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October 2018

SOLSTICE® L40X (R455A) BRIEF

CHILLVENTA 2018

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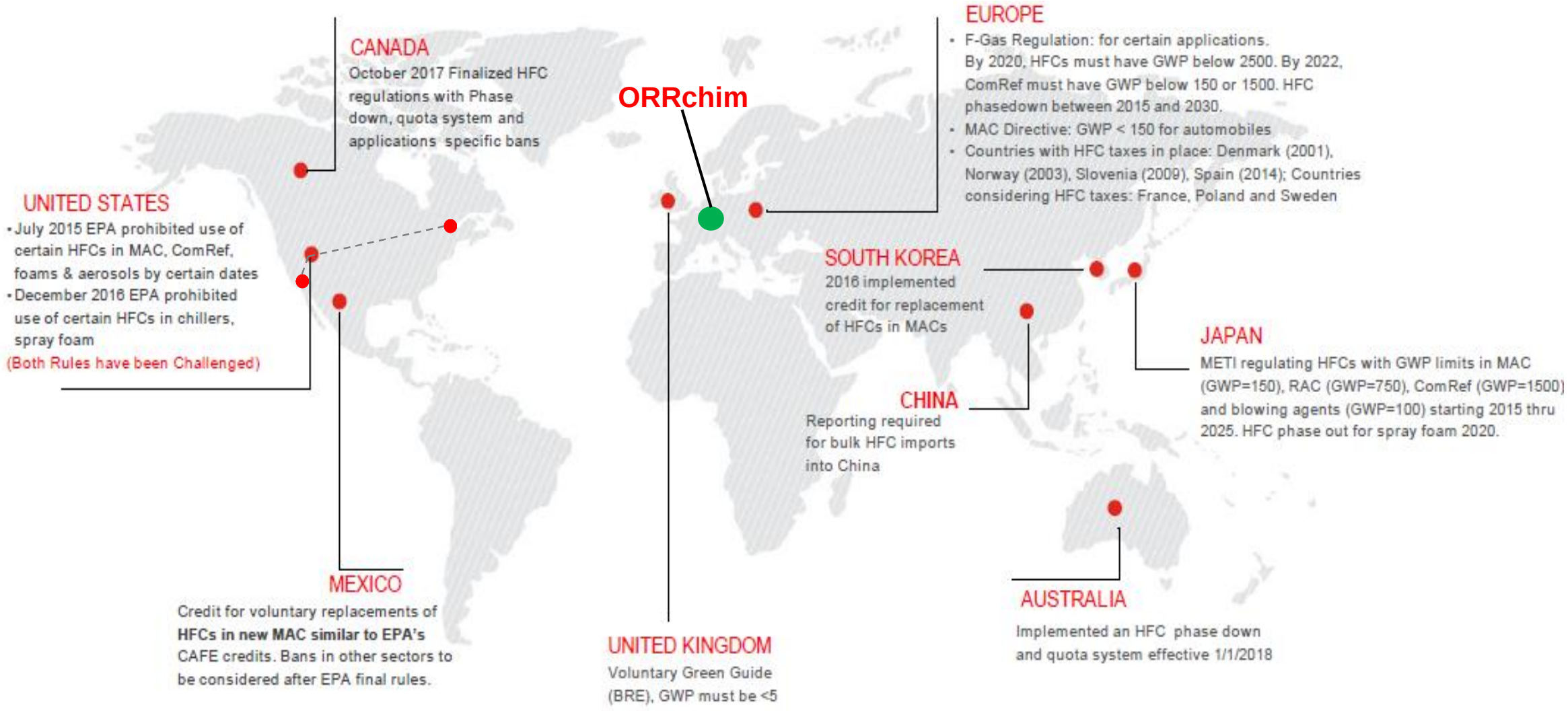
HFCs under pressure for global reduction



In addition to global regulations, Kigali amendment requires global HFC phase-down

