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CAREL solution for managing CO2 compressors rack

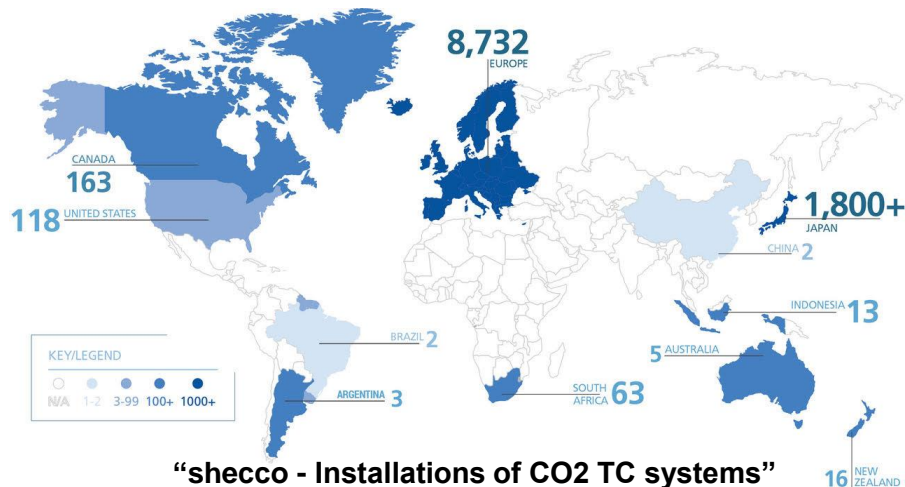
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Market background

According to a survey* of over 1,000 individuals with an interest in commercial and industrial refrigeration in North America, **82% of OEMs and 91% of consultants** said they saw **CO₂** as a viable **mainstream refrigeration technology**.

*<http://www.coolingpost.com/world-news/co2-refrigeration-now-mainstream/>



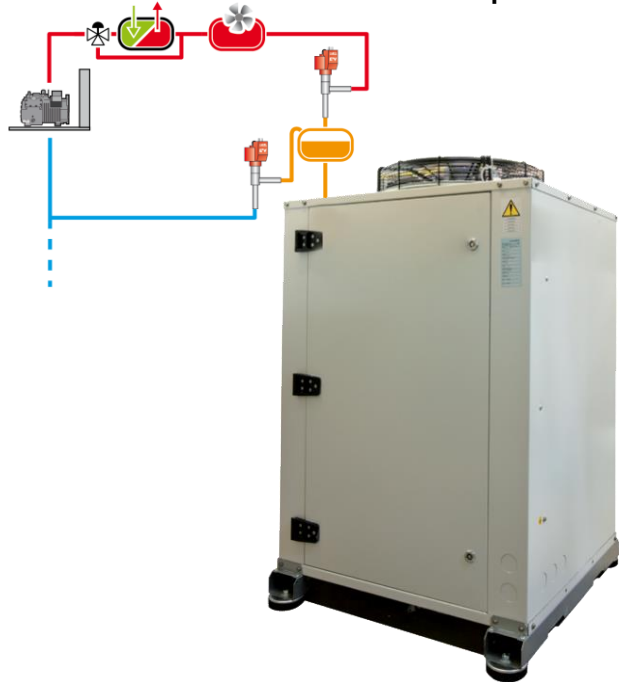
“shecco - Installations of CO₂ TC systems”



“shecco – Accelerate America January 2017”

The CDU application leader, Compressor neutral

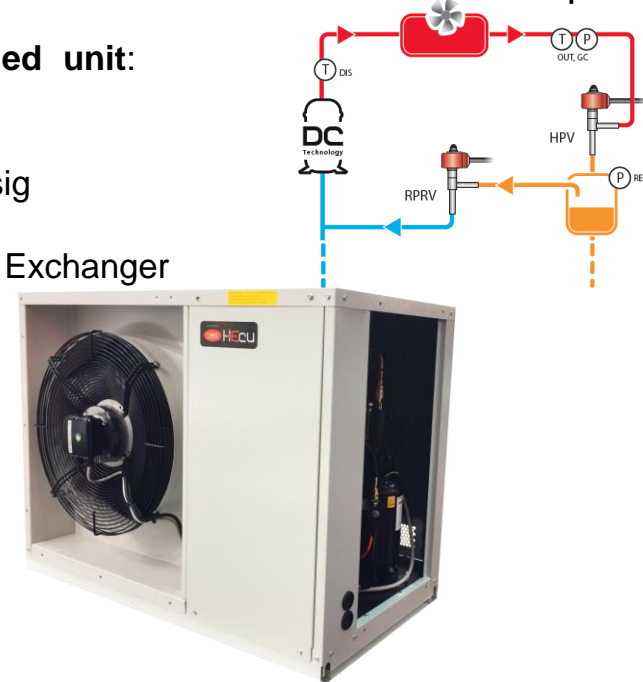
From semi-hermetic compressor



Simple and compact-designed unit:

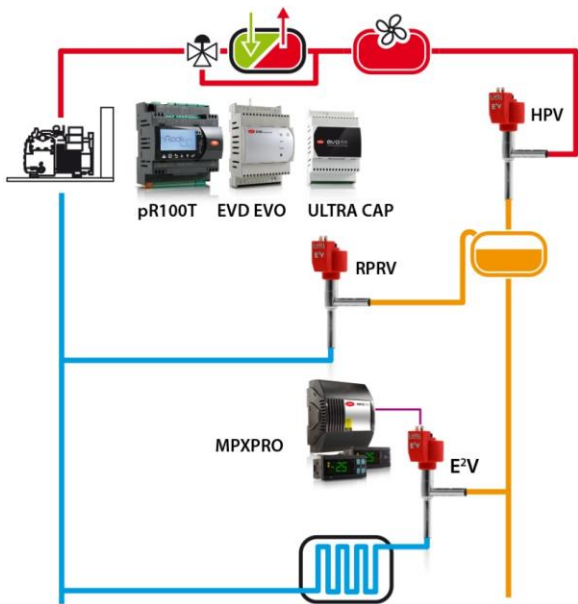
- Single temperature unit
- Variable speed compressor
- Receiver pressure at 1160psig
- 2030psig pressures valves
- 2030psig Brazed Plate Heat Exchanger
- Reliable safe system
- Air cooled condenser

To BLDC compressor



Carel control reciprocating CO₂ CDU

semi-hermetic compressor



pRack - pR100T Condensing Unit

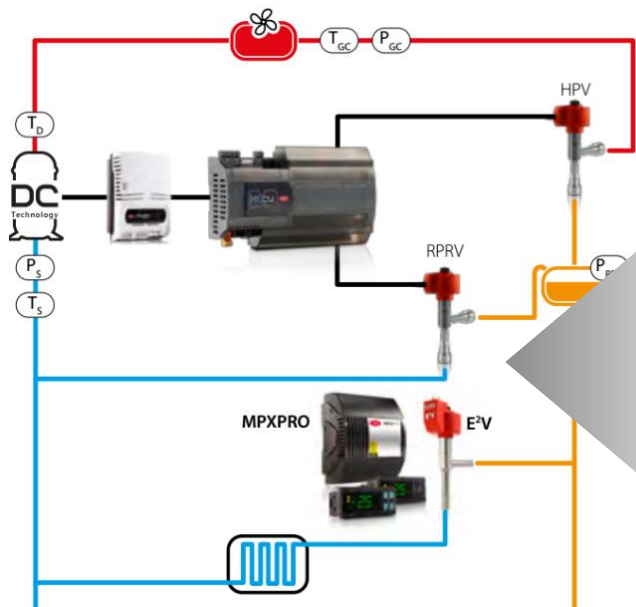
Complete management of a transcritical system, ideal for condensing unit or small C-store

Main CO₂ features

1. Compact: the only CO₂ transcritical controller in 6DIN
2. ExV integration: the only one supplier of small transcritical CO₂ valve E2V, to the new larger E3V
3. Modularity: fieldbus communication with external driver

Hecu CO₂ for DC inverter CDU

BLDC compressor



ALL in ONE

Fully integrated and compact solution

Unique controller board

For BLDC compressor management and CO₂ valves management, both high pressure and flash gas valves

