

STAR COOL

Refrigerants The pragmatic solution of today

Quotas, taxes, F-gas regulations, GWP, bans, efficiency, repair, import - there is a lot of uncertainty about the future landscape for refrigerants in our industry. And it appears certain that there will be significant impact within the lifetime of reefer containers ordered in the near future.

The pragmatic solution of today

By adjusting injection control, air flow and software for R513A compatibility, Star Cool offers an economically sound upgrade that can achieve a 56% reduction of GWP compared to the previously used R134a (GWP=1430). Among all A1 classified F-gases, R513A is the best choice to reduce the carbon footprint of reefer containers today.

Star Cool R513A

Factory charged with R134a, Star Cool R513A Optimized units allow you to switch the refrigerant platform at any point in time, offering a great deal of flexibility and product security when future refrigerant regulations come into force.

Engineered for reliability, the Star Cool R513A units are designed for compatibility with R513A without sacrificing performance when R134a is charged.

R1234yf is the main component of R513A, has been tested and proven in the automotive industry. It already has a positive track record of more than 44.4 million vehicles worldwide. Extensive tests at MCI with R513A have verified the compatibility and suitability of this R134a / R1234yf mixture for reefer applications.

Upgradeability

Star Cool reefers can be ordered from new, charged with R513A or optimized for R513A. An upgrade kit can be delivered for reefers ordered before August 2017.

Future solutions	Cost base	Technical complexity	Energy efficiency	GWP	TEWI R134a=100	Flammability
R513A	Low	Low	High	631	92	Non flammable (A1)
R290	Low	Low	High	3	89	Flammable (A3)
R32	Low	Low	High	675	92	Mildly flammable (A2L)
R452 (R404A Drop-In)	Low	Low	High	2140	105	Non flammable (A1)
CO ₂	High	High	Low	1	108	Non flammable (A1) High pressure

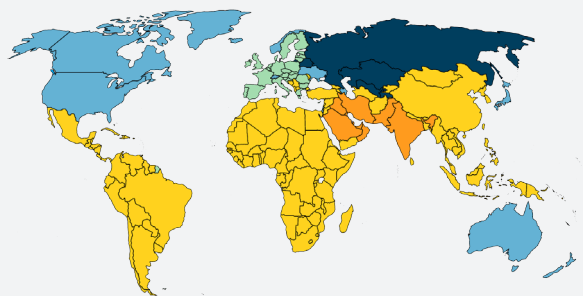
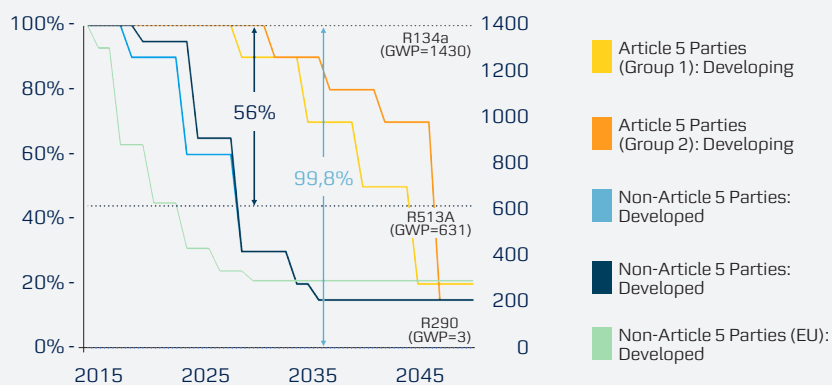
Benefits of R513A

- Compatible with existing equipment design/ lubricants, for retrofit and new systems
- Low GWP: 56% reduction compared to R134a
- Excellent capacity and energy efficiency match to R134a
- Non-flammable (ASHRAE A1)
- Approved by major equipment and component manufacturers
- Extensively field tested with no equipment/ lubricant/seal changes



Reduction of F-gases under Kigali Amendment

Adaptive MCI solution



What influences GWP?

When entering the atmosphere through leakage, a refrigerant influences the global warming by its potential to reflect radiative heat from the earth. This potential is influenced by the molecular structure as well as its lifetime in the atmosphere and is referenced to a natural substance (CO₂).

However, fossil fuels are used to power reefers on a vessel and CO₂ emitted into the atmosphere also has an impact on global warming. Inefficient systems use more energy and thus generate more CO₂. TEWI combines the emissions of both refrigerant and power consumption.

Total Equivalent Warming Impact

The Total Equivalent Warming Impact (TEWI) is a measure that combines the impact from direct and indirect emissions and gives a more holistic picture than a simple GWP comparison.

In particular, TEWI enables the comparison of efficiency of different refrigerant options in a specific application. For reefers, the real annual operation profile is taken into account, as they are operated mostly in hot climates and environments.

R513A is the pragmatic replacement for R134a, offering high energy efficiency and low GWP.

Theoretical average GWP & EU HFC Phase-Down schedule

In many regions of the world, refrigerant regulations are coming into effect. In the case of the European Union, emissions from HFC refrigerants will be reduced by 21% in 2031. When considering today's refrigerant quantities, a theoretical average GWP can be derived, indicating the necessary level of refrigerant GWP to comply with EU regulations.

Refrigerants with high GWP will not be explicitly banned but availability will decrease as prices will increase.

Theoretical average GWP

