KTH Energiteknik

Field measurements of supermarket refrigeration systems -CO2 vs. HFC-

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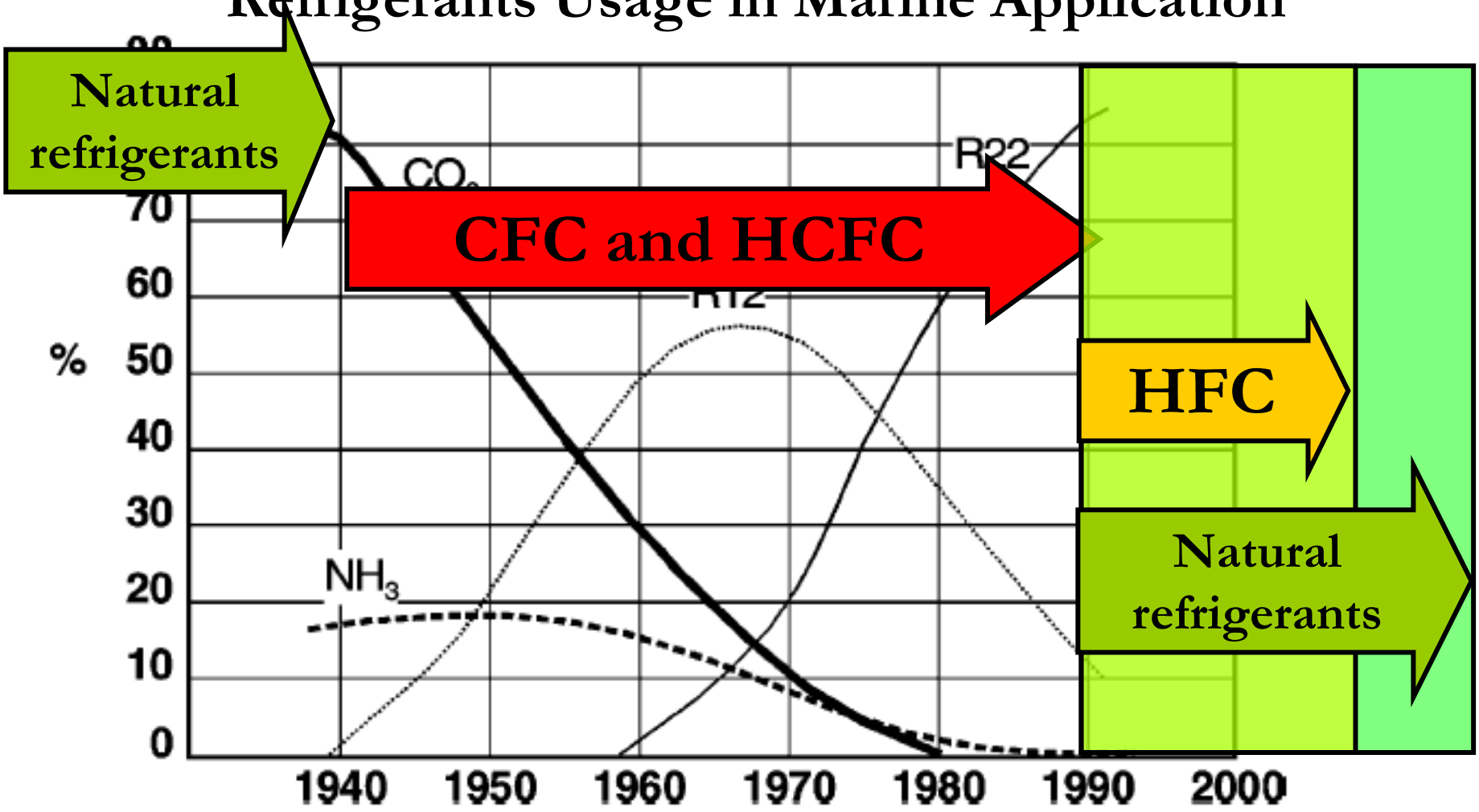
2012

Introduction-Background

Refrigerants Usage in Marine Application



Reference: Stera A. Lloyd's Register (1992)

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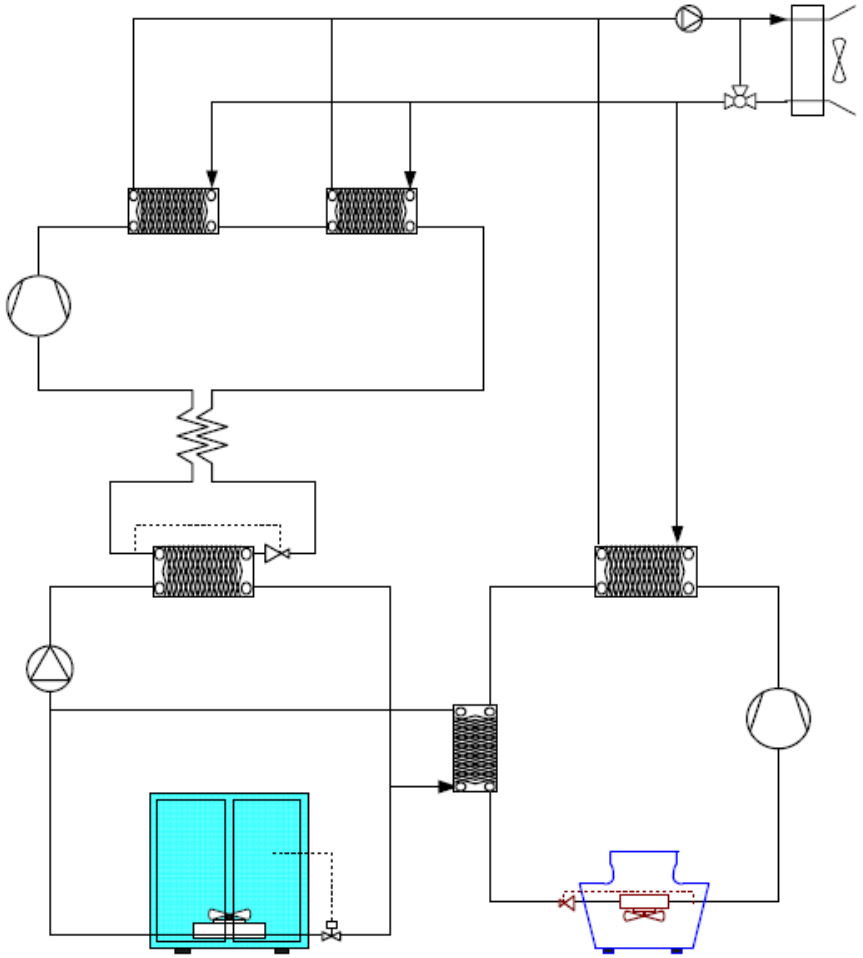
Conventional R404A system in Sweden

- **Main features**
  - Brine at medium temperature level
  - Sub-cooling of low temperature loop
  - Indirect heat reject to ambient!