Advanced DC compressor driver

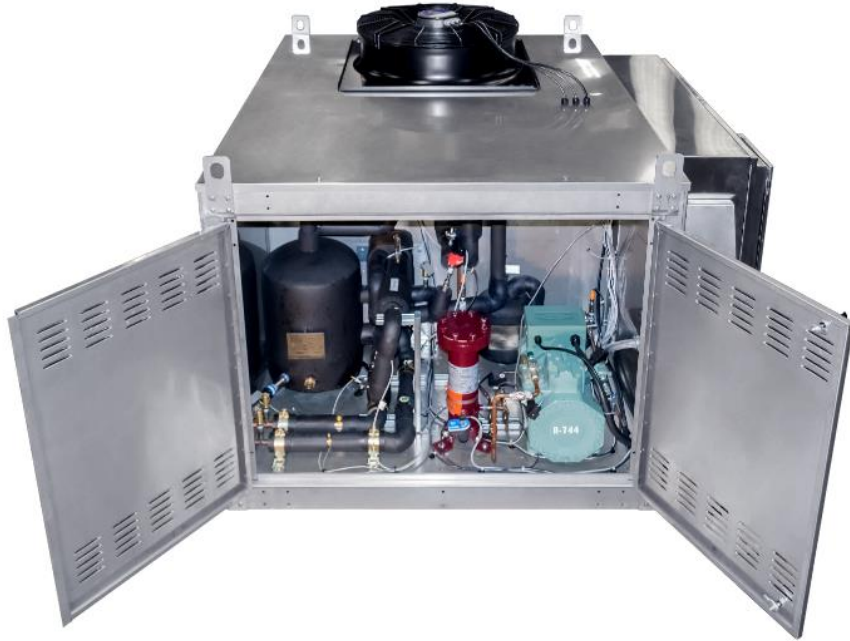
For an efficient and variable speed compressor driving and optimal performance at partial load

Electronic expansion valves

For a calibrated injection and precise regulation of gas cooler and receiver pressure

Real field installation

Transcritical CO₂ condensing unit



In partnership with

Zero Zone designs and manufactures custom engineered halocarbon, CO₂, and ammonia refrigeration systems for retail, cold storage / distribution, ice rinks, pharmaceutical, food processing, and other commercial and industrial applications. Zero Zone is proud to be a recognized leader in bringing high quality, innovative refrigeration systems to our customers.

Advanced control used – All in ONE

Transcritical CO₂ condensing unit management



Complete SW management of CO₂ CDU

- Direct management of back pressure and flash gas valve
- Dynamic control of high pressure
- Gas cooler and compressor variable speed control

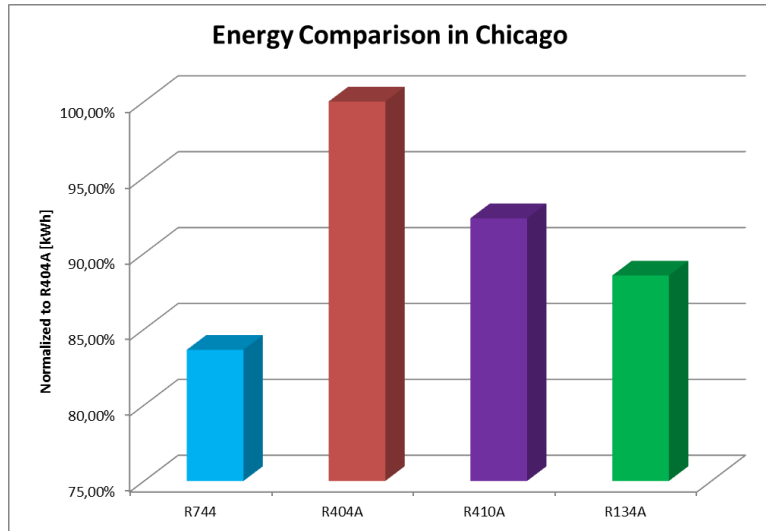
Complete HW management of CO₂ CDU

- Built in driver for ExV
- Ultracap technology will safely close the valves in case of power failure

Energy measurement of CDU

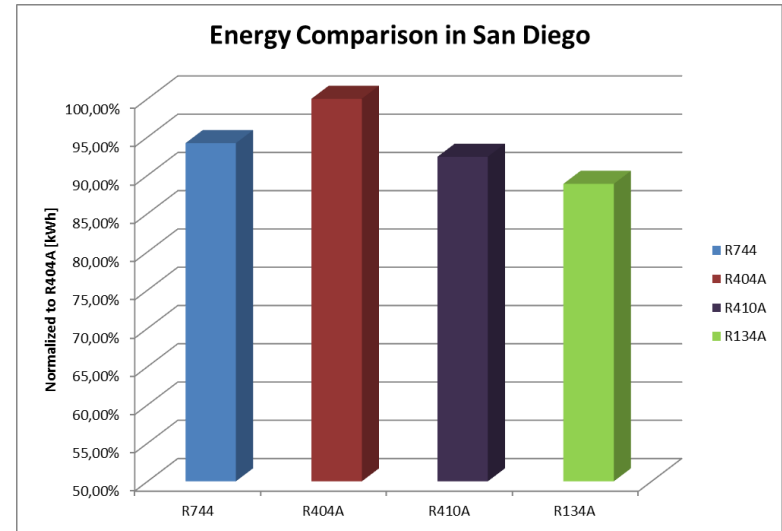
Comparing* different refrigerants in two different states