Honeywell Portfolio – Solstice Family

Energy efficiency

GWP

Solstice® HFO pure molecules
Low and medium pressure applications

	Nonflammable (ASHRAE A1)	Mildly flammable (ASHRAE A2L)	Examples of potential applications
R-134a GWP=1430		**Solstice® yf** GWP* < 1	Auto A/C, Vending, Refrigerators, **HP**
		Solstice® ze GWP* < 1	Chillers, CO_2 Cascades Refrigerators, **HTHP**
R-123 GWP= 77	**Solstice® zd** GWP* =1		Centrifugal Chillers, **VHTHP**

Solstice® Blends

	Non Flammable (ASHRAE A1)	Mildly Flammable (ASHRAE A2L)	Examples of potential applications
R-134a GWP=1430	**Solstice® N13 (R-450A)** GWP* = 547		Chillers, Med-temp Refrigeration, **HP**
	R-515B GWP* ≈ 300		
R-404A GWP=3922	**Solstice® N40 (R-448A)** GWP* = 1273	**Solstice® L40X (R-455A)** GWP* < 150	Low-Temp Refrigeration, **HP**
	Solstice® R452A GWP* = 1945		
R-410A GWP=2088		**Solstice® L41y (R-452B)** GWP* = 572	Stationary A/C Applications

EU28
↓20% energy in 2020

EU28
Fgas:
↓ CO_2e

ROW
Kigali Agreement
METI
SNAP, CARB…

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COMMERCIAL REFRIGERATION
- NEW SYSTEMS -

Solstice® L40X (R455A)

GWP<150 – A2L

System Trends in EU Retail Refrigeration

- **Convenience Stores**
  - Strong growth
  - Hydrocarbons common
  - Growth of self-contained integral systems

- **Small Supermarkets**
  - Steady growth
  - Development of new architectures for more efficient cooling & HVAC energy management (waterloop, semi-distributed)

- **Supermarkets**
  - Flat growth
  - CO_2 trying to increase market share
  - Semi-distributed architectures and cascade systems promise better eco-efficiency

- **Hypermarkets**
  - Declining
  - CO_2 already established
  - Cascade systems promise better eco-efficiency