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CO2 in Supermarket Refrigeration

Indirect

Cascade

Trans-critical

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Field Measurments Project

- Period: 2009-2011
- Co-financed by the Swedish energy agency
- Managed by IUC-SEK, Jörgen Rogstam
- Research done at KTH, Samer Sawalha and several MSc thesis students
- Several companies involved

Organisation	Participant/s
Sveriges Energi- & Kylcentrum	Jörgen Rogstam
KTH - Energiteknik	Björn Palm / Samer Sawalha
ICA	Per-Erik Jansson
Green and Cool	Micael Antonsson
Partor AB	Martin Johanson
WICA	Peter Rylander
Ahlsell	Torbjörn Larsson
Huurre	Göran Sundin
AGA	Christer Hens
Tranter	Ulf Vestergren
Cupori	David Sharp
Oppunda Svets	Ken Johansson
Energimyndigheten	Conny Ryytty

Systems in Field Measurments

- **12 systems in total**
  - Conventional systems (3)
  - CO2 trans-critical
    - Parallel (1)
    - Booster systems type 1 (2)
    - Booster systems type 2 (2)
  - CO2 cascade systems (3)
  - CO2 pump circulation (1)

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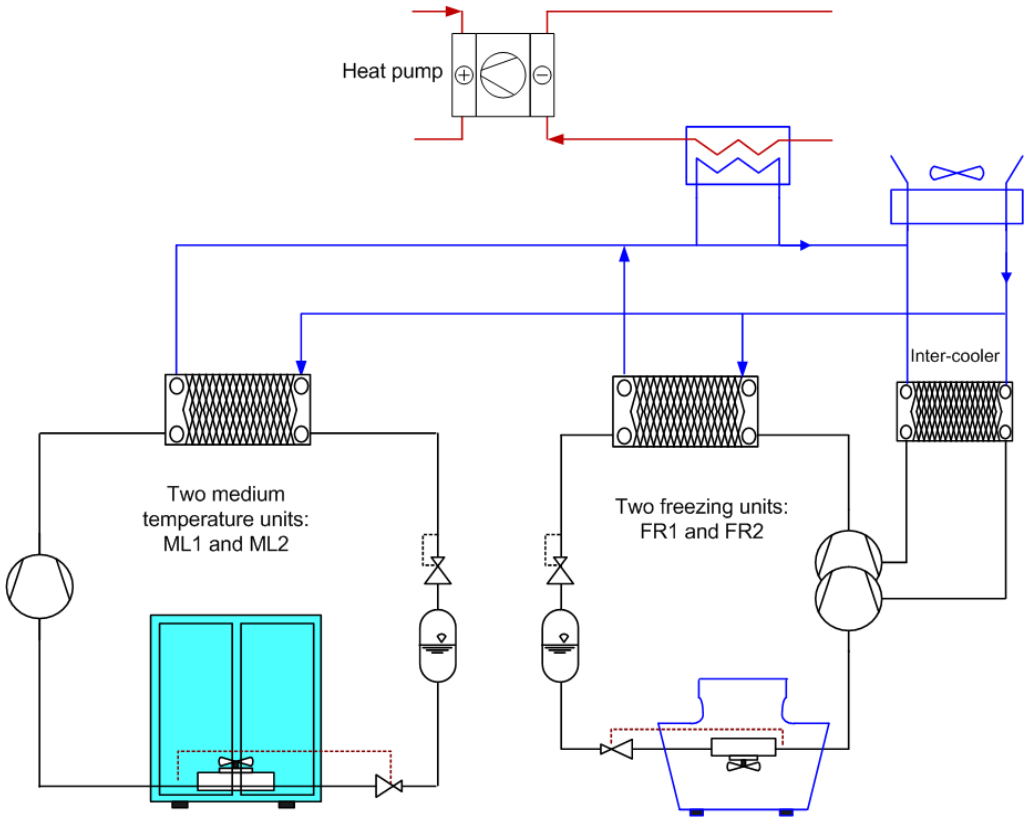
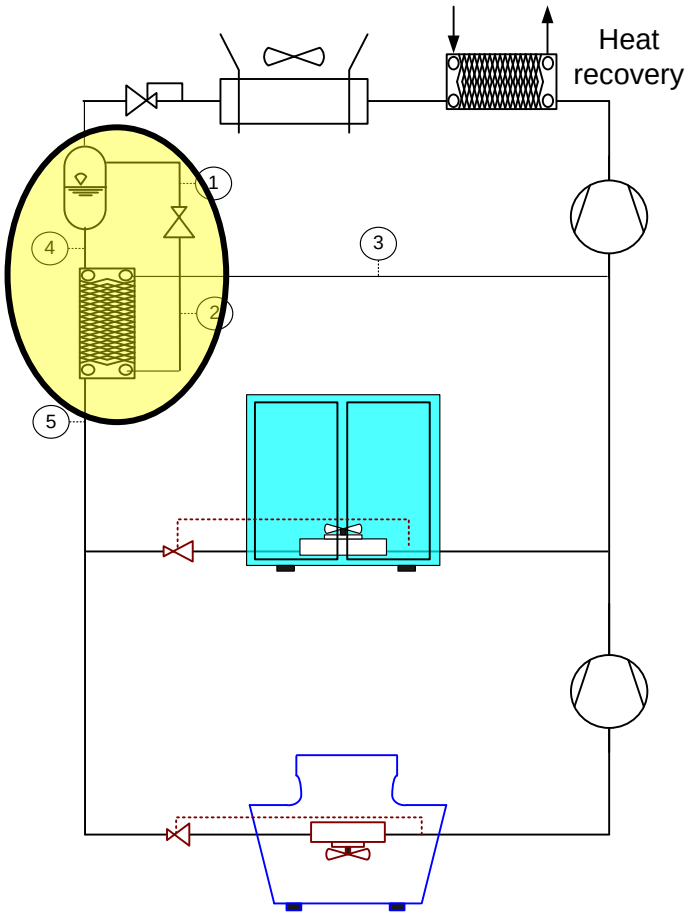
CO2 trans-critical systems



