

Hall 7A

**CHILLVENTA**

**Chillventa Specialist Forums 2022**  
**Chillventa Fachforen 2022**

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Koura #129



# Koura's Next Generation Refrigerants Enabling the Industry to Meet Future HFC Phasedowns

**Sarah Kim**

13.10.2022



Koura

# Who we are

## Our Legacy

1926



We are the largest producer of fluorspar in the world

2001

INEOS

Our "Mine to Market" structure ensures a secure supply chain for our customers across sectors

2010

Mexichem.  
FLUOR

Koura is a global leader in the development, manufacture and supply of fluoroproducts

2019

Koura

Proud member of the **Orbia Community**



# Klea<sup>®</sup> 473A



# Klea 473A

RAC Cooling Industry Awards 2022 winner for “Refrigeration Innovation of the year: Technology”

Solution for ultra low temperature refrigeration

- Non-flammable
- 85% GWP reduction vs R-23 (14,800)

Available in 2.5 kg (4 L), 10 kg (13.4 L), and 40 kg (60 L)

Applications:



High value cold chain



Pharmaceutical



Test chambers



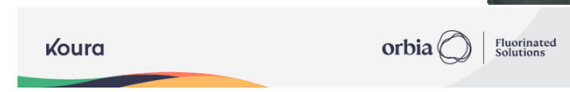
Medical



## Klea 473A

# Benefits

- Other proposed options: Highly flammable or high glide (15 – 20 °C)
- Retrofit existing R-23/508B systems
  - Low glide (4°C)
  - Caution needed when charging refrigerant
    - Guidelines and technical support available
- Improved energy efficiency and capacity vs R-23
- Effective to at least -75 °C
- Charge size reduction up to 15%
- Security of supply

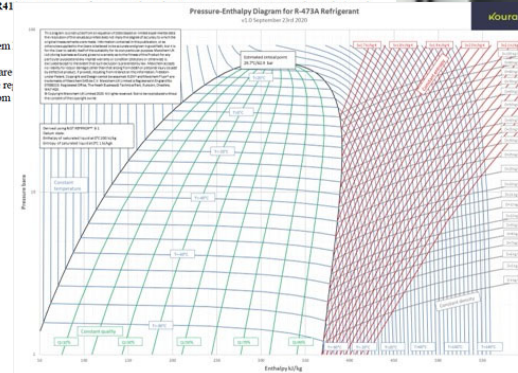


Subject: Charging Klea R-473A Systems from High Pressure Cylinders

Due to the pressure requirement of transport, Klea R-473A is shipped in high pressure steel cylinders and due to the high vapor density inside of these cylinders, alternative charging techniques are necessary to extract in-spec material into operating systems. If a user simply leaves the cylinder upright at ambient temperatures below 30°C (86°F), fractionation will occur and first charging draws into a system will be enriched with CO2 and R1132a which causes higher than normal discharge temperatures, while later charging draws will result in R125 enrichment which will negatively impact the ability to reach the -70°C temperature level desired by most customers. With this in mind, we have developed alternative methods to meet customer expectations.

It is important to note the saturation pressure of Klea R-473A at room temperature 25°C (56 barg, 812 psig), exceeds the safe operating pressure of most R41 operating limits.

1. Preferred method. If the system the cylinder into the system.
  - a. Klea R-473A cylinders are
  - b. Flow through a pressure re or hair dryer to the bottom



## Klea 473A

# Properties

### Composition R-744/1132a/23/125 (60/20/10/10%)

Property	Units	R-23	R-473A
ASHRAE 34 Classification		A1	A1
GWP (AR4)		14800	1830
Relative COP*		100%	98%
Relative Volumetric Capacity*		100%	119.7%
Temperature Glide*	K	0	2.5
Critical Temperature	°C	26.1	29.2
Critical Pressure	kPa	4830	6108
Liquid Density (0°C)	kg/m <sup>3</sup>	1035	895
Bubble Pressure (-60°C)	kPa	312	420
Bubble Pressure (-20°C)	kPa	1395	1790

\*Thermodynamic cycle calculation conditions: Single-stage, isentropic efficiency 65%, volumetric efficiency 100%, zero pressure drop  
Mean evap T = -70°C, Mean cond T = -20°C, Subcool = 5K, SH = 5K

## Klea<sup>®</sup> 473A



**+85%**  
Lower GWP\*\*



**Non**  
flammable



**-75°C**  
effective



**Ease of use**  
Drop in

\*\*Klea 473A v R-23 (14,800 GWP)  
and R-508 (13,396 GWP)

