



Business Case for
Natural Refrigerants

June 12-14, 2018 – Long Beach

Danfoss Multi Ejector Solution™

Transcritical CO₂
Refrigeration Systems
in all Climates



HOW CO₂ HAS EVOLVED AS REFRIGERANT

Today, CO₂ has proved itself as a highly reliable and cost effective refrigerant in all climates.

For retailers, this means that transcritical CO₂ refrigeration can be applied across the store, reducing complexity and cost during design, operation and maintenance.

This helps to maximize energy efficiency with transcritical CO₂ and heat reclaim.

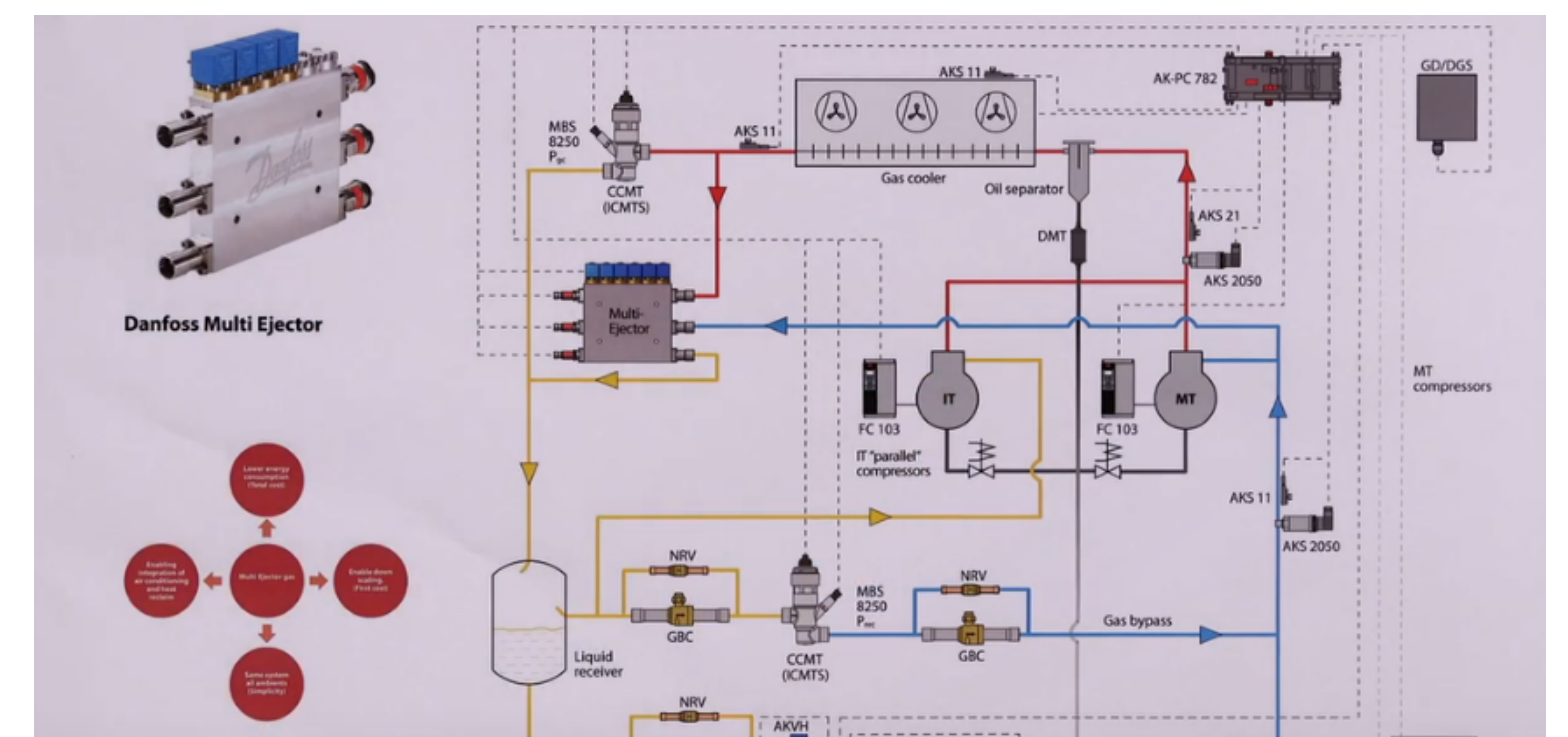
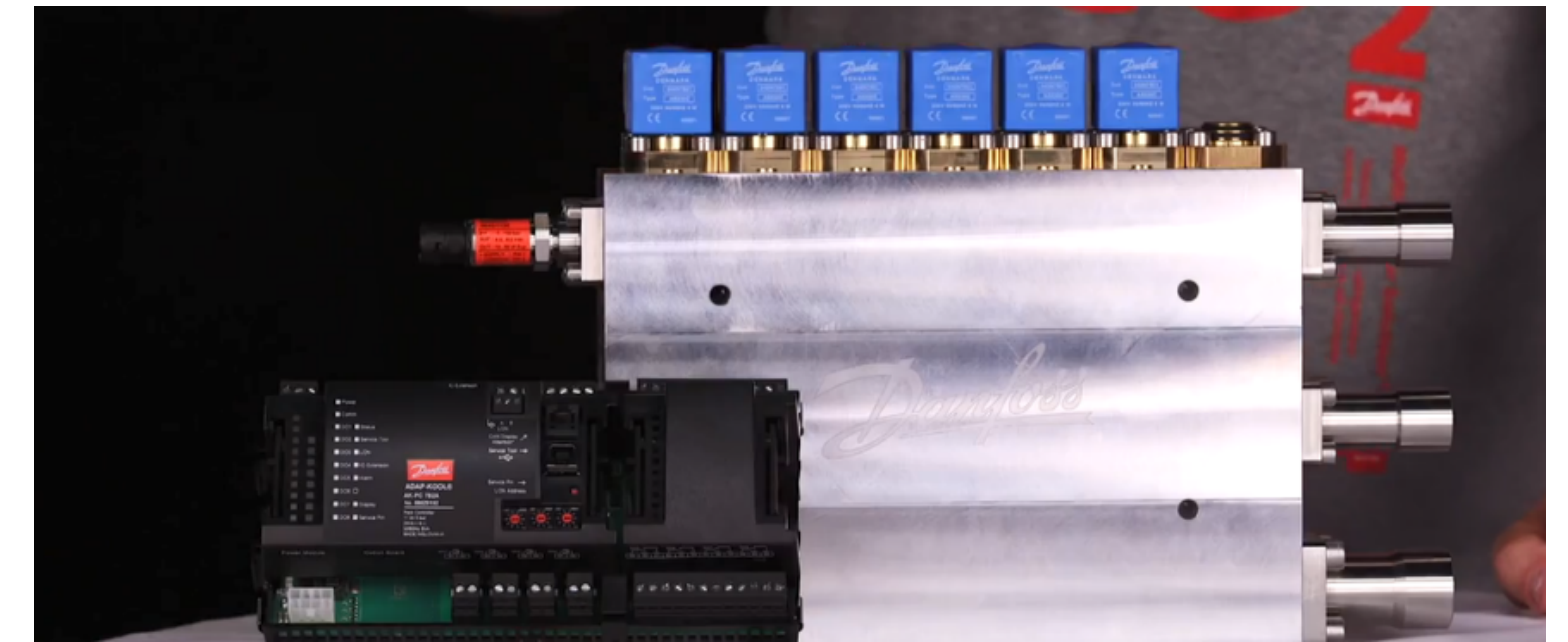
DIFFERENT TRANSCRITICAL CO₂ REFRIGERATION SYSTEMS