- Parallel



- Booster

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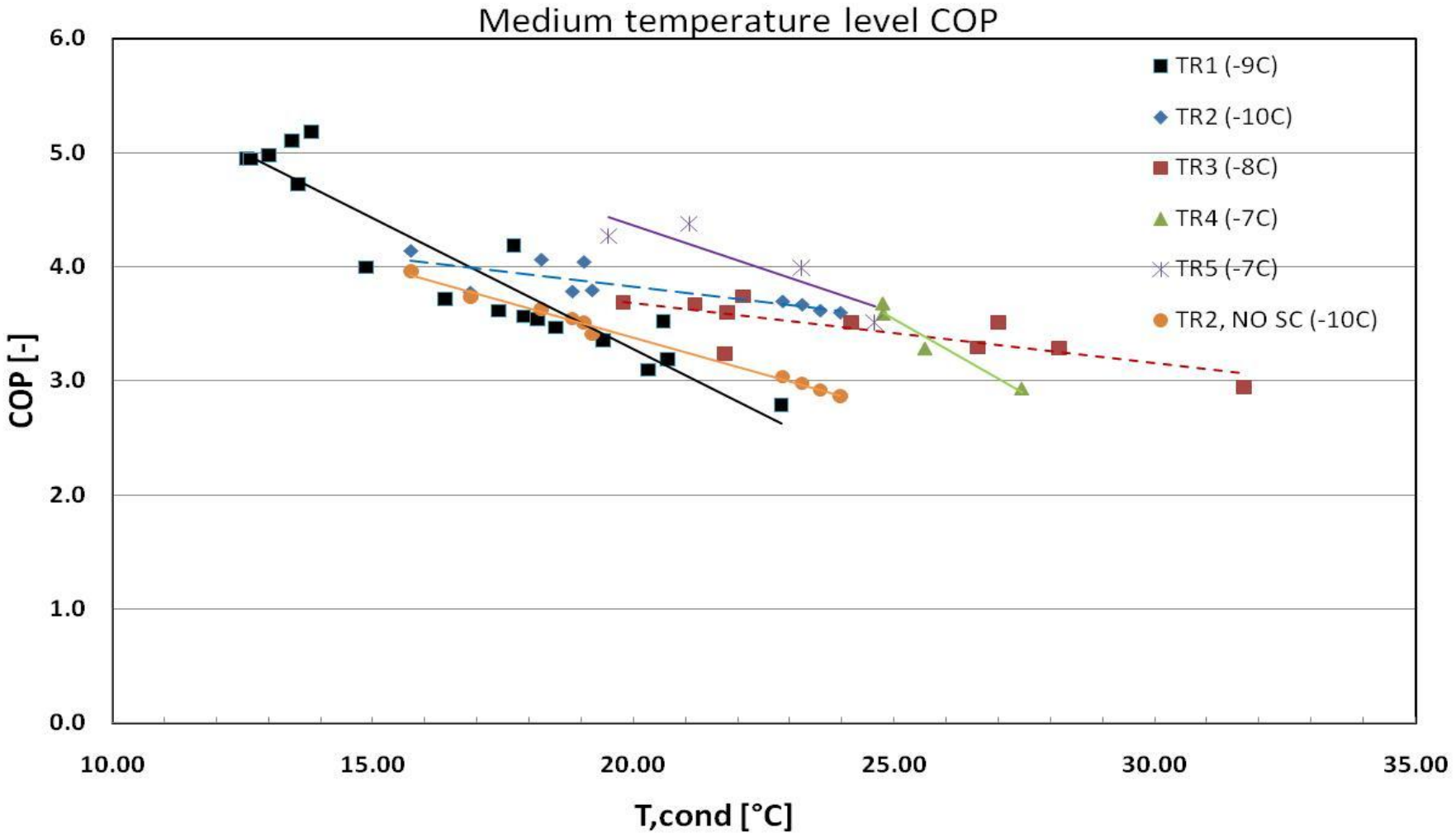
Medium temperature level COP



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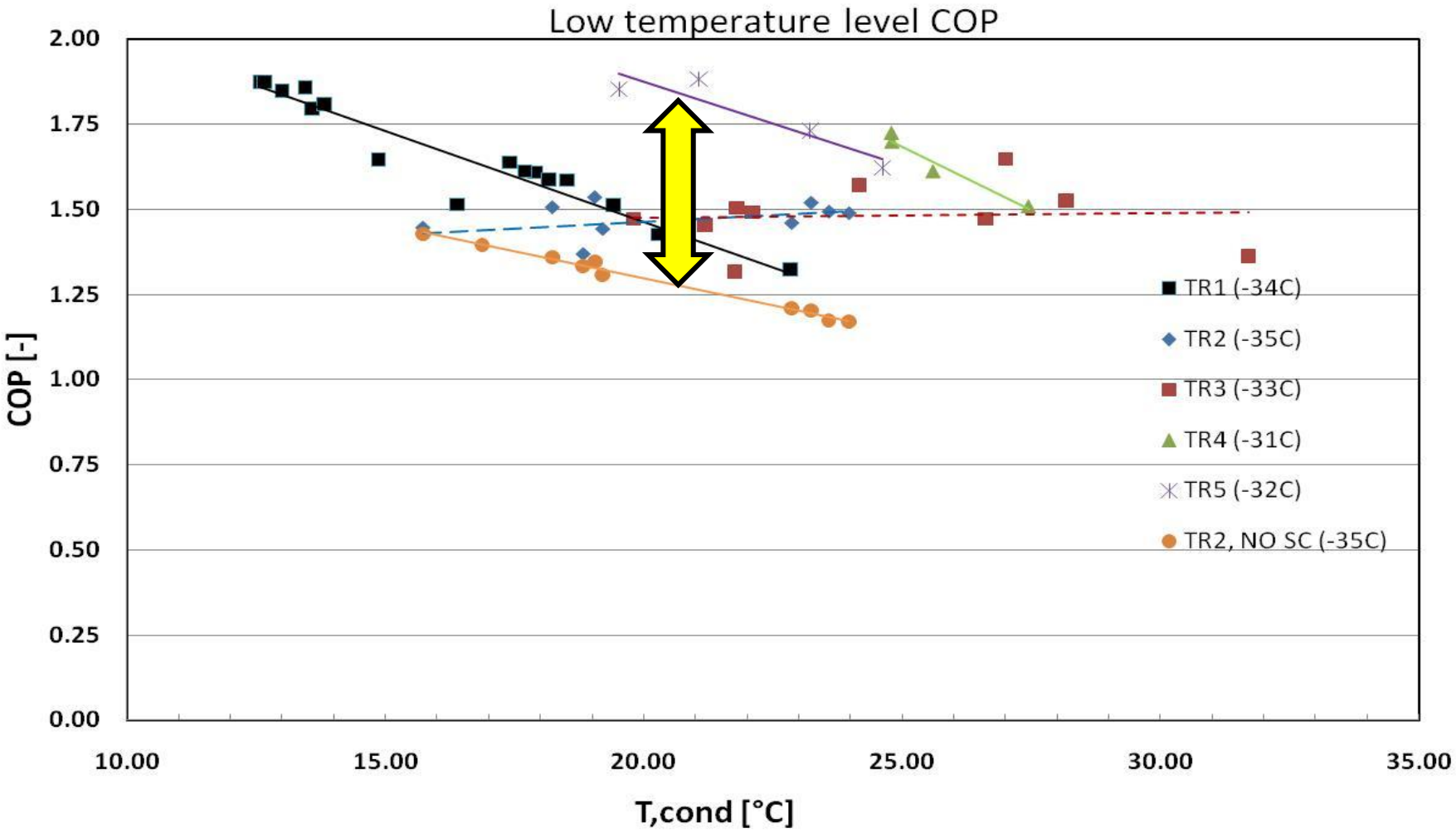
Low temperature level COP



