High Efficiency Solutions.

Knowledge Center

CAREL

The use of natural refrigerants on advanced waterloop systems

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ATMOsphere AUSTRALIA

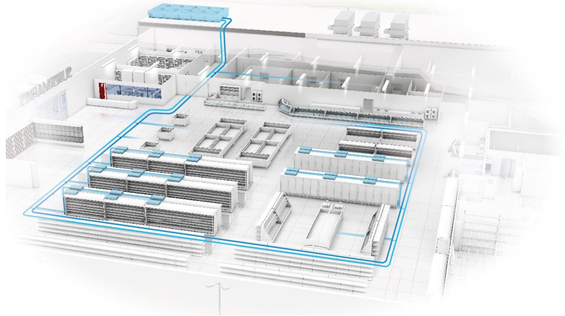
Business Case for Natural Refrigerants

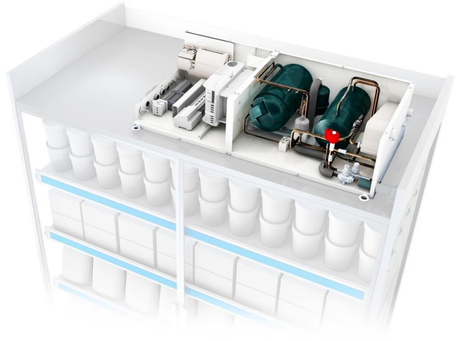
07/05/2018 – Sydney

Heos sistema

Natural efficiency
RED'Y for all climates

Waterloop system





with advanced technology

now available with natural refrigerants

CO2 R744

HC R290

Ready for 150g 500g R290 charge

Why waterloop?

- Less charge of refrigerant: less CO_2 equivalents in the system

- Ease of installation & maintenance

- Less leaks and lower frequency of leak checking

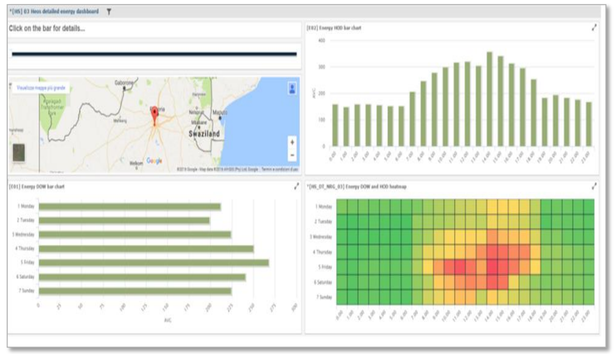
- Lower operating and maintenance costs

Why advanced technology?

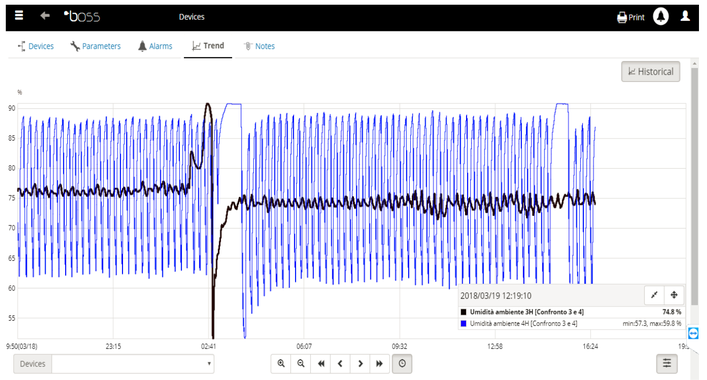
- Compliance with energy efficiency regulations

- Increasing of performance + reduction of operating costs

- Easier to prevent failures through advanced monitoring



- Reliable control of parameters



Heos vs. conventional waterloop

Project in collaboration with the University of Padova:

Comparison between Heos and waterloop with fixed speed compressor.