# Klea<sup>®</sup> 456A



# Klea 456A

Low GWP R-134a replacement

- Non-flammable
- 50% GWP reduction vs R-134a

Commercially available

Successfully servicing R-134a vehicles

Applications:



MAC  
(aftermarket)



Cold chain



Chillers



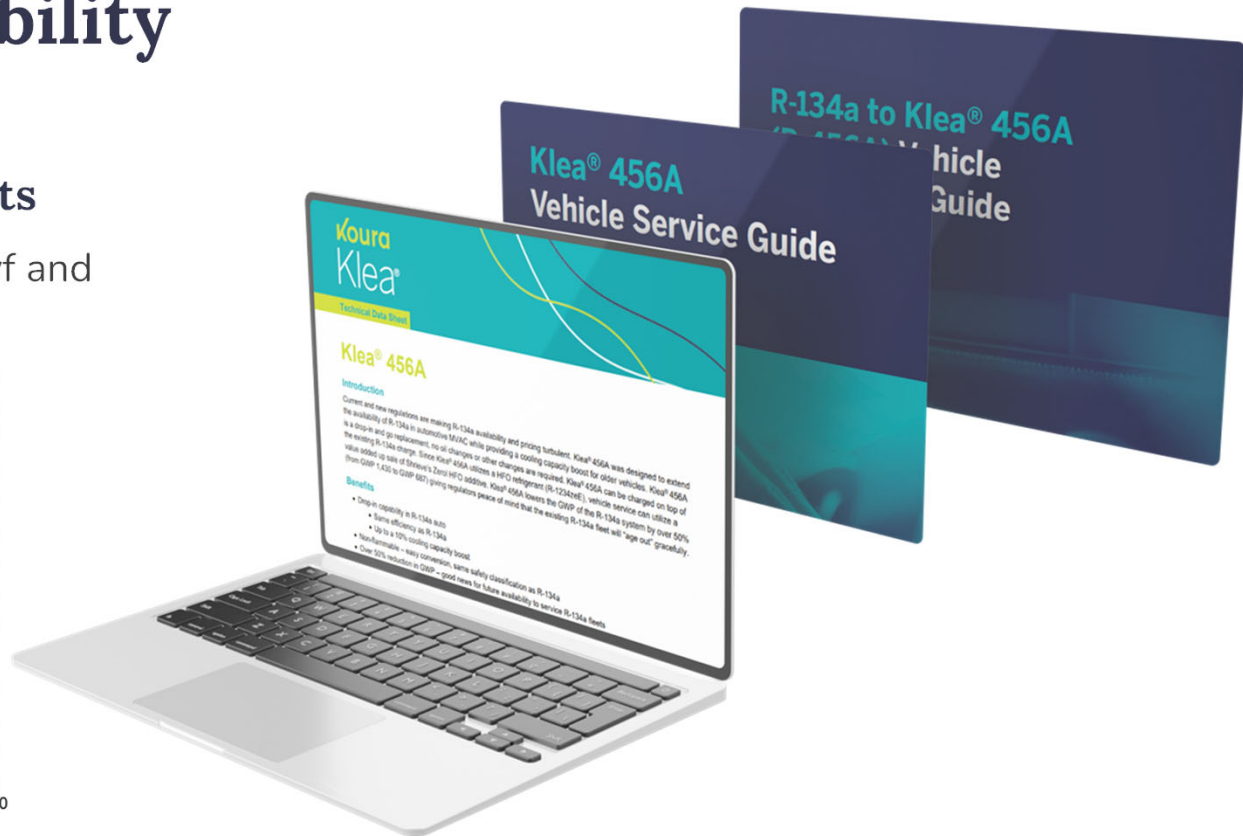
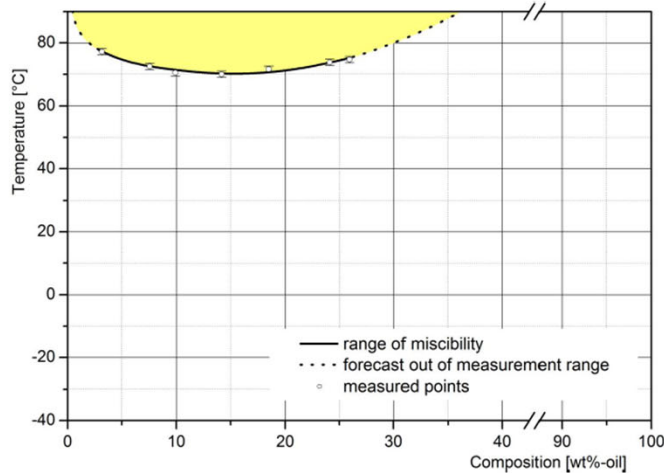
Heating

