



Refrigerants frozen out

For environmental reasons, R410A - a common refrigerant used in vehicle and trailer cooling systems - is being phased out. Brian Wall considers its effect on truck fleet manufacturers and suppliers, as well as alternatives

Around one in six trucks and trailers is now refrigerated, carrying food, pharmaceuticals and other highly valuable cargo that need both stable temperature and stable humidity. If those are the numbers, the science behind this process has also come a long way over the years from the days of using ice and salt.

Now, even though the market for refrigeration stretches far and wide, much of the technology is based on vapour-compression refrigeration. This system removes heat by evaporating a refrigerant substance that is later compressed and condensed.

Five years ago, a common refrigerant used in vehicle and trailer cooling systems, R410A joined the

ranks of those eventually to be phased out. With the introduction of F-gas legislation in Europe, there has been strong pressure to phase out refrigerants contributing to global warming, measured as their global warming potential (GWP) compared to CO₂. This includes the industry stalwart R404A (GWP of 3,922). There are two approaches to the future control of refrigerants in the EU. Those with a GWP of over 2,500, such as R404A, will be phased out; and those with a GWP below 2,500, such as R410A (GWP of 2,088), will be phased down. The process started in 2015 and will continue until 2030, by when an 80% phase-out/phase-down is targeted.

How will the future approach to regulations for refrigerants work? This will be based on the GWP of the

refrigerant charge - namely, the GWP of the refrigerant compared to carbon dioxide (also known as R744), multiplied by the charge. Systems with a low-GWP refrigerant can therefore have a larger charge than those with a higher GWP. As a result, many companies are replacing R410A with R32 (GWP of 675).

SUSTAINABILITY COMMITMENT

According to Dermott Crombie, Thermo King vice president for strategic initiatives, the company was the first manufacturer of transport refrigeration units to move away from R404A, developing and offering to the market R452A (GWP 2,141).

However, operators choosing any refrigerant should balance GWP with lifecycle cooling performance, LCCP, argues Crombie. "The vast majority



NEWS FROM SOLUTRANS (LYON, NOVEMBER 2019)

Chereau presented what it called the world's first hydrogen-powered refrigerated semi-trailer, developed by the €5.5 million, three-year ROAD project (pictured, right). New features include lighter chassis, aerodynamics, thermal insulation, clean energy production via hydrogen and optimisation of the management of the electrical equipment.

Also, temperature-controlled transport

firm Lamberet showed a multiplexed Frigoline fridge body, in which functions such as engine management and its interactions with the refrigeration unit, tailgate, doors and bodywork are controlled via CAN-Bus network.



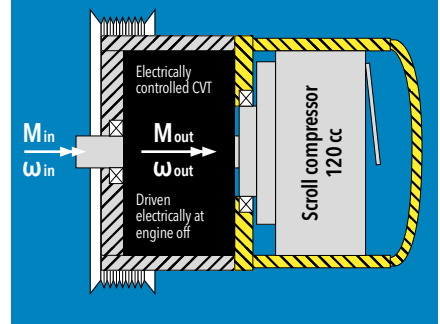


MAGNETIC GEAR

A novel air compressor drive, the Dual Drive, was demonstrated at the Bus World Show in Brussels by Sanden International. This compressor drive uses UK firm Magnomatics' Magsplit technology to effectively decouple the operating speed of the compressor from the operating speed of the engine. The Magsplit drive even allows the air compressor to be operated when the internal combustion engine is switched off, ideal for modern hybrid vehicles with stop-start systems and vehicles that operate in full-electric mode.

The Magsplit unit, diagram below, is a continuously variable transmission that uses a magnetic gear rather than a conventional planetary gear with metal teeth. It consists of a dual-rotor, single-stator machine whose electrical control can continuously vary the ratio between input and output. This can, for example, maintain a steady output even when input varies.

The technology is being developed for the driveline of passenger cars with Chinese firm Changan Automotive, and latterly for the driveline of 18t trucks. They are expected to reach the market after a smaller unit for vehicle air conditioning, which is predicted to launch in two years' time.



of the global warming impact of any refrigeration system is the indirect CO₂ emissions caused by energy consumption. These are heavily influenced by efficiency."

The technical challenge now is to provide refrigerants that meet all the requirements of the industry, but with lower and lower GWPs. Adds Crombie: "It is self-evident that the shorter the atmospheric lifetime of a refrigerant, the lower its global warming potential. Refrigerants with shorter atmospheric lifetimes typically have more hydrogen in their chemistry." That means these products tend to be at least mildly flammable.

CO₂ is another option, Crombie suggests. "The challenges it presents are very different to either the traditional vapour compression cycle or, indeed, cryogenics. CO₂ runs extremely high pressures, requiring specific design of the systems." However, more importantly, CO₂ does not condense above 28°C. That doesn't work with the standard vapour compression model; instead, in climates with warm ambient

temperatures, it would be used in a so-called 'transcritical' cycle, which offers lesser performance in both cooling capacity and efficiency - in conditions when both are needed.

There are other solutions for keeping temperature control without the use of the traditional compression/evaporation cycle. Some systems use cryogen (either liquid nitrogen or liquid carbon dioxide) as the 'fuel' for the system. Cryogen is allowed to evaporate in the evaporator coil, thereby removing heat, and is then lost to the atmosphere. They have been sold in northern Europe by Thermo King for more than a decade, states Crombie, adding: "However, they do require special infrastructure and will not fit all applications, due to range, refuelling, etc."

Another developer of cryogenic cooling systems is Dearman, which last year sent the Dearman-Hubbard transportation refrigeration unit fitted to a Paneltex trailer on a tour of five European countries (not including the UK). In August, TIP Trailer Services announced it would offer the units

as rentals to fleet customers in the Netherlands.

For its part, Swedish truck-refrigeration manufacturer Hultsteins' units are powered from the truck engine; other suppliers also offer this. Hultsteins CEO Börje Axelsson says he cannot understand why the industry has been so slow to follow a similar course. "We piggyback off the cleanest engine, the truck engine, to power the fridge, instead of installing engines that wouldn't meet even Euro 1. To my mind, it is shocking that these engines are allowed at all." [TE](#)