



Carrier

A United Technologies Company

COOL₂tec

The Ultimate **CO₂ Refrigeration System**
for every Food Retail Store Format

Environment is precious

Sustainability

Reliability

Energy Efficiency

Linde

CO₂ an environmental refrigerant

Carrier Commercial Refrigeration's mission is to deliver to food retail customers best in class sustainable refrigeration systems focusing on energy efficient design, optimal refrigerant use and professional after sales service.

Carrier has the right refrigerant solution for every application, but not every application will use the same refrigerant.

Carrier is a pioneer in CO₂ commercial refrigeration technology and has invested extensively in the development of

CO₂ systems for more than 10 years.

CO₂OLtec™ is the result of this major Research and Development effort.

CO₂OLtec™ provides both low temperature and medium temperature refrigeration solutions for all retail shop formats.

The total impact of a refrigeration system in terms of greenhouse gas emissions, also called TEWI (Total Equivalent Warming Impact), is derived from the indirect emissions (energy consumption) and the direct emissions (refrigerant leakages) over the lifecycle of the system. Choosing a CO₂ installation delivers world-class low TEWI

performance. Compared to a conventional HFC direct expansion refrigeration system a CO₂ installation has no global warming impact due to refrigerant leak and improves energy efficiency by about 10% on average in mild to cold climate conditions. The potential reduction of greenhouse gas emissions for a hypermarket is equivalent to the CO₂ emissions of over 400 cars.

CO₂ is an environmentally neutral refrigerant also used as an additive in beverages (carbonated drinks & soda water), available worldwide and affordable.



Carrier first in CO₂

More than a century ago Willis Carrier invented modern air conditioning and Carl von Linde invented modern refrigeration. These two prestigious founders continuously inspire and guide Carrier innovation.

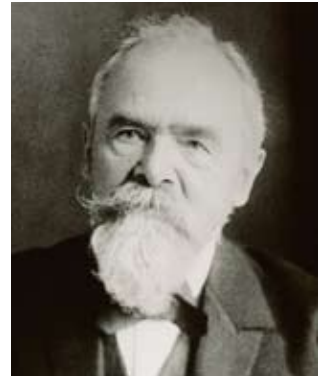
Carrier Commercial Refrigeration - in close cooperation with the largest food retail customers - has acquired profound CO₂ experience, built on the basis of over one-hundred transcritical installations covering all store formats. With over 10 million field operating hours, Carrier engineering teams have accumulated an invaluable quantity of

critical data positioning **CO₂OLtec™** as the leading CO₂ transcritical refrigeration system based on unique energy efficiency, reliability and sustainability.

With more than 100 systems in operation Carrier Commercial Refrigeration Food Retail customers have already proved their trust in **CO₂OLtec™** capabilities and reliability.



Willis Carrier invented modern air conditioning in 1902



Carl von Linde invented modern refrigeration in 1877



Edeka Hovener supermarket located in Germany operates with CO₂OLtec™ technology

Reliability & Performance

Research and Development

Carrier Commercial Refrigeration's Research and Development team works continuously on a wide spectrum of food retail refrigeration system technologies and beverage refrigeration equipment. Research and Development teams are based in two world class Lead Design Centers located in Germany and China; over 150 engineers operate over 6,000 square meters of laboratory space that includes testing facilities, climate chambers, modeling workshops, physical and chemical labs and a full scale CO₂ prototype shop.

Carrier Commercial Refrigeration's German Lead Design Center is located in Mainz, near Frankfurt. The site was founded in 1926.

Reliability

CO₂OLtec™ refrigeration systems have been designed and qualified to the highest technical standards. All components went through an extensive series of qualification tests at Carrier's Lead Design Center to ensure their reliability. Carrier has developed and qualified a proprietary passive oil management system for the refrigeration racks which does not require oil separators

and associated components. This feature ensures higher reliability. Redundancy has been designed into the system to ensure maximum reliability. In addition to component testing, the full CO₂ refrigeration system has been tested and qualified in the Lead Design Center prior to installation at our customer sites.