Klea 456A

# Compatibility & Miscibility

## Compatible with R-134a components

- Showed good miscibility with R-1234yf and R-134a compatible oil



Klea 456A

# Properties

Composition R-32/134a/1234ze(E) (6/45/49%)

Property	Units	R-134a	R-456A
ASHRAE 34 Classification		A1	A1
GWP(AR4)		1430	687
Relative COP*		100%	99.6%
Relative Volumetric Capacity*		100%	102.3%
Typical Temperature Glide*	K	0	3.8
Liquid Density (20°C)	kg/m <sup>3</sup>	1225	1182
Bubble Point	°C	-26.1	-30.8
Saturated Vapor Pressure (20°C)	kPa	572	555

\*Thermodynamic cycle calculation conditions: Single-stage, isentropic efficiency 65%, volumetric efficiency 100%, zero pressure drop  
Mean evap T = 10°C, Mean cond T = 40°C, Subcool = 5K, SH = 5K

## Klea<sup>®</sup> 456A



**50%**  
Lower GWP\*\*



**Non**  
flammable



**>10% cooling**  
capacity boost



**Ease of use**  
Drop in

\*\*Klea 456A v R-134a  
(568 vs. 1430)

**R-468C**  
**468B**

# R-468B & 468C

Applications:



Commercial & Residential AC



Commercial Refrigeration  
(based on charge size)

## Matching properties/performance vs incumbent refrigerants

Property	Units	R410A	R-468C	R407C	R-468B
GWP (AR4)		2088	284	1774	89
ASHRAE classification		A1	A2L	A1	A2L
Composition	%	R-32/125 (50/50)	R-1132a/32/1234yf (6/42/52)	R-32/125/134a (23/25/52)	R-1132a/32/1234yf (6/13/81)
Relative COP*	%	100	101.8 (vs 410A)	100	98.5 (vs 407C)
Relative Capacity*	%	100	82.7 (vs 410A)	100	88.6 (vs 407C)
Temperature Glide*	K	0.1	9	5	10

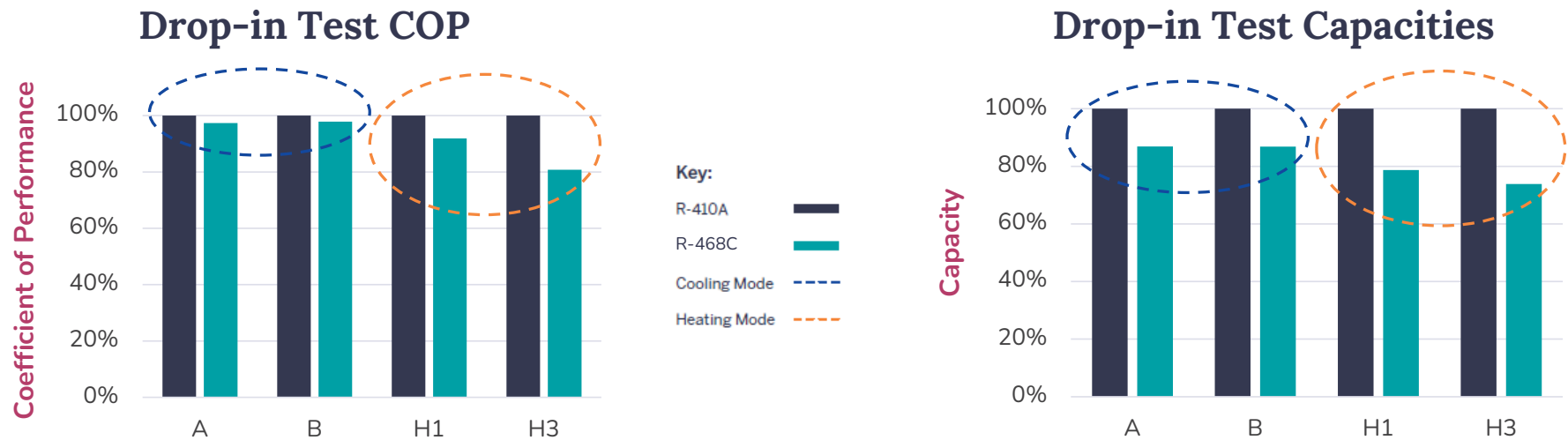
\*Thermodynamic cycle calculation conditions: Single-stage, isentropic efficiency 65%, volumetric efficiency 100%, zero pressure drop  
Mean evap T = 10°C, Mean cond T = 40°C, Subcool = 5K, SH = 5K





