



25 & 26 June 2015 - Atlanta, Georgia

THE FIRST HYDROCARBON VARIABLE SPEED ULT FREEZER

embraco

ThermoFisher
SCIENTIFIC



25 & 26 June 2015 - Atlanta, Georgia

THE FIRST HYDROCARBON VARIABLE SPEED ULT FREEZER

embraco

ThermoFisher
SCIENTIFIC



COOLING

SOLUTIONS FOR
TEMPERATURE SENSITIVE
PRODUCTS



ULTRA-LOW REFRIGERATION

Ultra-low refrigeration systems are primarily used for the storage of products in the following industries:



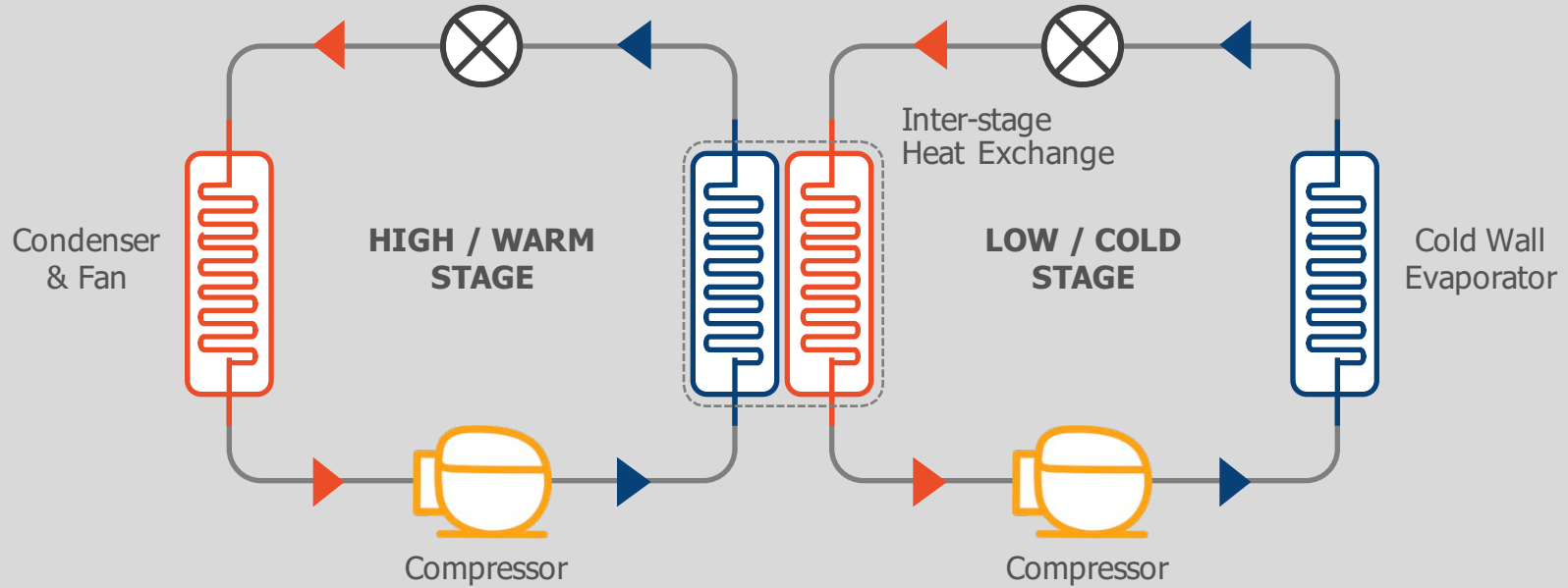
Biomedical



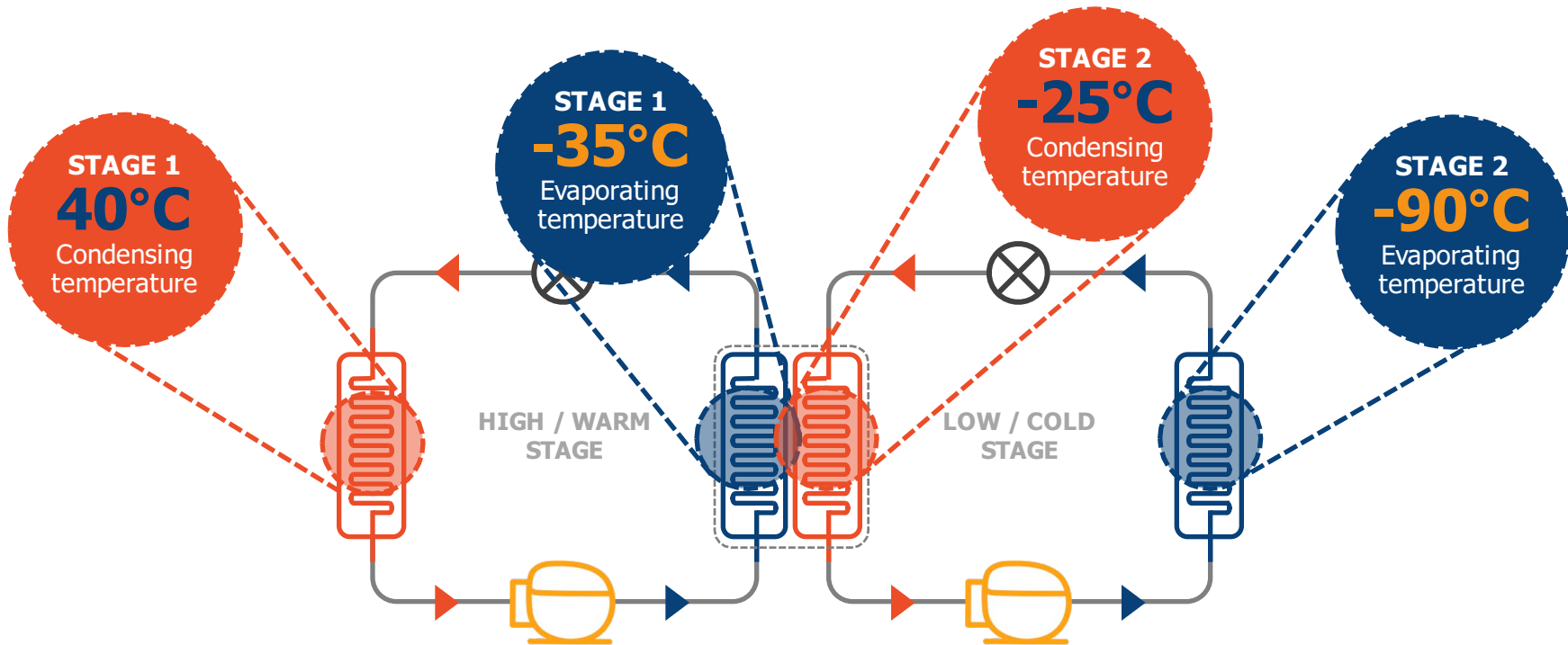
Chemical



Speciality



They typically operate from -90 to -70°C and are often a cascade design.