✓ Humidity and temperature surveillance in different shelfs
✓ Temperature sensor inside the products
✓ Analysis of the shelf life of the products

Heos vs. conventional waterloop

Laboratory located in Thiene (Vicenza, Italy)
Tests: from March to September 2018

Ambient temperature inside the room: 17-24 ° C

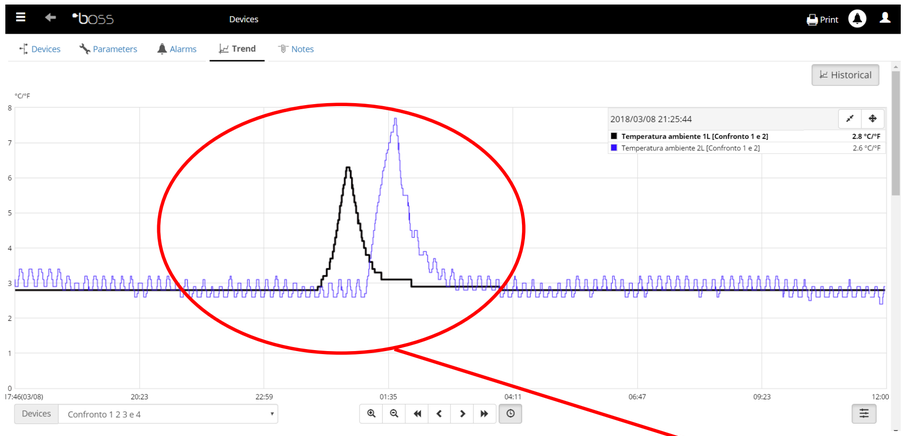
Ambient humidity inside the room: 30-70 % rH

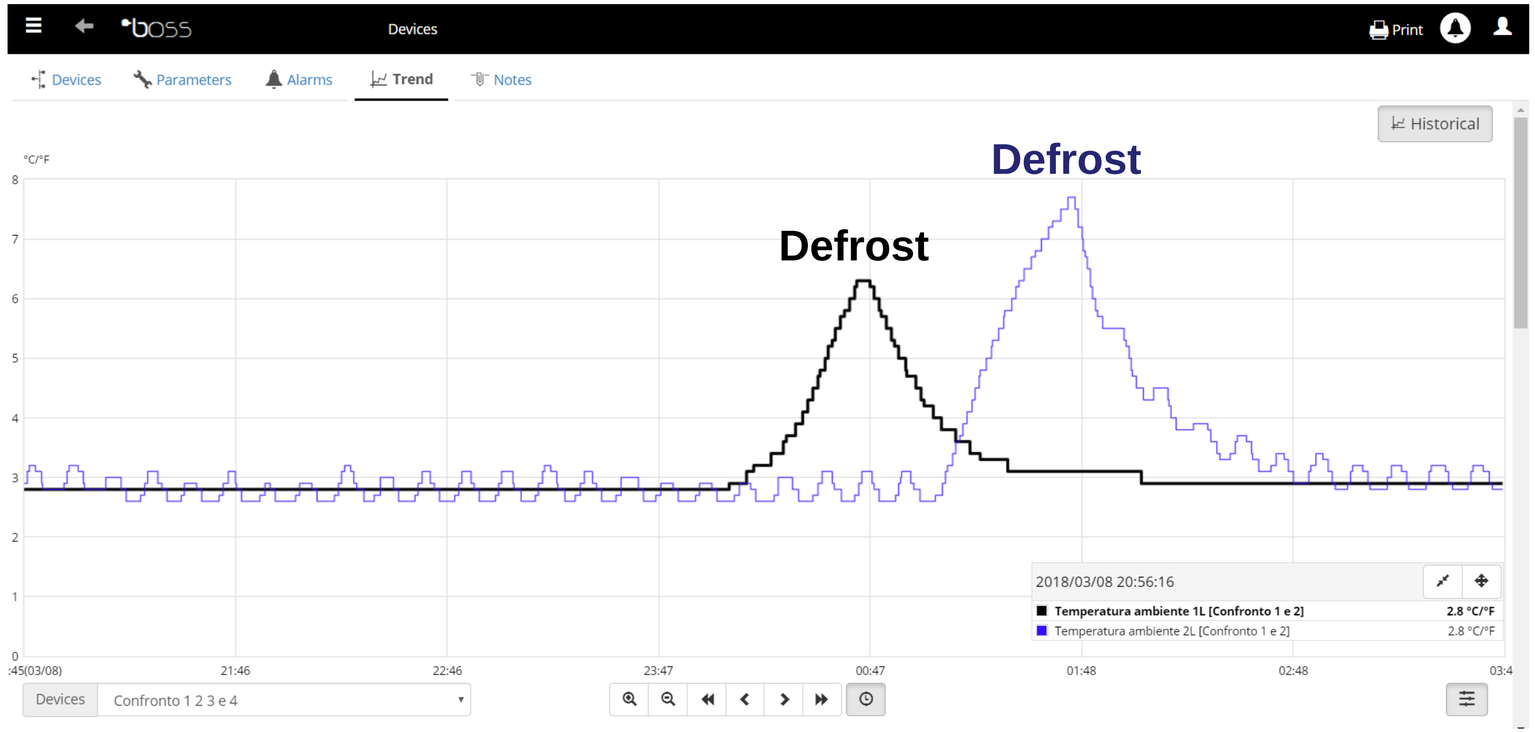
Preliminary results:
Temperature and humidity control inside the cabinets.