## R-468C

# Drop in Performance



- Lowest GWP amongst proposed R-410A replacement options
- 10% higher refrigerant charge with comparable performance vs R-410A
- TXV set to match R-410A's SH in cooling mode, which may have penalized heating performance

# Koura's Next Generation Refrigerant Development

- Actively developing thermal solutions with sustainability in mind
- From research to product launch to meet customer's need in compliance with regulatory transitions



**Origin**  
134a



**2022**  
**Launching**  
456A | 473A



**2025**  
**New products**  
**available**  
for Electric Vehicle,  
Heat pumps, HVAC



Advancing the  
industry to a  
**sustainable future**

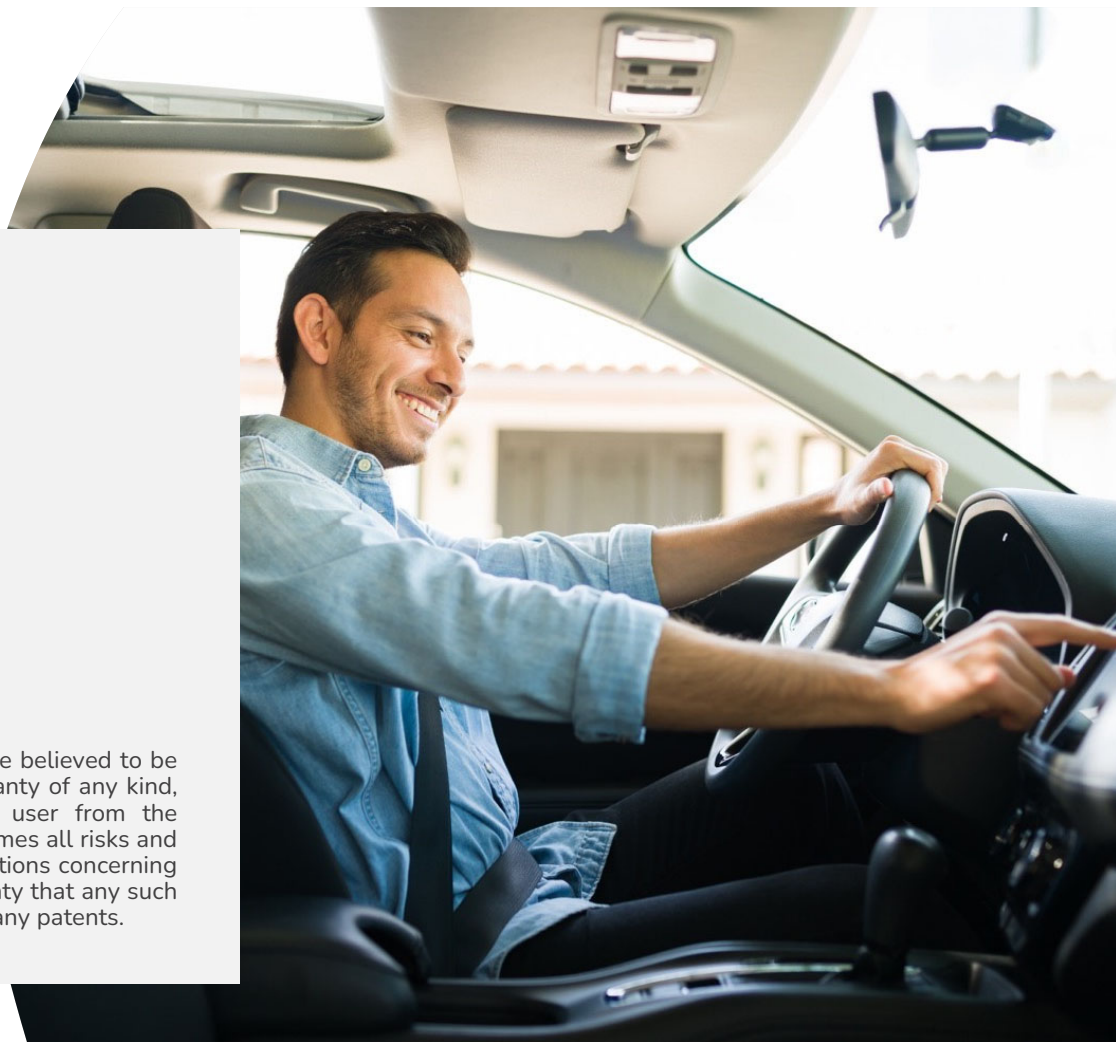
Through our innovation we are leading  
the way to a **sustainable future**

# Thank you

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Visit us at Booth 9-404

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# Koura

Koura is an Orbia business and part of the Fluorinated Solutions group.



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