R134A SEMINAR PRESENTATION

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WHY FREON CONVERSION?

Production of CFC-12 for use in the United States ceased on December 31, 1995 in accordance with the requirements of the Copenhagen Amendments to the Montreal Protocol and the Clean Air Act.

In September 1987, the United States and 22 other industrialized countries signed the Montreal Protocol to control the releases of ozone depleting substances.

On November 15, 1990, President Bush signed the 1990 Clean Air Act Amendments. The amendment establishes national policy for the reduction and ultimate elimination of Stratospheric ozone depleting substances.

HOW DOES EFFECT THE GENERAL AVIATION?

EPA REGULATIONS

The objective of the CLEAN AIR ACT Amendments (Title VI – Section 608) are to reduce the production, use, and emissions of ozone depleting substances to the lowest achievable level and promote the recapture and recycling of Class I (CFCs) and Class II (HCFCS) substances.

Effective July 1, 1992 it is unlawful to knowingly vent, release or dispose of CFCs and HCFCs during the repair, service, maintenance or disposal of appliances of industrial process refrigeration equipment. The venting prohibition for alternate refrigerants is effective November 15, 1995.

Only three types of releases are permitted under the prohibition:

1. De minimis quantities of refrigerant released in the course of making good faith attempts to recapture and recycle or safely dispose of refrigerant.
2. Refrigerants emitted in the course of normal operation of air conditioning and refrigeration equipment, as opposed to the above.

3. Mixtures of nitrogen and R-22 that are used as holding charges or as leak test gases, because as in these cases, the ozone-depleting compound is not used as a refrigerant.

Under Section 608 of the Clean Air Act, the EPA has issued regulations establishing five main requirements for recycling, emissions reduction, and disposal of Class I and Class II substances.

1. Service Practices - …
2. Technician Certification - …
3. Equipment and Reclaimer Certification - …
4. Leak Repair of Systems Containing More than 50 lbs. - …
5. Safe Disposal of Equipment and Appliances - …

ENFORCEMENT (Title VII) – The Act has a number of civil and criminal penalties that, upon conviction, would impose heavy fines and/or imprisonment. The regulations will affect violators at the administrative, manufacturing, distribution and user levels. Violations include failing to report, falsifying documents, tampering with monitoring devices and knowingly releasing these substances in to the ambient air, or using or manufacturing unapproved equipment.

The administrator of the agency will have the authority to process and initiate actions for violations which could result in the following:

1. Civil Penalties of up to $25,000 per day per violation of the Act.
2. For the encouragement of others to report violations, award up to $10,000 to persons furnishing information that leads to the conviction of a person violating provisions of the Act.

SUPPLY AND DEMAND

Since this production phaseout, the national supply of CFC-12 has depended upon the quantity of CFC-12 contained in stockpiles at the beginning of 1996, the quantity of CFC-12 reclaimed from existing air conditioning and refrigeration equipment, and illegal imports of CFC-12. The demand for CFC-12 is determined by the number of operating R-12 air conditioning and refrigeration systems that require refrigerant to replace R-12 lost through leakage and upon servicing (R-12 is the name for CFC-12 when it is used as a refrigerant).

This report presents updated estimates of the supply and demand of R-12 in the United States during the period 1999 to 2005.

The results of this analysis can be summarized as follows:

- **Spot Shortages in 1999 Unlikely.** This analysis determined that substantial amounts of R-12 remain available in the U.S. and spot shortages are highly unlikely for buyers this year. A heat wave in a densely populated area could cause a perceived shortage of R-12 because of distribution problems, however at present R-12 is easily obtained. It is possible that the U.S. will experience an R-12 shortage in 2000, depending on factors such as the rate of retrofitting and replacement of R-12 equipment and the quantity of R-12 reclaimed.
- **Reclamation Has Decreased Slightly.** The quantity of R-12 reclaimed in 1998 decreased slightly from the amount reclaimed in 1997. Most recovered R-12 is held by the owners to service other equipment (e.g., supermarket chains retrofit some stores and keep the recovered R-12 for their stores that still rely on R-12), rather than sent to reclaimers.
- **Potentially Strong Market for Reclamation.** Given the much slower than expected rate of retirement and conversion for R-12 chillers, for example, demand for reclaimed R-12 in this industry sector could increase noticeably from 1999-2005 as owners are faced with the prospect of a shortage. Without the availability of reclaimed R-12, shortages may occur earlier and affect more users. Nonetheless, despite the slower than expected retirement and retrofit rate for chillers, the market for reclaimed R-12 did not increase in 1998.
- **No Rise in Illegal Imports.** Even before the cessation of R-12 production in the United States, illegal imports entered the country in significant quantities because the high price of R-12 and the excise tax on R-12 made such activity very lucrative. While illegal imports will continue to enter the U.S., the amount of smuggling is not expected to increase in the future. This may be attributed to the increased success of U.S. law enforcement agencies in cracking down on illegal imports of R-12 in recent years. In fact, more and more individuals and companies are being charged for illegally importing R-12 into the U.S. now, than in previous years.

SO WHAT ARE THE ALTERNATIVES?

OEMS have chosen HFC134 as the refrigerant of new production aircraft. There are other refrigerants that have pluses, but many have negatives.

Background

Scientists worldwide have concluded that CFC-12 and other chlorofluorocarbons deplete the ozone layer. As a result, over 150 countries have signed a treaty to protect the earth's ozone layer called the Montreal Protocol. In the US, the Protocol is implemented by the Clean Air Act, and regulations issued under the Act ended the production of CFC-12 for air conditioning and refrigeration uses on December 31, 1995.

CFC-12 (also known by the trade name Freon) was widely used in air conditioners for automobiles and trucks for over 30 years. While new vehicles no longer use CFC-12, most vehicles built before 1994 still require its use for servicing. As a result, 30 million cars or more may need conversions to use an alternative refrigerant should the air conditioning develop a leak after CFC-12 is no longer available.

Note: there are several other relevant fact sheets available online and through our hotline.

Significant New Alternatives Policy (SNAP)

In 1994, EPA established the SNAP Program to review alternatives to ozone-depleting substances like CFC-12. Under the authority of the 1990 Clean Air Act (CAA), EPA examines new substitutes for their ozone-depleting, global warming, flammability, and toxicity characteristics. EPA has determined that several refrigerants are acceptable for use as CFC-12 replacements in motor vehicle air conditioning systems, subject to certain use conditions. This fact sheet lists the use conditions in detail and provides information about the current crop of refrigerants.

It is important to understand the meaning of "acceptable subject to use conditions." EPA believes such refrigerants, when used in accordance with the conditions, are safer for human health and the environment than CFC-12. This designation does not mean that the refrigerant will work in any specific system, nor does it mean that the refrigerant is perfectly safe regardless of how it is used. Finally, note that EPA does not approve or endorse any one refrigerant that is acceptable subject to use conditions over others also in that category.

Note also that EPA does not test refrigerants. Rather, we review information submitted to us by manufacturers and various independent testing laboratories. Therefore, it is important to discuss any new refrigerant with your vehicle dealer and shop technician before deciding to use it, and in particular to determine what effect using a new refrigerant will have on your warranty. Before choosing a new refrigerant, you should also consider whether it is readily and widely available, and your technician should consider the cost of buying recovery equipment for blends or recovery/recycling equipment for HFC-134a. Additional considerations about purchasing CFC-12 substitutes can be found in EPA's fact sheet titled "Questions to Ask Before You Purchase an Alternative Refrigerant."