Heos vs.conventional waterloop

Temperature trend in Heos showcase (black) and waterloop with fixed speed compressor (blue)

Sensors in the lower shelf





Heos vs.conventional waterloop

Humidity trend in Heos showcase (black) and waterloop with fixed speed compressor (blue)

Sensors in the higher shelf

Heos with natural refrigerants

Ready with propane and CO_2: very different options for a wide variety of requirements

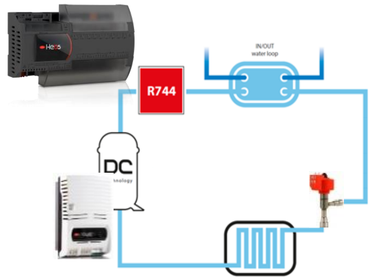
CO2 R744

- ✓ **Well accepted** from the market
- ✓ **Overcame worries** on pressures and usability
- ✓ **Innovation trends** ongoing
- ✓ **Technologies** for increase efficiency, specially in warm climates, are constantly being improved

HC R290

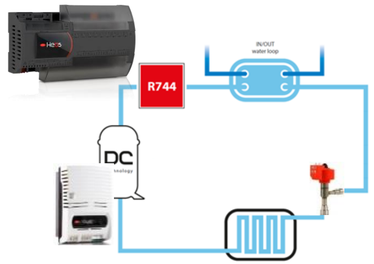
- ✓ **High efficiency** refrigerant
- ✓ **Standard working pressures**
- ✓ Ideal for **small units**
- ✓ IEC 60335-2-89 **up to 150 g per circuit** (probably **500 g** when it will be updated)
- ✓ EN 378 **up to 1.5 kg** per circuit

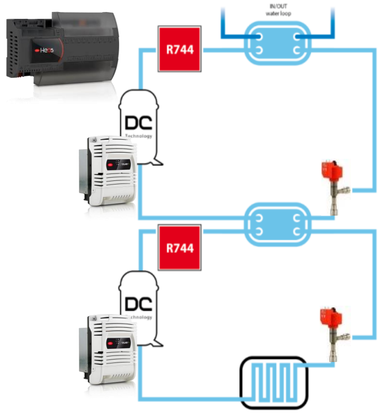
Heos with natural refrigerants



Single Circuit
Medium T transcritical
Low T subcritical
Standard ref. system design
Max P 60/90-120 barg

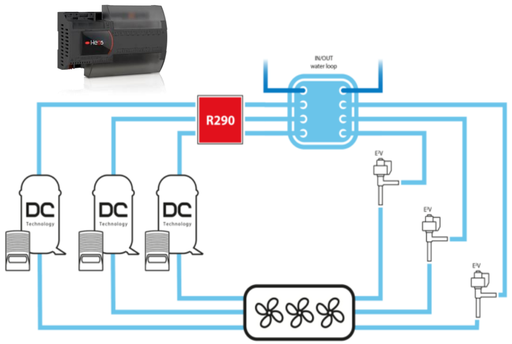
Single Circuit
Up to 150/500g
Small size loads
MT/LT application
EN 60079 compliant



