

Chillventa Specialist Forums 2024

Chillventa Fachforen 2024

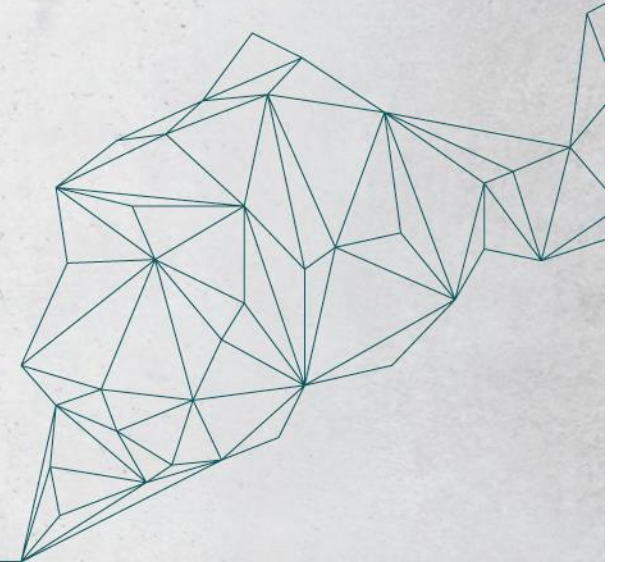
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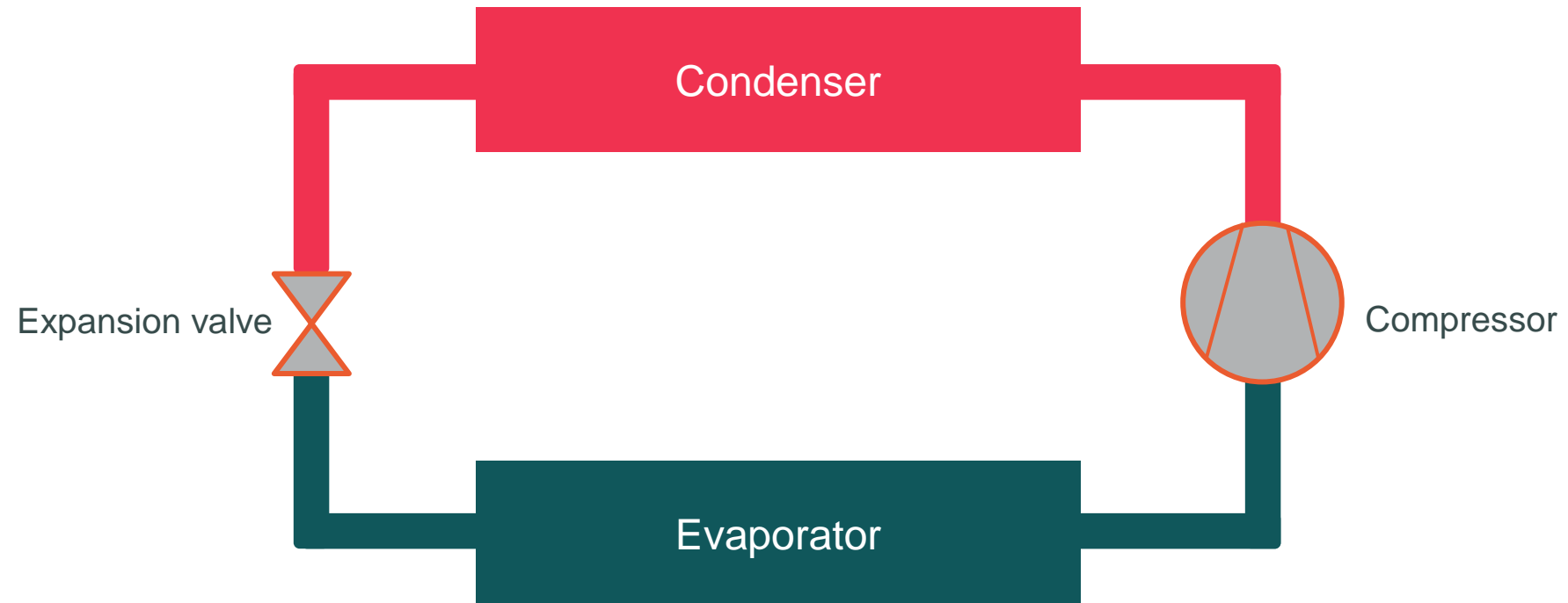