Definition of "Motor Vehicle Air Conditioning"

Under the SNAP program, the motor vehicle air conditioning (MVAC) end-use includes all forms of air conditioning that provide cooling to the passenger compartments in moving vehicles. This definition includes both MVACs, defined under the section 609 regulations at 40 CFR 82.32, and MVAC-like equipment, defined under the section 608 regulations at 40 CFR 82.152. EPA regulations issued under sections 608 and 609 of the

Clean Air Act distinguish between MVACs and MVAC-like equipment for purposes of refrigerant recycling and handling. EPA includes both in the SNAP MVAC end-use and has relied on this definition since the original SNAP rule of March 18, 1994 (59 FR 13044). All use conditions, unacceptability findings, and other regulatory actions for this end-use apply equally to on-road vehicles, such as automobiles and trucks, and to off-road vehicles, such as tractors, combines, construction, mining equipment, boats, planes, and trains.

Misleading Use of "Drop-in" to Describe Refrigerants

Many companies use the term "drop-in" to mean that a substitute refrigerant will perform identically to CFC-12, that no modifications need to be made to the system, and that the alternative can be used alone or mixed with CFC-12. However, EPA believes the term confuses and obscures several important regulatory and technical points. First, charging one refrigerant into a system before extracting the old refrigerant is a violation of the SNAP use conditions and is, therefore, illegal. Second, certain components may be required by law, such as hoses and compressor shutoff switches. If these components are not present, they must be installed. See the section below on use conditions for more information on these points. Third, it is impossible to test a refrigerant in the thousands of air conditioning systems in existence to demonstrate identical performance. In addition, system performance is strongly affected by outside temperature, humidity, driving conditions, etc., and it is impossible to ensure equal performance under all of these conditions. Finally, it is very difficult to demonstrate that system components will last as long as they would have if CFC-12 were used. For all of these reasons, EPA does not use the term "drop-in" to describe any alternative refrigerant.

Use Conditions

Under the SNAP rule, each new refrigerant must be used in accordance with the conditions listed below. If you choose to use an alternative, make sure the service shop meets these requirements and that it has dedicated recovery equipment for blends or recovery/recycling equipment for HFC-134a.

UNIQUE FITTINGS:

> Each new refrigerant must be used with a unique set of fittings to prevent the accidental mixing of different refrigerants. These fittings are attachment points on the car itself, on all recovery and recycling equipment, on can taps and other charging equipment, and on all refrigerant containers. If the car is being retrofitted, any service fittings not converted to the new refrigerant must be permanently disabled. Unique fittings help protect the consumer by ensuring that only one type of refrigerant is used in each car. They also help protect the purity of the recycled supply of CFC-12, which means it will last longer, so fewer retrofits will be necessary nationwide. The list of fittings is available in an EPA fact sheet titled "Fitting Sizes and Label Colors for Motor Vehicle Refrigerants."

Applicability to Manifold Gauges and Refrigerant Identifiers Manifold gauges allow technicians to diagnose system problems and to charge, recover, and/or recycle refrigerant. A standard fitting may be used at the end of the hoses attached to the manifold gauges, but unique fittings must be permanently attached at the ends of the hoses that attach to vehicle air conditioning systems and recovery or recycling equipment . Similarly, refrigerant identifiers may be used with multiple refrigerants. The connection between the identifier or similar service equipment and the service hose may be standardized and work with multiple hoses. For each refrigerant, however, the user must attach a hose to the identifier that has a fitting unique to that refrigerant permanently attached to the end going to the vehicle. Adapters for one refrigerant may not be attached to end 2 and then removed and replaced with the fitting for a different refrigerant. The guiding principle is that once attached to a hose, the fitting is permanent and is not removed.

LABELS:

Whether a car is originally designed to use a new refrigerant or is retrofitted, the technician must apply a detailed label giving specific information about the alternative. The label's background color is chosen by the manufacturer to be unique, and the label colors for each refrigerant are listed in an EPA fact sheet titled "Fitting Sizes and Label Colors for Motor Vehicle Refrigerants." The label shows:

- the name and address of the technician and the company performing the retrofit;
- the date of the retrofit;
- the trade name, charge amount, and, when applicable, the ASHRAE numerical designation of the refrigerant;
- the type, manufacturer, and amount of lubricant used; and
- if the refrigerant is or contains an ozone-depleting substance, the phrase "ozone depleter"

This label covers up information about the old refrigerant, and provides valuable details on the alternative and how it was used. It also tells the owner who performed the retrofit.

REMOVE ORIGINAL REFRIGERANT:

The original CFC-12 must be removed from the system prior to charging with the new refrigerant. This procedure will prevent the contamination of one refrigerant with another. Refrigerants mixed within a system probably won't work and could damage the system. As mentioned above, this requirement means that no alternative can be used as a "drop-in.".

BARRIER HOSES:

HCFC-22, a component in some blends, can seep out through traditional hoses.Therefore, when using these blends, the technician must ensure that new,

less permeable "barrier" hoses are used. These hoses must be installed if the system currently uses old, non-barrier hoses.. The table of refrigerants below notes this additional requirement where appropriate.

COMPRESSOR SHUTOFF SWITCH:

Some systems have a device that automatically releases refrigerant to the atmosphere to prevent extremely high pressures. When retrofitting any system with such a device to use a new refrigerant, the technician must also install a high-pressure shutoff switch. This switch will prevent the compressor from increasing the pressure to the point where the refrigerant is vented.

Alternative Refrigerants

The table below summarizes the following information about refrigerants reviewed under EPA's SNAP program for use in motor vehicle air conditioning systems. Note that "air conditioning" means cooling vehicle passenger compartments, not cargo areas, so refrigeration units on trucks and rail cars are not considered air conditioners.

If your browser cannot display tables, please call our Hotline at **800-296-1996** to receive a free copy of this fact sheet in the mail or by fax. The title is "Choosing and Using Alternative Refrigerants for Motor Vehicle Air Conditioning".

- Name: Many refrigerants are sold under various names. All known trade names are listed, separated by slashes.
- Status:
  - *acceptable subject to use conditions:* May be used in any car or truck air conditioning system, provided the technician meets the conditions described above. Note that EPA cannot guarantee that any refrigerant will work in a specific system.
  - *unacceptable*: Illegal to use as a substitute for CFC-12 in motor vehicle air conditioners.
  - *proposed acceptable subject to use conditions:* May be used legally. EPA will accept public comment on these refrigerants and then make a final ruling. There is no formal EPA position until then, and it is inappropriate for advertising to imply that EPA has found the product acceptable.
  - *not submitted:* Illegal to use **or sell** as a substitute for CFC-12 in motor vehicle air conditioning systems.
- Date of ruling: The date either a final rule or a proposed listing was published in the Federal Register. Note that proposed listings are not final and may change because of public comment.
- Manufacturer name and contact phone number: Call for more information on testing, performance, system compatibility, etc.
- Composition: Every refrigerant other than HFC-134a is a blend of several components.

