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Are You Pro Propane?

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We have thought about various refrigerant choices, and now we turn to the hydrocarbon family, the most common of which, as a refrigerant, is propane. It has often been said that choosing a refrigerant is an exercise in compromise because there are so many competing factors to consider, and they are sometimes contradictory. Hence, there is no perfect refrigerant.

Propane scores very highly in all criteria bar one. It has a suitable pressure-temperature relationship (very similar to R-22); it has a relatively high latent heat but a low index of compression; it is cheap and readily available, and it is compatible with mineral oils—not a surprise as it is a kind of mineral oil itself! Environmentally, it also performs well, having no effect on the ozone layer and a

low global warming potential—even lower than the HFOs.

Hydrocarbons are very widely used in the domestic refrigerator market, particularly in Europe where more than 85% of all refrigerators use one or other of the family. This was not always the case, but in the early 1990s when the Berlin Wall had recently fallen and the two halves of Germany were figuring out how to live together again after a 45-year separation, a small, struggling East German refrigerator manufacturer hooked up with Greenpeace to develop a “climate-friendly” refrigerator.

Their timing was excellent; the concept of CFC-free refrigeration was quickly adopted by the German government and translated soon after into a European regulation, and all of the major European manufacturers quickly followed suit. Early systems used a mixture of propane and isobutane to match the performance of R-12, but as the technology matured equipment was developed to use isobutane.

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Among the spin-off benefits of this change, it was noted that units are significantly quieter on starting than traditional R-12 and R-134a systems and the weight of refrigerant required is much less. The reduced noise is due to the absorption of refrigerant in the oil when the compressor is not running, enabling a gentle start against lower pressure. The reduced charge is due to the low liquid density—the volume of liquid required is about the same but it weighs less. They are also very efficient, helping manufacturers meet the stringent energy labeling requirements.

The labeling laws introduced in Europe in the 1990s had a scale from G (least efficient) to A (most efficient) but stepwise improvements in the requirements over the years have meant new, more efficient bands have been added;

A+, then A++ and then (you've guessed it), A+++.

Since mid-2012 all models must be at least A+ efficiency; it's a shame they didn't start further back in the alphabet.

The transition from CFC to HC in the European refrigerator market was quick and relatively simple because all the hard stuff took place at the factory. Production lines had to be retooled and in some cases completely reengineered

to cope with the flammability of the refrigerant now being used, but the technology of the refrigerator did not change dramatically, and in the eye of the householder there was no change at all. The fridge is installed and used in exactly the same way as it always was and there has been no discernible change in product safety.

This highlights a key difficulty when introducing hydrocarbons to an existing service organization. If a tech is being introduced to CO₂ as refrigerant, he is naturally wary—the pressures are higher and the gear looks a bit different. However, his regular habits in terms of service practice will stand him in good stead and not cause problems. On the contrary, a hydrocarbon system looks and feels much like a normal HFC system but regular habits, such as sweating off an

expansion valve, can cause major problems unless great care is taken to ensure the refrigerant is well out of the way. Propane has been adopted by a major UK supermarket as its preferred solution for its display cases—for them the various benefits of cost, efficiency and reliability outweigh the challenges they have had to overcome to take this road to environment-friendly refrigeration. ■

The motto from the walls of the energy efficiency office.



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