- ✔ 3 types of transcritical CO₂ systems are used in Food Retail applications

- ✔ Simple booster system is mostly used in smaller systems and in milder climates

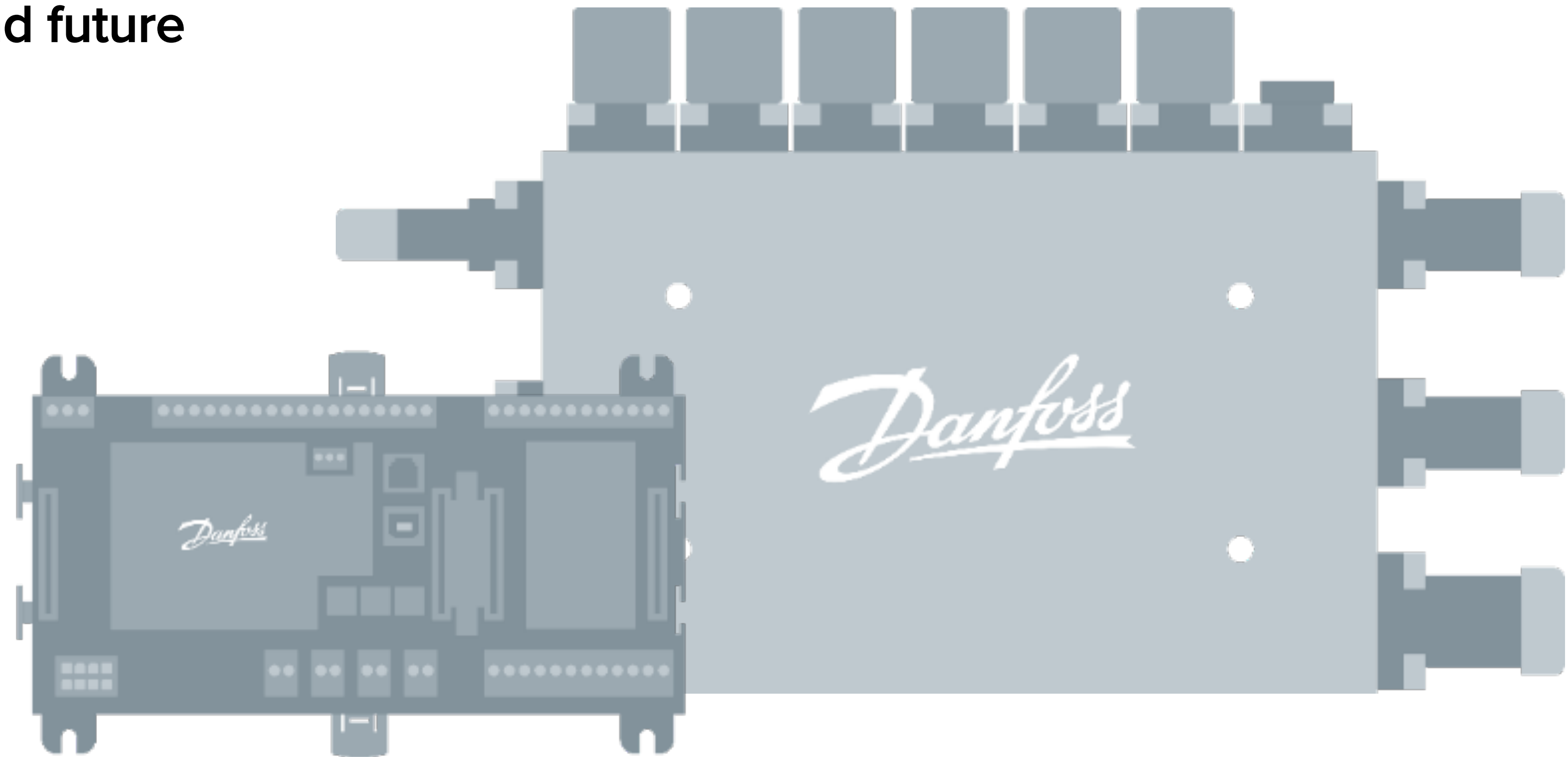
- ✔ Parallel compression is mostly used in larger systems and in warmer climates

- ✔ The Danfoss Multi Ejector Solution can be used in any store globally



MULTI EJECTOR SOLUTION™

The Danfoss Multi Ejector Solution™ is engineered to meet your present and future needs