Motor Vehicle Air Conditioning Substitutes for CFC-12
Reviewed Under EPA's SNAP Program as of June 3, 1997

Name (1)	Status (2)	Date	Manufacturer	Components / Reason Unacceptable						
				HCFC-22	HCFC-124	HCFC-142b	HFC-134a	Butane (R-600) (3)	Isobutane (R-600a) (3)	HFC-227ea
HFC-134a	ASU	3/18/94	Several	-	-	-	100	-	-	-
FRIGC FR-12	ASU	6/13/95	Intermagnetics General 800-555-1442	-	39	-	59	2	-	-
Free Zone/ RB-276 (4)	ASU	5/22/96	Refrigerant Management Services of Georgia 800-347-5872	-	-	19	79	-	-	-
R-406A/ GHG(5)	ASU	10/16/96	People's Welding 800-382-9006	55	-	41	-	-	4	-
GHG-X4/ Autofrost/ Chill-It (5)	ASU	10/16/96	People's Welding 800-382-9006	51	28.5	16.5	-	-	4	-
Hot Shot/ Kar Kool (5)	ASU	10/16/96	ICOR 800-357-4062	50	39	9.5	-	-	1.5	-
Freeze 12	ASU	10/16/96	Technical Chemical 800-527-0885	-	-	20	80	-	-	-
GHG-X5 (5)	ASU	6/3/97	People's Welding 800-382-9006	41	-	15	-	-	4	40
GHG-HP (5)	ASU	10/16/96	People's Welding 800-382-9006	65	-	31	-	-	4	-
Ikon-12	ASU	5/22/96	Ikon Corp. 601-868-0755	Composition claimed as confidential business information						
OZ-12®	UNA	3/18/94	OZ Technology	Flammable blend of hydrocarbons; insufficient data to demonstrate safety						
R-176	UNA	3/18/94	Arctic Chill	Contains CFC-12, which is inappropriate in a CFC-12						

				substitute
HC-12a®	UNA	6/13/95	OZ Technology	Flammable blend of hydrocarbons; insufficient data to demonstrate safety
Duracool 12a	UNA	6/13/95	Duracool Limited	This blend is identical to HC-12a® in composition but is manufactured by a different company
R-405A	UNA	6/13/95	Greencool	Contains a perfluorocarbon, which has extremely high global warming potential and lifetime

(1) R-401A (made by DuPont), R-401B (DuPont), R-409A (Elf Atochem), Care 30 (Calor Gas), Adak-29/Adak-12 (TACIP Int'l), MT-31 (Millenia Tech), and ES-12R (Intervest) have not been submitted for review in motor vehicle air conditioning, and it is therefore illegal to use these refrigerants in such systems.

(2) See text for details on legality of use according to status
ASU = acceptable subject to fittings, labeling, no drop-in, and compressor shutoff switch use conditions
UNA = unacceptable; illegal for use as a CFC-12 substitute in motor vehicle air conditioners

(3) Although some blends contain hydrocarbons, all blends that are ASU are nonflammable as blended

(4) Freezone contains 2% of a lubricant

(5) HCFC-22 content results in an additional use condition: must be used with barrier hoses

1. The following 18 states ban the use of flammable refrigerants such as HC-12a® and DURACOOL 12a® in motor vehicle air conditioning, regardless of the original refrigerant: Arkansas, Arizona, Connecticut, Florida, Idaho, Indiana, Iowa, Kansas, Louisiana, Maryland, North Dakota, Oklahoma, Texas, Utah, Virginia, Wisconsin, Washington, and the District of Columbia.

Blends –

As you know, EPA has worked closely with the industry to ensure the purity of recycled CFC-12 and HFC-134a, as provided by strict adherence to standards first established voluntarily by the Society of Automotive Engineers (SAE) and later incorporated into EPA regulations. In contrast, because such standards did not exist for blend refrigerants, technicians could recover them and send them to a reclaimer, but they could not recycle such blends. As explained in a letter to refrigerant manufacturers dated October 16, 1996:

> "Service shops may either recover HFC-134a or recycle it using special recycling equipment in the shop. Currently, however, it is not legal to

> recycle any other alternative MVAC refrigerant. EPA's policy is that until a standard for equipment designed to recycle a particular refrigerant is published and available (by EPA or an industry organization like SAE or UL), then it is illegal to recycle that refrigerant."

EPA has worked with UL and the MVAC industry since that letter was sent to develop a standard for blend recycling equipment. On May 29, 1998, UL adopted Standard 2964: Recover/Recycling Equipment and announced that it will accept equipment for certification testing. UL also solicited any additional comments that might be appropriate; if, after receiving comments, UL publishes an amended Standard, the new version will govern equipment certification. Standard 2964 includes numerous requirements for recycling equipment to guarantee that recycled blend refrigerant is similar in purity to recycled CFC-12 or HFC-134a. EPA believes that recycling equipment meeting this Standard will adequately remove oil, water, and other impurities. Under this Standard, technicians will follow similar procedures for recycling pure refrigerants, such as CFC-12 and HFC-134a, and blend refrigerants.

However, one key difference between pure refrigerants and blends is that blends may fractionate, meaning that it is impossible to predict in advance what composition will remain in the system after a leak. Because there is no means to guarantee the proper composition of a recycled blend, EPA believes it is appropriate to recharge such refrigerant only into the original vehicle. EPA is not allowing recycled blend refrigerant to be recharged into a vehicle other than the one from which it was removed. The only exception is for fleets of vehicles with a common owner; recycled blend refrigerant may be moved among vehicles within such a fleet.

In summary, it is now legal to recycle blend refrigerants used in MVACS using equipment certified to meet UL 2964, provided that refrigerant is returned to the original vehicle. Under the Significant New Alternatives Policy (SNAP) program, EPA has provided consumers with numerous options to replace CFC-12, and this new policy will ease the servicing of vehicles using blend refrigerants.

FAA APPROVED RETROFIT METHODS

FAA REGULATIONS
TYPES OF AIRCRAFT CERTIFICATION APPROVALS:

Aircraft modifications can be subdivided into minor and major changes. Minor changes are those which do not appreciably affect weight, balance, strength, reliability, operational characteristics, airworthiness characteristics, or emissions. Major changes are those which are not minor. The type of FAA approval applicable to a given modification is determined by the magnitude and complexity of the change.

Supplemental Type Certificates – Most major changes to Type Certificated products require a supplement to the Type Certificate (TC) called a Supplemental Type Certificate

(STC). In general, an STC is necessary for each TO product affected by the modification or installation. STCs are issued through an FAA ACO.

Field Approvals – Minor changes and some major changes can be field approved. This means that an FAA Flight Standards District Office (FSDO) inspector or an authorized designee inspects both the modification and supporting data. Approved data in the form of FAA Form 8110-3 will be submitted with the Field Approval Form 337. When the inspector determines that the design change complies with the applicable regulations, FAA approval is granted for the modification or installation by completing an FAA Form 337. Field approvals tend to take less time for completion and are less complicated than the STC application process. The dividing line between field approval and STC depends on the complexity of the modification.

In counsel with the FAA Aircraft Certification Office, it was determined that air conditioning conversions required an STC. This was based on the refrigerant composition change, the number of components changed, and the number of aircraft affected.

STANDARDIZATION

Standardization and Quality are the cornerstones of the aviation industry.

SAEJ1661 and standard maintenance practices were used to develop a specification to assure that the aircraft environmental control system retrofit will produce a system with equivalent or better capacity as the old system with minimum of downtime for the aircraft. The specification was also written to meet the requirements of the Federal Airworthiness Regulations (FARS).