In a transcritical CO₂ refrigeration circuit a working pressure up to 120 bar is required. In the store and in the cold rooms, Carrier has reduced the working pressure of up to 35-40 bar by using the proprietary CO₂OLtec™

Material compatibility and stability tests being conducted by Dr. Knut Petry, Head of the Chemical Laboratory at the Carrier Lead Design Center in Germany



system design. This pressure level is commonly found in cascade-type CO₂ low temperature refrigeration systems, a technical standard which is widely available in Europe already.

Performance

CO₂OLtec™ systems encompasses both low temperature and medium temperature solutions. CO₂OLtec™ medium temperature racks reject the refrigeration heat of the entire system through a gas cooler. Low temperature compressors are connected directly to the suction side of the medium temperature compressors. This system configuration is referred to as a ‘booster design’. The booster design coupled with the advantages of not requiring oil separators and associated components increases the efficiency of the CO₂OLtec™ system by an average of 10% versus a traditional HFC or CO₂ cascade system.

A significant advantage of CO₂ is its'

excellent heat transfer properties. Hence, the evaporation temperature in evaporators for CO₂ can be increased by 2 Kelvin on average compared with systems using HFC refrigerants. Due to the high volumetric cooling capability of CO₂, significantly narrower gauge pipe work can be used during installation.

The CO₂OLtec™ system provides attractive energy savings¹ as compared to conventional HFC direct expansion systems. During high ambient summer conditions, the refrigeration circuit is operated in transcritical mode; however the condensing temperature can be considerably decreased in winter, spring and in autumn resulting in better energy efficiency for CO₂ compared to HFC.

¹ Attractive energy savings can be obtained with average annual temperatures of up to 15°C - for reference, the annual average temperature in: Stockholm, 7°C; Paris, 12°C; London, 11°C; Milan, 13°C; Madrid, 14°C (Source: German National Meteorological Service 2007)



Carrier Lead Design Center in Germany



Carrier Lead Design Center in China



CO₂OLtec™ systems qualification tests being conducted into a CO₂ laboratory at the Carrier Lead Design Center in Germany

a Turnkey solution

Food Retail Applications

CO₂OLtec™ technology has been designed to equip all store formats, typically convenience stores, discount stores, supermarkets and hypermarkets. Carrier Commercial Refrigeration has combined decades of experience in food retail system design together with years of research and development in CO₂ refrigeration systems in order to launch the optimal CO₂OLtec™ solution.

With CO₂OLtec™ refrigeration systems, store owners select a reliable and environmentally advanced solution. CO₂ has the advantages of being a natural and cost-effective substance that not only enables store owners to avoid refrigerant taxes and reduce their global warming potential but also benefit from investment subsidies in several European countries. Besides the subsidies, the CO₂OLtec™ user can save energy costs over the full life time of the system.

In comparison to conventional refrigerants, CO₂ is the winner on all aspects for refrigeration applications:

- Sustainability
- Reliability
- Energy Efficiency

Keeping always in mind that Environment is precious.

Carrier's Project Engineers.



CO₂OLtec™ systems provide the ultimate refrigeration concept designed for reduced environmental impact using advanced Carrier technologies including specially selected and qualified components optimized for sustainability, reliability and energy efficiency.

Customer Benefits

- Elimination of direct emissions due to climate neutral CO₂ refrigerant
- Reduction of indirect emissions through increased energy efficiency
- State-of-the-art CO₂ refrigeration system delivered as a turnkey solution
- In house Service capability ensuring CO₂ system lifecycle performance
- Available for all food retail formats
- Reduced operating costs due to higher efficiency and avoidance of F-gas mandatory inspections