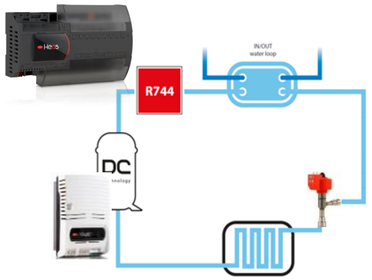


Double Circuit
Low T Cascade
Limited refrigerant charge
Only the high stage works with high water T (transcritical)

Multi Circuit
Up up to 3 ref. Circuits
All type of loads
MT/LT applications
EN 60079 compliant

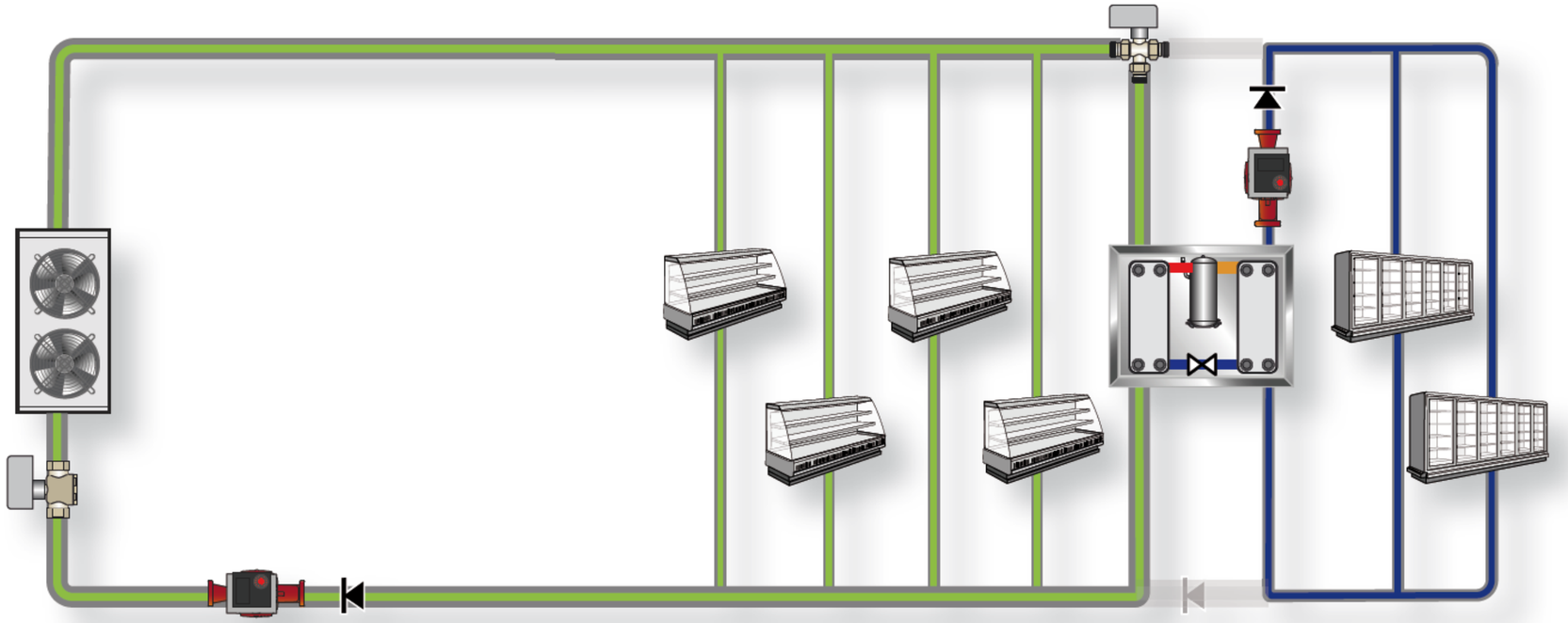


Heos with natural refrigerants

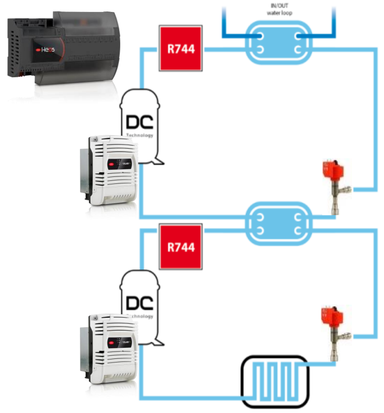


Single Circuit
Medium T transcritical
Low T subcritical
Standard ref. system design
Max P 60/90-120 barg

