cubigel®
compressors

HUAYI Statement:

Low GWP alternative refrigerants to R404A

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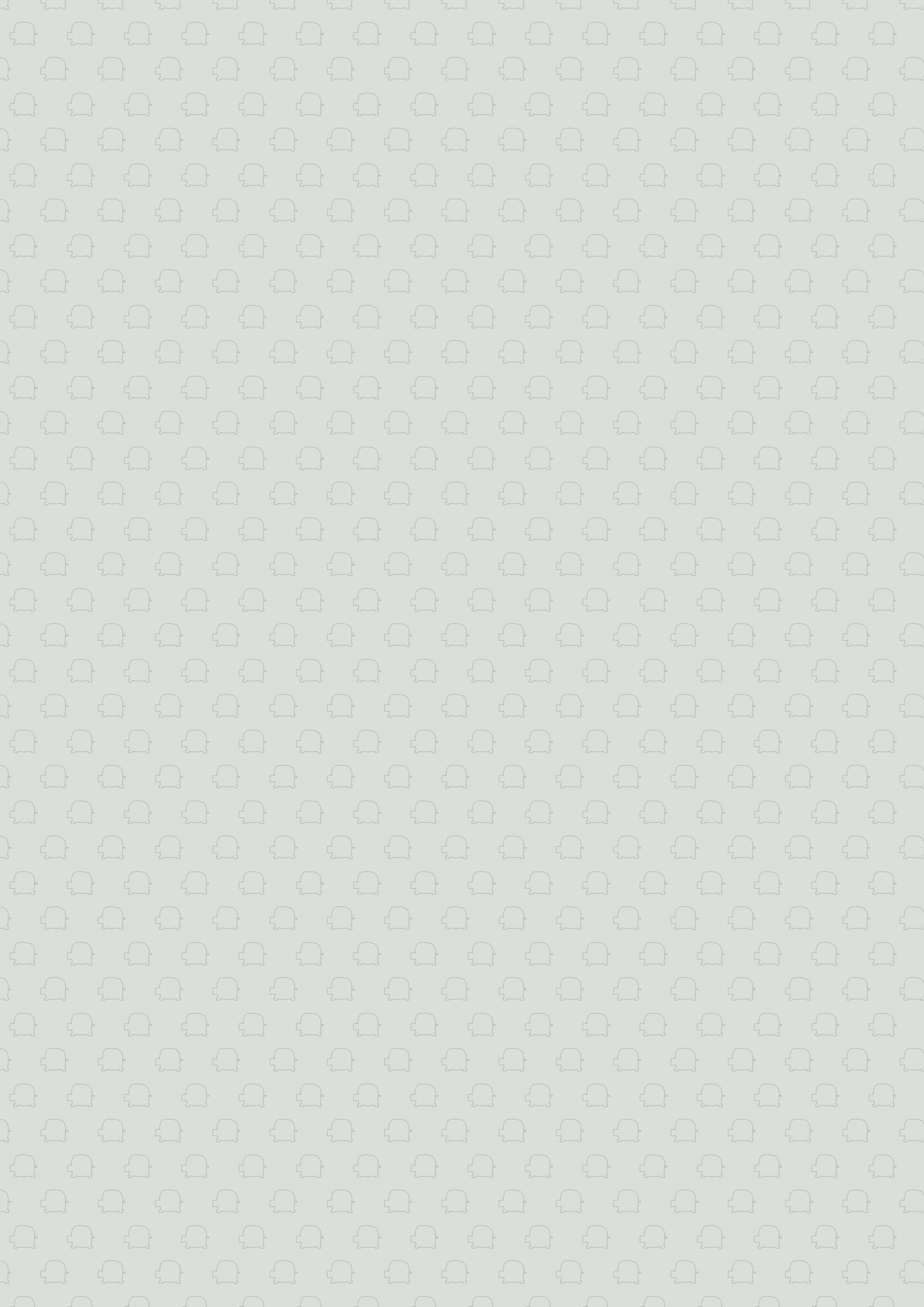


The Company:
HUAYI COMPRESSOR BARCELONA (HCB)

The HCB of today started out with Spanish and French capital in 1962, under the original name of “Unidad Hermetica”. Its goal was to meet the country’s needs for hermetic compressors and refrigeration equipment. Today, the company is corporate parent to the Cubigel Compressors® brand, and employs over 400 people at its 42,000 m2 plant in Barcelona, with a production capacity for 2.5 million compressors a year. While Europe is the main market, the company has a global presence through a network of 70 highly professional distributors in 65 countries. HCB markets compressors for commercial refrigeration under the well-known Cubigel Compressors® brand.