STANDARDIZED R134A COVERSIONS – R134A is not a direct substitute "drop-in" for R12 because of incompatibilities with system materials. Therefore, it is necessary to replace the oil, seals, dessicants, and generally to inspect and replace any worn parts. The goal of the modification is to bring the system into current environmental standards while meeting or surpassing the original factory specifications.

RECOVERY – The old refrigerant must be recovered/recycled per acceptable EPA regulations and methods.

FLUSH – Flushing of the system is done after the initial R12 charge has been recovered using a proper recovery procedure. It is very important that the mineral oil lubricant be removed from the system. Mineral oil mixed with R134A will thicken and solidify, causing blockages and rendering the system less efficient. Additionally, flushing will remove particulates and other contaminants in the system. The proper flushing equipment is very important. A qualified and licensed air conditioning service facility should have the proper equipment to perform this procedure. Some system components will need to removed and system plumbed back to a closed loop system the perform the flushing procedure.

COMPONENT REPLACE MENT – Once the mineral oil has been flushed from the system, it is time to install new components.

INSPECT AND CLEAN SYSTEM -

CONDENSER/EVAPORATOR – These components do not need to be replaced in the system. However, it is very important to the system efficiency that they be checked cleanliness. Straighten fins and removed any debris that may have become lodged between the fins. This will increase the rate of thermal conduction.

HOSES– Hose assemblies are very important items to review and replace. Installers will want to use barrier type hoses in the new system. R134A has a smaller molecule than R12. This means that the permeation rate of R134A will be higher in R12 hose assemblies.

COMPRESSORS – [add section]

SEALS/O-RINGS – Some existing soft seals (o-rings) react differently with R134A and lubricants. While the system is down it is an excellent time to replace the system soft seals. HNBR materials have been developed to fit the applications of the R134A systems while meeting the high and low temperature requirements of the aviation market.

EXPANSION VALVES – The system will operate at maximum efficiency by using expansion valves that set to use R134A. New expansion valves will different MOP and Superheat settings to match the system capacities.

SERVICE FITTINGS AND LABELS – Another important change that has to be made is the installation of new service fittings or fitting adapters. These new quick disconnect fittings are compatible with R134A service equipment and will prevent that later accidental contamination of the new system with different oils or refrigerants. A new service decal is affixed next to the service fitting to warn service technicians that the system is serviced with R134A and to not service with R12 equipment. These fittings and decals should be in accordance with SAEJ1660.

LUBRICANT – There are several oils that are compatible with R134A. These are Synthetic Polyol Ester Lubricant (ESTER) and Poly Alkiline Glycol (PAG) oil. Installer should use ESTER oil aircraft R!#$A systems to eliminate possible irritating exposure to PAG oils during servicing or during a leak in the cabin at altitude.

RECEIVER-DRYER – The receiver-dryer should be replaced with a component with either XH-7 or XH-9 desiccant. The receiver-dryer should be the last component replaced to minimize expose to atmospheric moisture.

LEAK CHECK – The system should be evacuated to a minimum of _____. A preliminary leak check can be preformed by holding a vacuum. _____ [insert setcion from EO. never use shop air to leak check

CHARGING – Changing of the system now must be done in accordance with proper procedures to prevent over-changing which could lead to system damage.

TEST-

DIAGNOSTICS-

EPA Guidance on Retrofitting to R-134a

OZONE PROTECTION HOTLINE TOLL-FREE (800) 296-1996

The term "retrofit" describes 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 air conditioning 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 guidance 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 online and from the Hotline number listed above.

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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 system. 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-warrantied 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 solution.

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 well as 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 rely primarily 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-warrantied 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.

- Cost: how much is the customer willing to spend? How much longer will he own the vehicle? Is the vehicle a refrigerant leaker or is this the first time in the life of the vehicle that the a/c system has been serviced?
- Climate: does he need adequate a/c performance (because he only takes the car out on Sundays in Boise), or polar-level a/c performance (because he uses the car six days a week in Biloxi)? If he lives in Biloxi, is he so concerned about retrofit cost that he would prefer the least-cost retrofit, even if that retrofit will not, in the

tech's judgment, provide performance comparable to the system performance with R-12?
- Components: are the existing components in the a/c system in good shape? Are they compatible with R-134a?

If an R-12 system is performing marginally, retrofitting alone will not make it better. In fact, since R-12 systems were not designed for use with R-134a, owners should be prepared for a slight reduction in a/c performance. In most parts of the country, this reduction will not be significant, and vehicle owners may not notice any difference in performance.

In warmer climates, however, where the a/c system is running at full blast many months during the year, performing a simple, least-cost retrofit may not produce satisfactory performance. In that case, a technician should be able to recommend to his customer what additional steps are most appropriate -- possibly installing a larger condenser, or adding a fan or high-pressure cut-off switch. Although these steps make the retrofit more expensive, at least the car owner has a choice of options.

In addition, on older models, it may be necessary to replace worn a/c system components. R-134a may operate at higher pressures than R-12, and these higher pressures may put additional stress on the a/c system, so that older, worn components may be more likely to fail.

Some vehicles may also have components that were not specifically designed with R-134a in mind, and as a result may not withstand the higher pressures of R-134a. As a result, these components may experience a shortened service life. That service life may be shortened only slightly, or a great deal. Only wide-scale durability testing on thousands, if not millions, of retrofitted vehicles will provide the automotive service industry with a full understanding of how retrofit affects the life of each a/c system component.

Service techs should keep in mind that there is no such thing as a universal retrofit procedure, or a simple kit a technician can purchase that will provide all the necessary parts to guarantee a successful retrofit for every make and model. Even within particular models, retrofit requirements may vary. A particular make, model and year vehicle driven for 90,000 miles in Houston may require a more extensive retrofit than the same make, model and year driven for 35,000 miles in Minneapolis.

The Society of Automotive Engineers (SAE) provides guidelines for a/c retrofit in their publication J1661. Several refrigerant and lubricant producers have published their own recommendations. EPA is compiling a list of organizations that offer either classroom or home-study (videotape/workbook) retrofit training. For EPA's current list, see "Resources for Retrofit Training" at the end of this document.

EPA Requirements for Retrofit

According to EPA regulations, the use of **any** alternative refrigerant to replace R-12 requires **at a minimum** that --

- unique service fittings be used in order to minimize the risk of cross-contamination of either the air- conditioning system or the service facility's recycling equipment;
- the new refrigerant be identified by a uniquely-colored label in order to identify the refrigerant in the system;
- all R-12 be properly removed from the system before filling the system with an alternative refrigerant;
- in order to prevent release of refrigerant to the atmosphere, a high-pressure compressor shutoff switch be installed on any system equipped with a pressure relief device; and
- separate, dedicated EPA-approved equipment be used to recover the R-12 from the system.

In addition, alternative refrigerant blends that contain HCFC-22 must be used with barrier hoses.

A Word on Replacements Other Than R-134a

A number of refrigerants other than R-134a have been listed by EPA as acceptable under its Significant New Alternatives Policy (SNAP) program, or are under SNAP review. The SNAP program evaluates sub-stitutes **only** for their effect on human health and the environment, and **not** for performance or durability. None of these refrigerants have been endorsed by the OEMs for use in vehicles, and few have had extensive testing in a wide range of vehicle models. In addition, most are currently not readily available in all areas of the country.

