you off that a system labeled to indicate that it has pure R-12 or R-134a in it actually is highly contaminated or contains another refrigerant altogether. However, you may also encounter a contaminated system, or a system that contains a blend refrigerant, that indicates pressures similar to those of pure R-12 or R-134a.

Purchasing a refrigerant identifier unit can help pinpoint many refrigerant identification problems, and EPA strongly recommends (but does not require) that techs obtain this equipment. You can use the identifier to confirm that the refrigerant your supplier is sending you is exactly what he says it is --pure and uncontaminated. The equipment you choose will depend on what you plan to do once you discover that refrigerant in a vehicle is not pure R-12 or R-134a. If for example, you decide to turn the customer with a contaminated system away, then a less-expensive identifier that simply tells you whether refrigerant is pure R-12 or R134a ("go/no-go") may be sufficient for you.

However, a unit that can help you identify the chemical composition of the refrigerant more specifically can be an important diagnostic tool, so that the extra cost may be well worth it. Some models can identify flammable substances, which require special care and safe handling (see section B below). Some models can tell you how much air is in recycled refrigerant, so that you can use these

models to determine whether the air purge cycle feature on your R-12 or R134a recycling equipment is functioning properly. Excess air in an A/C system can lead to false readings in electronic low charge indications in some vehicles; rapid clutch cycling and potential clutch failures; and noisy compressor operation. Finally, using this tool may build your customers' confidence in your diagnostic abilities.

Keep in mind that even the most sophisticated diagnostic units on the market today cannot properly identify all combinations of chemicals used in blend refrigerants. Diagnostic identifiers being sold today may be able to identify potential R-12 and R134a contaminants such as air, R-22, and hydrocarbons, but were not designed to identify R-124 and R-142b (chemicals that are components in many of the new substitutes), or to recognize particular chemical combinations as specific patented, marketed blend refrigerants. In the future, equipment manufacturers may develop equipment designed to identify all of the substitute refrigerants that are being marketed today.

Whether you are interested in purchasing a "go/no-go" unit or a diagnostic unit, check that the unit meets the SAE J1771 standard, which is an indication that the unit accurately identifies refrigerants. When claiming to meet this standard, manufacturers of identifier equipment are required to label the unit stating its level of accuracy.

If you are reluctant to invest in another piece of equipment, consider making an arrangement to borrow an identifier from a nearby service facility that has purchased one. That facility may agree to make its identifier available to you for a reasonable fee.

Recovering and recycling contaminated or unfamiliar refrigerants

You may not wish to turn away a good customer who comes to the shop with contaminated R-12 or R-134a, or with a substitute refrigerant for which you have no dedicated recovery or recycling equipment. What do you do?

Recovcering refrigerant. As a first step, the contaminated or unfamiliar refrigerant must be recovered. EPA prohibits venting any automotive refrigerants (including “unacceptable” refrigerants), no matter what combination of chemicals is in the refrigerant. The best way today that a tech can recover contaminated or unfamiliar refrigerant is to dedicate a recover-only unit to anything that is not pure R-12 or pure R-134a. Some equipment manufacturers may also be marketing new types of recover-only stations specifically designed to remove these refrigerants.

If the refrigerant you extract into a recovery unit contains a high level of flammable substances such as propane and butane, a fire hazard may result if the refrigerant comes into contact with an ignition source within the equipment. Whether you are purchasing a new piece of equipment to handle your contami nated and unfamiliar refrigerants, or you are converting a piece of existing equipment for this purpose, make sure you talk to your sales representative about what features have been incorporated into the equipment to guard against risks of ignition.

Refrigerant should be recovered into the standard DOT-certified, gray-with-yellow-top recovery tank, and if the tank is not equipped with a float valve (which serves as overfill protection), make sure it never gets filled beyond 60 % of its gross weighted capacity, as specified in the SAE J19 89 and J2211 standards.

If A/C service is not a large percentage of your business, then you may be reluctant to invest in another piece of recovery equipment. If this is the case, consider calling a local A/C specialty shop that may

have the equipment necessary to service contaminated refrigerants or refrigerants that are unknow to you .

Recycling refrigerant. Once recovered, refrigerant should not be recycled on-site unless uncontanminated R-12 or R-134a. Recovering contaminated R-12 or R-134a refrigerant into recycling equipment may damage the equipments. In addition, EPA regulations currently prohibit technicians from recycling blen substitute refrigerants (contaminated or not). EPA is working with independent testing laboratories ans with equipment manufacturers to determine whether it is possible to develop recycling epuiment to service these blends that protects both the health or safety of the technician, and the integrity of the A/C system.

Storage and Disposition of Contaminated or Unfamiliar Refrigerants

Once the refrigerant has been recovered, if you can't recycle it, what do you do with it? The answer, naturally, is that it depends.

