



Background

Refrigerant blends are mixtures of refrigerants that have been formulated to provide a match to certain properties of the refrigerants originally used. These blends have been researched and developed since the issue of the ODS phase-out emerged and are being produced by many chemical companies. Blends can have 2-3 or even 4 components, and can have a major component of a HCFC, HFC or HC; in most cases they will consist of a combination of these chemicals.

The refrigerant blends have their own trade names. The well-known ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers) refrigerant number also applies to blends. The attached annex extracted from the 2002 Report of UNEP Refrigeration Technical Options Committee lists most popular used blends and their numbers. The US Environment Protection Agency (EPA) through its Significant New Alternatives Policy (SNAP) provides lists of "Acceptable Substitutes for Class I (CFCs) Substances" (see attached websites) in Air Conditioning, Commercial Refrigeration and Non-commercial refrigeration for new production and retrofitting, which could be used as a good reference.

The blends that are currently widely used around the world are HFC based such as R-407C and R-410A to replace R-22. However, due to the increase of the prices of R-134a, the HCFC-based blends¹ such as R-406A and R-415B have entered into the regional and world servicing market for the replacement of R-12, and even R-134a.

This fact-sheet will limit its discussion on the blends for the replacement of R-12 only and not for R-22.

Technical facts of refrigerant blends

The HCFC based blends such as R-401A, R-401B, R-401C, R-406A, R-409A, R409B, R415B, R416A and zero ODP HFC/HC based R407A, R-413A, R-600a/R-290 can be used to replace R-12. All these blends are compatible with most of the materials used in R-12 based systems and will mostly operate with conventional mineral oils used with R-12 refrigerant. As the blends were made to have similar properties of R-12, they could be used as drop-in alternatives in R-12 based systems with an acceptable performance and (if so) a small energy consumption penalty. However, it might be necessary to note that, in some cases, there may be a need to make some changes to the R-12 based system while using some of the blends. Furthermore, using these blends as a retrofit for R-134a should really be avoided, because if the original system was designed for HFCs, lubricant problems may occur during the lifetime of the system. In this retrofit case, serious energy penalty problems may also occur, dependent on the design of the system.

These blends are non-azeotropic, i.e. the liquid and vapor composition is different at most given temperature and pressure. This specific characteristic of non-azeotrope blends causes concerns on composition changes in the refrigerant supply chain, including liquid removal

¹ HCFC blend means one or more components of the blend are HCFCs.

from containers for multi-component refrigerant mixtures in the manufacturer plant, and refrigerant transfers to smaller containers by dealers. The study conducted by ARI indicates “refrigerant mixtures can have composition changes during the handling procedures that lead to out-of-specification composition”. The refrigerant transfer and equipment charging by technicians, and refrigerant equipment leakage could also change the composition. The change of the composition will affect the performance to some extent. Accordingly, ASHRAE sets composition tolerances for specific blends, for example, ASHRAE composition tolerances for R-410A (R-32/R-125) are +0.5, -1.5% for R-32, and +1.5, -0.5% for R-125.

Several of the blends use flammable hydrocarbons as one of the components, and some blends just use a mixture of hydrocarbons. Therefore, some safety concerns are raised for their application. Some regions/countries set a limitation in specific equipment for such kinds of blends or even forbid the use.

In the developed countries, the HCFC based blends for replacement of R-12 were not widely used for manufacturing of new equipment or retrofitting of the existing equipment partly due to its ODP value, flammability and servicing complications. Also, the retrofitting of appliances is not practiced in developed countries mainly because of availability of recycled CFC- for servicing and high retrofitting cost due to higher labor charges vs. new equipment cost.

Pros and Cons of refrigerant blends

Pros:

The refrigerant blends provide another way to assist the country in compliance with the CFCs phase-out provision under the Montreal Protocol while not harming the interests of the end users;

The refrigerant blends (if main components are either R-22/R152a/HCs) are cheaper than R-134a and other alternatives; they are easy to get in the region;

The HCFC based refrigerant blends as mentioned above aimed to replace R-12 can mostly be used with mineral oils and can provide acceptable performance in retrofitted equipment.

Cons:

HCFC based blends are an interim CFC replacement solution.

Due to the non-azeotropic and possible flammable characteristics, the servicing procedure especially charging would be complicated and the technicians should be informed to follow proper handling procedures.

The introduction of more refrigerants in the market might confuse the technicians, causing more cases of cross-contamination in running the refrigeration system. Even though the short-term impact on the performance of the equipment might not be noticed by the equipment owner, it is believed the cross-contamination of refrigerant/lubricant will reduce the equipment’s energy efficiency and its performance, and shorten the operational life of the equipment.

More blends will also complicate the recovery/recycling programme due to the cross-contamination, as equipment with the blends might not be properly labeled or the technicians may just ignore the label (recovery/recycling will not work as all these blends have temperature glide, the recycled blends can not be used because of change in composition).

Some blends are advertised to replace R134a, so it might cause backward retrofitting from R-134a to HCFC based blends.

Tips to handle blends issue

- NOU needs to discuss and share experience and lessons for better management of the HCFC blends once they are entering into your national market
- Request the dealer to label the blends correctly, provide manufacturer's literature to technicians
- Alert the customs officers on the limitation of the refrigerant identifier and advise them not to use the identifier to confirm the composition of the blend in question.
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- Request the customs authority to provide a separate HS code for the blends under the 2903.40 (for HCFC/HFC/HC blends)(3824.71 for CFC blends).
- Check the composition of the blends with the customs officers to record the importation of the amount of HCFC along with the blend; this will be needed to report correct import data for HCFCs to the Ozone Secretariat.
- During your technicians training course on good practices, strengthen the training session on issues like proper handling of blends, including charging in liquid phase, don't top up, labeling the equipment properly, verifying the refrigerant carefully before conducting recovery/recycling, and cautioning on the flammability.
- Conduct a publicity campaign to raise the awareness of the end-user on the blends issues, so they could influence the market and avoid backward retrofitting.

For more information on blends, please visit the following websites:

The Australian Institute of Refrigeration Air Conditioning & Heating (Inc.): Refrigerant Selection Guide 2003 <http://www.ari.org/er/presentations/chemicals-WP.pdf>

ARI: Refrigerant Blends: Composition changes during refrigerant transfer and equipment charging, January 2000, <http://www.ari.org/er/presentations/chemicals-WP.pdf>

Article: A drop-in CFC12 replacement for automotive air-conditioning <http://yarchive.net/ac/r406a.html>

US EPA SNAP of Acceptable Substitutes for Class I (CFCs) Substances <http://www.epa.gov/ozone/snap/refrigerants/reflist2004.pdf>

Annex IV: Physical, safety, and environmental data for historical, current, and candidate refrigerants, RTOC 2002 Report: <http://ozone.unep.org/teap/Reports/RTOC/index.asp>

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