Growth on Small Formats and Flexible Refrigeration Architectures

Solstice® L40X (R-455A) vs. alternatives in Refrigeration

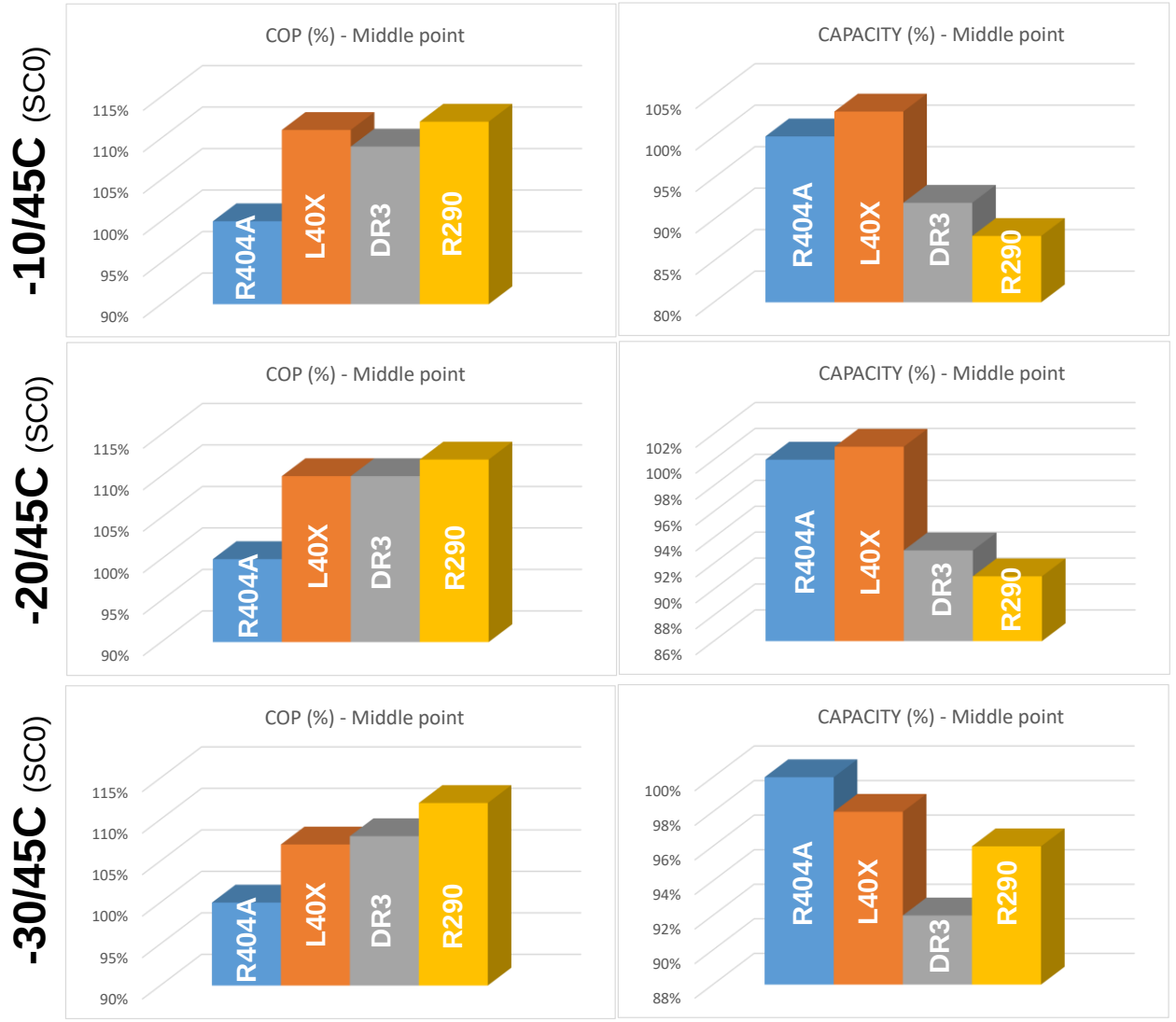
GWP=145

Solstice®L40X

NEK2134GK

embraco POWER IN. CHANGE ON.

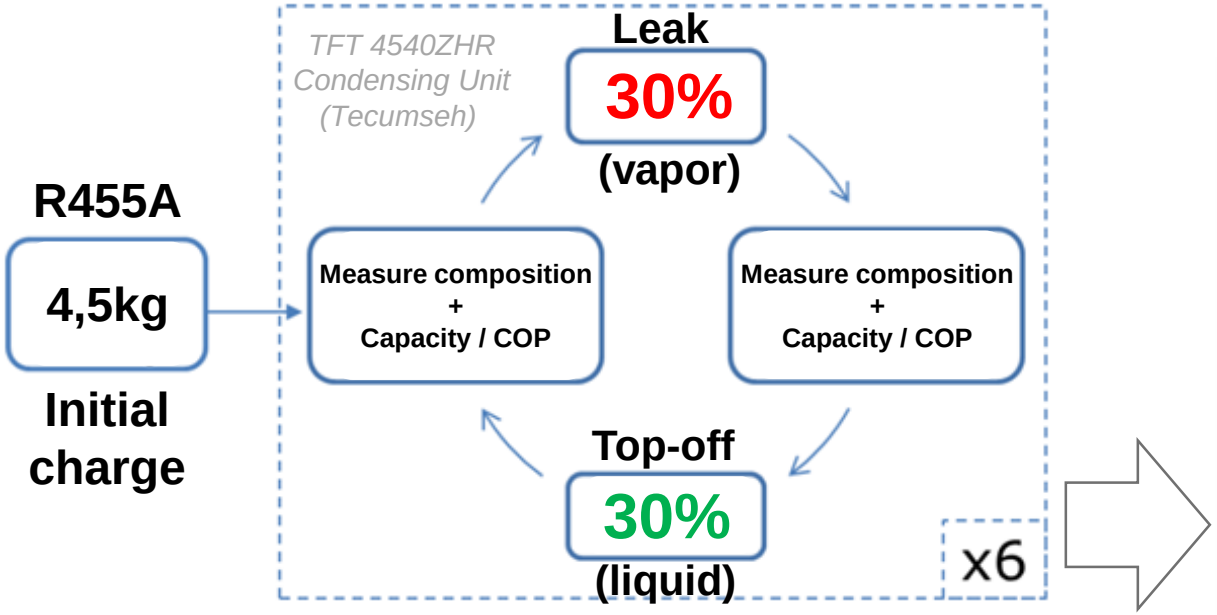
SH=11.1C for R404A, L40X and DR3
SH=22.2C for R290
(SH>20C needed for reliability)

