MAKING MODERN LIVING POSSIBLE

Natural Refrigerants in Asia Pacific

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Natural Refrigerants in the Cold Chain

Industrial Refrigeration Segment

- Ammonia (NH3) still a primary choice in medium and large size plants
- Increased focus on NH3/CO2 secondary and cascade systems in Japan, North America and Europe
- NH3 first choice replacement for HCFCs
- Emergence of NH3/CO2 cascade systems in developing markets

Food Retail / Supermarket Refrigeration

- Transcritical CO2 systems in Northern climates
- CO2 cascade systems in warm climates
- Increased interest of NH3/CO2 systems, especially in North America

Asia Pacific and Industrial Refrigeration

Japan Market – CO2

- Great inroads of CO2 as a secondary refrigerant (NH3/CO2)
- Cold Storage and Food Processing in medium and low temperature applications
- Safe and simple choice

China

- Emergence of NH3/CO2 cascade systems for Cold Storages
- Large scale project: 44,300 m2 cold store with ultra low temperature areas
- Energy reduction with a fraction of NH3 charge compared to conventional systems

Sample of Success – NH3/CO2 in China

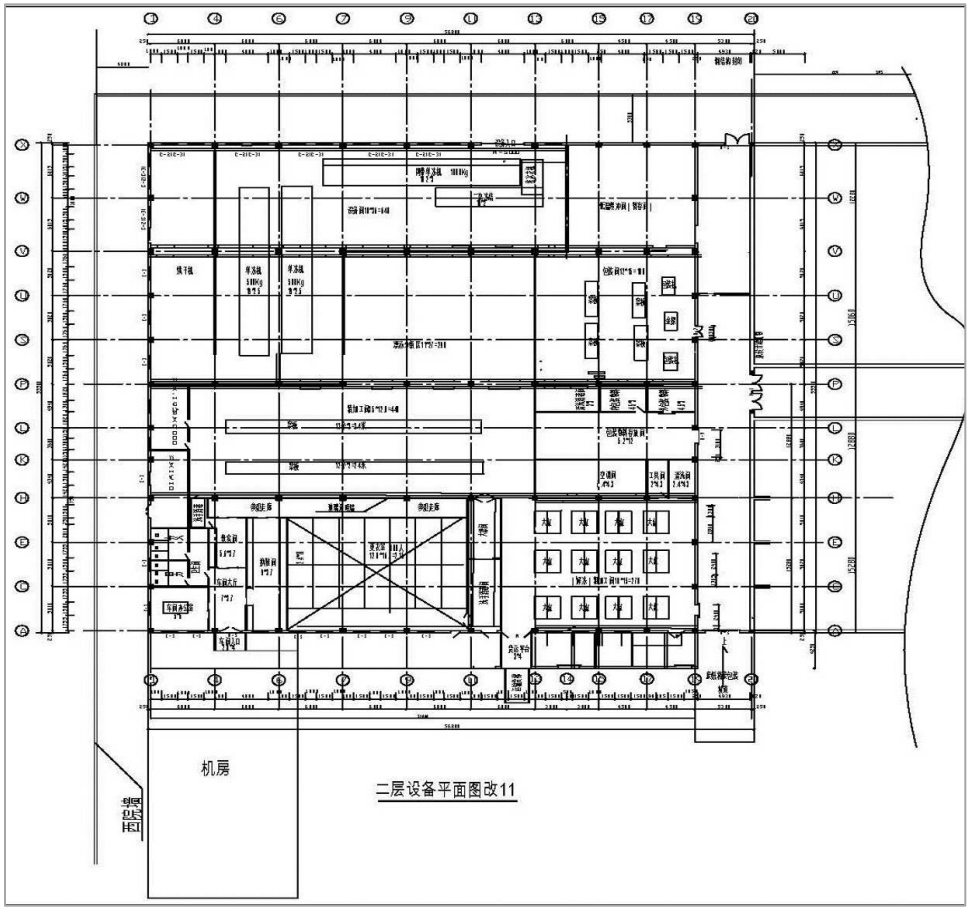
- Weihai Jiuye Cold Storage Co., Ltd (The 1st public bonded warehouse in China Shandong province)
- Main business: Food Processing (seafood, fruit & vegetable) & logistic cold storage
- One of the agricultural leading enterprise in China
- Installed by local contractor

Weihai Jiuye Cold Storage Major Drivers:

- High efficiency
- Safety
- System operation stability
- Environmentally-friendly
- State-of-the-art
- Optimized operating & maintenance cost

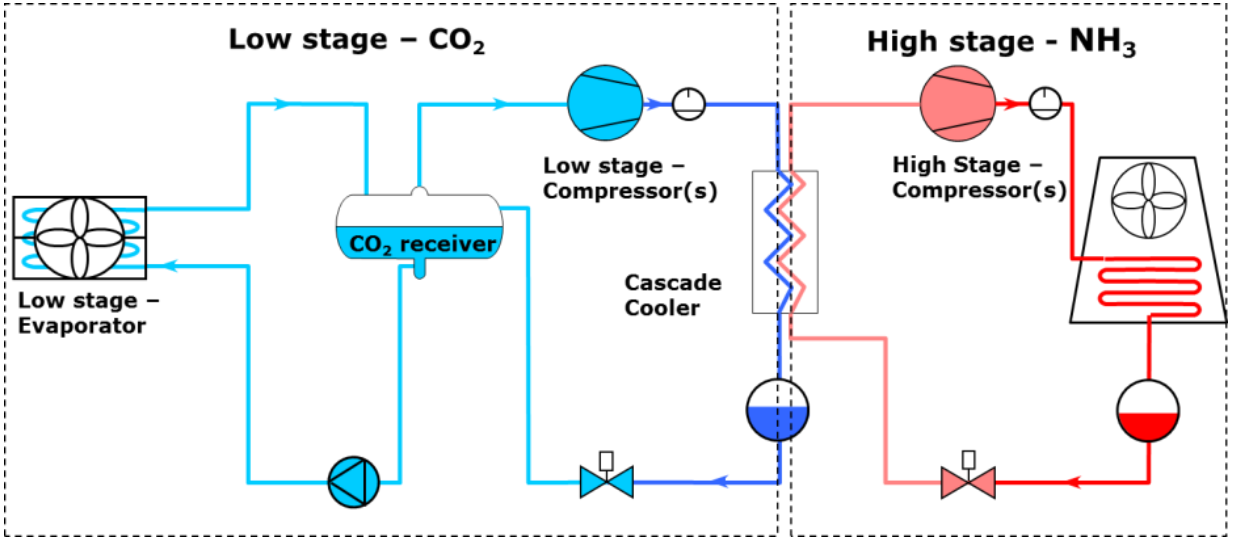
Example layout

- **Spiral Freezer**
  - Capacity: 0.5 t/h, 1 t/h
  - Temperature: -45 ℃
- **Second freezer**
  - Capacity: 1 t/h
  - Temperature: -35 ℃
- **Chilling room**
  - 110 m^2
  - Capacity: 20t
  - Temperature: -35 ℃
- **Cold storage room**
  - 500 m^2 X 4
  - Capacity: 50t X 4
  - Temperature: 0 ℃



State-of-the-Art Refrigeration System

- A well-known approach to fulfilling efficiency, and safety requirements via a NH3/CO2 cascade system
- NH3 charge reduction to 1/10th of traditional systems allows for large plant construction in heavily populated areas



Safe and well-built Machine Room

Energy Savings Overview

Operational cost [kWh/Ton] comparison based on the same seafood production output.

- This project: **NH_3/CO_2 cascade refrigeration system** with spiral freezer

  Temperature in: 10℃,

  Temperature out: -18℃,

  Duration: 30 minutes

  Efficiency: 105kWh/Ton

- Original system: **compressor LG20/LG16** with Spiral Freezer

  Temperature in: 10℃,

  Temperature out: -18℃,

  Duration: 30 minutes

  Efficiency: 118kWh/Ton

- Estimated Energy saving: **~ 11%**

Balance between ROI and Green Thinking

- Natural Refrigerants belong in all markets. Beyond North America, Europe and Japan, all relevant markets will benefit from a sound and long-term investment in the Cold Chain.

- Energy Savings around 10% can be realized especially when low temperature is required

- High efficiency and Zero-net direct emission systems help reduce the level of pollution in the region

Danfoss Contribution to the Cold Chain Development

Continuous innovation to fulfill reliable operation of modern systems

Commitment to providing training to local and global firms to facilitate the use of natural refrigerants

Danfoss and its partner in Japan, Saginomiya, help reduce carbon foot print of refrigeration systems via top of the line valves and controls

Support to government initiatives and stakeholders for the safe development of refrigeration in global markets

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Danfoss Partner in Japan