System Design

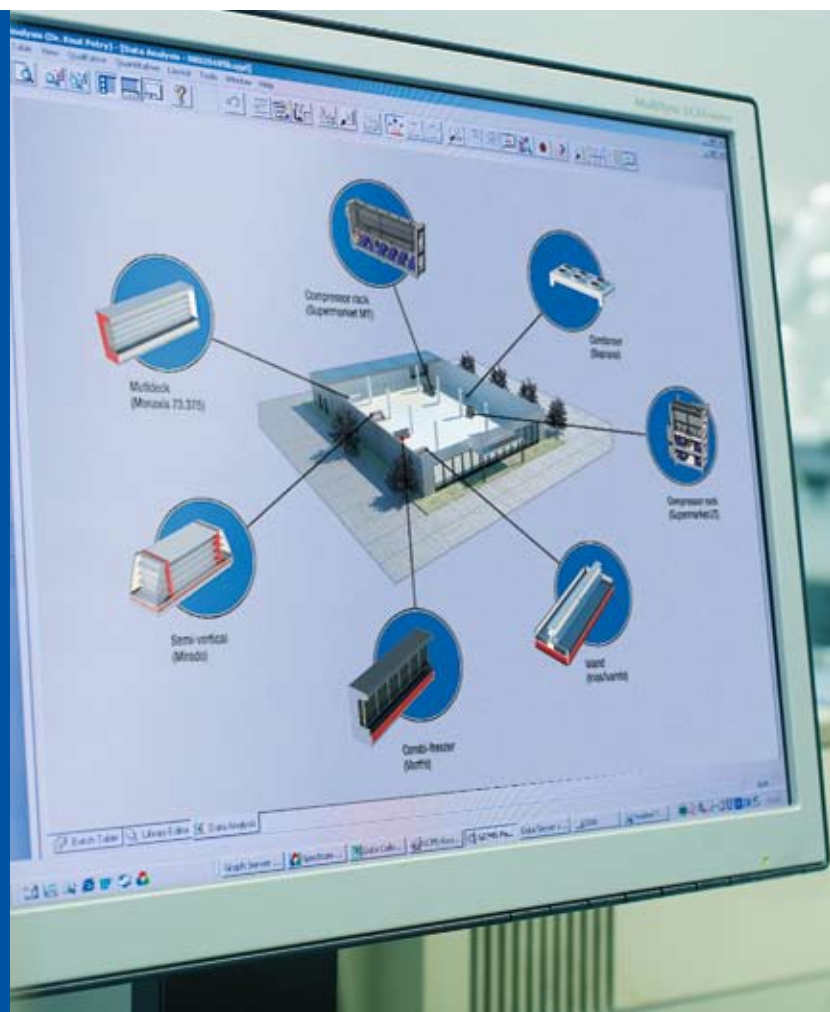
Carrier Commercial Refrigeration's in house Project Engineering organization has the capability to use the latest technology to design, on the basis of customer requests, an optimal store configuration. **CO₂OLtec™** takes advantage of automated calculation tools developed by Carrier for the design of refrigeration systems. The computing software Carrier uses to design piping networks reflects decades of experience in refrigeration project management optimizing economical and environmental aspects.

In addition, interacting with Carrier installation specialists provides customers with further opportunities to introduce new merchandizing and operating concepts. Carrier always guarantees that installation managers and supervisors are fully

trained on new technologies in order to enable them to support the success of **CO₂OLtec™** installations.

Project Life Cycle Management

Carrier's objective is to always ensure seamless refrigeration system integrations with streamlined service and maintenance programs that deliver reliable operation and sustainable solutions over their complete life cycle, whatever the store format. We provide our customers with state-of-the-art systems and in-depth field project installations, fully optimized and delivered on time. Service and maintenance programs are tailored to customers' individual requirements to meet the highest quality standards and to ensure minimum downtime.



Customer's messages

"Carrier provides state-of-the-art systems and in-depth practical project installations that are fully optimized and delivered on-time. They guarantee seamless refrigeration systems integration with streamlined service and maintenance programs that deliver reliable operation."

Dieter F. Wullschleger, Head of Corporate Communications, Cooperative Migros Basel, Switzerland

"Considered from a holistic perspective CO₂ refrigeration systems are attractive in economical and ecological terms. The current subsidies from BMU¹ / BAFA² help with the investment in this innovative technology. In combination with the usage of the refrigeration system's complete waste heat for heat recovery, we also meet the standards required by the Act on the Promotion of Renewable Energies in the Heat Sector (Erneuerbare-Energien-Wärmegesetz – EEWärmeG) of 2008 and the therein mentioned compensating measures, effective from January 1st, 2009."