Extreme low charge refrigeration systems with ammonia R-717

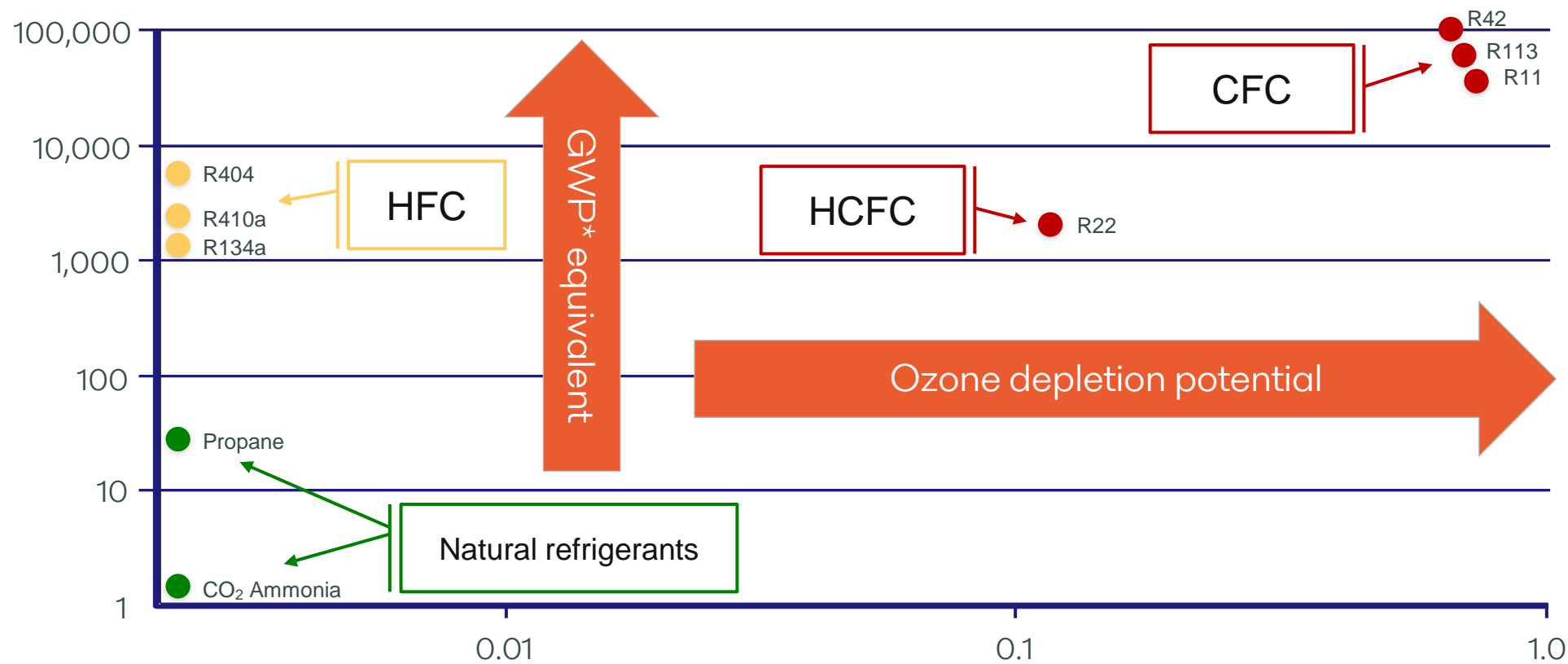
Christian Kempe - Alfa Laval

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Refrigerants



* GWP = Global Warming Potential

Håkan Eriksson
Jan Burman, Lennart Thaning och Stellan Winter

Hur farlig är en ishall med ammoniak?

Beräkningar av riskavstånd vid vådautsläpp av ammoniak samt
hur stora byggnader påverkar spridningen av gaser



How hazardous is R-717?

Swedish Defence Research Agency & Swedish
Contingencies Agency report:
*"How hazardous is an ice-hockey arena with
ammonia?"*

Risk area

- **Charge 600 kg = 100-200 m**
 - Evaporative air-cooled condenser
- **Charge 60 kg = The machine room**
 - Indirect system

Low charge definition?