CHALLENGES

Migrate to refrigerant with low GWP

Improve the energy efficiency of the systems

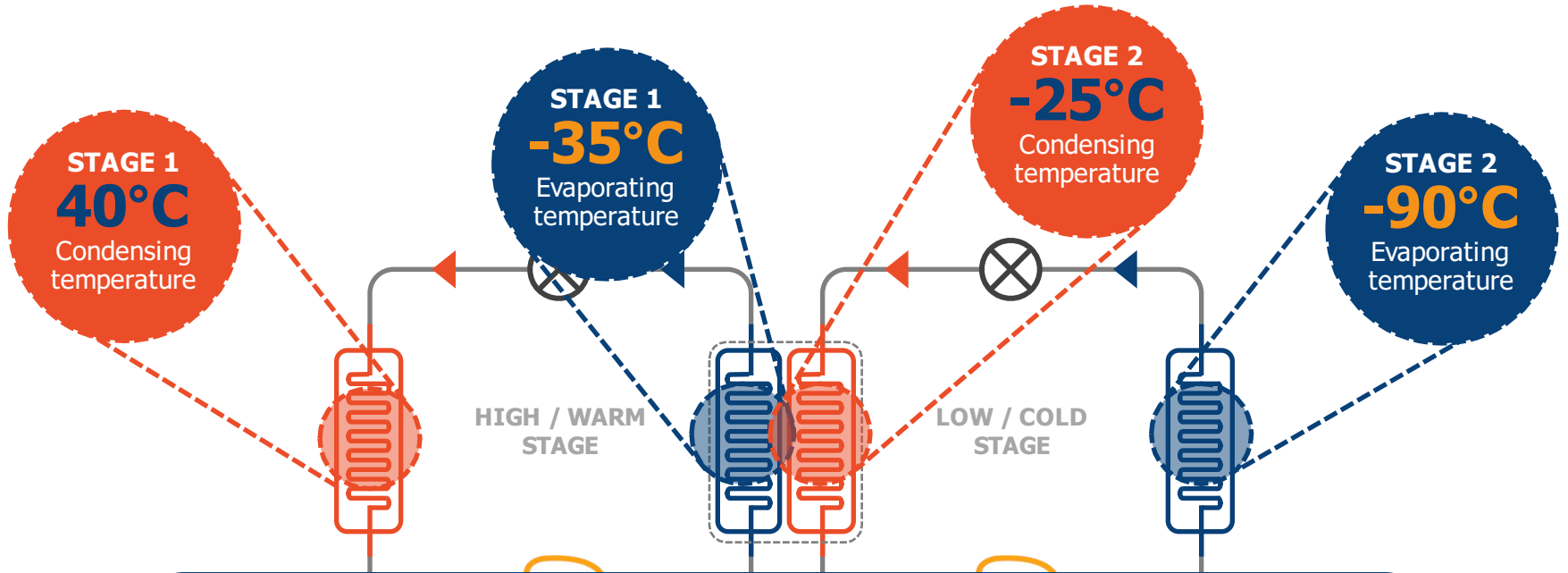
CHALLENGES



Migrate to refrigerant with low GWP

Improve the energy efficiency of the systems

THEORETICAL SIMULATION >>> CASCADE SYSTEM HFC vs. HC



	HFC R404A / R508B	HC R290 / R170
POWER OF COMPRESSOR – 1 st STAGE	880 W	720 W
POWER OF COMPRESSOR – 2 nd STAGE	550 W	500 W
SYSTEM COP (Btu/W-hr)	2.39	2.80
GWP	R404A: 3920 R508B: 13400	R290: 3 R170: 6

+17%

Natural Refrigerants
alone offer
significant efficiency
gains!


The low/cold stage compressor requires 30 - 40% less power than high/warm stage compressor allowing for system optimization. Currently, many designs are using the same model in both stages.