Hans-Joachim Behrendt, Energy Consultant Edeka Boeers, Bielefeld, Germany

*"In our tegut... market in Lorsch, we realize high energy savings through e*cube refrigerated cabinets in conjunction with CO₂OLtec™ refrigeration systems, which use exclusively the natural refrigerant CO₂."*

Claus Breitung, Head of Energy Management, tegut... Fulda, Germany

"The CO₂OLtec™ system based on Carrier's CO₂ technology prevents damage to the ozone layer; while at the same time reducing the greenhouse effect caused by refrigeration systems. Choosing a CO₂ installation delivers a world-class low TEWI performance."

Andrew Cropper, Shop Manager, Sainsbury's Greenwich, London, UK

¹ German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

² German Federal Office for Economics and Export Control

Short list of customers trusting CO₂OLtec™ technology everyday

MIGROS

tegut...

gute Lebensmittel

Sainsbury's



SPAR



coop

CO₂OLtec

footprint

CO₂OLtec™ European reference list is increasing rapidly proving the high customer confidence in the system's sustainability, reliability and energy efficiency.

CO₂OLtec™ footprint

- > 100 stores
- > 10 Megawatt™ refrigeration capacity
- > 10 countries
- > 100 years of operating performance

- **Austria**
> 100 kW
- **Czech Republic**
> 200 kW
- **Denmark**
> 3.000 kW
- **Germany**
> 3.000 kW
- **Hungary**
> 300 kW
- **Luxembourg**
> 300 kW
- **Norway**
> 1.300 kW
- **Switzerland**
> 3.000 kW
- **United Kingdom**
> 900 kW

Status as of September 2009

● CO₂OLtec™ systems running per country



Mechanical Systems

Carrier Commercial Refrigeration design and manufacture in house advance Food Retail refrigeration mechanical systems including racks, condensers and evaporators. These mechanical systems deliver, night and day, efficient capacity on demand adapted to meet the store design requirements with maximum reliability. Carrier CO₂ mechanical systems are a critical part of the CO₂OLtec™ system's overall reliability and efficiency.

MaxiCO₂OL and MiniCO₂OL

Food retail refrigeration racks should deliver - night and day - efficient capacity on demand adapted to meet the store design

requirements with maximum reliability.

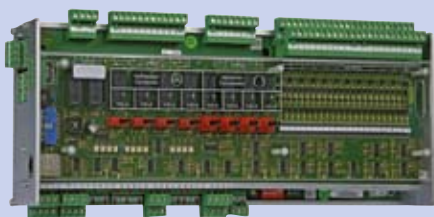
CO₂OLtec™ refrigeration racks - named MaxiCO₂OL and MiniCO₂OL - are designed to meet every store format capacity requirement, from discount stores to hypermarkets.

CO₂OLtec™ racks are manufactured in the world's largest refrigeration mechanical systems plant located in France. Carrier plants operate under a best in class total quality system called ACE (Achieving Competitive Excellence) managing all manufacturing processes and deployed across the world in all United Technologies Corporation plants from jet engine, to helicopter, or elevator production.

The CO₂OLtec™ refrigeration rack consists of specifically designed and engineered CO₂ compressors for direct expansion and high pressure system components tested extensively in the Lead Design Center and in the field to achieve highest standards of reliability. A specifically designed CO₂OLtec™ refrigeration rack microprocessor control system is available to meet customer specifications and ensure maximum reliability.

Electronic Control System

The CO₂OLtec™ refrigeration electronic controller has been designed especially for the transcritical operation of CO₂ multi-compressor sets together with chilled and frozen cabinets. All refrigerated display cabinets and cold room evaporators operate with electronic expansion valves piloted by the cabinet refrigeration controller. All CO₂OLtec™ stores are supervised by Carrier's world leading remote monitoring centre in Erfurt, Germany to ensure their reliability.