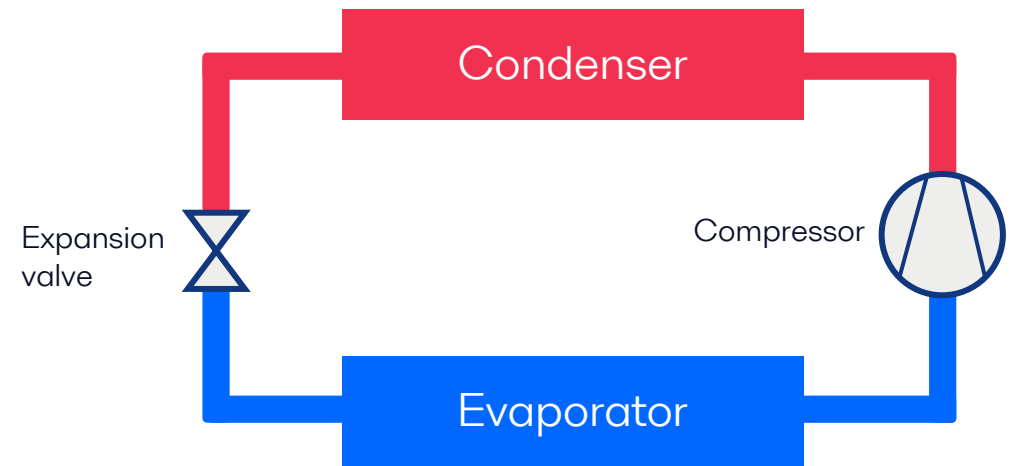
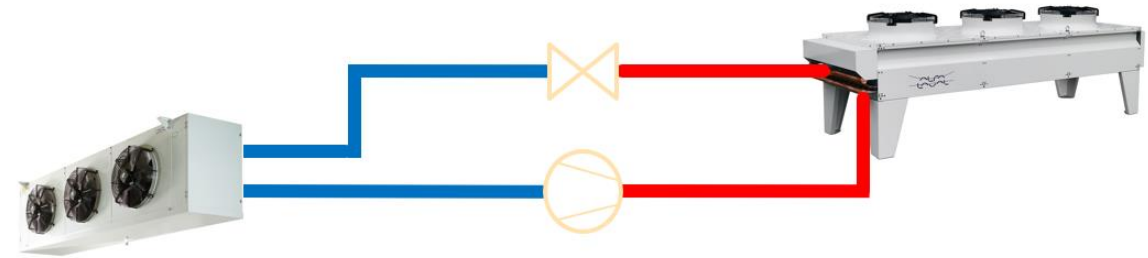
- Maximum total charge, kg?
- Charge per kilowatt, g/kW?