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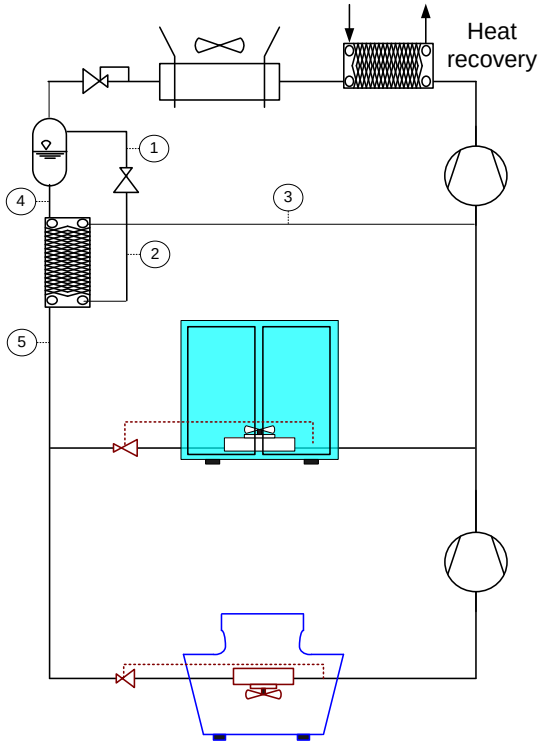
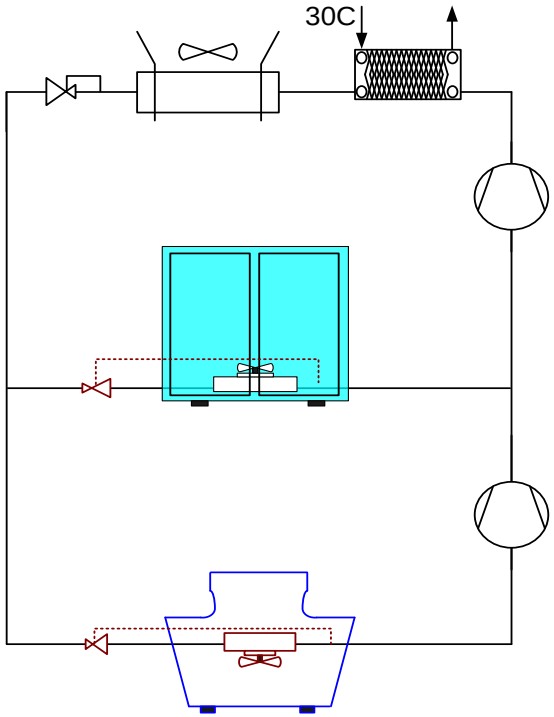
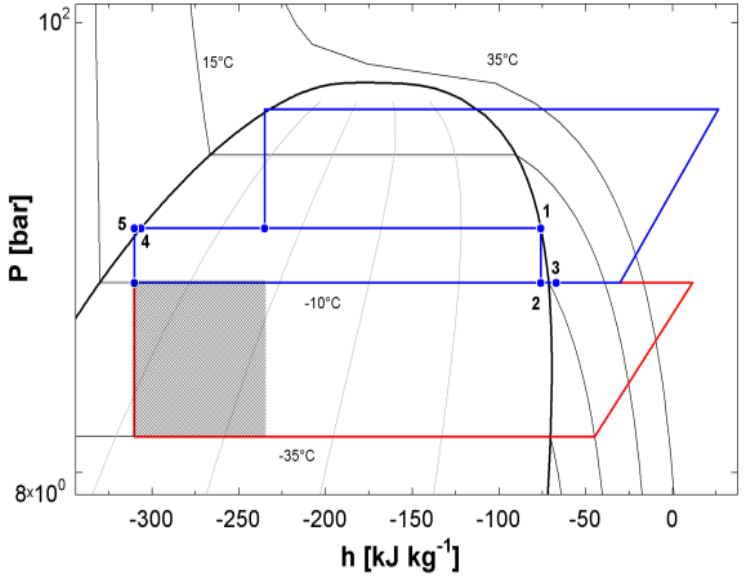
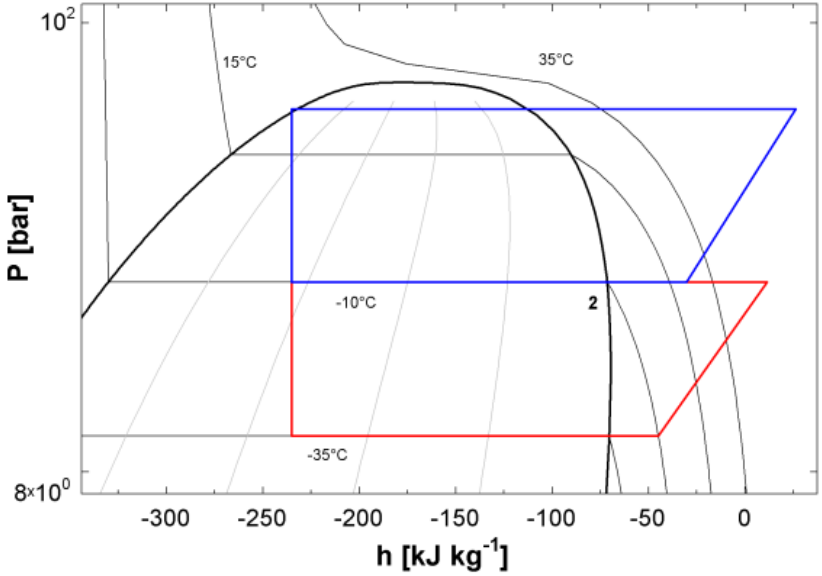
Low temperature level COP