In Illinois CO₂ is the most efficient refrigerant in terms of energy consumption



*Comparison based on:

- all are reciprocating compressors
- 8kW of cooling capacity @90°F
- 14°F evaporation saturated temperature

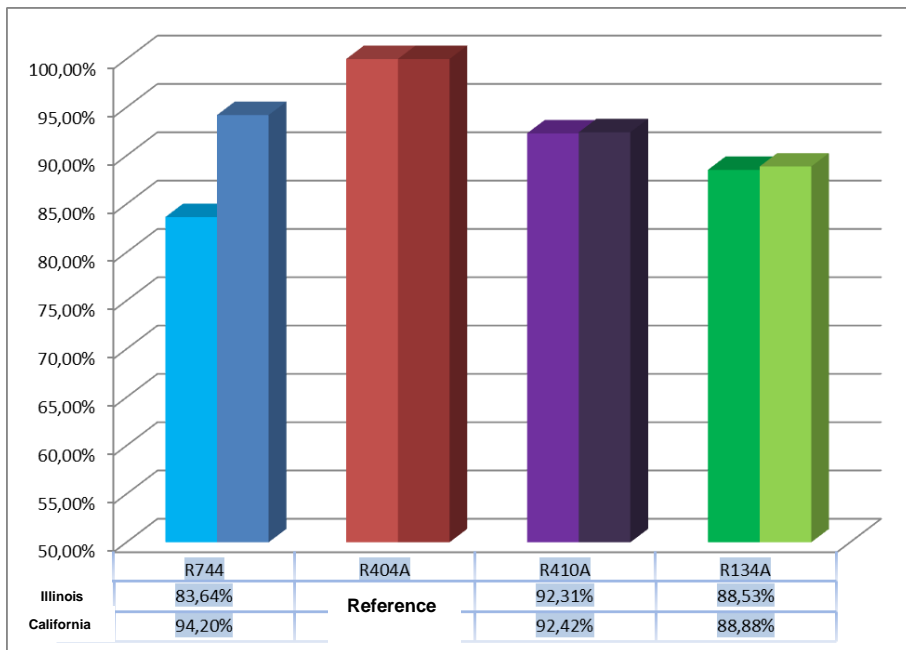


In California CO₂ is NOT the most efficient refrigerant in terms of energy consumption

R744 affected by climate

A single CO₂ compressor and circuit will be suffering from the heat load

Performance of R744 badly decrease in warm climate



Two different solution available to improve CO₂ performance in all condition



- Ejector technology

- BLDC technology



Efficiency @ all climate

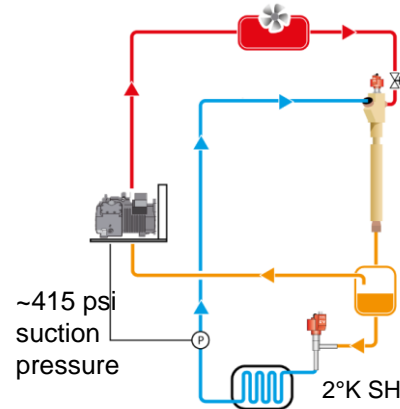
Different technology



Ejectors technology

Guarantee optimum efficiency based on:

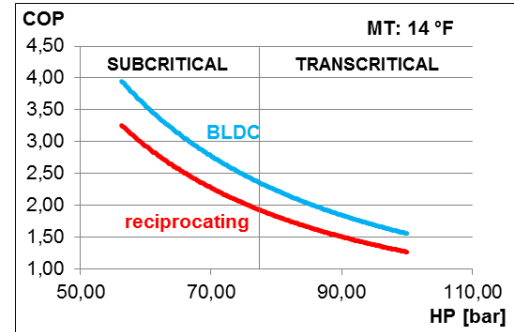
- direct expansion work recovery due to Venturi effect
- Higher evaporation temperature in MT cabinets
- Higher suction pressure at all MT compressors



BLDC technology

Wide range of modulation with high efficiency

- Wider range of modulation, up to 26% more
- Higher efficiency at every load condition
- Reduced number of ON-OFF cycles



Conclusions

- Technology neutrality, to boost CO₂ performances we need to explore all the possible solutions and make them available
- Scalability is a must to achieve satisfactory results in all commercial refrigeration markets; from convenience stores to large supermarkets
- Continuous modulation, for adapting to the different cooling and climate conditions is the key point to reduce system complexity and system costs
- Simplicity of the system and of the components is mandatory for all CO₂ deployments



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Thank you very much!