While some manufacturers of alternatives may be marketing their products as "drop-ins," keep in mind that because the regulations described above apply to any substitute for R-12, there is no such thing as a refrigerant that can literally be dropped in on top of the existing R-12 in the system. For more information on the SNAP requirements and on which alternatives have been reviewed, accepted, or deemed unacceptable by EPA, call the Ozone Hotline number above and request a copy of "Choosing and Using Alternative Refrigerants in Motor Vehicle Air Conditioning" or read it online.

Many service techs believe that R-134a is only a temporary replacement for R-12, to be used until a drop-in replacement that cools well and does not require a retrofit becomes available. Current research indicates that no such replacement refrigerant exists. The worldwide automotive industry conducted extensive research and testing on many potential substitutes for R-12 before selecting R-134a. EPA is not aware of any plans by the automakers to use any refrigerant in new vehicles other than R-134a.

R-134a Refrigerant

-- Toxicity, Flammability, Corrosion.R-134a is regarded as one of the safest refrigerants yet introduced, based on current toxicity data. The chemical industry's Program for Alternative Fluorocarbon Toxicity Testing (PAFT) tested R-134a in a full battery of laboratory animal toxicity studies. The results indicate that R-134a does not pose cancer or birth defects hazard. In addition, R-134a is being used in metered dose inhalers in Europe.

OEM engineers and chemical manufacturers have examined the flammability and corrosivity of each potential R-12 substitute. Like CFC-12, R-134a is not flammable at ambient temperatures and atmospheric pressures. However, R-134a service equipment and vehicle a/c systems should not be pressure tested or leak tested with compressed air. Some mixtures of air and R-134a have been shown to be combustible at elevated pressures. These mixtures may be potentially dangerous, causing injury or property damage. R-134a is not corrosive on standard steel, aluminum and copper samples.

When handling R-134a, as with any other chemical, service techs should be sure to work in a well ventilated area. It is never a good idea to inhale *any* vapor to such an extent that it replaces the oxygen in your lungs.

-- How Much to Charge into the System. The amount of R-134a charged into the system should normally be 80-90% of the amount of R-12 in the system. Most a/c system manufacturers provide guidelines regarding the amount of R-134a to be used.

Lubricants

-- PAGs vs. Esters. The mineral oil used with R-12 cannot be sufficiently transported throughout the a/c system by R-134a. Automobile manufacturers tested both PAGs and esters for refrigerant/lubricant miscibility, lubricity, chemical stability and materials compatibility. In the process of developing recommendations, they also considered the additives and conditioners present in the oils. Most - but not all -chose to use PAG lubricants in new vehicles equipped with R-134a, and are also recommending PAG lubricants for retrofits. Some compressor manufacturers are shipping new compressors with PAGs, some with esters, and some are shipping them empty.

PAGs are hygroscopic, which means that they will draw water from the atmosphere when exposed. Many aftermarket a/c specialists are choosing to use ester lubricants because they believe that the hygroscopic characteristics of PAGs may limit their lubricating ability and introduce corrosion into an a/c system. Esters are also hygroscopic (although less so than PAGs), and care must still be taken to ensure that excess moisture does not go into the system. It is good practice to use PVC-coated gloves (or, if that is impractical, barrier creams) and safety goggles when handling these lubricants, since prolonged skin contact and/or even brief eye contact can cause irritations such as stinging and burning sensations. You should also avoid breathing any vapors produced by the lubricants, and make sure to use them in well ventilated areas. And be sure to keep both PAGs and esters in tightly sealed containers, both so that humidity does not contaminate the oil, and so that vapors do not escape.

-- **Flushing.** The amount of mineral oil that can safely remain in a system after retrofitting, without affecting performance, is still being debated. It was originally thought that any mineral oil left in the system might cause system failure. As long as the tech has removed as much of the old mineral oil as possible, any residual R-12 left in the system should not have a significant effect on the performance of the system. Removing the mineral oil may require draining certain components. Unless the vehicle manufacturer recommends flushing the system during the retrofit procedure, a service tech can assume that flushing is not necessary. (Although the SAE J1661 procedure for retrofit includes flushing, SAE no longer believes that flushing is critical to a successful retrofit.)

Hoses and O-Rings

When R-134a was first introduced, it was thought that all non-barrier/nitrile hoses would have to be replaced during an a/c retrofit. Early laboratory tests showed that the small R-134a molecules leaked through the walls of non-barrier hoses more readily than the larger R-12 molecules did. In the lab, this caused unacceptably high leakage rates. More recent testing, however, has shown that oil used in automotive a/c systems is absorbed into the hose to create a natural barrier to R-134a permeation. In most cases, the R-12 system hoses will perform well, provided they are in good condition. Cracked or damaged hoses should always be replaced with barrier hoses.

Unless a fitting has been disturbed during the retrofit process, replacement should not be necessary. Most retrofit instructions call for lubricating replaced O-rings with mineral oil to provide this protection.

Compressors

Industry experts once thought that a retrofit would require compressor replacement. This belief helped create some of the horror stories about the expense of retrofitting. Now it is routinely accepted that most compressors that are functioning well in R-12 systems will continue to function after the systems have been retrofitted.

When a compressor is first run with R-12, a thin film of metal chloride forms on bearing surfaces and acts as an excellent anti-wear agent. This film continues to protect after the system has been converted to R-134a. This helps explain why a new R-12 compressor may fail more quickly if it is installed in an R-134a system without the benefit of a break-in period on R-12.

A few older compressors use seals that are not compatible with either R-134a or the new lubricants. The compressor manufacturer can identify which compressors need special attention. Any compressor that has seals made of Viton® should not be used with R-134a because the refrigerant will cause the seals to swell excessively.

Of course, any compressor that is not in good shape should be replaced during the retrofit procedure. Service techs should make sure that any replacement compressor is approved for R-134a by its supplier.

Desiccants, Accumulators, Receiver/Driers

R-12 systems use an XH-5 desiccant, while R-134a systems use either XH-7 or XH-9 desiccant. Some manufacturers recommend routine replacement of the accumulator or receiver-drier to one containing XH-7 or XH-9 during the retrofit procedure. (Any systems with silica gel should also be switched to XH-7 or -9 desiccant.) Others recommend leaving it alone. Manufacturers generally agree, however, that the accumulator or receiver-drier should be replaced if the vehicle has over 70,000 miles or is older than five years, and is opened up for major repair. In that case, the only recommendation is to use the R-134a-compatible desiccants.

Condensers and Pressure Cutout Switches

When retrofits were first studied several years ago, it was thought that the condenser and perhaps the evaporator would have to be replaced to maintain an acceptable level of cooling performance on a retro-fitted system. Now, it is generally accepted that if an R-12 system is operating within the manufacturer's specifications, there may be no need to replace either part.

It is true, however, that the higher vapor pressures associated with R-134a may result in lost condenser capacity. When retrofitting, service techs should consider how the air flow and condenser design on the particular vehicle will affect the success of the retrofit. In some cases, the installation of pusher-type engine/condenser cooling fans mounted in front of the condenser have improved the performance of retrofitted a/c systems.

Service techs should also be aware that bent, misshapen or improperly positioned airflow dams and directors may affect performance. Some OEMs are including hood seal kits as part of their recommended retrofit procedures. In addition, systems that are not equipped with a high-pressure cutout switch should have one installed to prevent damage to a/c parts and to prevent refrigerant emissions. The installation of a high-pressure cutout switch will shut off the compressor when high pressures are encountered, reducing the possibility of venting the refrigerant and overheating the engine cooling system.