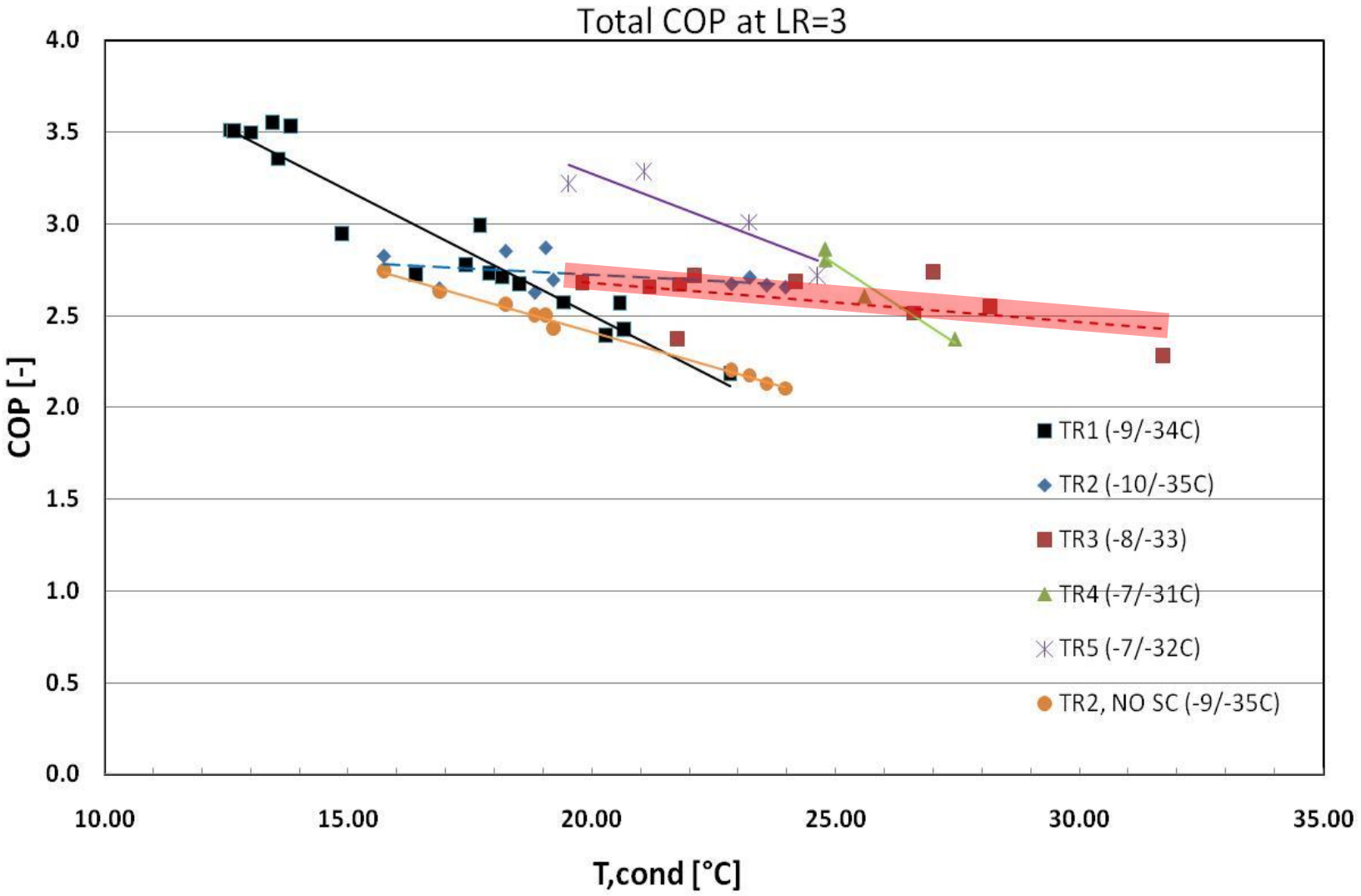








Total system COP- comparable conditions



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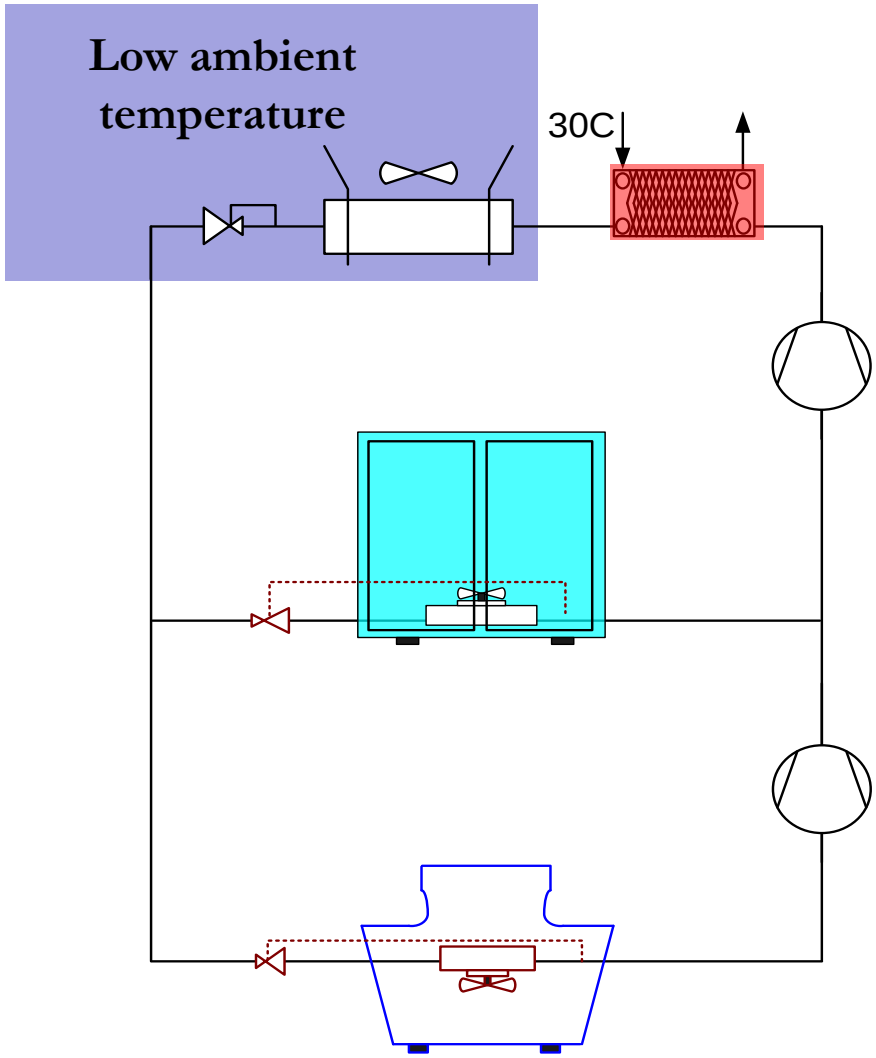
Operation in heat recovery mode