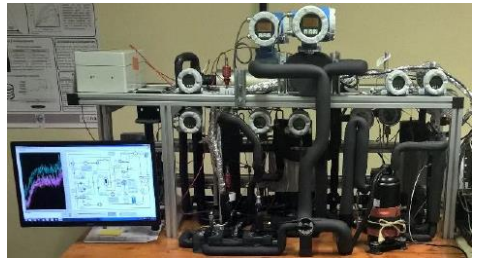


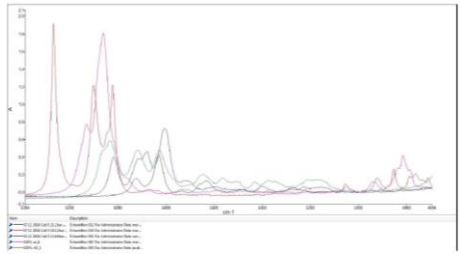
L40X has close COP and higher capacity than R-290

R455A Fractionation investigation

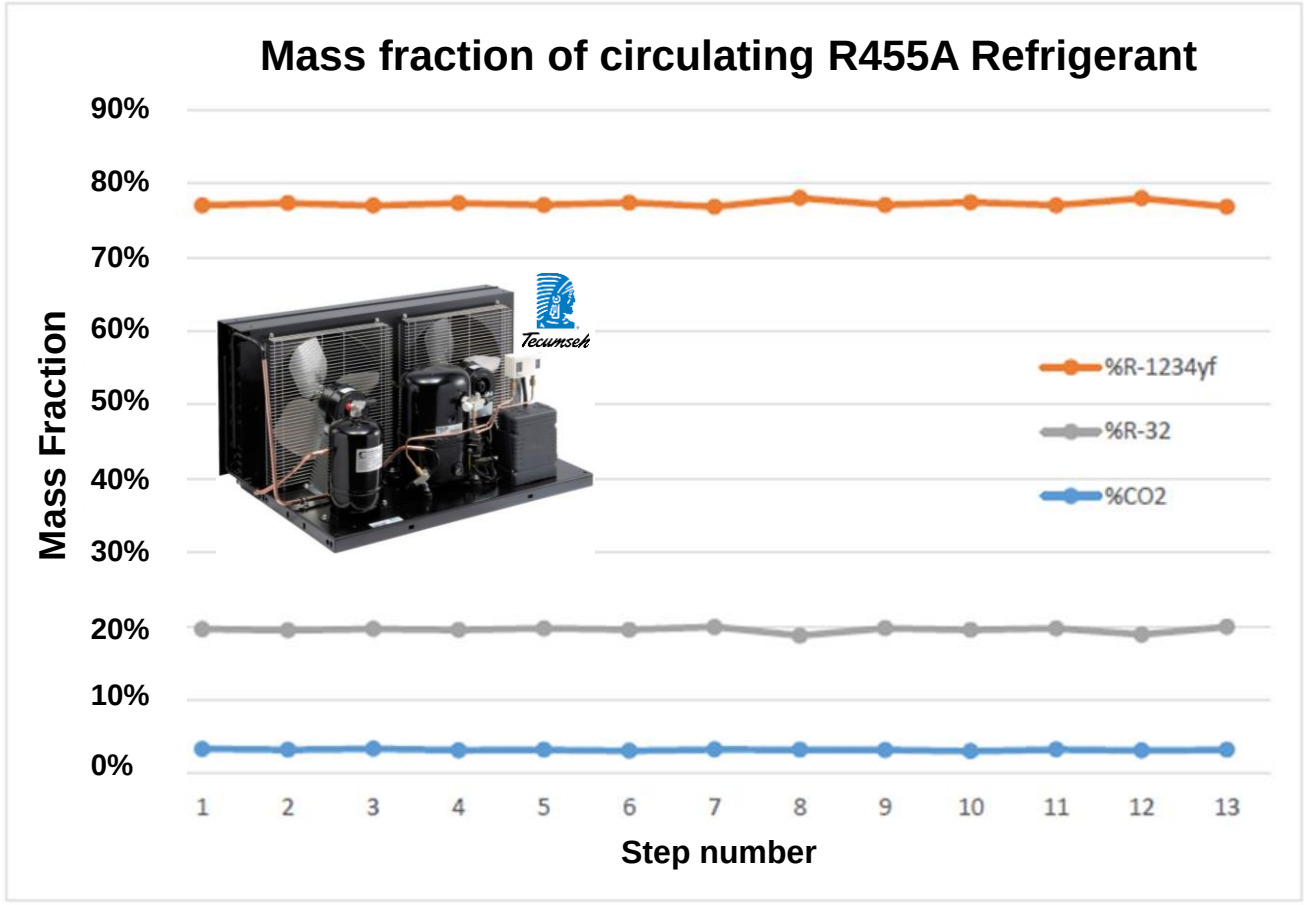
(CETIM / CNAM are French Research Institute)





