United States Environmental Protection Agency
Office of Air and Radiation Stratospheric Protection Division 6205J
June 1997 EPA-430-F-97-065

Choosing and Using Alternative Refrigerants for Motor Vehicle Air Conditioning

OZONE PROTECTION HOTLINE TOLL-FREE (800) 296-1996
EPA'S MOTOR VEHICLE AIR CONDITIONING WORLD WIDE WEB SITE:
http://www.epa.gov/ozone/609/

Note: this version contains several changes from earlier versions. In particular, an explanation of the compressor cutoff switch has been added to the discussion of the use conditions and to footnote 2 on the table of refrigerants, and GHG-X5 and Duracool (a refrigerant similar to HC-12a®) have been added to the table of refrigerants.

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.

EPA 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/recycling equipment for that refrigerant.

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."

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/recycling equipment for that refrigerant.

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/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 will mean it will last longer, so fewer retrofits will be necessary nationwide.

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 color is chosen by the manufacturer to be unique, and it contains:

- 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 replace the old hoses with new, less permeable hoses. The table 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.

- 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 substitutes for CFC-12 in car or truck 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 for use 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.

For More Information

EPA's Stratospheric Ozone Protection Hotline (800-296-1996) distributes numerous fact sheets and brochures. In addition, this information is available on EPA's World Wide Web site (http://www.epa.gov/ozone/title6/609/). Each of the following explains one issue related to motor vehicle air conditioning and ozone depletion:

- Qs & As on Motor Vehicle Air Conditioning: What Consumers & Service Technicians Want to Know
- Qs & As on HC-12a, OZ-12, and Other Flammable Refrigerants
- Questions to Ask Before You Purchase an Alternative Refrigerant
- The Facts Behind the Phaseout (ozone depletion science; found at http://www.epa.gov/ozone/science/sc_fact.html)

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)	Iso-butan	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	Freezone 888-373-3066			19	79			
Ikon-12	ASU	5/22/96	Ikon Corp. 601-868-0755	Composition claimed as confidential business information						
R-406A/ GHG/ McCool (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	
GHG-HP (5)	ASU	10/16/96	People's Welding 800-382-9006	65		31			4	
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
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®						
R-405A	UNA	6/13/95	Greencool	Perfluorocarbon component; 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.