Refrigerant Controls

Refrigerant controls -- whether they are orifice tubes or expansion valves that meter refrigerant flow, or pressure cycling switches or other pressure controls designed to protect against freezing -- may have to be changed during the course of a retrofit.

SAE J1661

GROUND SUPPORT EQUIPMENT

Process Definitions

Recovery: To remove refrigerant in any condition from a system and store it in an external container without necessarily testing or processing.

Recycling: To reduce contaminats in used refrigerant by separation with single or multiple passes through devices such as replacable filter core driers, which reduce moisture, acidity, and particulate matter.

Reclaim: To reprocess refrigerant to new product specifications by means which may include distillation. Chemical analysis of the refrigerant is required to assure that appropriate product specifications are met.

Refrigerant Containment Options

1. Recover and reuse without processing
2. Recover and recycle on site
3. Recover and reclaim off site
4. Recover and destroy

	Option 1	Option 2	Option 3	Option 4
R-12	Yes	Yes	Yes	Yes
R-134a	Yes	Yes	Yes	Yes
Blend	Yes*	No	Yes**	Yes

*Must be used in same vehicle or fleet
**Manufacturer Specific

Impact of Motor Vehicle Air Conditioners

One of the largest uses of CFC-12 in the U.S. is as a refrigerant in motor vehicle air conditioners (MVACs). Section 609 of the Act gives EPA the authority to establish requirements to prevent the release of refrigerants during the servicing of MVACs and to require recycling of refrigerants. Widespread refrigerant recycling reduces the demand for virgin CFC-12 and thus extends the time that it will be available. The following sections describe the requirements of the law and its potential impact on the service industry.

Recycling vs. Reclamation

In the discussion below, recycling means the use of a machine to remove impurities and oil and then recharge the refrigerant into either the same car or a different car. Recycled refrigerant is not as pure as reclaimed refrigerant. Recycling occurs in the service shop.

Reclamation means the removal of all oil and impurities beyond that provided by on-site recycling equipment, and reclaimed refrigerant is essentially identical to new, unused refrigerant. Reclamation cannot be performed in the service shop. Rather, the shop generally sends refrigerant either back to the manufacturer or directly to a reclamation facility.

Handling CFC-12

Venting CFC-12

Another section of the Clean Air Act, section 608, prohibits releasing CFC-12 into the atmosphere. The prohibition on venting CFC-12 has been in effect since 1992.

Section 609 Regulatory History

The original regulation promulgated under section 609 was published in July 1992. That regulation established standards for equipment that recovers and recycles CFC-12 refrigerant from motor vehicle air conditioners, rules for training and testing technicians to handle this equipment, and record-keeping requirements for service facilities and for refrigerant retailers. A supplemental final rule published in May 1995 established a standard for equipment that recovers but does not recycle CFC-12, and training and testing technicians to handle this equipment.

Approved Equipment

Technicians repairing or servicing CFC-12 MVACs must use either recover/recycle or recover-only equipment approved by EPA. Recover/ recycle equipment cleans the refrigerant so that oil, air and moisture contaminants reach acceptably low levels. A list of approved recover/recycle and recover-only equipment is available from the Hotline.

Technician Training and Certification

Technicians who repair or service CFC-12 motor vehicle air conditioners must be trained and certified by an EPA-approved organization. Training programs must include information on the proper use of equipment, the regulatory requirements, the importance of refrigerant recovery, and the effects of ozone depletion. To be certified, technicians must pass a test demonstrating their knowledge in these areas. A list of approved testing programs is available from the Hotline and the web site listed above.

Recordkeeping Requirements

Service shops must certify to EPA that they own approved CFC-12 equipment. If refrigerant is recovered and sent to a reclamation facility, the name and address of that facility must be kept on file.

Sales Restrictions

Section 609 has long prohibited the sale of small cans of ozone-depleting refrigerants to anyone other than a certified technician. The sale of **any** size container of CFC-12 to anyone other than certified technicians was prohibited under section 608 of the Act beginning on November 14, 1994. This provision is

intended to discourage "do-it-yourselfers" who recharge their own air conditioners. Such individuals often release refrigerant because they typically do not have access to recovery/recycling equipment. The Agency encourages "do-it-yourselfers" to bring their cars to certified technicians who can properly fix air conditioners using approved equipment. This avoids damage to A/C equipment by improper charging and helps to protect the environment.

Handling HFC-134a

Venting HFC-134a Refrigerant

Section 608 of the Clean Air Act prohibits releasing HFC-134a into the atmosphere. The prohibition on venting HFC-134a has been in effect since November 1995.

Section 609 Regulatory History

In March, 1996, EPA proposed a rule to require recycling of HFC-134a. The rule proposed standards for recover-only and recover/recycle equipment and rules for training and testing technicians to handle this equipment. EPA requested comments from the public about this proposed rule, and, after reviewing the comments, published a final rule on December 30, 1997. This final rule will become effective on January 29, 1998. For more information about this rule, see the fact sheet "Summary of Final Rule Governing Substitutes for CFC-12 Refrigerant in Motor Vehicle Air Conditioners" available through the Hotline and the web site.

Approved Equipment

Technicians who repair or service HFC-134a MVACs must recover the refrigerant and either recycle it on-site, or send it off-site to a reclamation facility so that it may be purified according to ARI Standard 700. Technicians must use EPA-approved equipment to perform the refrigerant recovery and recycling. Recover/ recycle equipment cleans the refrigerant so that oil, air and moisture contaminants reach acceptably low levels. A list of approved recover/recycle and recover-only equipment is available from the Hotline and the web site listed above. Note that certain EPA-approved models can recycle both CFC-12 and HFC-134a refrigerants.

Converting CFC-12 Equipment for Use with HFC-134a

EPA regulations prohibit technicians from changing fittings on the same unit back and forth so that the unit is used for CFC-12 in the morning, HFC-134a in the afternoon, then back to CFC-12 again, etc.

EPA regulations specify that when equipment is converted for use with a new refrigerant, the converted unit must be able to meet the applicable equipment standard set forth in the regulations. CFC-12 equipment may be permanently converted for use with HFC-134a under certain conditions. EPA intends to issue regulations placing certain restrictions on these retrofits in the future. Those restrictions may require that the manufacturer's service representative rather than

the automotive service technician perform the retrofit, that a unit may only be retrofitted if retrofit procedures have been certified by an independent testing laboratory such as Underwriters Laboratories, and that an appropriate label is affixed to the unit. In addition, the retrofitted unit must meet the technical specifications of SAE standard J2210 and must have the capacity to purify used refrigerant to SAE standard J2099 for safe and direct return to the air conditioner following repairs.

Currently, however, in the absence of any EPA regulations, a service facility may perform such a retrofit, or may have the equipment manufacturer's service representative perform the retrofit, as long as the fittings are changed in accordance with EPA's Significant New Alternative Policy (SNAP) program regulations. The Agency cautions technicians, however, that even though recovering a given refrigerant using permanently converted equipment is legal, it may not be technically desirable. The equipment is designed to be compatible with specific refrigerants, and incompatible materials may cause short circuits, damage to seals, and compressor failure. Technicians should check with the recovery equipment manufacturer for recommendations about the recovery of refrigerants other than the refrigerant the equipment was originally intended to recover. Conversion of recovery equipment for use with other refrigerants may also invalidate any warranties offered by the equipment manufacturer.