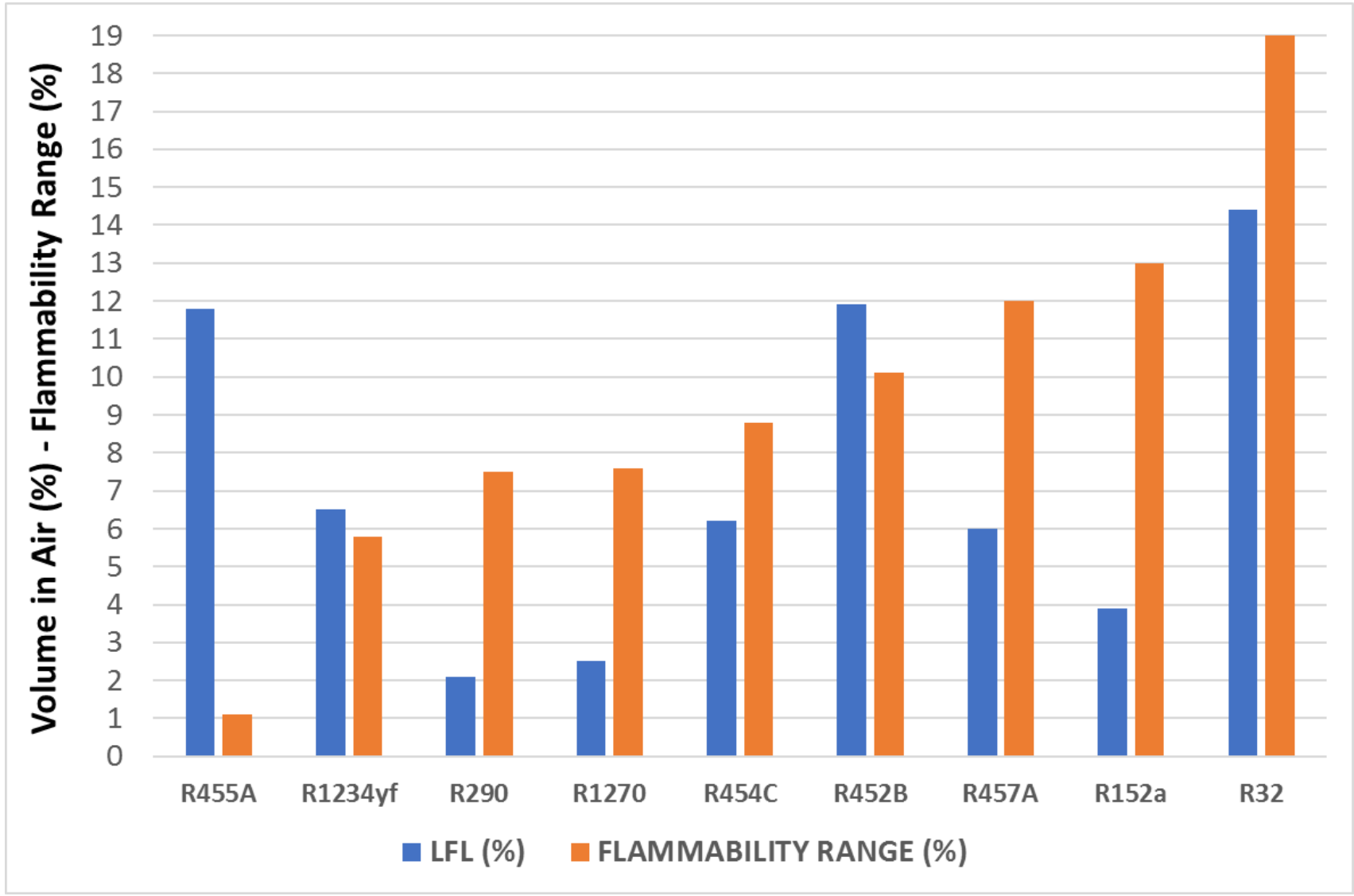


Composition in circulation measured by IR Spectrometry