Storage. If the refrigerant in your "junk" tank contains significant amounts of flammable substances, it may be considered hazardous and you should make sure you follow any local ordinances that govern the storage of combustible mixtures.In addition, if your shop generates over 100 kilograms (220 pounds) of hazardous wastes per month (including used coolant, and battery acids), then your shop must meet certain storage and transportation requirements under the Resource, Conservation and Recovery Act (RCRA). For more details, call the RCRA Hotline at (800) 424-9346 and ask for EPA publication 530-K-95-001, the 1996 update of "Understanding the Hazardous Waste Rules – A Handbook for Small Business." You may also wish to check out the world wide web site of the Coordinating Committee for Automotive Repair at ww.ccar-greenlink.org.

Disposition. If the refrigerant in your "junk" recovery tank is a chemical "soup" – either contaminated R-12 and R-134a, or a mixture of those contaminated refrigerants and some blend refrigerants that you are unfamiliar with—then the contents should be reclaimed or destroyed. You should investigate all your options and pick the one that makes the most economic sense for you.

If you have a contract in place with a waste hauler, contact the hauler to see if they can handle the material. Waste haulers may require that the contents be identified first and any charge you for this identification procedure. They are most likely to send the tank to an incinerator for destruction. You may also want to contact one or more

reclaimers, who will send the refrigerant off-site either for destruction, or for reclamation, which involves breaking it up into its chemical components and purifying each of the components .

Some reclaimers can handle tanks sent to them from anywhere in the nation. A reclaimer does not necessarily have to be located in your area.

Due to the expense involved in reclaiming, some reclaimers may not accept less than 500 or

1000 pounds of contaminated or mixed refrigerant. In addition, you should be aware that not all reclaimers have the technology to handle all contaminated or mixed refrigerants. However, if one tells you that he is not interested in receiving your tank, don't necessarily assume that the next reclaimer you call will say the same thing.

Before you enter into any agreement with either your waste hauler or a reclaimer, make sure you understand all of the costs involved; there may be separate charges for identifying the material, transporting it and destroying it. If you are responsible for shipping the tank, make sure that the hauler or reclaimer explains to you how to comply with any applicable DOT, state and local requirements relating to shipping.

If you have questions about disposing of specific blend refrigerants, call the refrigerant manufacturer. Most manufacturers of blend refrigerants have made arrangements with specific reclaimers to handle their used refrigerant. For a list of these telephone numbers, see the EPA fact sheet "Choosing and Using Alternative Refrigerants," Available from the Hotline or on the web sit at http://www.epa.gov/ozone/title6/snap/ macssubs. Html.

The term "retrofit" decries special procedures required to convert an R-12 system to use an alternative refrigerant. This document will describe some facts about aftermarket options and procedures for retrofitting a vehicle's a/c system to R-134a.

Automakers worldwide chose R-134a to be the long-term replacement for R-12 in automotive A/C systems, both in new vehicles and in retrofit applications. If information becomes available, EPA may develop similar guidelines in the future for retrofitting to refrigerants other than R-134a. At this time however, wide- scale performance testing has not been performed on vehicles retrofitted to these refrigerants. Should you have questions about retrofitting to an alternative refrigerant, consult the refrigerant's manufacturer. You may also want

to review the EPA publication "Choosing and Using Alternative Refrigerants in Motor Vehicle Air Conditioning" available from the Hotline number listed above, or electronically at www.epa.gov/ozone/title6/snap/macssubs.

OEM Retrofits

Vehicle manufacturers (also known as original equipment manufacturers, or OEMs) have developed retrofit kits or guidelines for some of their models. These procedures were designed to provide the best level of performance with the new R-134a systems. Although using these kits and guidelines will provide the greatest assurance that comparable a/c performance will be achieved, the costs of these OEM procedures will in many instances be relatively high. For example, while certain models can receive an OEM-warranted retrofit for under $150, including labor, other OEM retrofits will run a customer over $650. Many car owners will not want to pay such high costs for a retrofit and may look to the aftermarket for a less expensive soultion.

In addition, because the OEM retrofit kits and guidelines are generally only available for late 1980s and early 1990s models, an aftermarket retrofit may be the only option for many vehicle owners.

Least-Cost Aftermarket Retrofit

Many car owners may express interest in receiving a least-cost retrofit. Procedures required for a least-cost retrofit are simple and do not require major component changes. Generally, the process calls for removal of the old refrigerant, installation of new fittings and a new label, and the addition of either a polyalkylene glycol (PAG) or polyol ester (POE or ester) lubricant as wells the R-134a refrigerant. For many vehicles, this simple, least-cost retrofit should provide the vehicle owner either with a/c performance comparable to the R-12 system performance or with a/c performance that, although slightly reduced, is still sufficient to satisfy the customer. A least-cost retrofit, however, may not provide a satisfactory solution for certain vehicles.

Communicating With the Customer

Although EPA has been educating car owners about options available to them in converting their a/c systems, many consumers will primarily rely on their service technician to educate them. Service facilities that wish to offer retrofit as a service to their customers need to consider what kind of retrofit procedure they will offer, and how they will warranty the work performed. When determining whether to recommend a retrofit to a customer, and what kind of retrofit to offer—an OEM-warranted retrofit (if available), a least-cost retrofit, or something in between—a service tech will need to consider (or ideally, discuss with the customer), the three C's: cost, climate and components