

# Naturally *Safer*



Carrier Transicold evaluated a full spectrum of alternative refrigerants during development of the NaturaLINE® container refrigeration unit. The natural refrigerant carbon dioxide (CO<sub>2</sub>) was the best choice for a variety of reasons. It's efficient. With a global warming potential (GWP) of one, it's carbon neutral. The product is cost-effective and available worldwide.

CO<sub>2</sub> is also a refrigerant leader in another key area: safety. CO<sub>2</sub> 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, CO<sub>2</sub> 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	Propane Propene Isobutane	A3	
	HFO-1234yf AC-5	A2, A2L	Ammonia
Low Flammability	HFC-134a HFC-404A HFC-407C HFC-407F HFC-452A Carbon Dioxide	A1	
No Flame Propagation			
	Low Toxicity		High Toxicity

## ASHRAE 34 Refrigerant Safety Designations

*There are other low-GWP natural refrigerants (white text), but none are as safe as CO<sub>2</sub>. Ammonia is classified as highly toxic. Hydrocarbons such as butane and propane are highly flammable. In contrast, CO<sub>2</sub> is nonflammable and does not support combustion. In fact, it's commonly used in portable fire extinguishers.*



United Technologies  
turn to the experts 

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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 refrigerant, classified by the ISO 5149 Safety and Environmental Standard as A3 for high flammability, if that refrigerant were to leak into a 40-foot container, the gas concentration could be 8.5 times the permissible refrigerant concentration limit. 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.

In contrast, an internal leak of CO<sub>2</sub> 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 concentrations, CO<sub>2</sub> 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 CO<sub>2</sub> products produced by Carrier, including the CO<sub>2</sub>OLtec® commercial refrigeration system, of which more than 1,500 are being safely used in supermarkets throughout Europe. Similar to the CO<sub>2</sub>OLtec 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 CO<sub>2</sub> is not only a wise choice, it is the natural choice for shipping safety and peace of mind.

### CO<sub>2</sub> REFRIGERANT FUNDAMENTALS

- GWP of one, the lowest global warming potential of all potential refrigerant alternatives
- Non-ozone depleting
- Nonflammable and nontoxic at low concentration (ASHRAE 34 safety classification A1)
- Protected against phaseouts, taxes and F-gas regulations
- Cost-effective, available worldwide, requires no special disposal
- Efficient



## NaturaLINE®

[www.carrier.com/container](http://www.carrier.com/container)

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