

Last update: November 2018

Hydrocarbon (HC) Refrigerants in Vapour Compression Refrigerating Systems

1 General

The global community, with the Paris Agreement and the Kigali Amendment to the Montreal Protocol, made another important step towards the reduction of CO₂ emissions due to human activities, to preserve our planet for future generations. The global phase-down of HFCs in the refrigeration sector is representing an important contribution to the international mitigation efforts. The latest EU F-Gas regulation imposes a ban of certain high GWP refrigerants in the next few years in several applications. The Phase Down will considerably limit the available quantities of HFC refrigerants on the market.

Other areas are following these directions. For example, Canada has now published HFC rules, where for specific applications and dates a GWP-limit is prescribed. In the USA, even if the EPA rules on the subject were vacated for the time being, California is about to release final rules on phase down of high GWP substances still in 2018. All these developments point in a similar direction: providing an impulse to lower the GWP of the refrigerants used without compromising the indirect CO₂ emissions during the lifetime of the equipment.

Hydrocarbons have proven to be suitable refrigerants in several applications - regarding thermodynamics, reliability and safety. *ASERCOM* member companies have collected experience with their use in different fields and are engaged in standardization work to enable appliance and system manufacturers to use HCs as refrigerants in a safe way.

This statement focuses on applications in European countries where uniform standards for flammable refrigerants are used with the exemption of some local peculiarities.

The European Commission identified that current safety standards have only limited rules for the use of flammable, low GWP refrigerants. Based on this report's findings, the European Commission mandated the standardization bodies CEN-CENELEC to facilitate the update of the relevant standards.

Present Product Safety Standards (IEC/EN 60335-2-40 / 89) and Horizontal Standard (EN 378) set up rules for a charge of HC refrigerant depending on the location of the system, its design and its accessibility to the public, which in some cases under IEC 60335 could allow up to 4.94 kg of R-290 charge as an example, under EN 378 it can be limited to 5kg or up to no charge limitation. In 2017, TC182 published the revised EN378 where A2L flammability class is recognized. The charge limits and the risk management for indoor units are addressed for refrigerating systems using A2L. The last revision of IEC 60335-2-40 has been published in 2018, where A2L refrigerants is recognized as a new class and detailed design requirements for equipment with A2L refrigerants are set.

Ongoing standardization activity at IEC level (SC61C/WG4 and SC61D/WG16) should allow higher charges of flammable refrigerants due to specific additional safety measures. The new IEC60335-2-89 publication is expected as of 2019

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Only units designed and approved for HCs must be used.

2 Major applications – ASERCOM position

2.1 Hydrocarbons (HCs) in household and similar appliances (refrigerators, freezers, bottle coolers etc.):

- extremely small leakage rate due to the hermetically sealed system.
- factory assembly (adaptations for HC technology).
- small refrigerant charge (<150 g).

2.2 Hydrocarbons (HCs) in commercial refrigeration, air conditioning and heat pump systems:

- Self-contained refrigeration systems, product type approved for HCs at factory (designed, assembled and tested at manufacturing plant level).
- In case of failure / leakage systems should be preferably maintained / repaired in a proper risk approved space or taken back to the manufacturing site unless the installer is certified and confident to handle HCs.
- Clear and complete safety regulations for system not falling under the Product Safety Standards (IEC/EN 60335-2-40 / 89) need to be established on a harmonised basis.
- Components approved by the manufacturer are already available for use with HCs.

2.3 Hydrocarbons (HCs) in transport refrigeration and transport air conditioning systems

- An A2L refrigerant was accepted and implemented into personal car air conditioning systems. Currently there is no information about plans to go to HCs.
- The cargo and passenger transport segment is a complex topic due to European directives and local regulations across Europe.
- This is particularly true for transport vehicles equipped with HC refrigeration and/or air conditioning systems crossing Europe where application of regulations may differ from one state to another one.
- Transport refrigeration or air conditioning systems are exposed to additional load given by the operating environment - especially vibrations and risk of vehicle accident are increasing the requirements for safety measures.
- Refrigerant charges in transport refrigeration and transport air conditioning systems are in the most cases above the limit allowed for locations accessed by public.
- We therefore need further detailed studies and assessments prior to including the transport segment into this publication in more detail.

2.4 Hydrocarbons (HCs) in large commercial and industrial applications:

- Outdoor installation of units is preferred.
- All safety aspects are considered, and relevant regulations and standards are applied.

3 Product Liability

As a result of the EU Product Liability Directive, product liability law in Europe has been harmonized, however, in view of certain discretion granted by the Directive to the Member

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States in connection with its implementation and due to the fact that such implementing legislation is embedded in the traditional and widely different tort law in existence in the various countries, there is no uniform product liability law even throughout the EU Member States. Consequently, it is inevitable that, despite EU efforts, even within the EU product liability claims would be treated and decided upon differently depending on where they are brought forward.

It must be pointed out that even compliance with the applicable regulations and standards (like ATEX 2014/34/EU) does not necessarily release the system manufacturer from liability.

In designing such systems, Safety Standards (IEC EN 60335-2-24 / 40 / 89 and EN 378) should be considered and applied.

The following precautions need to be taken into consideration as well:

- A careful risk assessment for the system including the risk due to the flammability is necessary to be done by the manufacturer.
- Use of components suitable for flammable refrigerants and meeting appropriate safety requirements (including potential PED requirement).
- Close attention to leakage rate with relevant improvements of design and installation of systems as well as manufacturing and testing facilities.
- 3rd party verification /approval for manufacturing, testing and charging even when it might not be mandatory at a country level.
- New skills and Know-How for planners, installers and maintenance technicians as well as constant training of all the operators...
- Tooling suitable for flammable environment must be used for installation and service/maintenance
- A careful risk assessment for the system use on site, including all phases of the system life, like operation, maintenance and disposal, is necessary to be done by the end user.

The points mentioned above are a prerequisite to consider HC as a viable alternative.

ASERCOM will continue to monitor the scientific and technical developments relevant in the subject matter of this summary. *ASERCOM* will endeavour to provide - without assuming an obligation to this effect - updates whenever new aspects have to be considered. *ASERCOM* might change its position with respect to the recommendations contained herein.

These recommendations are addressed to professionals, industrial, commercial and domestic refrigeration system manufacturers/installers. They have been drafted on the basis of what *ASERCOM* believes to be the state of scientific and technical knowledge at the time of drafting, however, *ASERCOM* and its member companies cannot accept any responsibility for and, in particular, cannot assume any liability with respect to any measures - acts or omissions - taken on the basis of these recommendations.
