THE USE OF ALTERNATIVE REFRIGERANTS, TRAINING, CERTIFICATION AND THE RIGHT EQUIPMENT

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A Good Decision with Great Influence

The new F-gas regulation No 517/2014 was adopted in April 2014 and went into force on 1 January 2015. The decision to ratify the regulation was a good decision. Good for the end user, good for the RACHP business, but mostly good for the environment.

The new regulation will however have a great influence on the whole RACHP industry for many years to come. As it is formulated, it actually will have a bigger impact on common people than was the case when phasing out the CFCs in the 80s and 90s. This time anyone who gets in contact with the heat pumping technology will be affected. All from large industries and offices to small restaurant and supermarket owners. Well known best practices, refrigerants and system solutions will be challenged and will have to change or develop.

Tight Time Schedule Calls for Urgent Actions

The time frame set for the transition from high GWP to low or zero GWP refrigerants is extremely tight. This calls for urgent actions in order to meet and fulfil the targets of the regulation, namely:

- Dissemination
- Component and system development
- Training and certification of competence

Dissemination

Dissemination of the F-gas regulation and its consequences is definitely the most important, but in the same time the most difficult issue.
The need for information is enormous and so are the number of stakeholders. In order to get the transition from high to low GWP refrigerants moving in the speed needed, everyone concerned must have knowledge of the regulation and the impact it will have on his or hers specific business. All from design engineers via manufacturers and contractors to end users.

This calls for involvement on many levels, all from highest European one all down to the local contractor. Major contributors must however be national authorities such as National Environmental Protection Agencies.

What we have seen so far though is a somewhat laid-back attitude from Agencies in many countries. Necessary human or financial resources are not allocated. And you almost get the feeling they are taken by surprise of the overwhelming needs.
This is of course very unsatisfactory as it jeopardizing meeting set goals resulting in a failure that might fire back on our whole industry.

Component and system development

The route away from high GWP refrigerants have two pathways, one synthetic and one natural.

Challenges for the synthetic pathway will be similar to what have been experienced during previous refrigerant conversions. Namely, how to predict reliable and efficient running conditions, preserved lifetime on components and tight and safe systems.
Once again lubricant viscosity and miscibility, gasket tightness and hot gas temperatures will be checked and evaluated.

A new element though, compared to earlier conversions is the fact that all low or zero GWP refrigerants are flammable. This will call for special efforts mainly on keeping the systems tight and by doing so keeping them safe.

Low refrigerant charges will minimize the risk of leakage. We have already seen an increase in decentralized system designs in supermarkets using plug-in display cases instead of traditional centralized DX-ones. Also indirect systems using secondary refrigerants can be expected to be more common. The very popular VRF-technology will here have an interesting issue to deal with.

Also the natural pathway will meet challenges linked to component design. Some similar to the synthetic ones, mainly for the hydrocarbons, but also unique ones like high pressure (carbon dioxide) and toxicity (ammonia). But these conditions are known since long, even though mostly within more heavy duty applications. The issue now is to transform this knowledge down to smaller more commercial systems.

The big challenge for systems with natural refrigerants will instead be the development on system design and how to improve energy efficiency.
Environmental friendliness comes not only by the choice of refrigerant but in a much higher degree from the overall performance of the refrigeration system. For a traditional AC chiller as much as 90-95% of the GHG impact comes from the energy used to run the chiller, and how that energy is produced. Therefore, nothing has been achieved by placing a chiller on the market with low GWP refrigerant but poor performance.
Much have already been done in this area. But I am totally convinced there are much more to come of clever system designs introducing new technologies both within traditional refrigeration techniques as well as for controls, heat transfer and system integration.

Training and certification of competence

No targets set in the F-gas regulation will be met if we do not have skilled people knowing what they are doing. Therefore, all means and ways that secure and confirm correct skills in handling alternative refrigerants are crucial. So far no uniform certification scheme has been set on European level. Instead is it up to the individual member states or their national business associations to set their own rules.
The consequence is, as one could expect, that requirements vary greatly between the countries. All from Germany and the Netherlands were detailed schemes for all types of natural refrigerants are in place, to fix. Sweden were no requirements at all exists when it comes to personal certificates for working with ammonia, hydrocarbons or carbon dioxide. Same goes for HFOs who neither are included in the F-gas regulation.

This is of course totally unacceptable, both from a European market point of view, but even more from a personal technician safety point of view.
Rather week initiatives are taken on EU level, but the feeling is that it will take long time before any clear structure is in place.