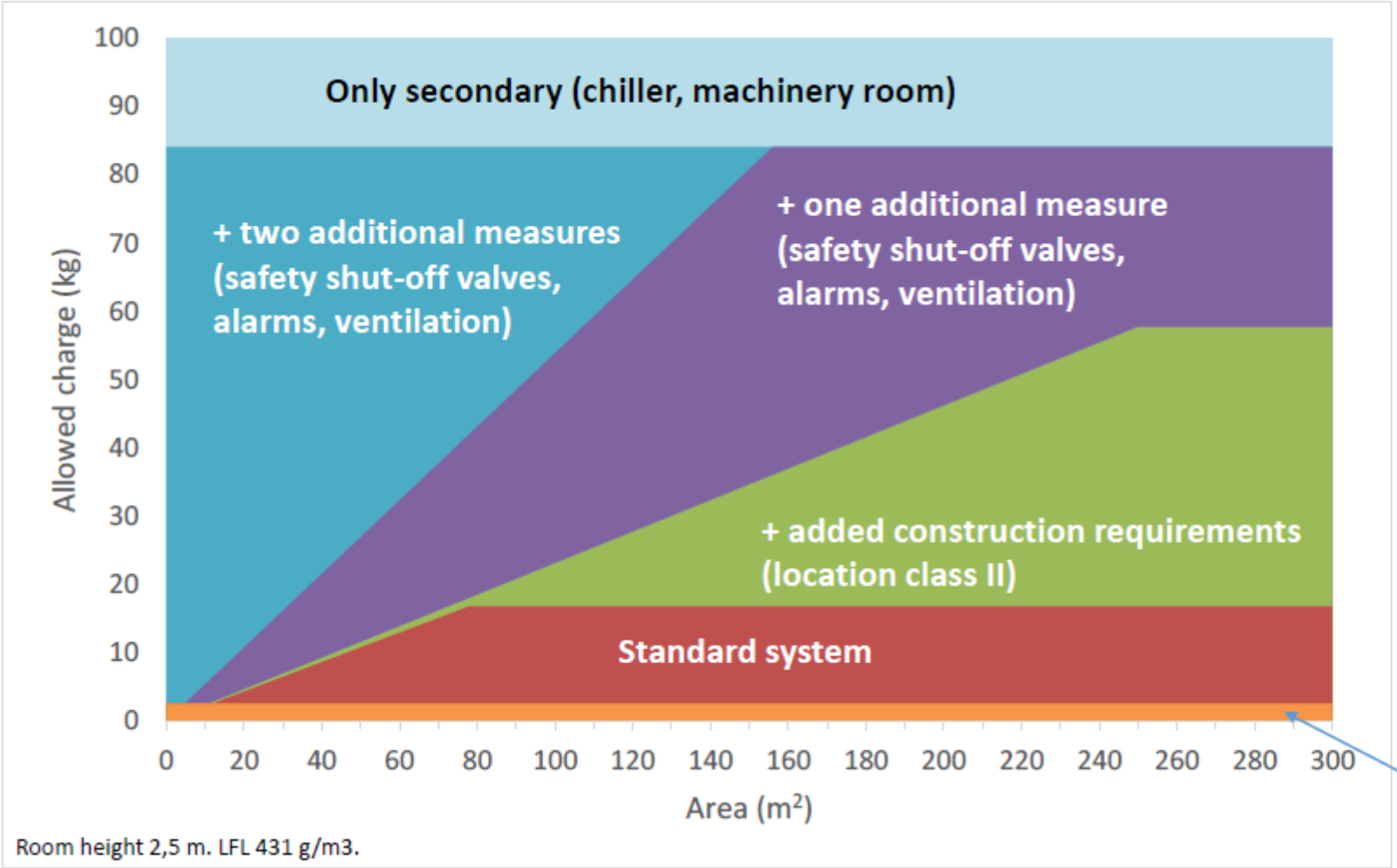
Solstice L40X (R455A): No fractionation observed after 6 leakage / top-off!