MULTI EJECTOR REDUCES ENERGY CONSUMPTION IN ALL CLIMATES

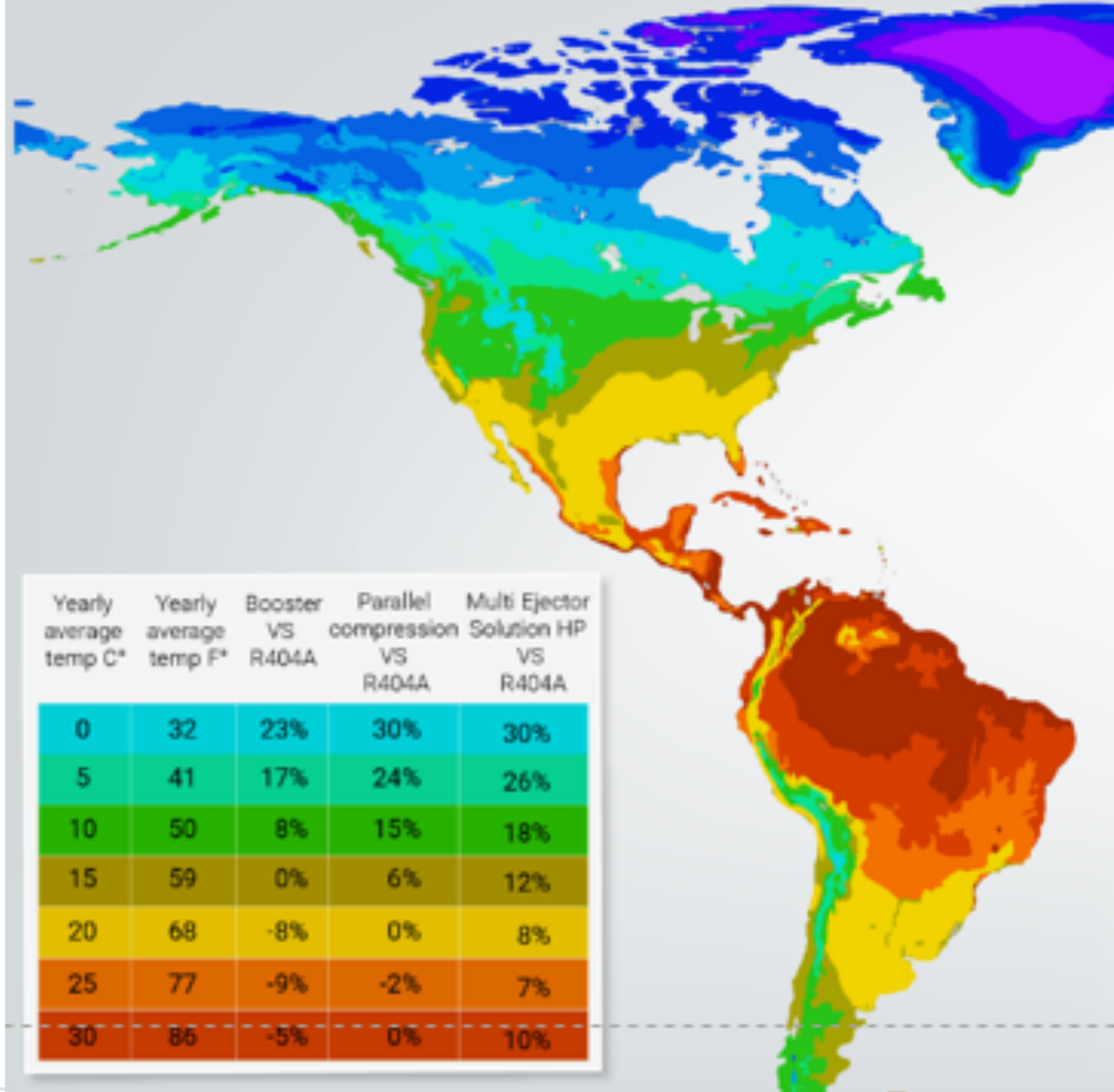
The Danfoss Multi Ejector is designed to eliminate the CO₂ equator making transcritical CO₂ systems more efficient in all climates.

The flexibility makes it possible for professionals to optimize compressor capacity and reduce energy consumption, thus improving their performance.





ENERGY CONSUMPTION OF CO₂

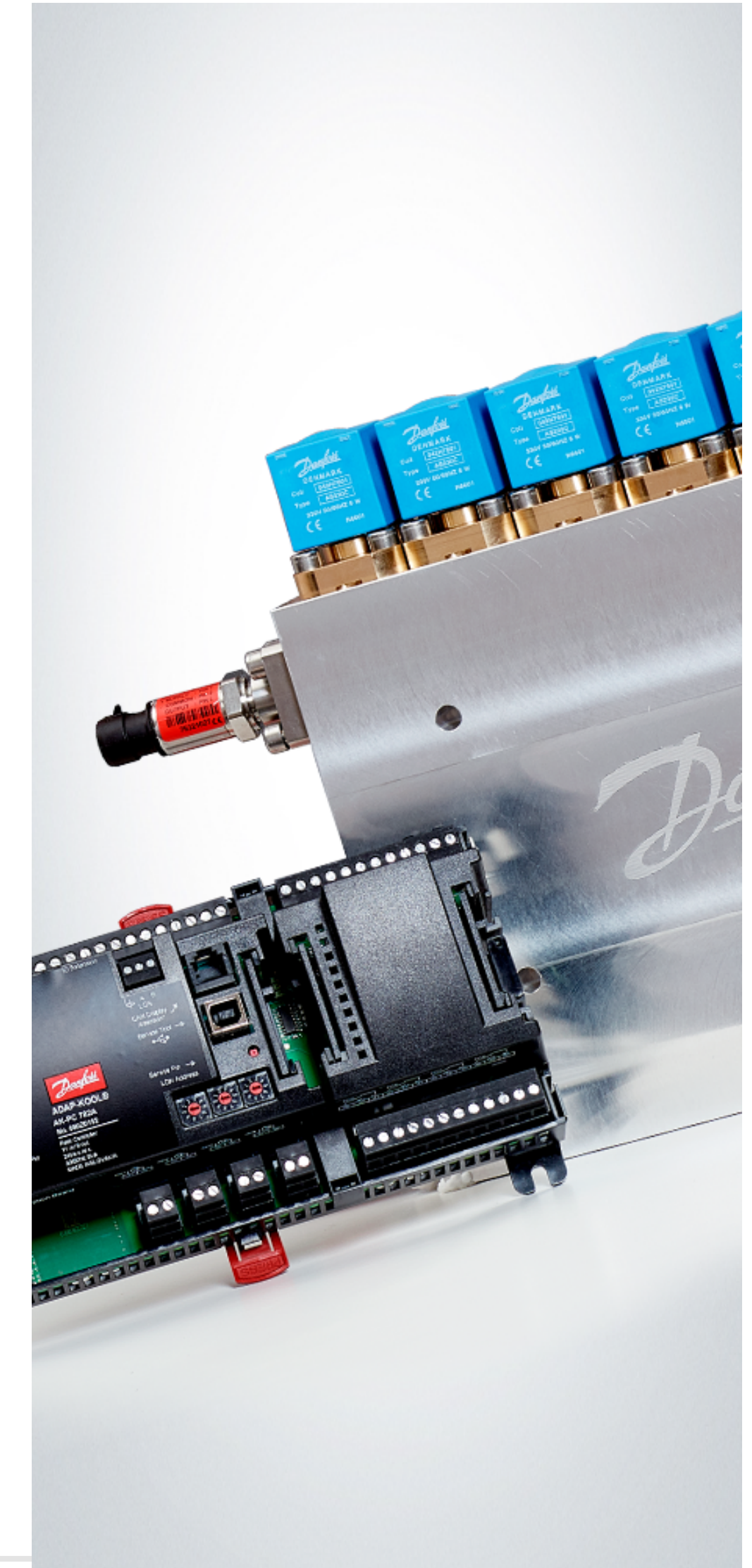


MULTI EJECTOR SOLUTION™

Our new Danfoss Multi Ejector Solution™ consists of two products:

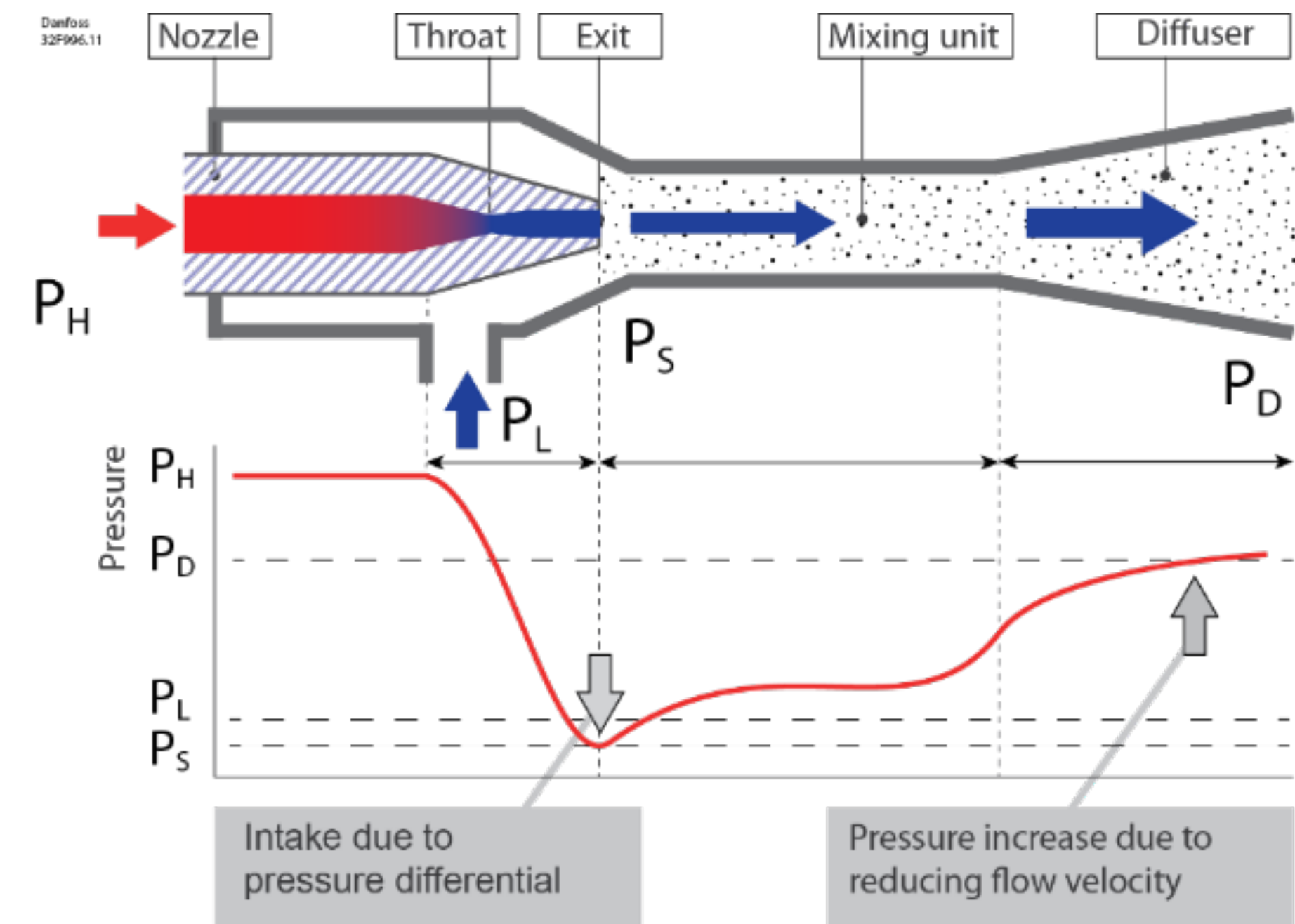
- Danfoss Multi Ejector
- Danfoss AK-PC 782A Pack Controller

By uniting the two great products into one best-in-class solution, professionals all over the world now have the chance to exploit the numerous benefits of using CO₂ as a refrigerant and improve transcritical CO₂ refrigeration systems across all climates.



WORKING PRINCIPAL OF THE MULTI EJECTOR

1. CO₂ leaves the gas cooler. The high pressure CO₂ (P_H) enters the motive nozzle where the expansion takes place.
2. At the nozzle exit, the speed is very high which results in low pressure. The low pressure then drags in gas from the MT suction (P_L).
3. From there, the two units are mixed in the mixing unit where the pressure is higher than at the outlet due to the mixing of gas from a higher pressure.
4. After the mix, the flow enters the diffuser and the flow slows down. The shape of the diffuser enables the conversion from kinetic energy (velocity) to potential energy (pressure). After the diffuser, the flow returns to the receiver.



A SOLUTION WITH MULTIPLE VALUES

Optimization of Compressors



Less compressor capacity needed and the solution can control three suction groups.