Operation with Chiller for LT showcases



Heos with natural refrigerants



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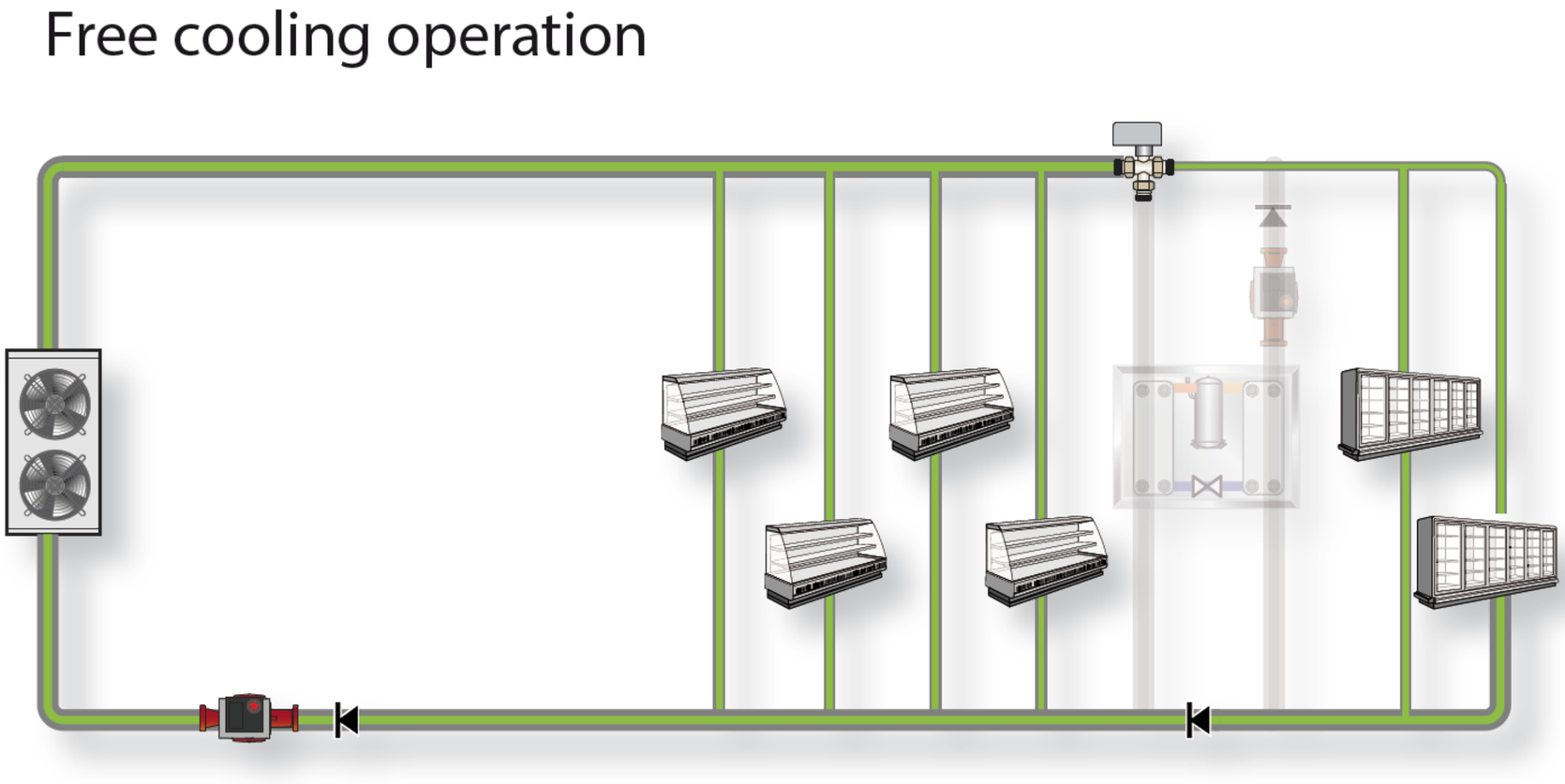