CO₂OLtec™ Electronic controller



Condenser



MAXICOOL



MINICOOL

Refrigerated Display Cabinets

Carrier has the largest range of refrigerated display cabinets, all available for CO₂ applications and tailored for all customer solutions delivering best in class efficiency and merchandizing performances. Carrier refrigerated display cabinets are manufactured in world class plants located in the Czech Republic, France, Hungary, and Italy.

Energy consumption combined with significantly rising energy costs have become core topics for food retailer customers. Carrier Commercial Refrigeration sees these issues as critical challenges and

considers energy efficiency as a top priority. It is clearly proven that CO₂ refrigerated display cabinets adapted and engineered to a CO₂ rack can, in the long term, provide a reliable and efficient refrigeration system. Carrier e*cube cabinets are designed to integrate potent and complex energy saving devices. Contrary to individual optional energy savings components, e*cube devices are all laboratory tested and factory mounted allowing Carrier to provide to customers accurate performance data and technical information. The e*cube range combined with CO₂OLtec™ systems can demonstrate optimal energy characteristics.



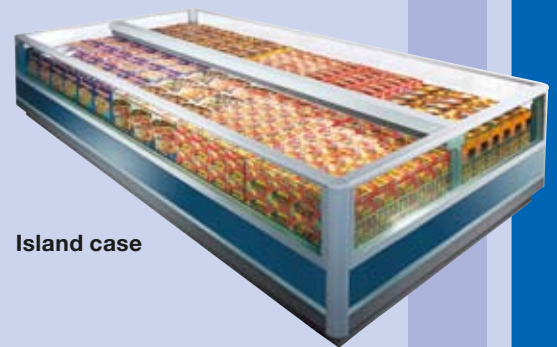
Carrier CO₂OLtec™ remote cabinet assembly line, Czech Republic



Carrier CO₂OLtec™ rack assembly line, France



Serve-over counter



Island case



Vertical freezer



Multideck

After Sales Service

Carrier Commercial Refrigeration operates an integrated service network across the world in order to guarantee food retail refrigeration system performance throughout its life time. All Service Technicians are trained on Carrier Refrigeration system technologies including electronic controls, mechanical system operation, refrigerated cabinets operation and safety.

Every refrigeration system is vulnerable to the negative influence of environmental and operational factors such as vibration, dirt, seasonal temperature fluctuations, refrigerant losses, humidity or incorrect use of the refrigeration system, plus natural aging of all components. These factors lead to significant deterioration of performances of any refrigeration system.

CO₂OLtec™ systems are always serviced by highly qualified Carrier Service Technicians ensuring the customer of optimal system reliability and efficiency during its life time.

CO₂OLtec™ life time system efficiency and reliability requires:

- In-depth Service Technician knowledge of CO₂ and CO₂OLtec™ technologies
- State of the art diagnostic equipment and tooling
- Strict and standard inspection and maintenance protocols
- Access to original equipment parts
- Remote monitoring connection to Carrier center where CO₂ specialists are located 24 Hours a day, 365 days a year



Average Potential Savings

- Modernising of the refrigeration system - 15-20 %
- Optimum control - 5-10 %
- Appropriate technical maintenance - 10-15 %

Total savings potential if all actions are implemented - up to 25%

Leak test done by a service technician, Michael Sebastian, from Carrier Refrigeration Germany



Food retail customers can always choose tailored packages within Carrier Commercial Refrigeration extensive Service product portfolio.

Service Contract

Carrier service contracts are structured to satisfy each customer's specific service requirements. They can run for one to several years, and include any combination of preventative maintenance and leakage inspections, emergency repair of cabinets and the refrigeration system, cabinet cleaning, condenser cleaning, and e*Service.

On Call

Carrier offers the most extensive network of refrigeration service technicians to respond to customer's emergency service needs 24/7/365. Call centers are fully staffed and trained to dispatch service technicians quickly

and efficiently. Qualified service technicians arrive on-site, with tools and safety protocols needed to troubleshoot and perform even the most difficult repairs.

e*Service

Carrier's refrigeration technology offers a broad remote service product portfolio, known as e*Service, which is highly recommended for all **CO₂OLtec™** systems, to ensure best energy efficiency and reliability. This includes 24 hours/365 days a year alarm monitoring, fault diagnosis by our qualified staff, remote system repair, and timely dispatching of service technicians.