Technician Training and Certification

Technicians who repair or service HFC-134a MVACs must be trained and certified by an EPA-approved organization. If a technician is already trained and certified to handle CFC-12, he does not need to be recertified to handle HFC-134a.

Recordkeeping Requirements

Service shops must certify to EPA that they own approved HFC-134a equipment. Note that this certification is a one-time requirement, so that if a shop purchased a piece of CFC-12 recycling equipment in the past, and sent the certi-fication to EPA, the shop does not need to send a second certification to EPA when it purchases a second piece of equipment, no matter what refrigerant that equipment is designed to handle. If refrigerant is recovered and sent to a reclamation facility, the shop must retain the name and address of that reclaimer.

Sales Restrictions

Right now, there is no restriction on the sale of HFC-134a, so anyone may purchase it. This year, EPA will issue a proposed rule under section 608 of the Act that will include a proposal to restrict the sale of HFC-134a so that only technicians certified under sections 608 and 609 may purchase it. After the proposed rule is published, EPA will review comments from the public on the proposal and will then publish a final rule sometime in 1998 or 1999.

Handling Other Refrigerants that Substitute for CFC-12

Venting Substitute Refrigerants

Other than HFC-134a, all EPA-accepted refrigerants that substitute for CFC-12 in motor vehicles, and that are currently on the market, are blends that contain ozone-depleting HCFCs such as R-22, R-142b and R-124. Section 608 of the Clean Air Act prohibits venting any of these new blend substitutes into the atmosphere. The prohibition on venting these ozone-depleting blends has been in effect since 1992.

Section 609 Regulatory History

The December, 1997 final rule established a standard for equipment that is designed to recover, but not recycle, any single, specific blend substitute refrigerant.

Using Older Equipment to Recover Blends

Technicians have a number of choices in recovering blend refrigerants. One option is that a technician may permanently dedicate an older piece of equipment he owns to recovering one or more blend refrigerants. The technician may also use this equipment to recover contaminated CFC-12 and HFC-134a and other "mystery mixtures." This equipment, however, may no longer be used to recover uncontaminated CFC-12 or HFC-134a. Refrigerant recovered using this kind of "junk" tank must then be shipped off-site for reclamation or destruction.

Using New Equipment to Recover Blends

Another option for recovering a blend refrigerant is to use a new piece of EPA-approved equipment designed to recover, but not recycle, any single, specific blend refrigerant. The EPA regulation published in December, 1997, includes an appendix that describes the standards that this new equipment must meet.

In addition, EPA is currently working with independent testing laboratories and equipment manufacturers to devise a standard for new equipment that can recover, but not recycle, both multiple blend refrigerants and contaminated CFC-12 and HFC-134a. EPA will finalize a standard for this type of equipment by the end of 1998. This equipment may be commercially available by the 1998 A/C season. EPA expects to grandfather any equipment purchased in 1998 before the EPA standard becomes finalized.

Recycling Blends

As of June 1, 1998, EPA allows recycling of refrigerant blends used in motor vehicle air conditioning systems (MVACs), provided that a) recycling equipment meets a new Underwriters Laboratories (UL) standard (Standard 2964) and b) refrigerant is returned to the vehicle from which it was removed. The only exception to item b) is for fleets of vehicles with a common owner; recycled blend refrigerant may be moved among vehicles within such a fleet. EPA detailed this policy in a June 1, 1998 open letter to the industry. Certified recycling equipment may be commercially available during the 1998 A/C season. EPA plans to adopt this new UL standard into EPA's regulations and to grandfather any equipment that (1) meets the UL standard and (2) is purchased before the date on which EPA publishes a proposed rule to adopt the UL standard.

Converting CFC-12 or HFC-134a Recover/Recycle Equipment for Use with Blend Substitutes

EPA currently prohibits the conversion of existing CFC-12 or HFC-134a recycling equipment for either temporary or permanent use with a blend refrigerant, unless the equipment is used only to recover, but not to recycle, the refrigerant. In the future, EPA may issue regulations allowing these conversions but placing certain restrictions on who performs the conversions, what models may be converted, etc.

Technician Training and Certification

Technicians who repair or service MVACs that use blend refrigerants must be trained and certified by an EPA-approved organization. If a technician is already trained and certified to handle CFC-12 or HFC-134a, he does not need to be recertified to handle a blend refrigerant.

Recordkeeping Requirements

Service facilities that work on vehicles that use blend substitutes must certify to EPA that they own approved equipment designed to service these refrigerants. Note that this certification is a one-time requirement, so that if a shop purchased a piece of CFC-12 or HFC-134a recycling equipment in the past, and sent the certification to EPA, the shop does not need to send a second certification to EPA when it purchases a second piece of equipment, no matter what refrigerant that equipment is designed to handle. If refrigerant is recovered and sent to a reclamation facility, the shop must retain the name and address of that reclaimer.

Sales Restrictions

Section 608 regulations prohibit the sale of any size container of any blend refrigerant to anyone other than a certified technician. This prohibition began in November, 1994.

FREQUENTLY ASKED QUESTIONS

Ten Questions to Ask Before You Purchase An Alternative Refrigerant

OZONE PROTECTION HOTLINE TOLL-FREE (800) 296-1996

Many new alternative refrigerants marketed for use in the motor vehicle and stationary/commercial sectors are being touted by their manufacturers and distributors. Whether you're a nationwide distribution chain or a one-man service shop, you should take the time to determine how well an alternative will work and whether it may pose any problems for your customers or liability for you. Consider asking your supplier, whether it is the refrigerant manufacturer or a distributor, the following questions.

1. Is the refrigerant on the Environmental Protection Agency's SNAP (Significant New Alternatives Policy) Program list of acceptable substitutes, and therefore legal to use as a substitute for a CFC refrigerant? If so, are there any restrictions on how the refrigerant can be used?
2. How much will the alternative refrigerant cost?
3. What does the system manufacturer have to say about this refrigerant and whether it is compatible with system components? Will using a particular refrigerant void any warranties on the system the refrigerant is used in?
4. What recycling and/or reclamation standards apply to the refrigerant? Can the refrigerant be recycled or reclaimed to those standards?
5. What equipment must be used with the alternative refrigerant?
6. Has the alternative refrigerant been evaluated by ARI (the Air-Conditioning and Refrigeration Institute)? If an alternative is to be reclaimed, will it be reclaimed to ARI's 700 standard? If not, then how will the purity of the reclaimed alternative refrigerant be assured?
7. Is the alternative refrigerant flammable?
8. Is the refrigerant readily and widely available?
9. What is my liability if I sell an alternative not yet listed as acceptable by EPA or if I put it in a customer's system?
10. Are any alternative refrigerants more environmentally beneficial than others?

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1. **Is the refrigerant on the Environmental Protection Agency's SNAP (Significant New Alternatives Policy) Program list of acceptable substitutes, and therefore legal to use as a substitute for a CFC refrigerant? If so, are there any restrictions on how the refrigerant can be used?** EPA's SNAP program determines what risks alternatives to CFC or HCFC refrigerants pose to human health and the environment. EPA evaluates the alternative refrigerant's ozone-depleting potential, global warming potential, flammability, and toxicity. The SNAP evaluation, however, does not determine whether the alternative will provide adequate performance or will be compatible with the components of an A/C or refrigeration system. Call the Hotline number listed above for the SNAP fact sheet on alternative refrigerants and for lists of refrigerants accepted under SNAP, or download a version of the current list.