What is AREA doing?

AREA has ever since the new F-gas regulation first was discussed been very active in the process of formulating a realistic, usable and understandable regulation. We have actively participated in hearings and stakeholder meetings. And we have supported and encouraged our National association members in their work. Considering the circumstances, I would say we have been rather successful in that work.

Members of AREA are RACHP contractors who design, install, service and maintain all types of refrigeration and heat pump systems. With the new regulation in place will a great number of new or new/old refrigerants enter the market. All from new A2L refrigerants via the new/old carbon dioxide and ammonia to hydro carbons. None of these refrigerants are included in the regulation 517/2014 and therefore not regulated with regards to required skill, competence or safety.
As a consequence, in order to ensure the highest level of safety, reliability and energy efficiency when handling these new refrigerants, AREA has initiated and are participating in several activities related to personal competence and safety as well as system efficiency and safety.

A clear standpoint from AREA has always been neutrality towards different types of refrigerants. As long as a refrigerant is legal to use, high efficient and environmental friendly we do not object it being used.
But, the use should always be done in a safe way.

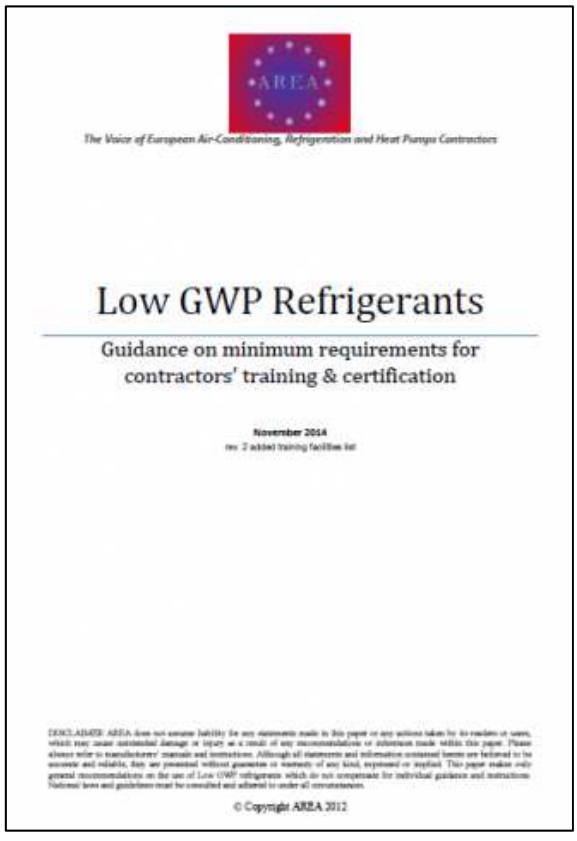
Safe for the technician who handle the gas, and safe for the surroundings where the equipment is placed.

As said earlier, dissemination is the most important issue. If people doesn't know, how can you expect them to act in a correct way?

To support our national member associations has AREA issued a number of position papers and guidelines. All to be found on our website http://area-eur.be/publications.

In this respect I would like to point out two guidelines specially aiming on requirements linked to A2L and A3 refrigerants.

First is our "Guidance on minimum requirements for contractors' training & certification".


AREA

The Voice of European Air-Conditioning, Refrigeration and Heat Pumps Contractors

Low GWP Refrigerants

Guidance on minimum requirements for contractors' training & certification

November 2014

This guideline has two main objectives:

- Set the general position of AREA on the use of low GWP refrigerants in RAC installations
- Set basic competence requirements for RACHP contractors dealing with low GWP refrigerants.

In the guideline you find for example a technical comparison between different low GWP refrigerants. You also find minimum requirements for training as well as training recommendations for the same.

