

Naturally *Safer*



Carrier Transicold evaluated a full spectrum of alternative refrigerants during development of the NaturaLINE® container refrigeration unit. The natural refrigerant carbon dioxide (CO₂) was the best choice for a variety of reasons. It's efficient. With a global warming potential (GWP) of 1, it's carbon neutral. The product is cost-effective and available worldwide.

CO₂ is also a refrigerant leader in another key area: safety. CO₂ is nonflammable and, at typical occupational concentrations, nontoxic, two critically important attributes for container operations. First used as a refrigerant more than a century ago, CO₂ has a long track record of safe, reliable use.

Hazard Prevention

Nonflammable refrigerants make sense for refrigerated containers, which are often subject to rough handling and are stored in tight proximity to one another. With a nonflammable refrigerant, there is no concern about the possibility of a volatile situation if there was a leak inside a container's confined cargo area. (Continued)

High Flammability	R-290 (Propane) R-1270 (Propene) R-600a (Isobutane)	A3			
	Low Flammability	R-32 R-1234yf R-1234ze	A2, A2L	Ammonia	B2
No Flame Propagation	R-134a R-404A R-407C R-407F R-452A R-513A R-744 (Carbon Dioxide)	A1			B1
	Low Toxicity		High Toxicity		

ASHRAE 34 Refrigerant Safety Designations

There are other low-GWP natural refrigerants (white text), but none are as safe as CO₂. Ammonia is classified as highly toxic. Hydrocarbons such as butane and propane are highly flammable. In contrast, CO₂ is nonflammable and does not support combustion. In fact, it's commonly used in portable fire extinguishers.



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Despite having a safe alternative, some container refrigeration unit manufacturers are advocating the use of flammable refrigerants – natural and otherwise.

In the case of propane, if that refrigerant were to leak into a 40-foot container, the gas concentration could be 8.5 times the maximum permissible refrigerant concentration limit, as defined by ISO 5149:2014, Refrigerating Systems and Heat Pumps – Safety and Environmental Requirements. This is based on the lower flammability limit of propane and could be 34 times that of what's allowed after applying a safety margin. Inside a 20-foot container, those factors double. That level of risk is simply unacceptable when nonflammable alternatives are available.

In contrast, an internal leak of CO₂ would not pose any flammability risk or add any new risk to the environment.



Refrigerated containers, stacked closely hundreds at a time on ships and thousands at a time in shipyards, require noncombustible refrigerants.

Breathe Easy

Nontoxic at low concentration, CO₂ is part of the natural atmosphere that we breathe. It is injected into carbonated soft drinks and naturally occurs in beer and sparkling wines.

The NaturaLINE system is one of several CO₂ products produced by Carrier, including the CO₂OLtec® commercial refrigeration system, of which thousands are being safely used in supermarkets throughout Europe. Similar to the CO₂OLtec system, the NaturaLINE unit operates at higher operating pressures than today's hydrofluorocarbon (HFC) systems – up to 1,800 psi (125 bar). The NaturaLINE unit

is governed by EU's Pressure Equipment Directive (PED), and requires no special training or certification for service. The unit design and manufacture take into account all relevant factors influencing safety during the intended lifetime of the product. The result is a unit with more rugged construction than in typical HFC units, and its components are tested at pressures well beyond those seen in service. The NaturaLINE unit has three layers of system safety limits that include software controls that limit pressures, an electromechanical high-pressure switch and a mechanical pressure-relief valve.

When it comes to natural refrigerant systems, the NaturaLINE unit using CO₂ is not only a wise choice, it is the natural choice for shipping safety and peace of mind.

CO₂ (R-744) REFRIGERANT FUNDAMENTALS

- Power consumption comparable to Carrier's best-selling unit
- Excellent efficiency, especially for part-load perishable cargo
- ASHRAE 34 and ISO 817 safety classification A1, nonflammable and nontoxic
- U.S. EPA-approved for transport applications and unaffected by phasedowns, F-gas Regulations and Kigali Amendment to the Montreal Protocol
- No refrigerant tax
- No intermediate refrigerant step needed
- Familiar controls and maintenance
- Global support from Carrier



NaturaLINE®

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