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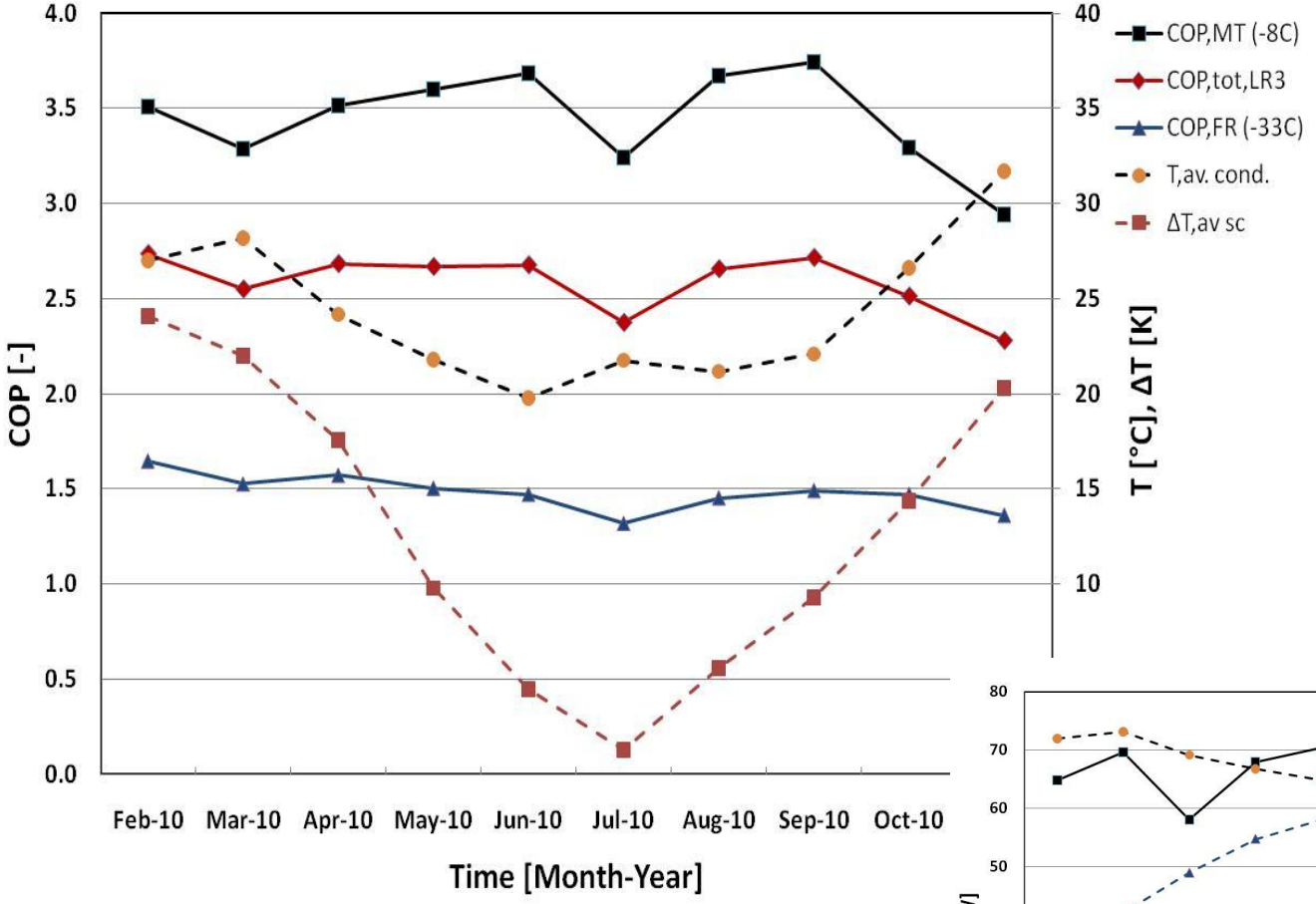
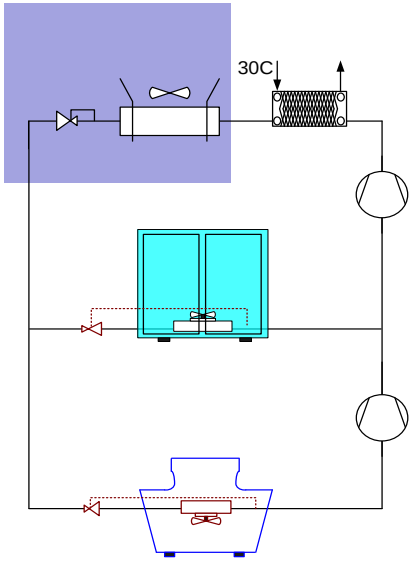
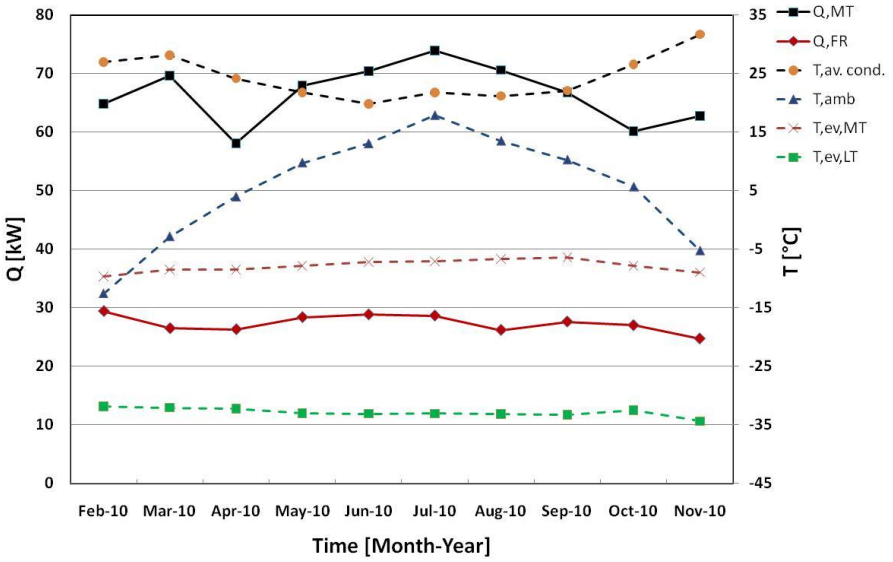
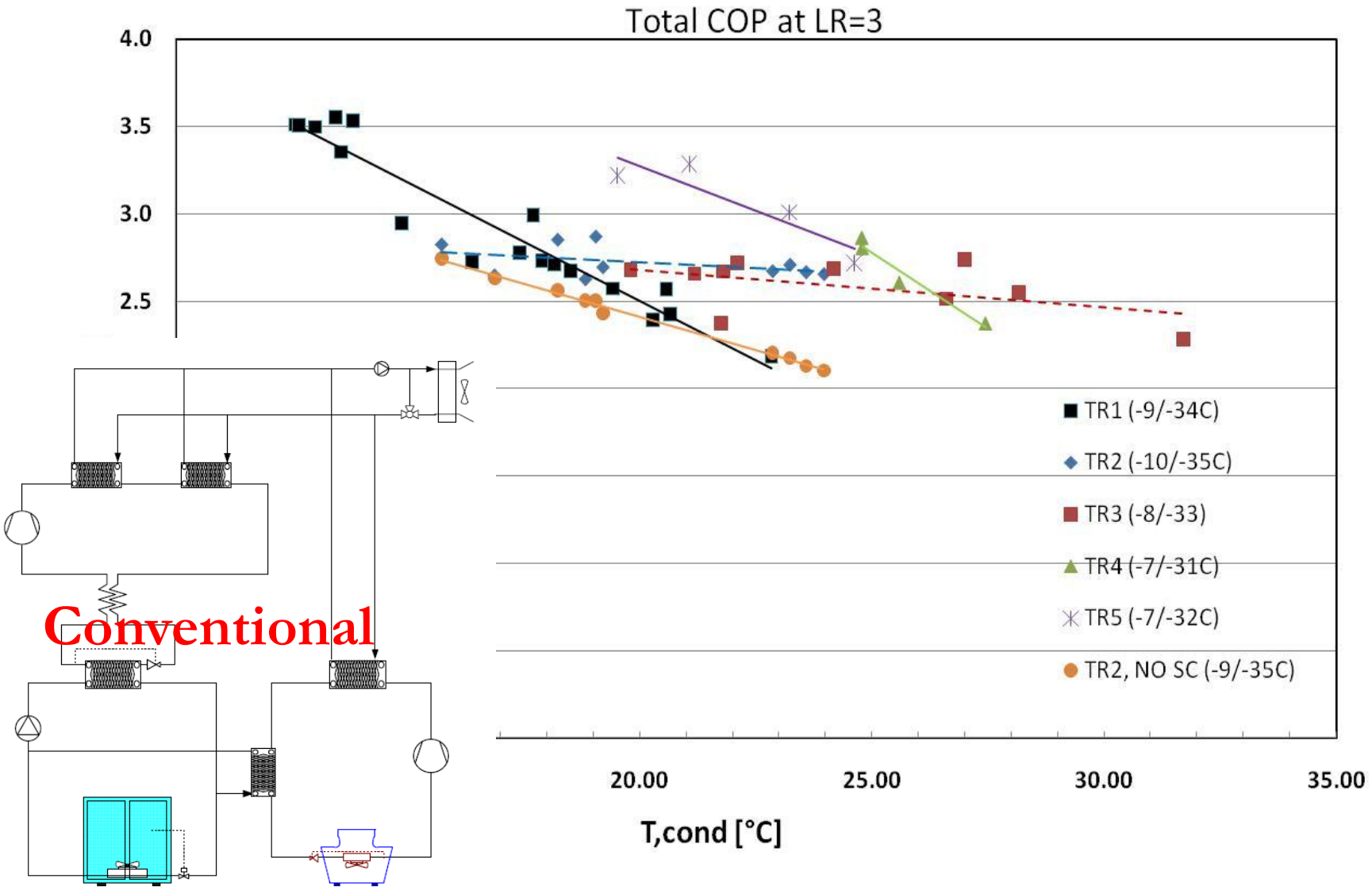
Total system COP- comparable conditions