Introducing
EMBRACO'S
FULLMOTION
compressor



**HIGH
EFFICIENCY**



OVERDRIVE



RELIABLE



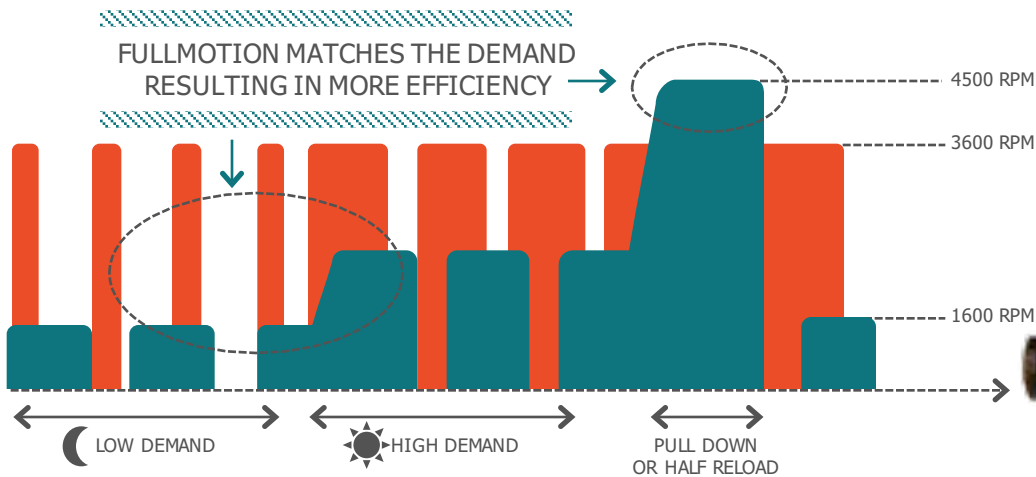
**LOW NOISE &
LESS VIBRATION**

Fullmotion BENEFITS



1

ENERGY SAVINGS

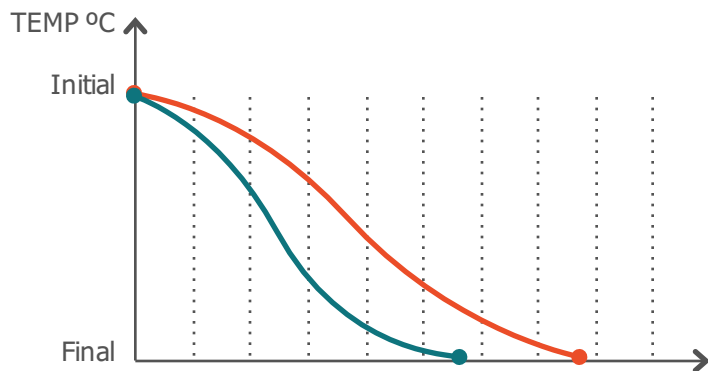


Fullmotion **BENEFITS**



2

REDUCED PULLDOWN TIME



20%

Average pull-down
time reduction

 **FULLMOTION**
 **ON-OFF**

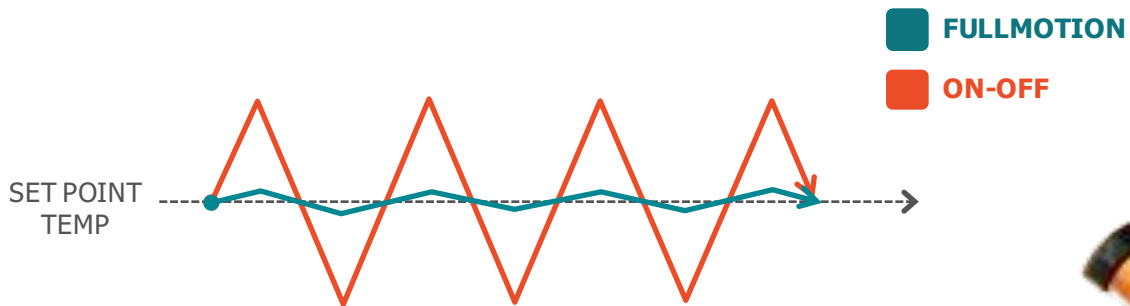


Fullmotion **BENEFITS**



3

TEMPERATURE CONTROL



CASE STUDY

TSX

ULTRA-LOW

by **THERMOFISHER SCIENTIFIC**



CASE STUDY

TSX achieves additional energy savings using 3 key design elements



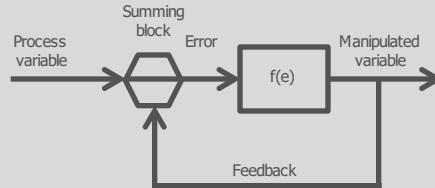
15%
Theoretical
up to 50%
Actual

NATURAL REFRIGERANT



R290, high/warm stage
R170 + R290 blend,
low/cold stage

ALGORITHM DEVELOPMENT



Patented controls

VARIABLE SPEED COMPRESSOR




Fullmotion by Embraco

CASE STUDY

TSX IS A SPECIAL ULTRA-LOW



	SO QUIET / SILENT	PEAK PERFORMANCE	ENVIRONMENTALLY FRIENDLY	CARGO CAPACITY	INDEPENDENT CERTIFICATION	ADAPTIVE CONTROLS	LOW ENERGY
NATURAL REFRIGERANT		✓	✓				
EMBRACO FULLMOTION	✓	✓	✓				
ALGORITHM		✓	✓				
ZERO LANDFILL FACTORY			✓				
OTHER	✓	✓		✓	✓		

 Up to **50%** energy savings
From **17** to **9** kWhr/day
Compared to R404A/R508B single speed designs.