High System Reliability

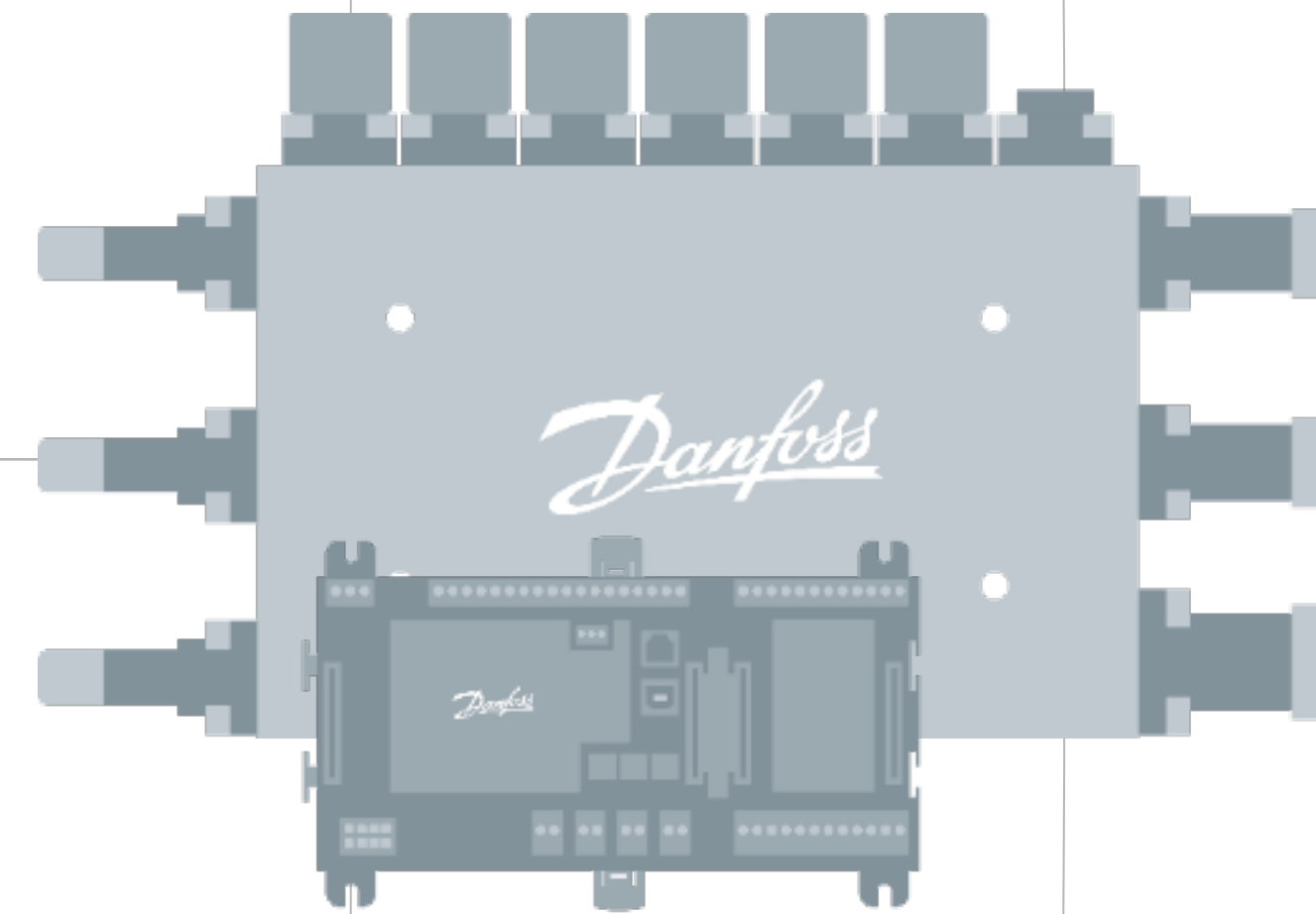


Ensures max uptime and high system reliability with 4-6 redundant ejectors, backup systems, and emergency operations.

Easy Installation



Reduces installation complexity with build-in strainer and connectors for both welding and soldering.



One Solution for all Climates

Apply transcritical CO₂ refrigeration systems in all climates to ensure optimum performance – even in warmer climates.



Service

Eases service with user-friendly tools, fast operation on the strainer and ejectors, and LED plug for trouble shooting.



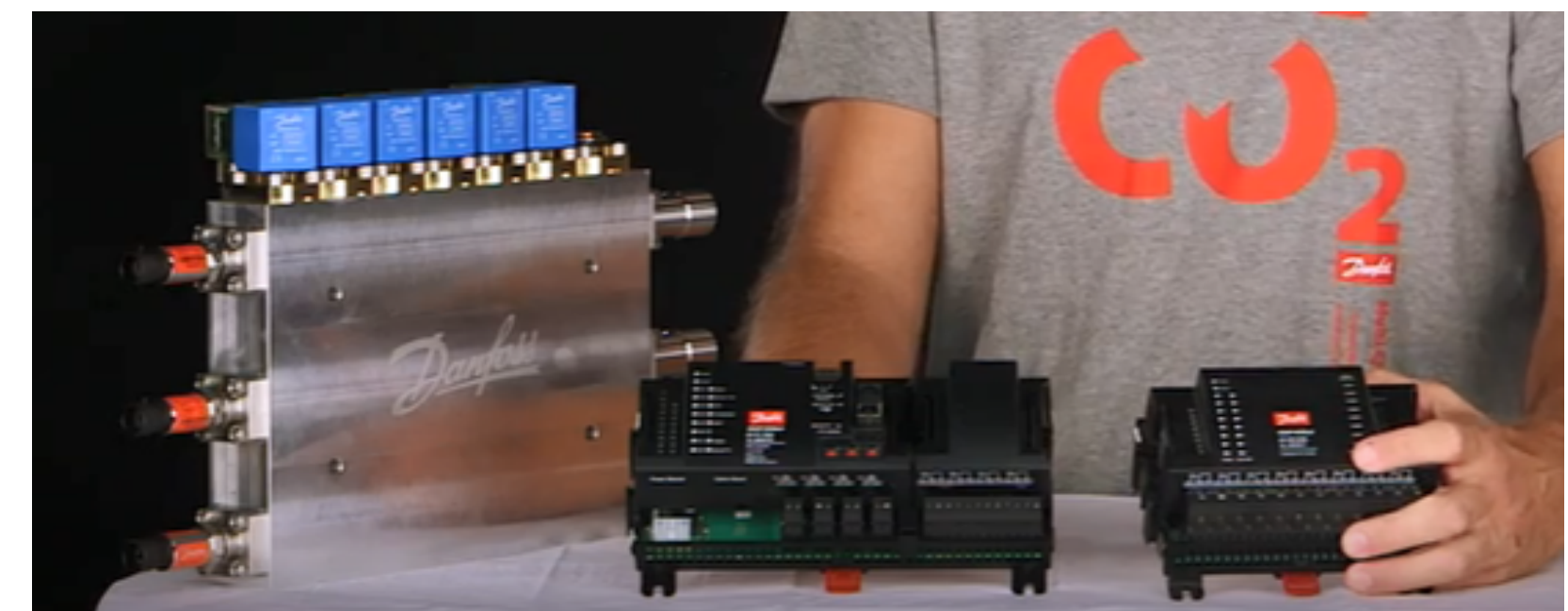
Savings

Provides initial and operational savings with easy installation, reduced need for compressors, and lower energy consumption.