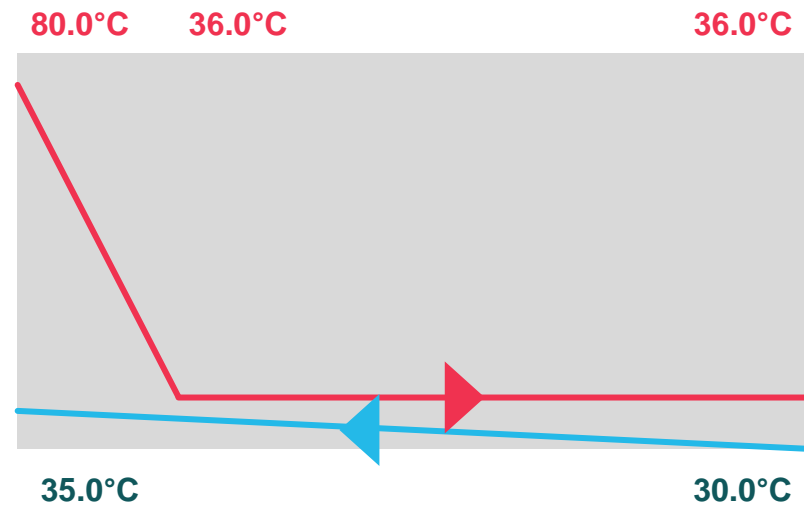
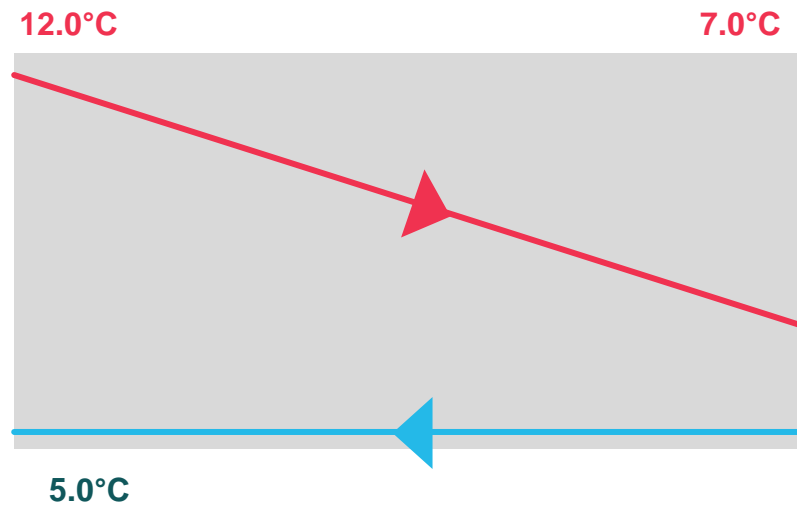
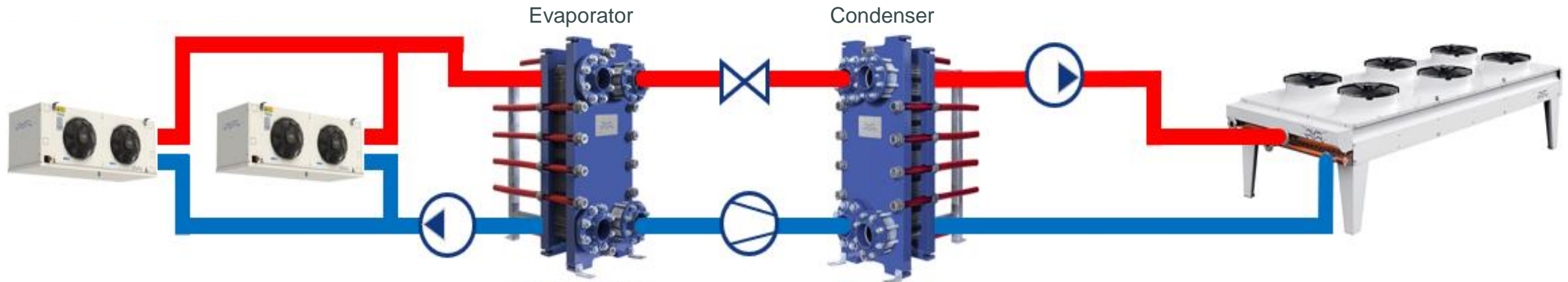
Direct system