Original Equipment spare parts

As the original manufacturer of much of the equipment, Carrier is uniquely prepared to provide its customer's with the parts they need ... when they need them. With **CO₂OLtec™**

systems, all critical refrigeration system spare parts have been identified and located to allow for rapid delivery to certified service technicians.



Carrier European Remote Monitoring Center, Germany



Carrier European Original Equipment Parts Center, Czech Republic



Maintenance & Renovation

Without proper service procedures, even the highest quality technology equipment cannot be guaranteed to work in a continually optimal state. In addition to standard Service contracts Carrier can deliver specific maintenance, renovation, and system enhancement in accordance with customer requirements.



Carrier Commercial Refrigeration Call Center

Refrigerant Charge Detection

Leaking units dramatically increase a system's power requirement, and therefore energy consumption. If the refrigerant partly escapes due to a leak, optimal temperatures cannot be reached even if the energy use is increased. In line with European laws Carrier service package includes regular leak detection test reducing the emission of greenhouse gases.

Heat Exchange Service

Layers of dirt on evaporators and condensers prevent heat transfer. Heat transfer efficiency falls and energy consumption increases. Dirty refrigerated display cases are not only unhygienic and inefficient; they also cause operating faults impacting refrigeration system proper operation. Cleaning service are highly

recommended to keep your **CO₂OLtec™** system operating at peak performance.

Energy Optimization

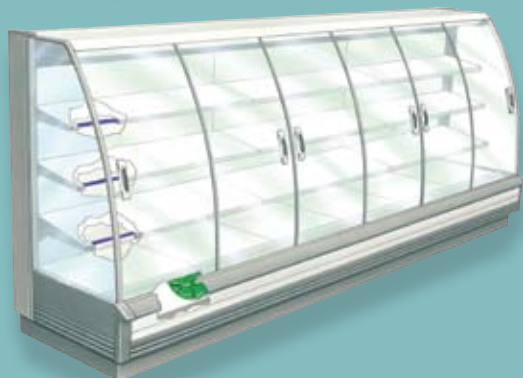
Using data obtained through e*Services, Carrier is able to analyze the energy efficiency of your refrigeration system and make recommendations for improvements.

Oil ageing and quality maintenance

Constant operation of a food retail refrigeration system places the highest demands on the properties of the lubricants. If the oil and filters are not replaced regularly, dirt and particle friction will cause damage. Oil sample analysis enables accurate detection of degrading lubricants. Carrier maintenance not only provides proper exchange cycle for oil and filters, but also ensures that the best possible machine oil is used.



Energy enhancement: doors, LED lighting, evaporator and fan efficiency, ...



Carrier Commercial Refrigeration offices

Austria

Carrier Kältetechnik Austria Ges.m.b.H.
1232 Vienna-Inzersdorf
Phone +43 1 661 04 0

Belgium

Carrier Refrigeration Belgium SA/NV
2627 Schelle
Phone +32 3 231 50 93

China

Carrier Refrigeration System (Shanghai) Ltd.
Shanghai 200003
Phone +86 21 23 06 30 00

Croatia

Carrier Kältetechnik Austria Ges.m.b.H.
Glavna podružnica Zagreb
10000 Zagreb
Phone +385 1 2484 000

Czech Republic

Carrier chladicí technika CZ s.r.o.
190 00 Prague 9
Phone +420 281 095 111

Denmark

Carrier Refrigeration Denmark A/S
8350 Hundslund
Phone +45 86 55 02 55

Finland

Carrier Kylmäälä Oy
04601 Mäntsälä
Phone +358 19 52 29 200

France

Carrier Refrigeration Distribution France SAS
94100 St Maur des Fossés
Phone +33 1 43 97 61 00