   EPA may place conditions or restrictions on how an alternative can be used. For example, using a motor vehicle A/C refrigerant accepted under SNAP as a CFC-12 substitute requires, among other things, the use of a new label and new fittings unique to the alternative, and the CFC-12 must first be removed from the system. Note that there is no do-it-yourself (DIY) exemption from SNAP requirements. Both service technicians and DIYers who use alternatives found unacceptable under SNAP or ignore use conditions have violated the Clean Air Act. A fact sheet explains the current status of all refrigerants reviewed so far for motor vehicle air conditioning.

2. **How much will the alternative refrigerant cost?** Many manufacturers and distributors of alternative refrigerants may point out how much less expensive their product is than the refrigerant it is substituting for. Potential purchasers, however, should compare the cost of the product with the cost of other substitutes. For example, if you are considering purchasing a blend refrigerant that substitutes for CFC-12, consider its cost relative to the cost of HFC-134a, which is generally considerably less expensive than blend refrigerants.

3. **What does the system manufacturer have to say about this refrigerant and whether it is compatible with system components? Will using a particular refrigerant void any warranties on the system the refrigerant is used in?** Because of the wide range in equipment types and designs, EPA does not issue retrofit procedures. The best source of information on how a given substitute will perform in a system is the manufacturer of the system and its components. Note that lab data have indicated that HCFC-22 refrigerant is not compatible with XH-5 or XH-7 desiccant, and that HCFC-22 can also damage NBR nitrile and HNBR rubber hoses and O-rings. If you are considering using a blend refrigerant that includes HCFC-22 as a major component, then you should ask about these issues before you purchase the refrigerant.

   In addition to questions about the alternative's performance in a particular end use, you should determine whether charging a system with a new refrigerant will void any warranty. Many component manufacturers have stated that their warranties will be voided if any refrigerant other than R-12 or R-134a is charged into the system.

4. **What recycling and/or reclamation standards apply to the refrigerant? Can the refrigerant be recycled or reclaimed to those standards?** The Clean Air Act requires that EPA establish standards for the recovery, on-site recycling and off-site reclamation of refrigerants, including alternatives accepted under SNAP. The Agency's standards for recovering and recycling refrigerants in motor vehicles are generally based on Society of Automotive Engineers (SAE) standards. EPA's standards for reclaiming refrigerants from motor vehicles and from stationary/commercial A/C and refrigeration systems are generally based on ARI (Air-Condtitioning and Refrigeration Institute) standards. If these standards have not been published by EPA for a particular alternative, then they may be under development by EPA, SAE or ARI. Check to make sure that the refrigerant manufacturer intends to work with these organizations to develop uniform methods for extraction, recycling and reclamation. You can call the Hotline number listed above to determine the status of EPA standards and requirements.

Note that currently, there is no way to recycle blend refrigerants on-site at an automotive facility, so that used blend refrigerants must be sent off-site for reclamation or incineration.

5. **What equipment must be used with the alternative refrigerant?** Equipment that is used by a facility to service R-12 or R-134a A/C systems may not be used to charge, recover or recharge a blend refrigerant. Technicians must therefore dedicate newly purchased equipment to that blend. Alternatively, a shop may convert a piece of R-12 or R-134a equipment for permanent use with the blend refrigerant. For more information on equipment requirements, see the EPA document "Just the Facts for MVACs."

6. **Has the alternative refrigerant been evaluated by ARI (the Air-Conditioning and Refrigeration Institute)? If an alternative is to be reclaimed, will it be reclaimed to ARI's 700 standard? If not, then how will the purity of the reclaimed alternative refrigerant be assured?** ARI, an A/C and refrigeration manufacturers' trade association, develops standards for the industry. ARI's 700 standard specifies acceptable levels of refrigerant purity for fluorocarbon refrigerants including R-12, R-22, R-134a, R-500, and R-502 and for certain refrigerant blends. The purpose of the 700 standard is to enable users to evaluate and accept or reject refrigerants, whether virgin, reclaimed or repackaged. Reclamation of these refrigerants in both the motor vehicle and stationary/commercial sectors must follow the 700 standard.

7. **Is the alternative refrigerant flammable?** Both ASHRAE (the American Society of Heating, Refrigerating and Air-Conditioning Engineers) and EPA evaluate refrigerant flammability. As part of its SNAP review, EPA requires that a new refrigerant be tested according to the American Society of Testing Materials (ASTM) E-681 testing method. E-681 is used to determine the concentrations in air at which a substance is flammable, at normal atmospheric pressure. In addition to testing the refrigerant itself, if a blend contains a flammable component, EPA requires leak testing to ensure that the composition does not change and become flammable. EPA prohibits the use of any flammable CFC-12 substitutes in motor vehicle A/Cs.

   If a substitute is flammable, EPA requires a comprehensive risk assessment for each proposed end-use. This risk assessment estimates the likelihood of fire and the potential results if a fire were to occur, in addition to suggesting measures to mitigate this risk. State governments, fire marshals, building code organizations, and other local authorities may have issued prohibitions or other regulations

related to flammable refrigerants. Check with them before buying, selling, or using a flammable refrigerant.

8. **Is the refrigerant readily and widely available?** If an automotive service technician charges a system with an alternative refrigerant that later becomes unavailable, or that is not available nationwide, then at the next servicing, the system may have to be retrofitted to another appropriate substitute. The customer may be unwilling to pay for the retrofit, or may be unhappy that his vehicle cannot be therwise serviced at the facility he chooses.

9. **What is my liability if I sell an alternative not yet listed as acceptable by EPA or if I put it in a customer's system?** Under EPA regulations, a refrigerant manufacturer must submit information on a new refrigerant for SNAP review at least 90 days before marketing the product. This 90-day period is required by Section 612 of the Clean Air Act, but the Act did not prohibit sale and use of that refrigerant after the 90-day period. Thus, if the Agency is still engaged in its review when the 90 days elapses, the product can be sold and used, even though it is not "EPA acceptable." However, EPA may later determine that the product is unacceptable under SNAP. It makes sense, then, to determine whether SNAP review is complete -- if not, it may be only temporarily legal to use the alternative refrigerant. If you purchased the refrigerant during the SNAP review, and EPA later determines that it is unacceptable, you may be stuck with a large inventory of refrigerant no one can legally use!

   The Clean Air Act only granted EPA the authority to regulate the ***use*** of alternative refrigerants, not the ***sale*** of them. Even if EPA determines that an alternative is unacceptable, it is still legal to sell it. However, putting it in a customer's A/C or refrigeration system is considered use, not sale, so a service technician who charges a system with an unacceptable refrigerant may be subject to a $25,000 fine and up to five years' jail time.

10. **Are any alternative refrigerants more environmentally beneficial than others?** HFC-134a does not contain chlorine and therefore does not contribute to ozone depletion, although like other HFCs, it contributes to global warming. HCFC-22 and all other HCFCs contribute to both ozone depletion and global warming. All blend refrigerants listed as acceptable for motor vehicle use contain HCFCs.

Sources of additional data:

www.faa.gov/
www.epa.gov/ozone/title6/

Questions: