Cold Chain under control from start to finish
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The Linde Group is a world leading gases and engineering company with a wide range of products and services, including industrial gases, speciality gases, chemicals and refrigerants gases.
Refrigeration & air conditioning has steadily become a part of every day life. Particularly for Food & Beverage: Chilling and freezing, transportation.
Cold Chain under control from start to finish
Perishable Goods Transportation & Distribution

Our food is chilled, frozen, stored, transported and displayed in refrigerated units to extend and preserve.
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The Industry-Temperature Zones in Distribution & Transport of Foods

- frozen foods
  temperature range: -24°C until -18°C

- fresh meat and mincemeat
  temperature range: 0°C until 2°C

- chilled delicatessen
  temperature range: 2°C until 4°C

- fresh goods (dairy products, fruit, vegetables)
  temperature range: 4°C until 8°C

- sensitive to cold fruits and vegetables
  temperature range: 8°C until 15°C

- Rest of foods without chilling
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The Industry-Transport Levels (Links of cold chain)
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The Industry-Transport Levels (Links of cold chain)
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The Industry-Transport Cooling for level 1&2

Level 1: transport from the:
- factory to cold store
- cold store to regional distribution centre (RDC)

•Main transport cooling system:
  truck refrigeration (cooling of the whole body or part body)

•Benefits Truck refrigeration:
  - big volumes with similar temperature
  - long distances
  - few door openings
  - specialized logistic systems
    (e.g. dairy products)
Currently the majority of food/goods are transported utilising mechanically refrigerated trailers or trucks. Mechanical refrigerated trucks and trailers predominant transport of frozen and chilled products throughout the world.
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The Industry - Transport Cooling for level 3

Level 3: transport from the
- central store of the wholesaler to the outlet
- bakeries store to bakeries outlet (shop)
- catering kitchen to the location of event

Two main transport cooling systems:
a) truck refrigeration (cooling of the whole body)
b) insulated container refrigeration (cooling of insulated containers)

Benefits Truck refrigeration:
- big volumes with similar temperature
- long distances
- few door openings
- specialized logistic systems
  (e.g. dairy products)

Benefits Insulated container refrigeration:
- direct store delivery (drop ship)
- different temperatures needed
- smaller volumes/temperature
- a lot of stops and door openings
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The Industry-Current Methods of Transport Level 3

Mechanical Refrigeration 13m trailers & 8m

Insulated cooled pallet container
volume: 500 - 1600 L
1. **Dry ice**

This has a cold temperature of – 78 ° which is released by sublimation. Dry ice is flexible, simple in using and available in different sized slices (0,6 – 10 kg)

2. **Cold holdover plates (eutectic plates)**

These are available in the fresh food area (- 3 °) and deep frozen (- 21 °). They are filled with non toxic brine (salt/water mixture). They can be re-used by re-freezing in special fridges.

3. **Cooling with cooling unit (seldom, )**
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Alternative Cooling Method for Transport of Perishable Goods

Cryogenic Offering (Sustainability)
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Reasons for renewed interest Cryogenic Cooling Systems

**Environmentally Driven**
- Reduction Carbon Foot Print
- Use of renewable (CO2)
- More Efficient Systems

**Mechanical**
- Reduction in noise
- Reliability
- Reduction in service costs
- Reduction in weight
- Improved cooled down

**Safety**
- Easy to use
- Breathable atmosphere indirect systems
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Reasons for renewed interest Cryogenic Cooling Systems

**Legislation**
- Refrigerants being prohibited to be used
- Red diesel tax?

**Customers/Public Profile**
- Supermarkets want to be seen to have a greener distribution system
- Present a green image

**Linde**
- Global Company
- Engineering expertise
- Respected
- Established within the chilled/frozen food processing
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Linde Technology-The SnowCool® System for insulated containers

SNOWCOOL for transport of fresh products (0-15°C) or frozen goods (<-18°C)

The production of the snow is independent and flexible:
- injection station installed in the cold store
- supply of liquid CO₂ through a steady state bulk tank
- safe filling gun of LCO₂ into the snow box® within the container
- producing a defined volume of now after a simple keypress.

The snow is generated in the pistol by releasing liquid CO₂,
- contained in the stainless steel box
- return of the spent cold gas through the pistol and the exhaust hose
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SNOWCOOL®
Cold Chain under control from start to finish
Ready filled container ready for distribution

Preparation in the consignment zone
Frostcruise indirect LN cooling system

— Create an efficient method of using the refrigerant
— Produce a safe indirect system
— Produce a standardised offering
— Ensure temperature is controllable for required periods of time
— Produce multi temperature compartments
— Produce a low noise alternative to diesel powered systems
— Environmentally Friendly
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Frostcruise In transit Truck Refrigeration Design & Description

Tank and filling station

1. LN-Tank and piping
2. Heat exchanger
3. Control unit
4. Container
5. Filling station
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Frostcruise In transit Truck Refrigeration Design & Description

Filling tank

Heat exchanger
Thank you for your attention.