LFL and Flammability Ranges comparison



Solstice L40X (R455A): High LFL and smallest flammability range!

EN378 charge for R-455A (per circuit) for standard systems



84,0 kg

57,7 kg

16,8 kg

2,6 kg

No room size requirements below 2,6 kg

Most systems:

- Placed at least partly in occupied space
- Mostly ordinary people have access

Allowed charges can cover most of the target applications

Self-Contained Integral Systems

Commercial

Project:	**Plug-In Cabinet**
Date:	2017
Application:	Med / Low Temp
Location:	UK
Refrigerant:	R-455A
Ref. Volume:	1.4 – 1.6 kg / unit
Ref Class:	A2L

OEM: ES System K

Cooling Cabinets with A2L (R-455A)

- 2 doors (1.6 meters)
- 3 doors (2,4 meters)

Key Differentiators:

- Additional capacity & less circuits vs. R-290 use
- Low noise
- Low energy consumption

Integral ‘Monoblock’ System

Commercial

Project:	**Zanotti**
Date:	2017
Application:	Monoblock (MT)
Location:	Italy / EU
Refrigerant:	R-455A
Ref. Volume:	500 g
Ref Class:	A2L

Testing Conducted

ALL PASSED

- Component Conformity
- Capacity v’s R404A
- Analysis of Fractionation
- Analysis of Possible Ignition

Test 2: No Evidence of Ignition

- This test assessed risk of flammability. They deliberately created a ‘triple failure’ scenario, replicating the effect of broken fans, faulty safety switch and a refrigerant leak. Once the surface temperature of the unit’s heating elements had reached 370 °C, they induced a deliberate Solstice L40X leak. There was no evidence of ignition.

Many OEM’s Go Beyond the Standards to Ensure Safe Operation

Food Service and Industrial Kitchen

Commercial

Project:	**Tournus**
Date:	2016
Application:	Comm. Kitchen
Location:	France
Refrigerant:	R-455A
Ref. Volume:	<500 g
Ref Class:	A2L

According to EN 378:

- Max. refrigerant charge based on the LFL of the refrigerant
- Guidance on appropriate risk assessment – conducted by the OEM:
  - In case of leakage, the refrigerant may not over-concentrate close to areas/components which could potentially trigger sparks (*contactors/switches, relays,* non-ATEX-proof components, etc.). They simulated a refrigerant leak and measured the concentration of refrigerant in possible ignition areas.
  - In case of over-concentration, they checked if the energy/heat generated by the component (normed) is sufficient to bring the mixture air/refrigerant to flame (comparison with the MIE of the refrigerant).

Why?: No safety risk in public area (validated by Bureau Veritas / LCIE / INERIS)

THANK YOU!

Questions?

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