The table below shows the respective properties of the low GWP refrigerants under consideration

	HFC	Natural			HFO
Refrigerant		HCs	Ammonia	CO_2	1234yf
GWP (100 years)	✗✗ R134a 1300 – R410A 1900	✔ 3 - 5	✔✔ 0	✔✔ 1	✔ 4
Toxicity	✔✔	✔✔	✗✗	✔	✔✔
Flammability	✔✔	✗✗	✗	✔✔	✗
Materials	✔	✔	✗	✔	✔
Pressure	✔	✔	✔	✗✗[2]	✔
Availability	✔✔	✔	✔	✔	✗✗
Familiarity	✔✔	✔	✔	✗	✗

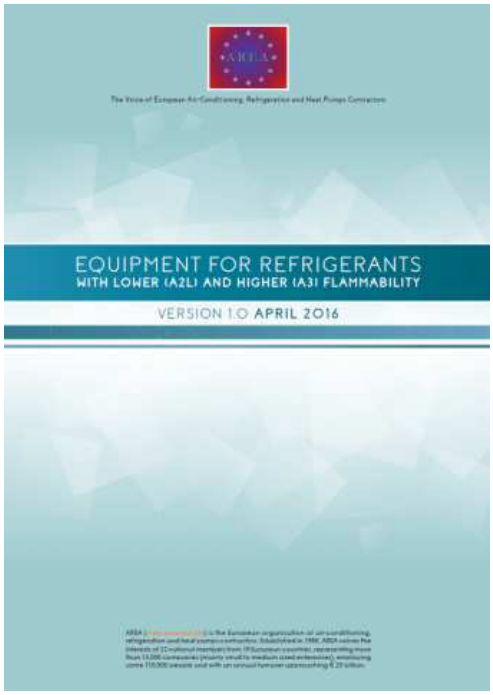
Very poor ✗✗ Poor ✗ Good ✔ Very Good ✔✔ *Source: F-gas support Information Sheet - RAC7 alternatives*

Table taken from the guidelines showing respective properties of different low GWP refrigerants

	HC	NH_3	CO_2
BASIC THERMODYNAMICS AND PHYSICS			
Thermodynamic properties of low GWP refrigerant: temperature, pressure, density, thermal capacity, p/h diagram	T	T	T
Differences between low GWP refrigerants and HFCs	T	T	T
Toxicity characteristics, grades and limits for the human body	----------	T	T
Characteristic of flammability of the substances, velocity of propagation, LFL, UFL, occupancy	T	T	----------
Specific components for that refrigerant in the refrigeration cycle	T	T	T
Material compatibility	----------	T	T[3]
Oil compatibility, requirements and oil return	T	T	T
REGULATIONS AND STANDARDS			
Knowledge of European and national regulations and standards	T	T	T
Storage of the refrigerant	T	T	T
Transport of the refrigerant	T	T	T
Describe the process for handing over system to customer, completing and passing on appropriate commissioning documentation[6]	P	P	P

Part of table showing minimum requirements for listed modules on natural refrigerants

Secondly, I want to mention a guideline released in April 2016 named “Equipment for refrigerants with lower (A2L) and higher (A3) flammability”.



This is a hands-on guide for those working with flammable refrigerants giving them a tool to understand the equipment that should be used when installing, commissioning and servicing refrigeration plants.
The guide covers all from tools & equipment via leak detection and evacuation to safety procedures when doing service or recovery.

REAL Alternative programme

Last but not least I want to mention the REAL Alternative programme (part of the EU Leonardo life-long learning programme). A very successful blended learning programme now fully in place.
REAL Alternatives is built on the REAL Skills Europe & REAL Zero containment approaches. (Refrigerants, Emissions And Leakage - Zero). The free multi-lingual learning materials were launched in 2015 and are now available for individual development or use as classroom training materials. They include e-learning content, electronic tools, a comprehensive library gathered from existing resources. The e-library contains over 100 useful industry resources.

EN378

The REAL Alternatives e-learning has now been updated to take into account changes introduced in the revised EN378 Safety Standard published in 2016. The free programme is designed to help engineers understand the differences they need to be aware of when using alternative refrigerants such as HFOs, hydrocarbons, carbon dioxide and ammonia. The introductory module covers basic properties but also restrictions on use and charge sizing calculation, with a series of examples based on different scenarios.
Find out more on http://www.realalternatives.eu/about-u

AREA also involve internationally outside Europe via cooperation with UNEP (United Nations Environmental Programme) with the aim to train technicians securing a lowest competence level in developing countries.
All with the overall aim to reduce Greenhouse gases and by such protecting our environment.
The earth is not ours – we are just borrowing it from our children.
Therefore, was the decision to ratify the F-gas regulation No 517/2014 a good decision. Good for the end user, good for the RACHP business, but mostly good for the environment.

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AREA, (Air-conditioning and Refrigeration European Association) voices the interest of 22 national associations from 19 European countries, representing more than 13,000 companies, employing some 110,000 people and with an annual turnover approaching EUR 23 billion.