Real Experience Heos

MT Santiago

- Length: 2.5 m
- 4 doors
- Class 3M0
- Cooling Capacity: 1.1 kW
- R-290 charge: Under 350 g per circuit
- 2 circuits

LT Astana

- Length: 2.5 m
- 4 doors
- Class 3L1
- Cooling Capacity: 1.3 kW
- R-290 charge: Under 350 g per circuit
- 2 circuits

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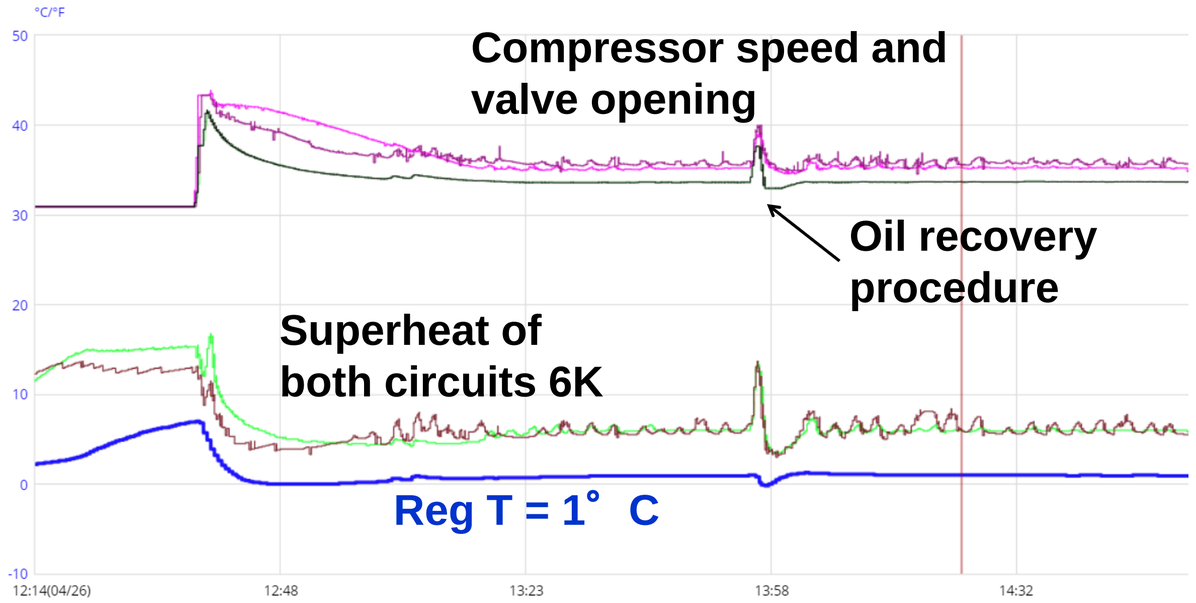
RUNNING IN LABORATORY IN SYDNEY SINCE MARCH 2018

Heos R-290 available for the whole range of cabinets: MT and LT, counters and multideck