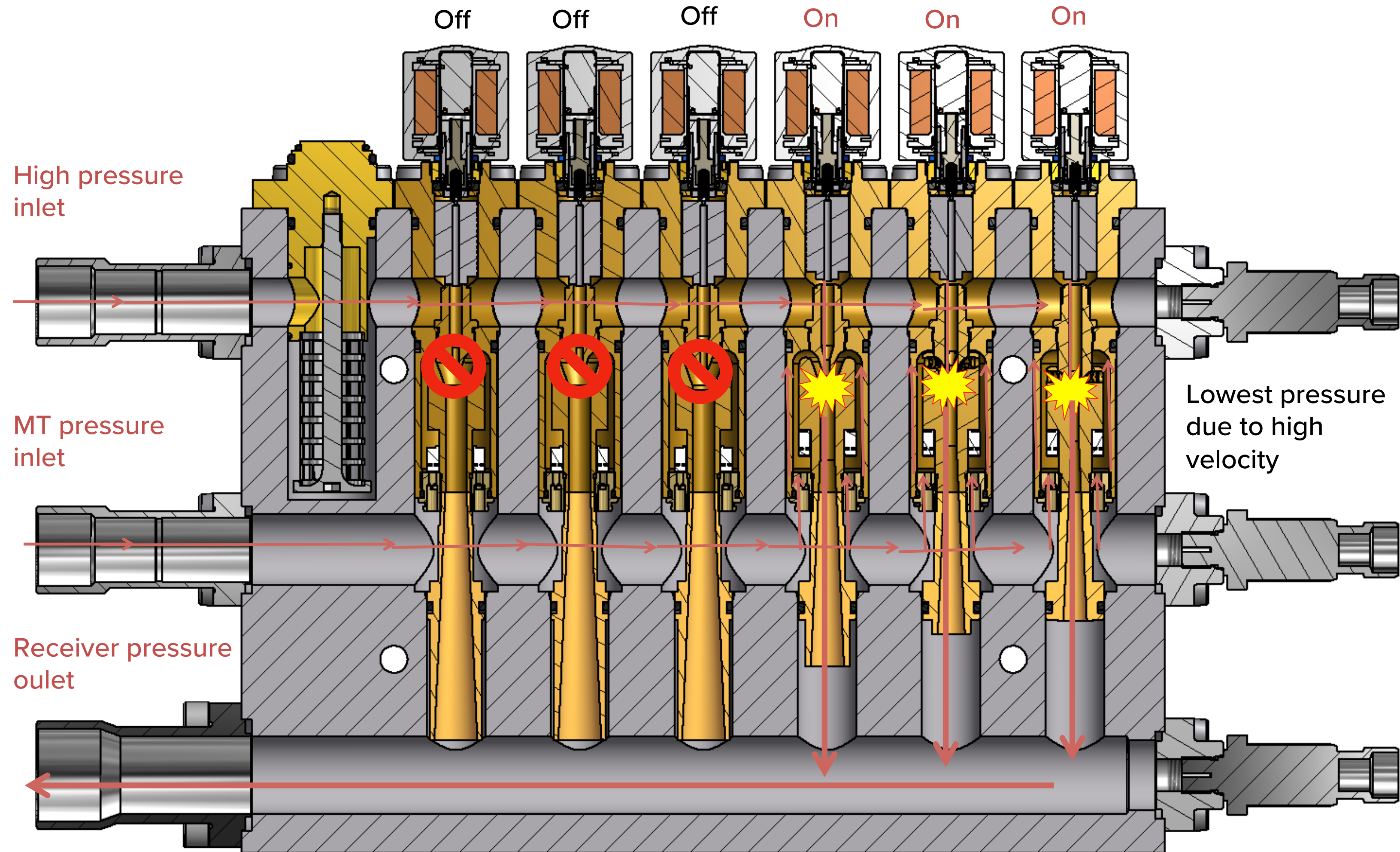
DANFOSS AK-PC 782A PACK CONTROLLER

- ✓ Allows customization according to the particular pack size and design
- ✓ It controls up to 3 compressor groups: MT – LT - IT of parallel compression
→ 12 compressors in total
- ✓ The pack controller will execute several control loops simultaneously on the application
- ✓ The algorithm will ensure safe operation and do a decent job under difficult operational conditions

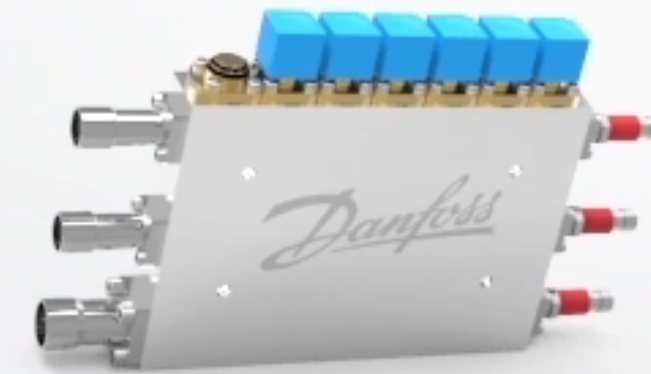


HOW DOES THE MULTI EJECTOR WORK?

See the closed
check valves 1 - 3



**GET CLOSER TO
THE MULTI
EJECTOR
WATCH THIS
ANIMATION**



AK-PC 782A FOR INTEGRATED AND OPTIMIZED PACK CONTROL

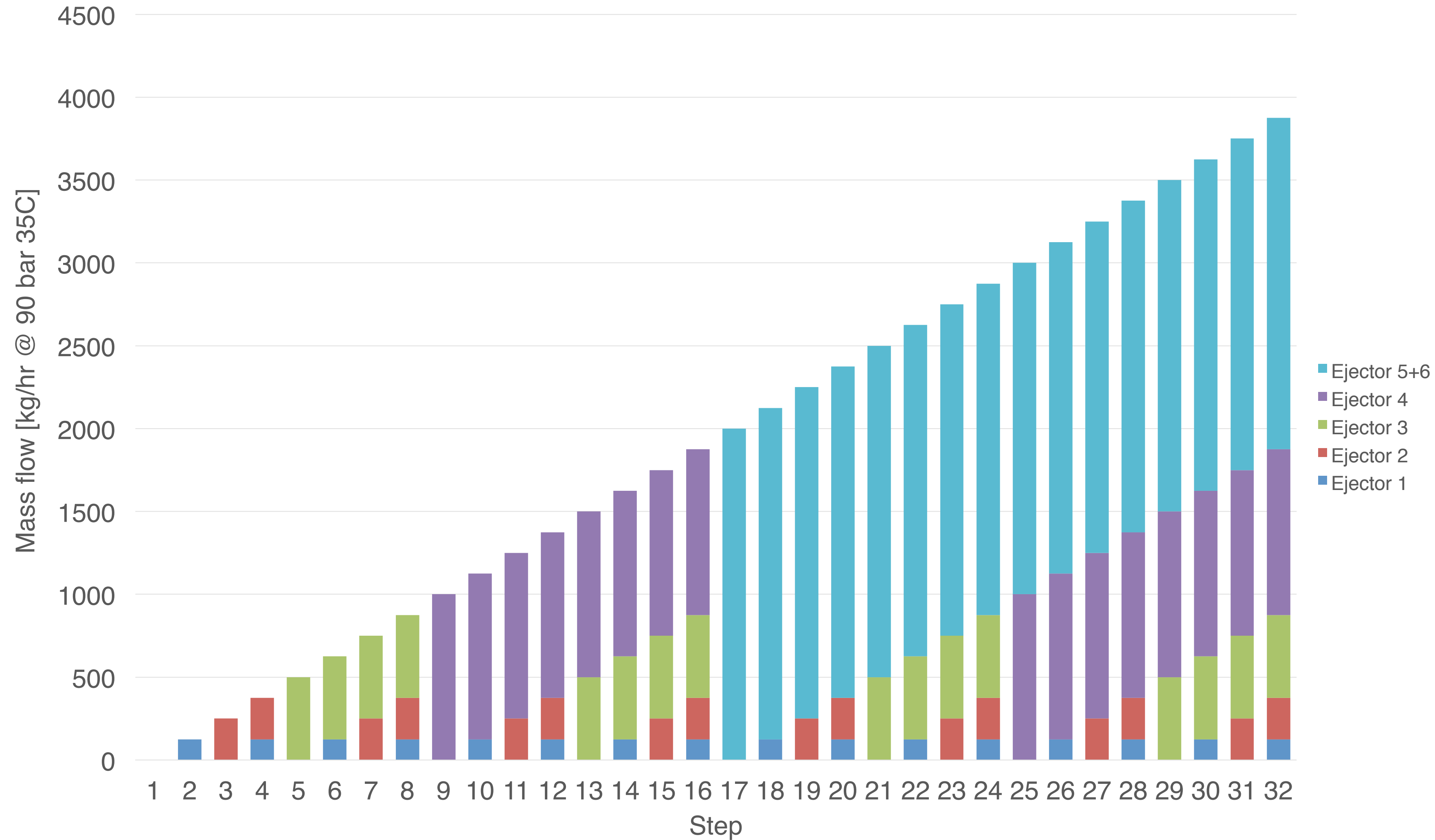
AK-PC 782A is a powerful and flexible controller that provides precise regulation, improved efficiency, and enhanced user friendliness for pack control in transcritical CO₂ supermarket systems.

