



solutions for europe

natural refrigerants

16-17 March 2015 in Brussels

Enex srl

*Reliability, efficiency & cost of
CO2 commercial refrigeration*

Reliability & easy service

Lifetime required: for a car 5.000 hours / for a refrigeration system 80.000 hours -16 times more. Component technology existing today cannot sustain the duty (i.e. max compressor lifetime 30.000 h) – fail situations and part replacement must be considered in design phase

FILL THE GAP BETWEEN LIFETIME REQUIREMENT & POSSIBILITY :

- Robust circuit design with proper backup and redundancy*
- Effective backup: not a simple duplication of one part of critical components (backup of landing gear on airplanes is not the duplication of the motor pushing out the wheels)*

ELIMINATE RISKS, WHENEVER POSSIBLE:

- Design for overfeeding, beside increasing efficiency, eliminates the “nightmare” of liquid suction to compressors, the most frequent cause of compressor breakdown (due to bad control of superheat – i.e. defective temperature and pressure sensors)*

MAXIMIZE LIFETIME :

- Circuit piping designed to avoid corrosion (stainless steel and proper insulation)*
- Full welded design*

SIMPLIFY SERVICE & REDUCE DOWNTIME :

- Design for service: normal and extraordinary service operation (i.e. a change of one component) do not require to stop the system.*
- Designed for fast service (parts of circuit can be easily isolated still keeping functionality)*

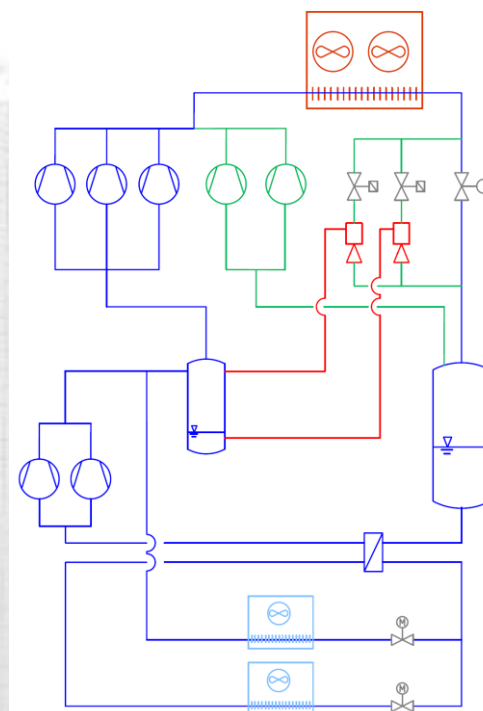
Efficiency – in all Europe

- Being the conventional design not suitable for Italy, Spain, etc a new concept was developed progressively since 2008
- More than 60 units with auxiliary compressors are working in this moment (Italy, Spain, Switzerland)
- More than 20 systems already installed with ejector design, first one in 2012, more are on the way
- Various improvement “steps” with increasing efficiency level
- The “full saving” version consumes 25-30% less of a standard CO₂ solution in a typical southern Europe climate

Efficiency improvement also in cold climates during heat recovery period.

Cost varies with the solution, so as it is possible to maximize the return of investment.

Circuit design “full saving” version

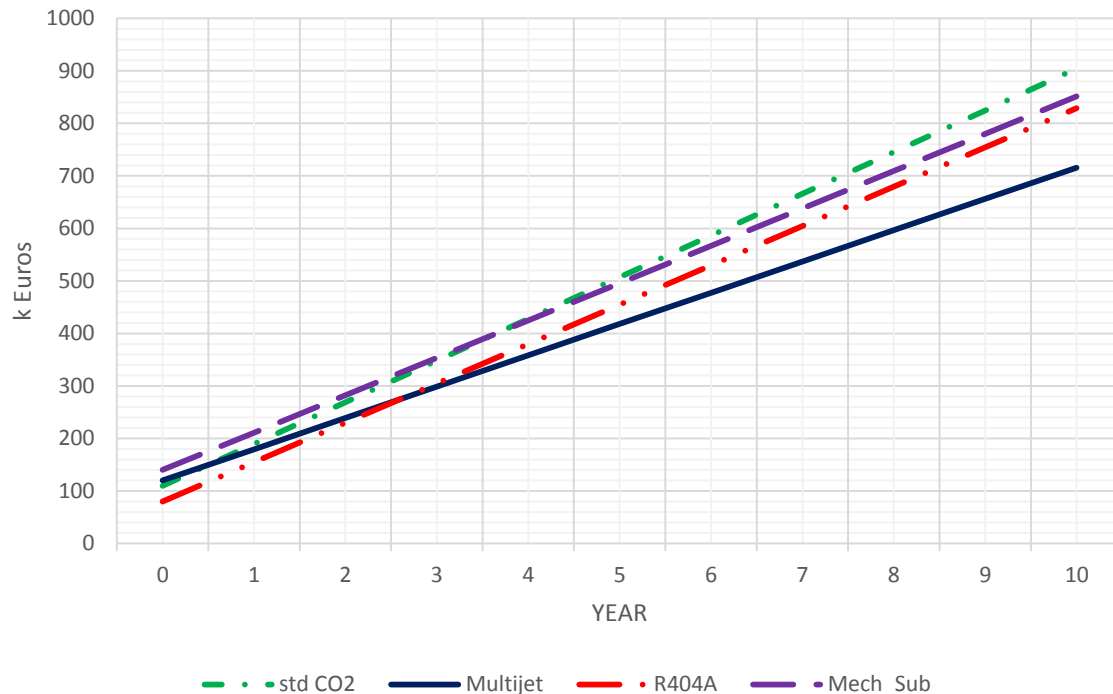


Cost comparison during lifetime

Investment + energy cost for different solutions - large capacity system in warm climate

- Booster type 250 kW (net) MT - 50 kW LT - Design point: 38° C
- With intercooler/air cooled gas cooler-condenser.
- Top version – referring to reliability/efficiency

First cost+Energy cost



Conclusions

Reliability, cost and efficiency are linked.

It is possible to cross the Atlantic ocean in 3 weeks with this

or in 6 (dangerous) weeks with this



- Cheap



- Efficient – better use of energy from the wind
- Reliable, with backup and redundancy

Best choice depends on the duty: open sea or week-end coastal sailing?



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Thank you very much!