

→ Natural refrigerants

THE LINDE GROUP

*Linde*

Natural refrigerants for  
a cleaner tomorrow.

Cool by nature.

# In tune with nature. Meet environmental regulations with natural refrigerants.

As a world-renowned company with far-reaching technical expertise, Linde is ideally positioned to make a valuable contribution to the protection of our environment. We have therefore committed ourselves to the responsible use of natural resources, the development of clean technologies and the replacement of harmful substances with eco-friendly alternatives.

Whether your application is air conditioning, refrigeration, process chilling or heat extraction, we can help you meet environmental regulations. Our range of natural refrigerants provides zero ODP (Ozone Depletion Potential) and minimal GWP (Global Warming Potential) in a cost-efficient solution that perfectly suits your requirements. It's a natural choice.



Natural refrigerants ensure a top score in environmental performance – for ice rinks and many other applications.

## R717 (ammonia)

- Environmentally friendly: zero ODP, zero GWP
- Excellent thermodynamic properties and low energy requirements; often acknowledged as the most efficient refrigerant
- Mildly toxic and flammable with a pungent odour
- Applications: large air conditioning systems (chillers), commercial refrigeration, chilled storage, food freezing, brewing, industrial heat extraction, ice rinks etc.

## R744 (CO<sub>2</sub>)

- Environmentally friendly: zero ODP, GWP=1
- Excellent thermodynamic properties and low energy requirements
- Often used as a secondary refrigerant along with ammonia, thereby opening up applications where ammonia as a single-stage refrigerant would not be applicable
- Non-flammable, mildly toxic, asphyxiant in high concentrations and odourless
- Applications: static and mobile air conditioning systems, chilled warehousing, commercial refrigeration, chill cabinets and vending machines, industrial heat extraction, process chilling, low- and ultra-low-temperature applications

## What are natural refrigerants?

Natural refrigerants are chemicals which occur in nature's bio-chemical processes and can be used as cooling agents in refrigerators and air conditioners. They do not deplete the ozone layer and make negligible (or zero) contribution to global warming. Their high efficiency also means that they make a lower indirect contribution to global warming than many fluorocarbon refrigerants.

## The benefits of natural refrigerants

**Regulatory compliance:** In many countries, the use and availability of HCFCs and HFCs are controlled by legislation due to their environmental impact. Natural refrigerants, on the contrary, are not subject to the Montreal Protocol, the Kyoto Protocol or other related local environmental legislation.

**Long-term viability:** Natural refrigerants have been used since the 19th century. They are neither subject to future phase-out controls nor is it likely that they will be subject to future legislation.

**Low environmental impact:** They have zero ODP and minimal GWP. In comparison, commonly used HCFCs and HFCs have a GWP varying from hundreds to thousands.

**High performance:** They have excellent thermodynamic properties.

**Cost competitiveness:** The use of natural refrigerants generally leads to lower operating costs due to less leakage, lower maintenance requirements and better energy efficiency.

**Compatibility:** Natural refrigerants work well with commonly used oils and other fluids. Please note that they are not generally suitable for retrofit in existing systems.

## The choice is yours

Linde offers a comprehensive range of natural refrigerants as well as traditional fluorocarbon refrigerants to the refrigeration and air conditioning industry. We provide packages from laboratory samples to 15-tonne bulk deliveries.

### Natural refrigerants

- R717 (ammonia)
- R744 (CO<sub>2</sub>)
- Hydrocarbon refrigerants

### Fluorocarbon refrigerants

- HCFCs, HFCs and fourth-generation HFOs

## Quality, safety and innovation

Impurities such as moisture can have a significantly negative impact on the efficiency of the refrigerant. We therefore ensure that our products and packages meet or exceed the highest quality and safety standards through tight quality controls. All our sites supplying liquid CO<sub>2</sub> are certified to ISO 9001.

Natural refrigerants have some different chemical properties than fluorocarbon refrigerants and require adequate safety measures. Our highly experienced experts are on hand to provide advice on how to handle our products in the safest way. They can also help you with your product choice, offering guidance on regulatory matters, product details and applications.

Through our strong focus on innovation, we stay on top of the latest developments. Thus, we are able to continually provide you with state-of-the-art products, packages and engineering solutions that increase the efficiency and profitability of your application.

Reliability at home: Natural refrigerants keep foods fresh and tasty.

### Hydrocarbon refrigerants

- Wide range of high-performance hydrocarbon refrigerants including R600a (isobutane), R290 (propane), R1150 (ethylene), R1270 (propylene) and blends of these products
- Environmentally friendly: zero ODP, GWP < 8 (relative to CO<sub>2</sub>=1)
- Flammable and non-toxic
- Applications: industrial and domestic air conditioning systems, domestic appliances, commercial and industrial refrigeration, chill cabinets and vending machines, heat pumps, low- and ultra-low-temperature applications



# Getting ahead through innovation.

With its innovative concepts, Linde is playing a pioneering role in the global market. As a technology leader, it is our task to constantly raise the bar. Traditionally driven by entrepreneurship, we are working steadily on new high-quality products and innovative processes.

Linde offers more. We create added value, clearly discernible competitive advantages and greater profitability. Each concept is tailored specifically to meet our customers' requirements – offering standardised as well as customised solutions. This applies to all industries and all companies regardless of their size.

If you want to keep pace with tomorrow's competition, you need a partner by your side for whom top quality, process optimisation and enhanced productivity are part of daily business. However, we define partnership not merely as being there for you but being with you. After all, joint activities form the core of commercial success.

**Linde – ideas become solutions.**

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