CASE STUDY

ENERGY

EFFICIENCY

WITHOUT

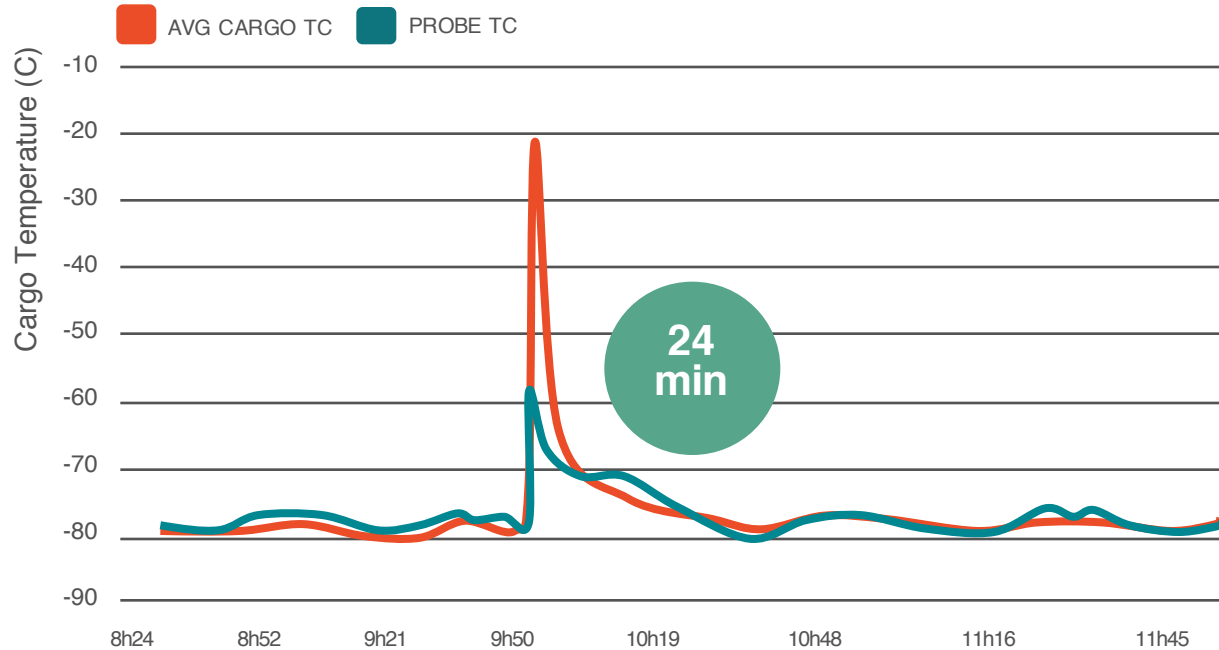
PERFORMANCE

COMPROMISE



CASE STUDY

-80C 1 min Door Open Recovery in 20C



Door open recovery performance meets customer expectations **without compromise** using Fullmotion overdrive assist.



Modern automobile engines vary the number of active cylinders depending on usage.

The Fullmotion allows for a similar in situ adjustment for Ultra-low freezers.

TSX
ULTRA-LOW
IS 2.5 x
QUIETER



Silent like operation

46 dbA @ low RPM

CUSTOMER FACING PERFORMANCE



**+/- 3C
temperature
Variation**

**High
Cargo Volume:
60000
vials**

**Fast
door open
recoveries:
24 min**

The TSX is for sale as a 50Hz version and will be available in a 60Hz version Summer 2015.

A laboratory setting with a pipette dispensing liquid into test tubes. The background is a blurred image of a laboratory bench with various glassware and equipment. A dark teal banner with the word 'CONCLUSIONS' in white capital letters is overlaid on the left side of the image.

CONCLUSIONS



Ultra-low cascades
can effectively use



Natural Refrigerants
realizing both
performance & energy goals.





EPA has already developed
a standardized
energy test
for
Ultra-low cascades.



Combining Fullmotion
with other **design elements**
enhance the
benefits.

Embraco is the first manufacturer offering a special
compressor for the Ultra-low cascade low/cold stage



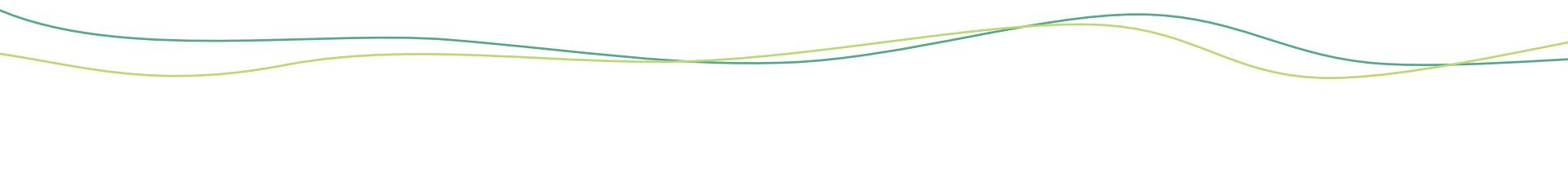


CONSIDERATIONS ON NATURAL REFRIGERANTS

DESIGN

- ▶ Design for low charge (< 150g)
- ▶ Design to pass the lower flammability limit
- ▶ Verify your oil compatibility
- ▶ Check for sound reduction agent compatibility
- ▶ Be prepared to adjust/review your reliability test plans (ex. valve velocities)

LABORATORY / TEST FACILITY

- ▶ Natural Refrigerants monitoring for test rooms
 - ▶ Determine maximum number of units per test room
- 

FACTORY

- ▶ Accurate and repeatable charging strategy
- ▶ Develop and train associates

FIELD / SERVICE

- ▶ Training for charge venting and recharge methodologies





ATMO
sphere

business case

natural refrigerants

embraco

ThermoFisher
S C I E N T I F I C