Germany

Carrier Kältetechnik Deutschland GmbH
50999 Cologne
Phone +49 2236 601 01

Greece

Carrier Frigel Apostolou SA
10442 Athens
Phone +30 210 5763950

Hong Kong

Carrier Hong Kong Ltd.
Kowloon
Phone +852 26 94 53 33

Hungary

Carrier Hätéstechnika Forgalmazó
Magyarország Kft./
Carrier Refrigeration Distribution Hungary
Ltd.
1037 Budapest
Phone +36 1 437 05 10

India

Carrier Airconditioning and Refrigeration Ltd.
Gurgaon, Harayana 122001
Phone +91 124 482 55 00

Ireland

Carrier Refrigeration Ireland
a branch of Carrier UK Ltd
Dublin 24
Phone + 353 1 451 5585

Italy

Carrier Refrigeration Distribution Italy SpA
20090 Buccinasco (Milan)
Phone +39 02 488 675 1

Korea

Carrier Refrigeration Korea
Youngdeungpo-gu, Seoul
Phone +82 2 20 71 51 03

Malaysia

Carrier (Malaysia) Sdn. Bhd.
47610 Subang Jaya, Selangor Darul Ehsan
Phone +603 802 47 77 88

Middle East

Linde Kältetechnik GmbH – (Carrier
Commercial Refrigeration)
Dubai – United Arab Emirates
Phone +971 4 222 5216

Netherlands

Carrier Bedrijfskoeling Nederland B.V.
4104 AW Culemborg
Phone +31 345 544 444

Norway

Carrier Refrigeration Norway AS
0668 Oslo
Phone +47 23 37 58 40

Philippines

Carrier Linde Refrigeration Phils., Inc.
Alabang, Muntinlupa City
Phone + 632 775 06 30

Poland

Carrier Chłodnictwo Polska Sp. z o.o.
02-676 Warsaw
Phone +48 22 54 40 100

Russia

Carrier Refrigeration Rus
109240 Moscow
Phone +7 495 933 11 75

Singapore

Carrier Singapore (Pte) Ltd.
Singapore 608926
Phone +65 65 67 55 22

Slovakia

Carrier chladiaca technika Slovakia s.r.o.
949 07 Nitra
Phone +421 377 764 011

Slovenia

Carrier Kältetechnik Austria Ges.m.b.H. –
Podružnica Ljubljana
1000 Ljubljana
Phone +386 1 2425 523

Spain

Carrier Refrigeración Ibérica SA
08036 Barcelona
Phone +34 93 4527 184

Sweden

Carrier Refrigeration Sweden AB
213 76 Malmö
Phone +46 40 664 51 70

Switzerland

Carrier Kältetechnik Schweiz AG
4133 Pratteln
Phone +41 61 816 66 66

Taiwan

Carrier Transicold Pte Taiwan Branch
Taipei
Phone +886 2 28 81 18 00

Thailand

Carrier Linde Refrigeration (Thailand) Ltd.
Bangkok 10510
Phone + 66 25 17 20 00

United Kingdom

Carrier Refrigeration UK Ltd.
Oxford OX4 6HQ
Phone +44 1 865 337 700



think system - master energy

Smart systems use energy wisely, where needed, when required. Based on this understanding we offer solutions combining energy, efficiency and ecology. This stands for energy savings over the entire life cycle, sustainable performance in temperature quality and food safety, and significant carbon footprint reduction. This is where we focus our energy. Increased sales are one of the benefits for our customers. We provide more: sustainable, state-of-the-art refrigeration solutions.

Carrier Commercial Refrigeration is a leading supplier of high efficiency turnkey refrigeration systems and services in the food retail industry. Contact one of our local offices to discover our complete range of products and services offering on: www.carrier-refrigeration.de

- | | |
|---|---|
|  CO ₂ Cooling Systems |  Counters, Multidecks, Semi-verticals, Roll-in cabinets and Ultrafreshness |
|  HFC Cooling Systems |  Islands, Wall-sited cases and Vertical freezers |
|  Applications, Cooling Systems |  Plug-in cases |
|  Condensers, Cooling Systems |  Services |
|  Control Cooling Systems | |



Carrier

A United Technologies Company