The controller flexibility and efficiency makes it the obvious choice for all sizes of packs in all climates.



HOW TO CONTROL THE MULTI EJECTOR

Multi Ejector Capacity Control for High Pressure (HP)



HOW THE AK-PC 782A FEATURES CREATE VALUE

- ✓ Improves energy efficiency because of suction pressure optimization.
- ✓ Improves energy efficiency by high efficient heat reclaim.
- ✓ Increases energy efficiency by enhanced transcritical control.
- ✓ Increases food safety and reliability thanks to safety monitoring and redundancy.
- ✓ Reduce installation complexity and time with improved controller integration and application flexibility.
- ✓ Reduce manufacturing, commissioning and service complexity and time with the easy-to-use service tool.

THE MULTI EJECTOR SOLUTION™ PORTFOLIO

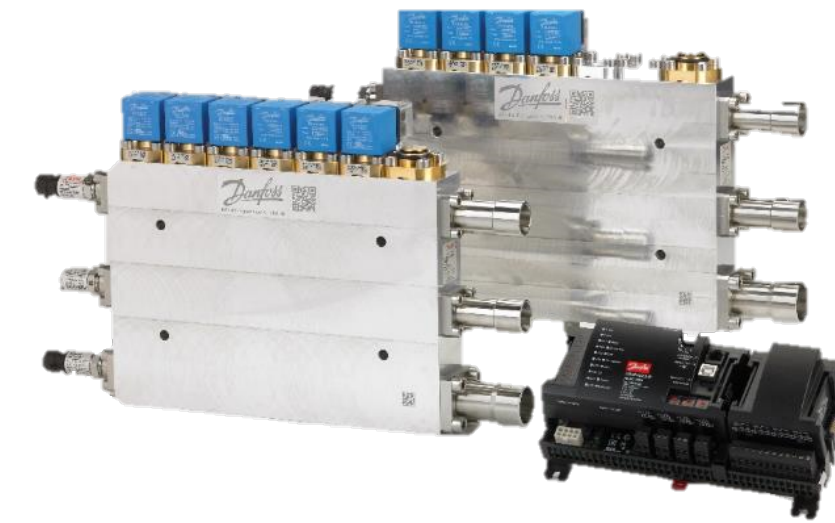
Multi Ejector Solution is available in three types:

- [High Pressure](#) for racks with parallel compression
- [Low Pressure](#) for rack with CO2 booster (MT/LT)
- [Liquid Ejector](#) for rack with CO2 booster (MT/LT) or parallel compression

To decide which version is best, these factors must be considered:

- ✓ CO₂ technology
- ✓ Climate and ambient temperatures
- ✓ Store size

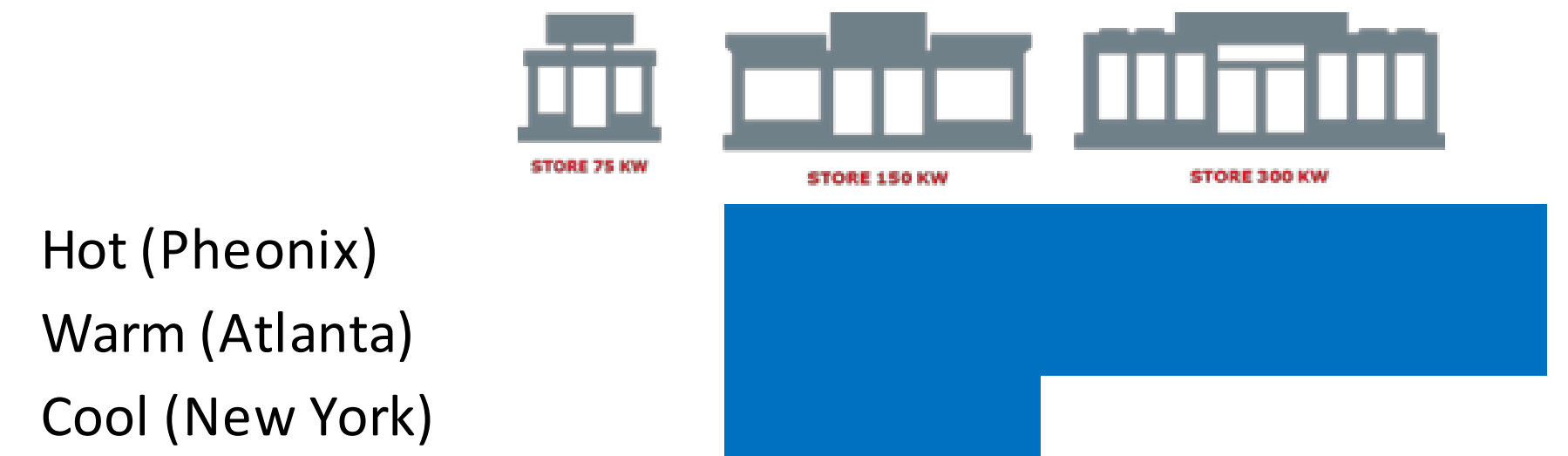
MULTI EJECTOR SOLUTION APPLICATIONS



Booster System + LP Multi Ejector Solution



Parallel System + HP Multi Ejector Solution

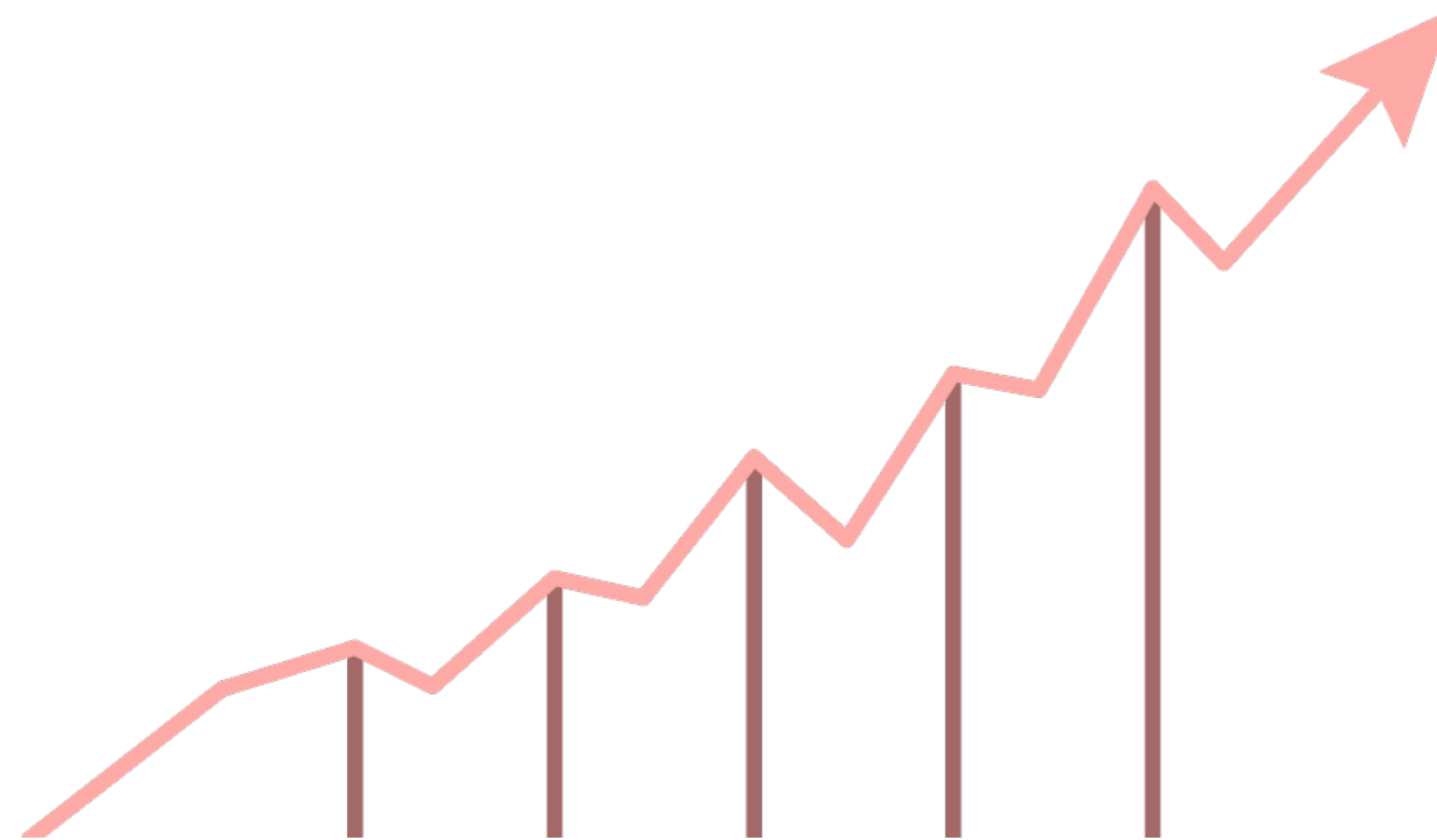


Transcritical System + HP Multi Ejector Solution



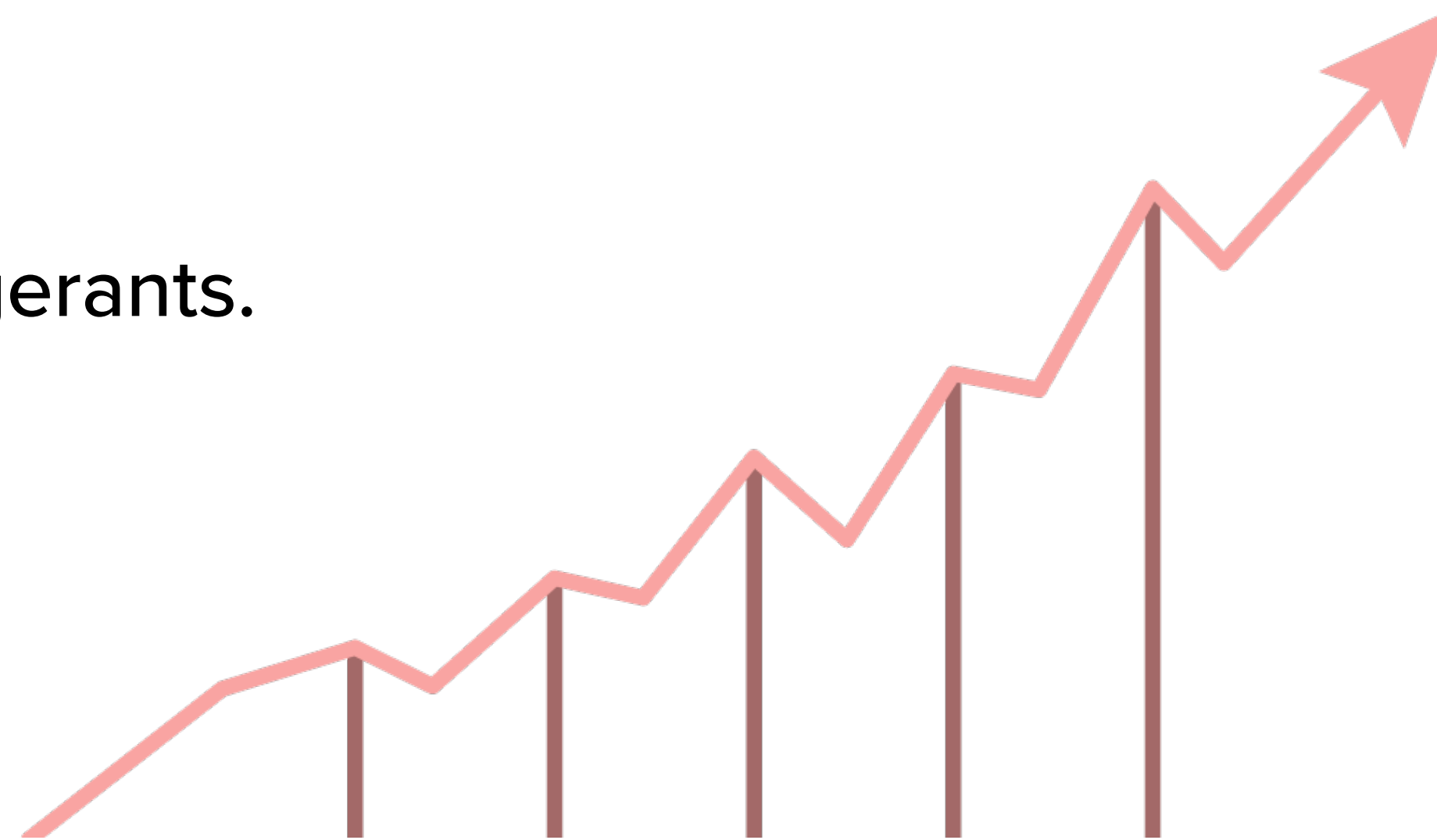
HOW THE MULTI EJECTOR SOLUTION™ CREATES VALUE FOR OEMs

- ✓ First cost savings (system is cheaper – competitive advantages).
- ✓ Part of the new CO₂ wave.
- ✓ Easy installation and service.
- ✓ Safe and secure system with redundancy.
- ✓ Retro fit option (on parallel compression).



HOW THE MULTI EJECTOR SOLUTION™ CREATES VALUE FOR END-USERS

- ✓ First cost savings.
- ✓ Energy and compressor savings.
- ✓ Safe and secure system with redundancy.
- ✓ Retro fit option (on parallel compression).
- ✓ Future proof solution with CO₂ - natural refrigerants.
- ✓ One solution world wide.





ATMO
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Thank you very much!

ENGINEERING
TOMORROW