Total system COP- comparable conditions



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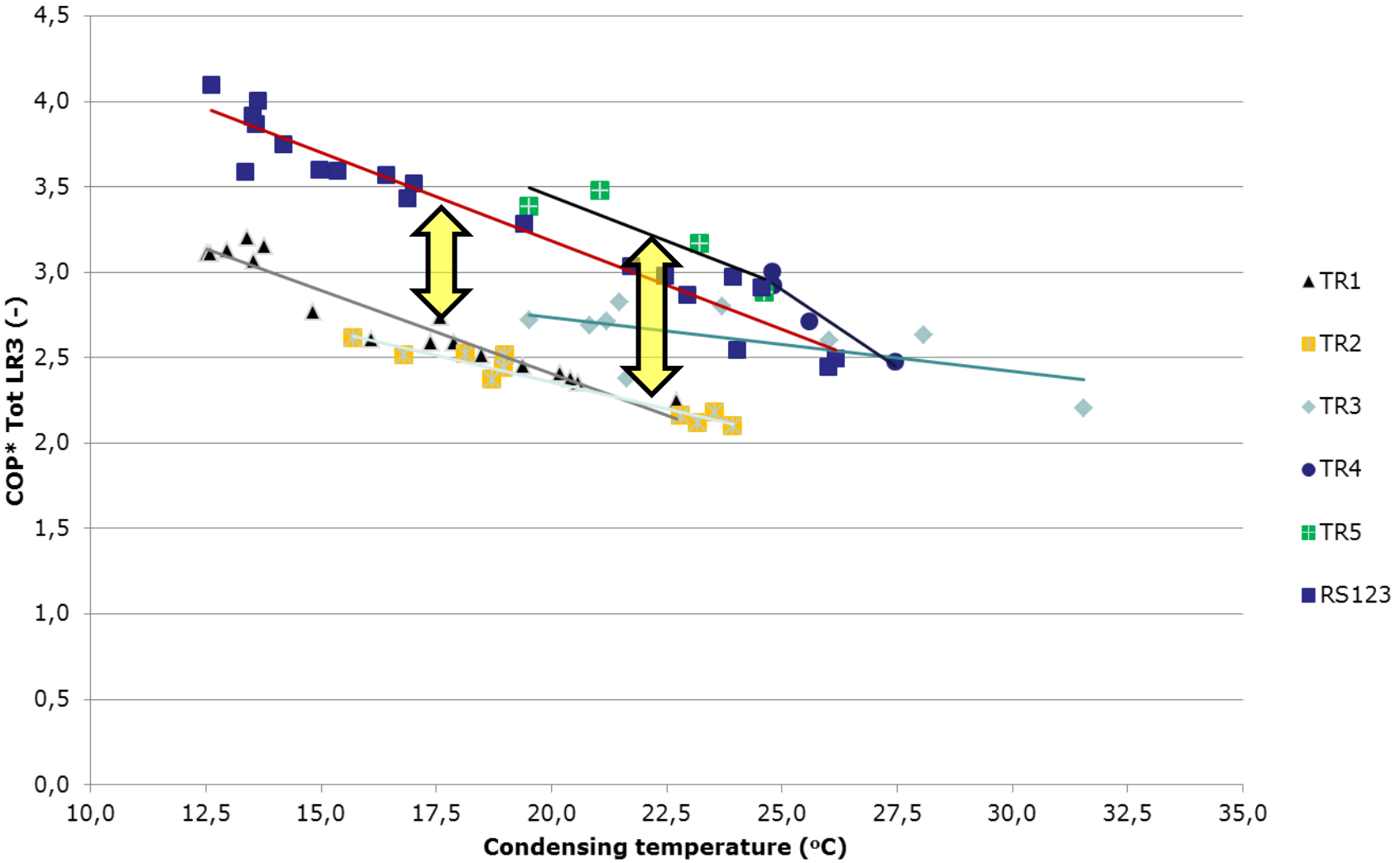
Total system COP- comparable conditions