Traditional cold storage system

- Direct cooling of air-coolers
- Pumped



Indirect system



Temperature loss

Effects on COP and operational cost – Ammonia system

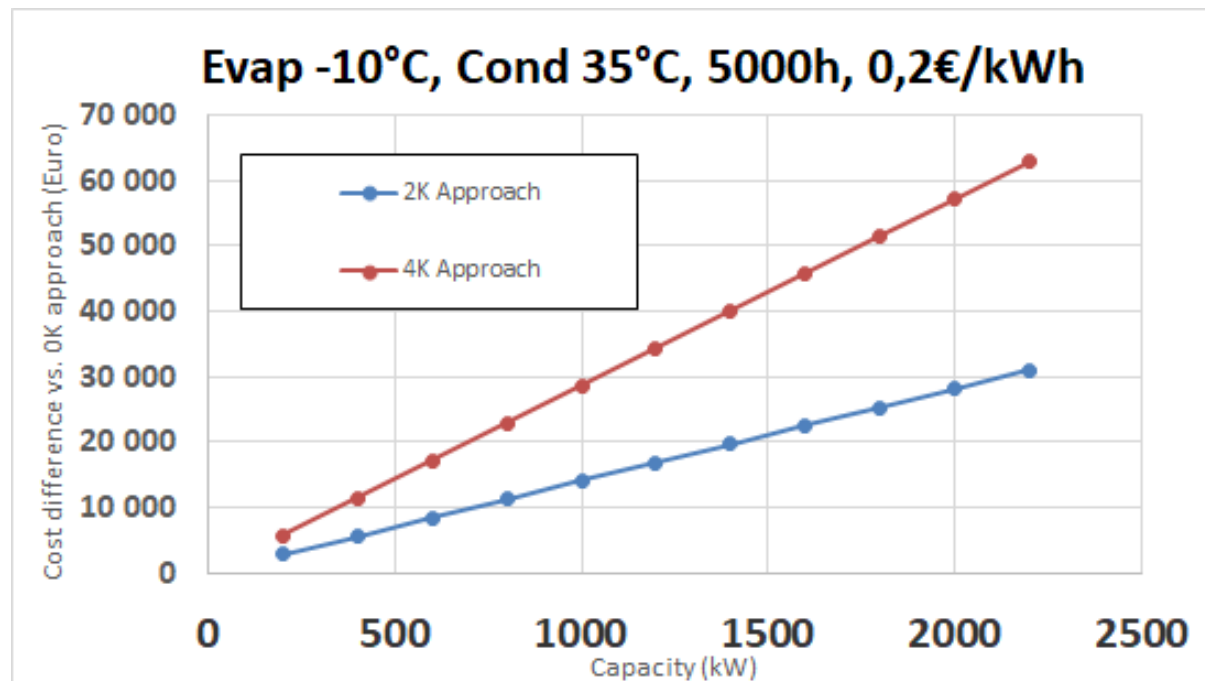
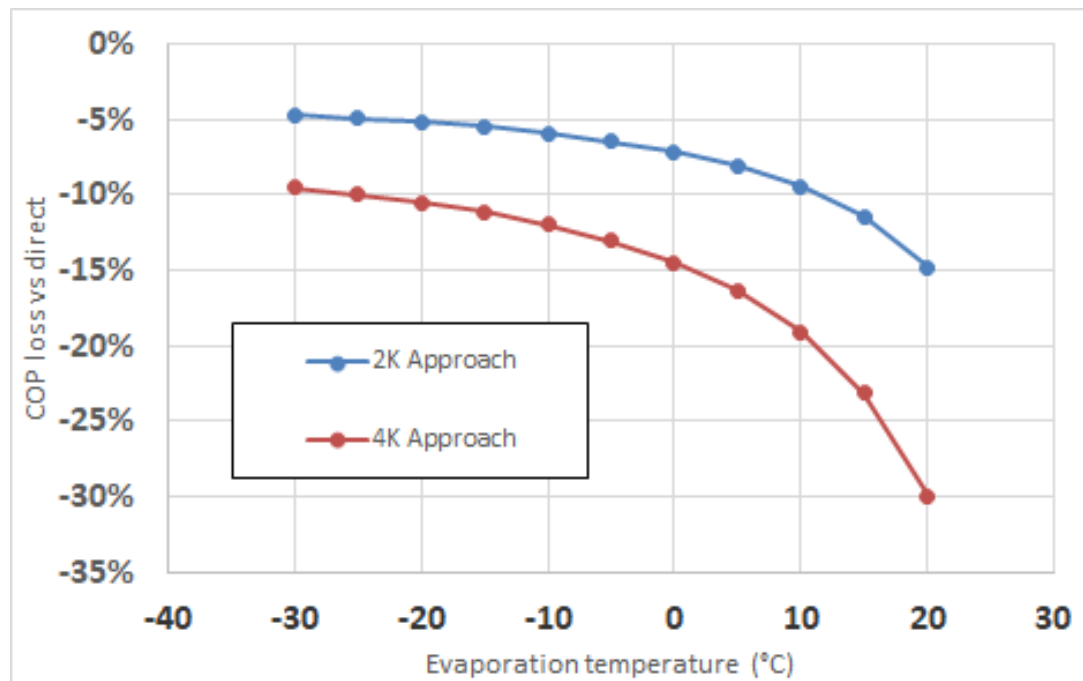
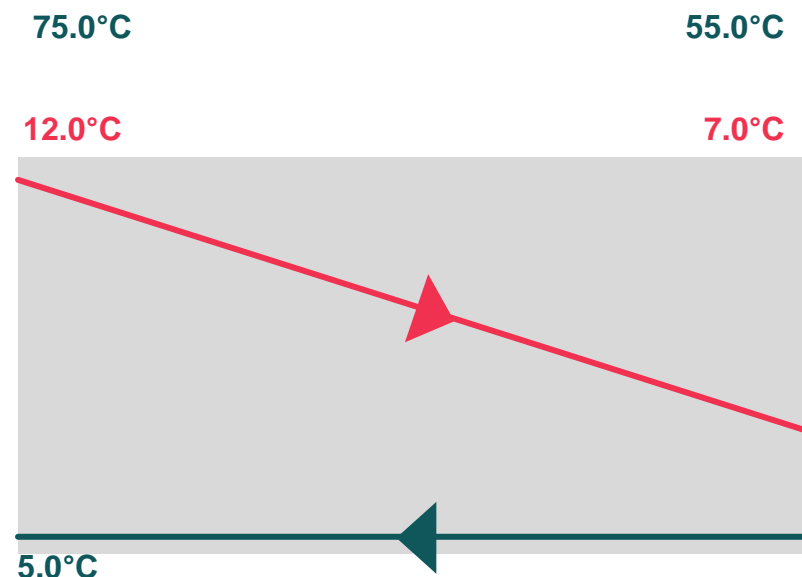
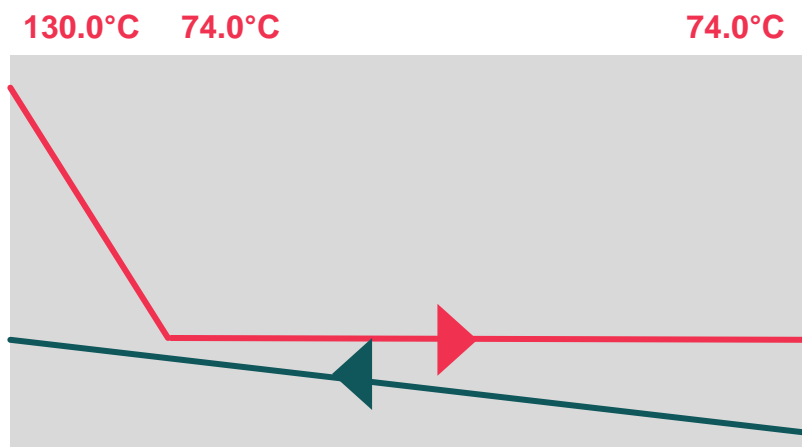