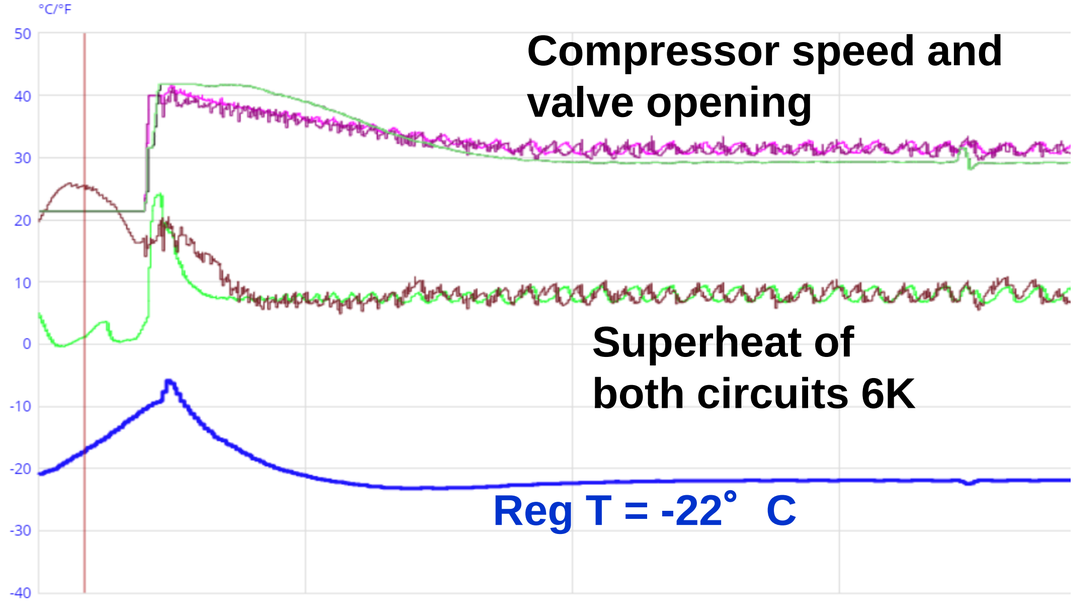
Real Experience Heos

MT Cabinet – 2 circuits



- Both compressors are driven at the same speed
- Regulation temperature is perfectly stable
- Optimal superheat control

LT Cabinet – 2 circuits



- Pull down time LT: 40 min
- Regulation temperature is perfectly stable
- Optimal superheat control

Real Experience Heos

MT

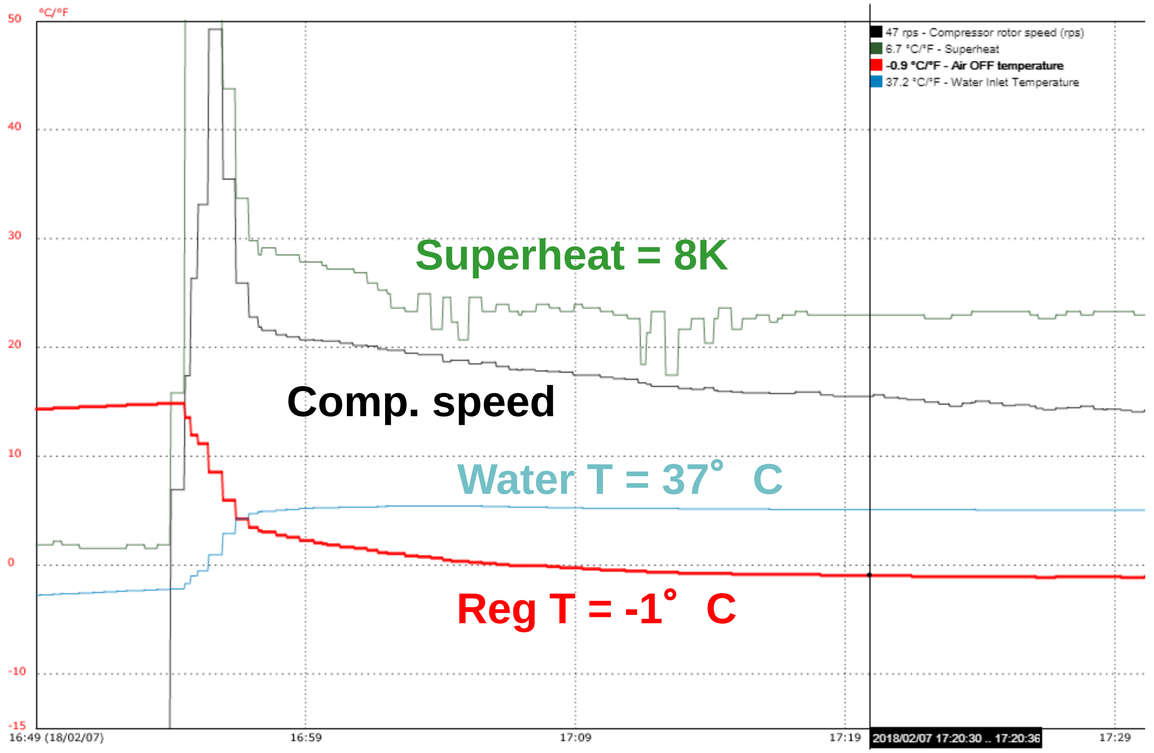
- Length: 2.5 m
- 4 decks
- Open cabinet
- Class 3M1
- Cooling Capacity: 5.5 kW @-7° C
- CO_2 charge: 1 kg
- IMQ certified
- Safety tested up to Water T 50° C

