



THE HFOS ARE COMING

Following on from the A to F article last month our attention changes to the other end of the alphabet. With another Chillventa Exhibition upon us, the HFO refrigerants are finally starting to make their mark. There are some very good reasons why R-1234ze will be featured in new equipment on display. Peter Dinnage of Climalife reports.

While R-1234yf has stolen much of the headlines in the press, it is R-1234ze(E), one of the other versions of tetrafluoropropene, that is likely to make a much bigger impact upon the air conditioning, heat pump and refrigeration sector. HFOs (hydrofluoroolefins) are unsaturated hydrofluorocarbons, but they can also be considered as fluorinated hydrocarbons, depending on terminology. Either way, it is the double carbon bond that is the essential characteristic that contributes to the very low GWP, which makes it of interest.

GWP Value

R-1234ze with a boiling point of -18.2°C has similar properties to that of R-134a and so can be classed as a medium pressure refrigerant. It also ticks a number of other boxes. Firstly it is a single component and therefore no temperature glide, it also has a very low GWP and thermodynamic properties which give it excellent energy efficiency in new equipment. The efficiency is even more pronounced at high ambient temperatures which makes it attractive across all climate zones and also for eco-design. It is non-flammable below 30°C and is classed as such for storage and transport purposes, although it has an Ashrae A2L classification. Lastly, it works with POE oils.

More importantly the refrigerant is commercially available, much cheaper than its R-1234yf counterpart and there are compressors and products on the market starting to use R-1234ze as the refrigerant.

Although the IPCC 4th Assessment which is used for the new F-Gas regulations assigns it a GWP of 7, the latest 5th Assessment indicates that the GWP of R-1234ze is less than 1. This means that the GWP of R-1234ze is comparable with CO_2 and lower than hydrocarbons.

Energy Efficiency

Whilst GWP values are a much debated topic the real benefits of R-1234ze are seen in the energy efficiency savings it can deliver. At first glance R-1234ze has approximately 25% less capacity than R-134a, but that is only part of the story. At the same time compressor power

consumption and condensing capacity are lower which deliver the better energy efficiency. In new design equipment where the capacity can be optimised the energy efficiency can be in the region of 5-8% better.

R-1234ze is ideally suited for a number of applications, air cooled chillers are already on the market with Airedale being the latest to announce their range. Star Refrigeration offer R-1234ze as an option on their Indigo chillers with increased efficiency and lower total cost of ownership. While in smaller equipment Precision Refrigeration are offering R-1234ze refrigerators for foodservice applications and claim better efficiency than those on other refrigerant options. These are often situated in kitchens where high ambient temperatures are encountered. It also has potential in medium temperature refrigeration applications and the use by Waitrose in a commercial application is already well documented. Other case studies are appearing all the time.

Food Industry Usage

Although not ideally suited for retrofit of existing R-134a systems, it is possible where the equipment is oversized for the intended use. In France Climalife has helped Central Froid use refurbished Copeland compressors selected to run on R-1234ze for Les Délices de la Belle Noé, who produce traditional charcuterie meat products. The food preparation, storage and packing rooms all need to be kept at a temperature between 0°C and 10°C .

Another innovative application for R-1234ze in the food industry is a heat recovery system capable of processing foodstuffs at temperatures as high as 97°C and rapidly cooling them through chilled water down to 2°C . In this application it was reported that Ammonia cannot reach temperatures above 80°C of water temperature while CO_2 did not have enough efficiency at high temperatures. The results and the compressor COP obtained with R-1234ze are very encouraging.

This also bodes well for heat pump applications where high temperatures are required whilst retaining good COP and energy efficiency.

As it is a single component it also has the potential to be used in flooded evaporator systems or centrifugal chillers for medium temperature applications.

The very low GWP of R-1234ze also means that it is finding use in some of the blends that are now coming to market or are under development as replacements for higher GWP HFCs.

Although there are many challenges ahead for the industry as it tries to use lower GWP refrigerants effectively and efficiently without incurring increased running costs. R-1234ze is one refrigerant that looks like it can not only deliver very low GWP, but good energy efficiency as well, without the need for high pressure equipment or the need to use high flammable gases. We can expect to see a lot more use of R-1234ze in chiller, heat pump and medium temperature applications very soon.