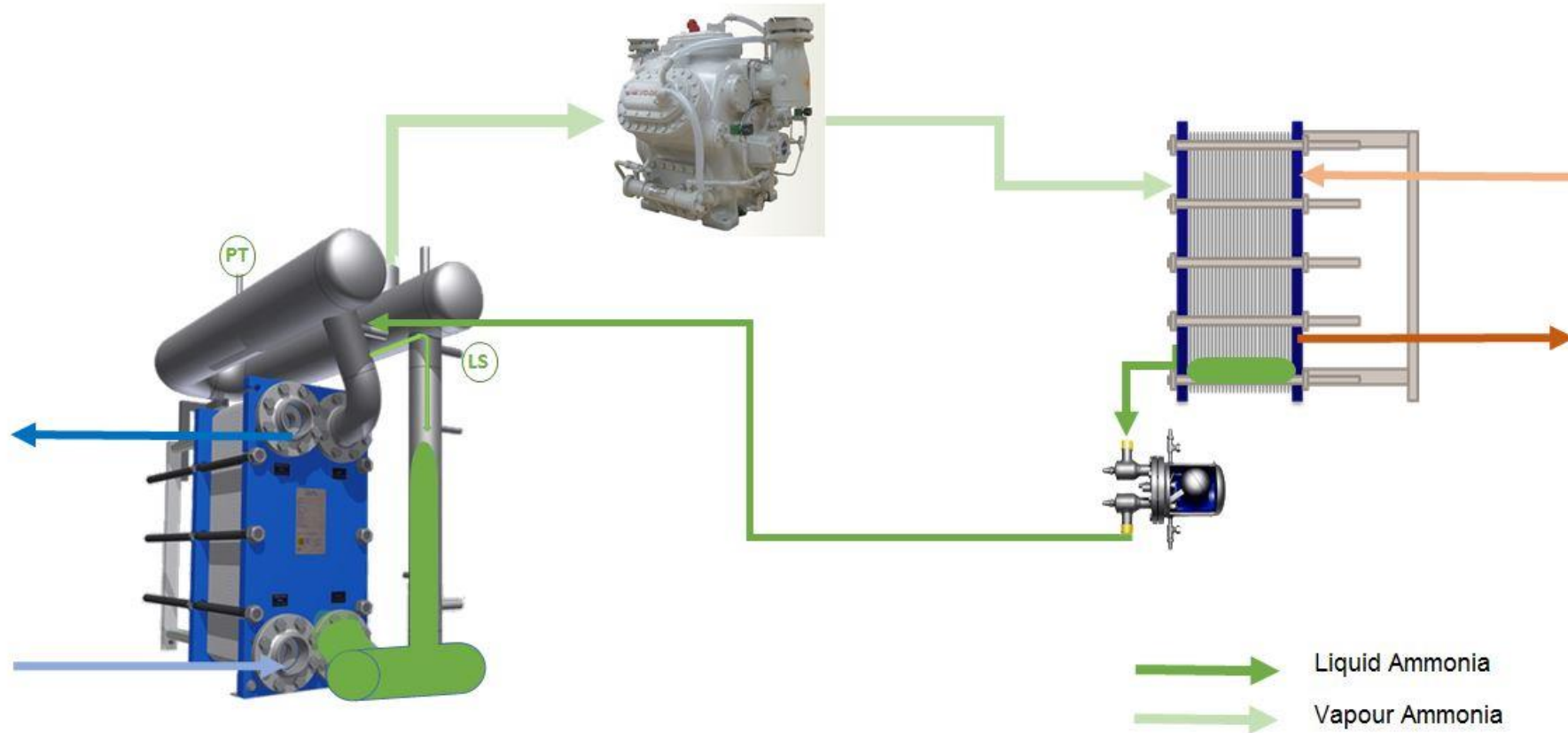
Plate heat exchangers

Keep temperature approach to a minimum

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Semi-welded plate heat exchangers and charge



Ammonia Charge at full capacity

U-turn separator

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Heat pump installation

Evaporator

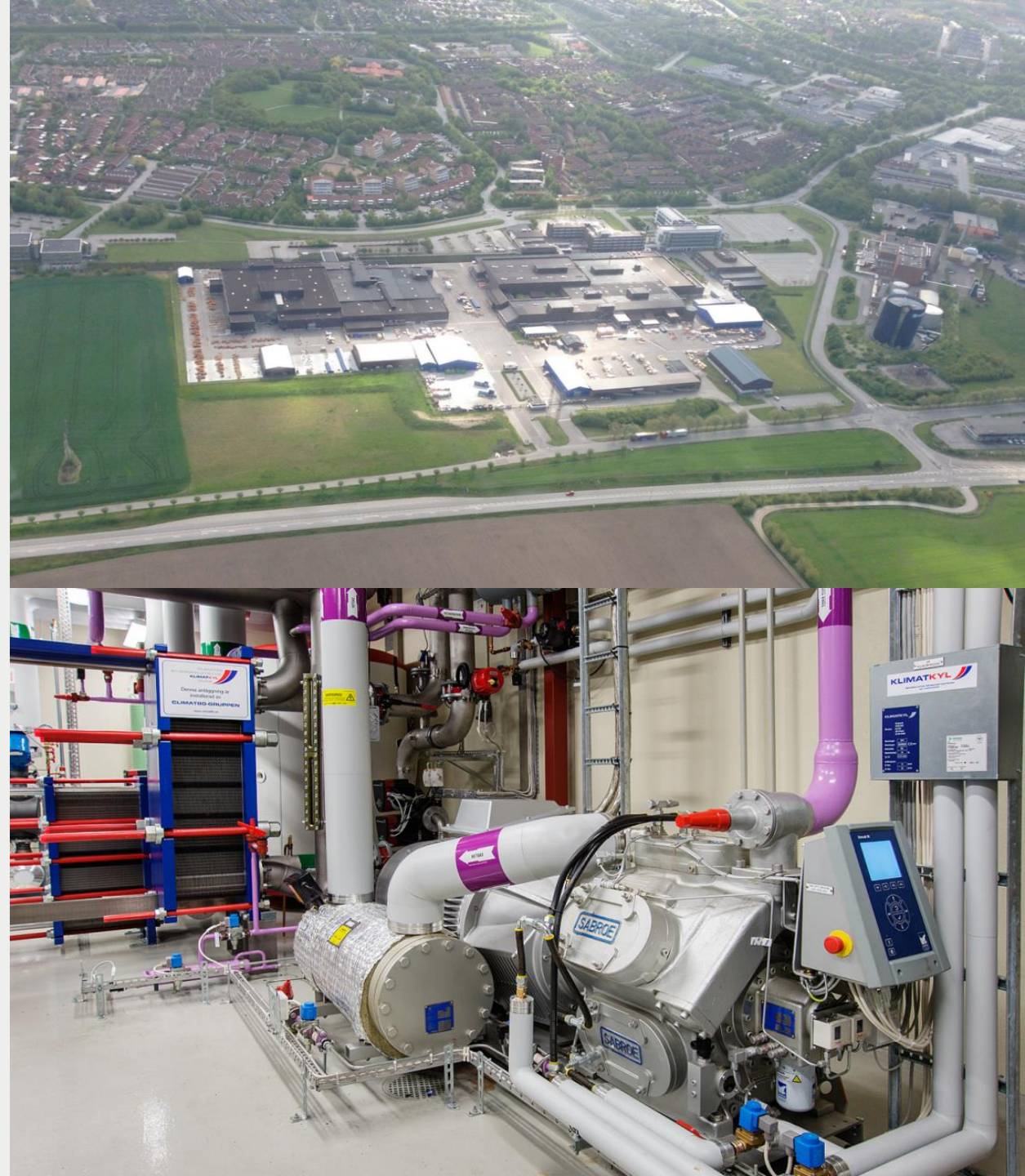
- 700 kW
- SWPHE & U-turn
- Glycol 40°C → 30°C