High evaporation temperature for conventional systems

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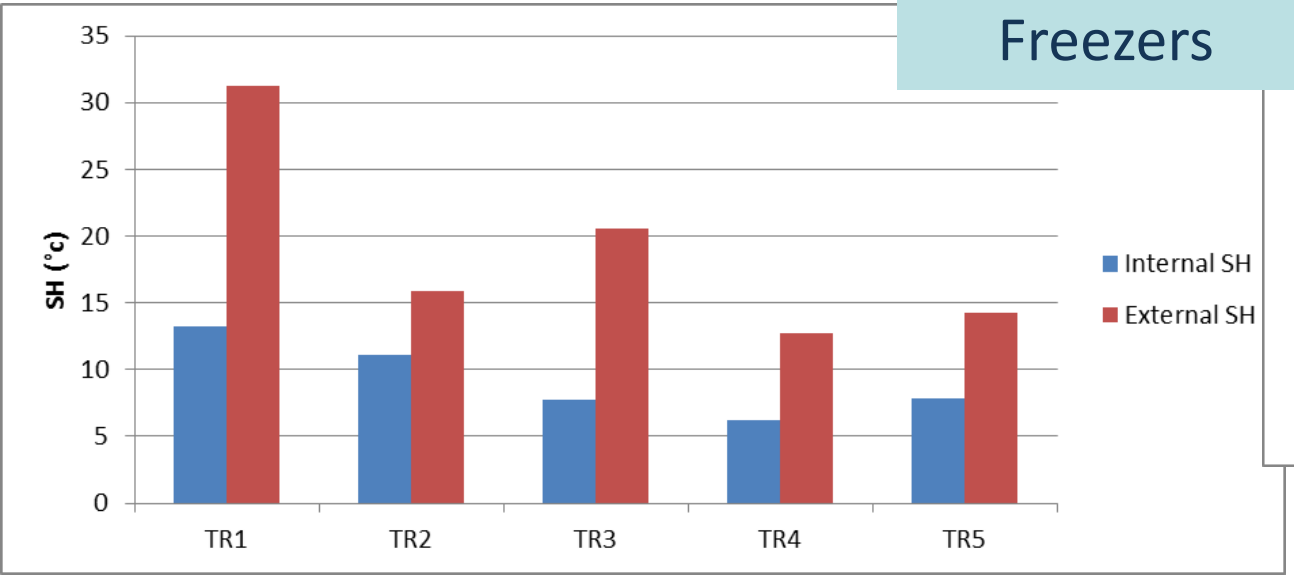
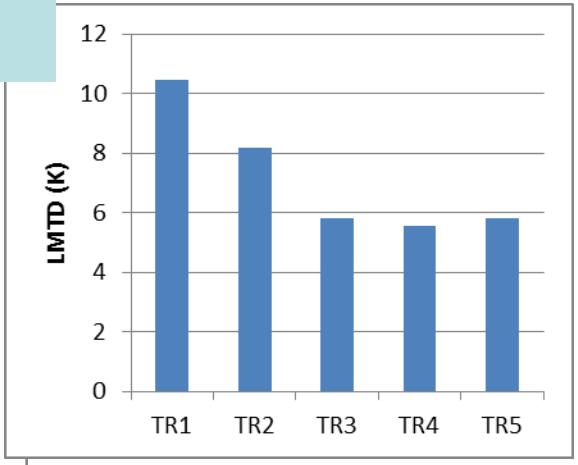
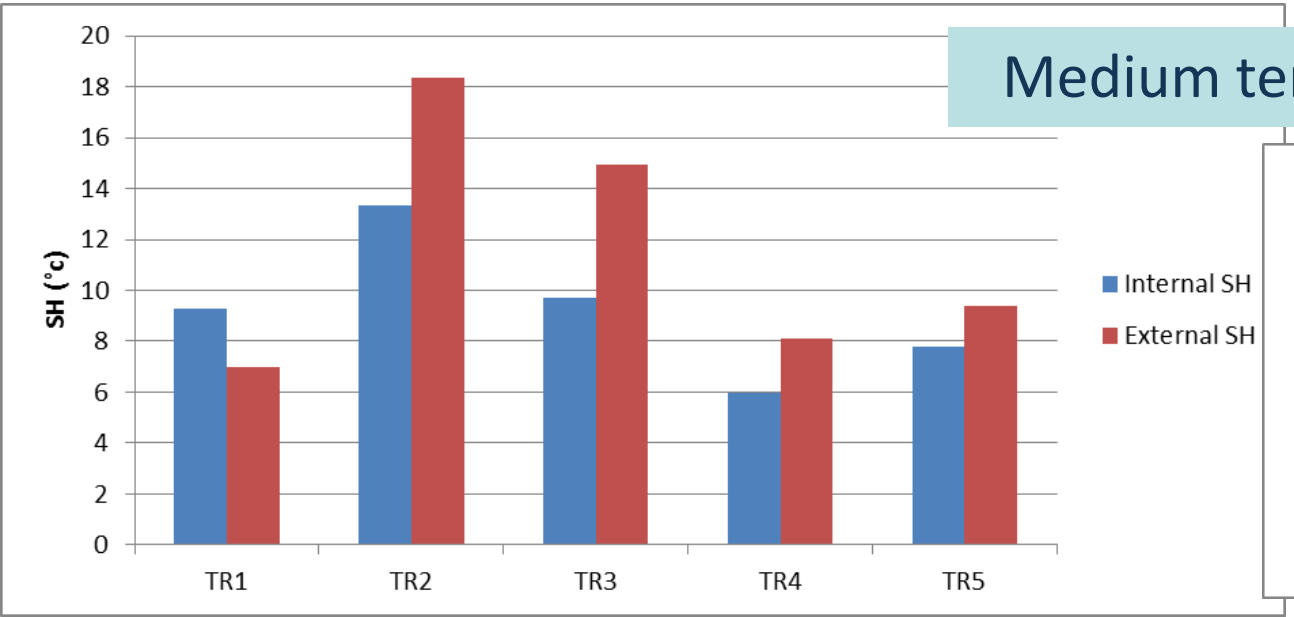
Internal and external superheat

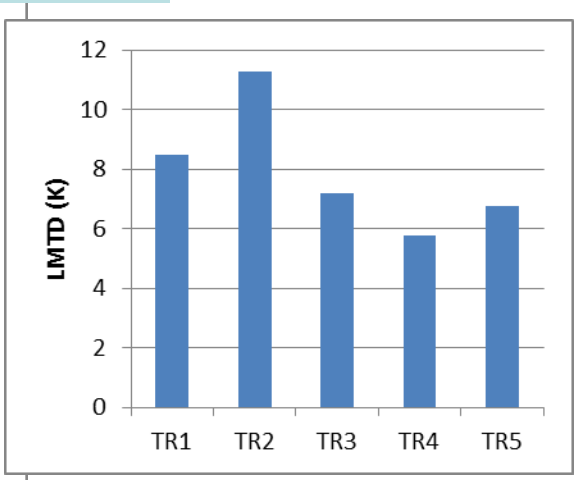
Freezers





Medium temp





Field Measurments Results

- CO2 systems have COP's comparable to an "advanced" conventional system solutions
- Potential for CO2 systems to have good performance in heat recovery mode
- How to run field measurements? Why to measure?

Field Measurments Results

- All details on the field measurment project can be found at:

http://www.kth.se/en/itm/forskning/forskning-egi/ett/projekt/co2-suprmarket-refrigeration/publications-1.301166

Thank you