COMMISSIONING IN AUSTRALIA JUNE 2018

Heos CO_2 available for the whole range of cabinets: MT and LT, counters and multideck

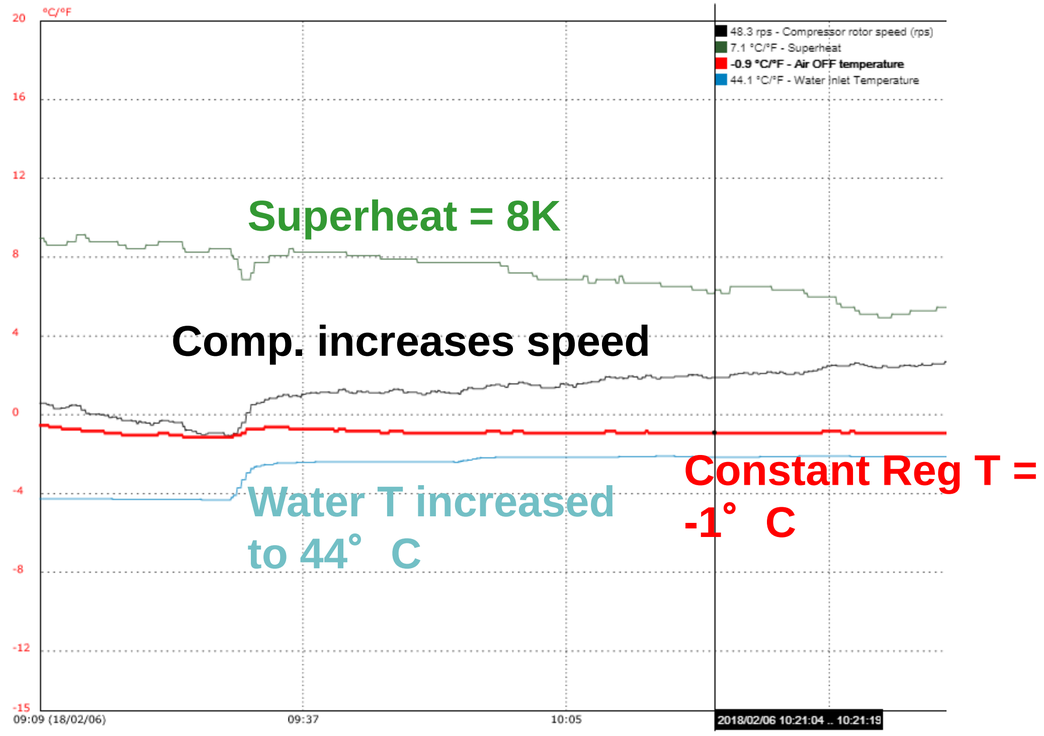
Real Experience Heos

Transcritical Pull down



With water temperature at 37 ° C the pull down duration is approx. 10 minutes, even working in transcritical conditions.

Water T increase



The system can keep regulation T at setpoint even when increasing the water temperature from 37 to 44° C!

Conclusions

- **Natural refrigerants DC waterloop system** are becoming a reality in **Australia**.
- High pressures, low efficiency in warm climates, flammability and reduction of refrigerant charge are not an issue **if managed correctly**.
- Clear and harmonized **normative, training, best practices and knowledge sharing** are vital for the success of this new frontier for natural refrigerants.
- Energy efficiency is not the only driver. **TCO: total cost of ownership of refrigeration systems** running for at least 10 years.
- No unique natural choice: **Propane Vs. CO_2**. Both of them has different pros and cons. Each end user can decide which are the advantages that fit better with its own needs.

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Solutions.

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