Condenser

- 826 kW
- Water 55°C → 65°C

Charge: 40 kg

Extreme low charge refrigeration systems

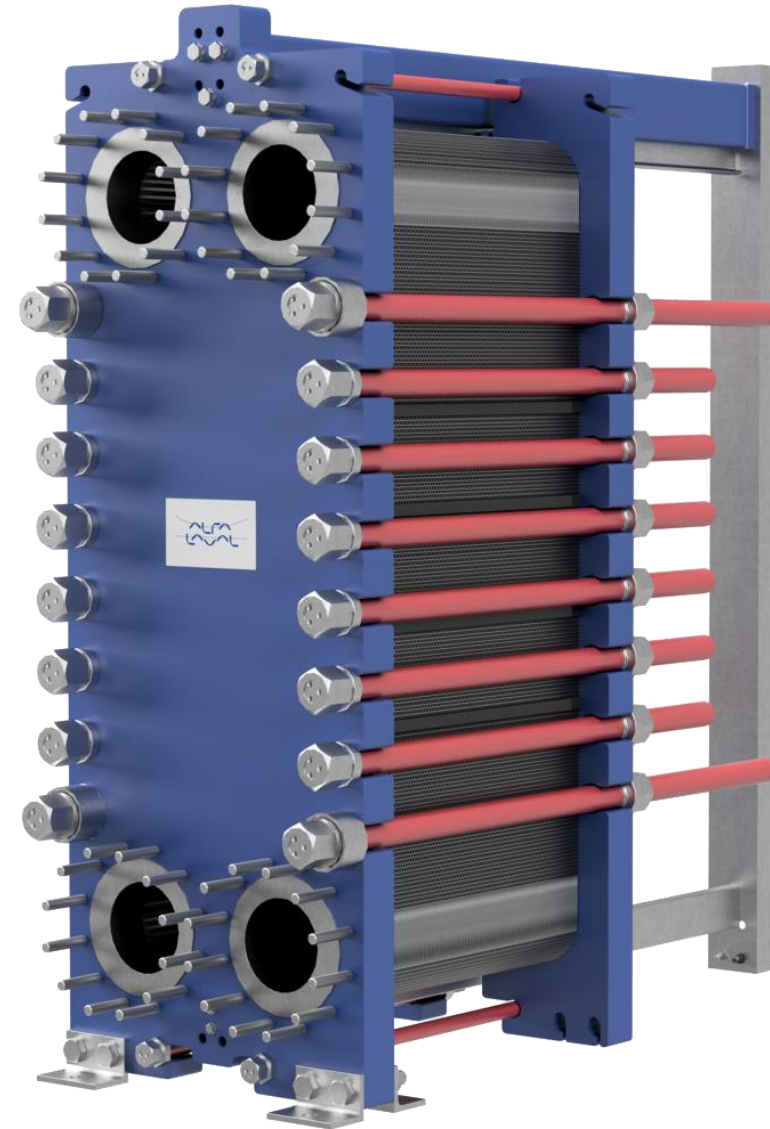


Summary

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Natural refrigerants work in the long run

- Small charge: reduced risk
- Indirect systems
 - Low charge
 - Kept in the machine room
- Key to high performance
 - Low temperature approach



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