HCB, under the umbrella group Huayi Compressor Co. Ltd., has an annual turnover exceeding 39 million units in sales. Huayi Compressor Co. enjoys the solid backing of the Chinese giant, Sichuan Changhong Electric. Since its founding in 1990, Huayi Compressor Co. has achieved world leadership in the manufacture of hermetic compressors for refrigeration. Its broad portfolio of equipment covers a wide variety of applications in domestic appliances, such as refrigerators, water dispensers, dehumidifiers, etc.

Introduction

From 2015 the F-Gas Regulation (517/2014) in Europe and the EPA (Environmental Protection Agency) in United States are limiting the use of high GWP (Greenhouse Warming Potential) refrigerants in the next years, as R404A, in refrigeration and air conditioning industry.

The fluorinated gases were artificially created for industrial purposes, these represent approximately 15% of greenhouse gas emissions in industrialized countries. Compounds such as sulphur hexafluoride (SF6) or perfluorocarbons (PFCs) used in various industrial processes are especially damaging because they can trap heat in the atmosphere up to 22,000 times more effectively than CO2 and pollute for thousands of years.

The industry has been using significant quantities of fluorinated greenhouse gases for refrigerators, air conditioning, the production of aerosols and fire extinguishers, etc. In the European Union (27) alone, it is estimated the region exceeded 850 million tons of CO2-eq emissions in 2010.The best known of these gases, chlorofluorocarbons (CFCs), led to a global debate over the final two decades of the previous century owing to their destructive properties regarding the ozone layer. Their gradual withdrawal from the market since the signing of the Montreal Protocol of 1987 and replacement by hydrofluorocarbons (HFCs), has only provided a solution to the ozone problem, but not for climate change.

Regulation 842/2006 of the European Union initiated a protracted legislative voyage towards greater oversight of fluorinated greenhouse gases. That text included a package of measures designed to contain emissions, as well as requirements to force gas recovery at the end of the useful life of equipment, to label equipment, and various prohibitions and restrictions on the market. The failure of the results led just eight years later to the issue of the new Regulation, 517/2014, currently in force.

The highlight of this latest European regulation is the progressive reduction scheme (phase down), which provides for reducing the amount of HFC that producers and importers may market in the Union. The goal takes as a baseline the volume traded in 2015, reducing it to 21% by 2030 under Regulation 517/2014, while the European Commission can recalculate the schedule every three years starting in 2017. The legislators also established a schedule of restrictions on the use of HFCs in new equipment, as well as expanding the scope of containment measures and new labelling requirements. Overall, it is estimated that a reduction in the emission of these greenhouse gases of about 70-80% in the EU 27 will result.

Apart from hydrocarbons, where Huayi Compressor Barcelona have a complete range of compressors, the refrigerant industry is offering many alternatives to replace the R404A, such as R407F (GWP = 1823), R449A (GWP = 1397) or R452A (GWP = 2141). Huayi Compressor Barcelona is following the refrigerant trends and is performing several activities with these new refrigerants trying to find the most suitable replacement for the R404A with low GWP that can comply with the environmental regulations.

F-Gas Regulation (New Equipment)

From 1st January 2020	HFC with a GWP of 2500 or more will be banned on refrigerators and freezers hermetically sealed for commercial use (**R404A**, **R507**, etc…).
From 1st January 2022	HFC with a GWP of 150 or more will be banned on refrigerators and freezers hermetically sealed for commercial use (**R134a**, **R410A**, **R407C**, etc…).

EPA (Environmental Protection Agency)

From 1st January 2017	HFC in Supermarket Systems will be banned (R134a excluded).
From 1st January 2018	HFC in remote condensing units will be banned (R134a excluded).
From 1st January 2019	HFC in Vending Machines and stand-alone units for medium temperature below 2200 btu/h.
From 1st January 2020	HFC in stand-alone units for medium temperature equal or greater than 2200 btu/h and stand-alone units of low temperature.

Alternatives to R404A: R449A and R452A

Huayi Compressor Barcelona has a complete product range of Hydrocarbon compressors that meet with the New F-Gas Regulation in Europe. Due to the charge limitation for flammable refrigerants (150 g.), there are some barriers for the use of these refrigerants in some types of applications.

Lastly, Huayi Compressor Barcelona, following the refrigeration market trends, has tested the R449A and R452A, refrigerants that could be mid-term alternatives for R404A with low GWP in refrigeration systems and further for retrofitting of existing refrigeration systems (see characteristics in Table 1).

Characteristic	R404A	R449A*	R452A*
Group Name	HFC	HFO	HFO
GWP	3260	1397	2140
ODP	0	0	0
Inherent COP	Medium	Medium	Medium
T (1 bar) ºC	-46,5	-46	-47
Critical Point	72ºC	81,5ºC	74,9ºC
	37,31 Bar	44,70 Bar	40,02 Bar
Flammable (*)	No	No	No
Oils	POE	POE	POE

Table 1

These new refrigerants are in inside safety class A1 (not toxic and not flammable) and have higher temperature glide comparing to R404A (R449A = 4K and R452A = 3K).

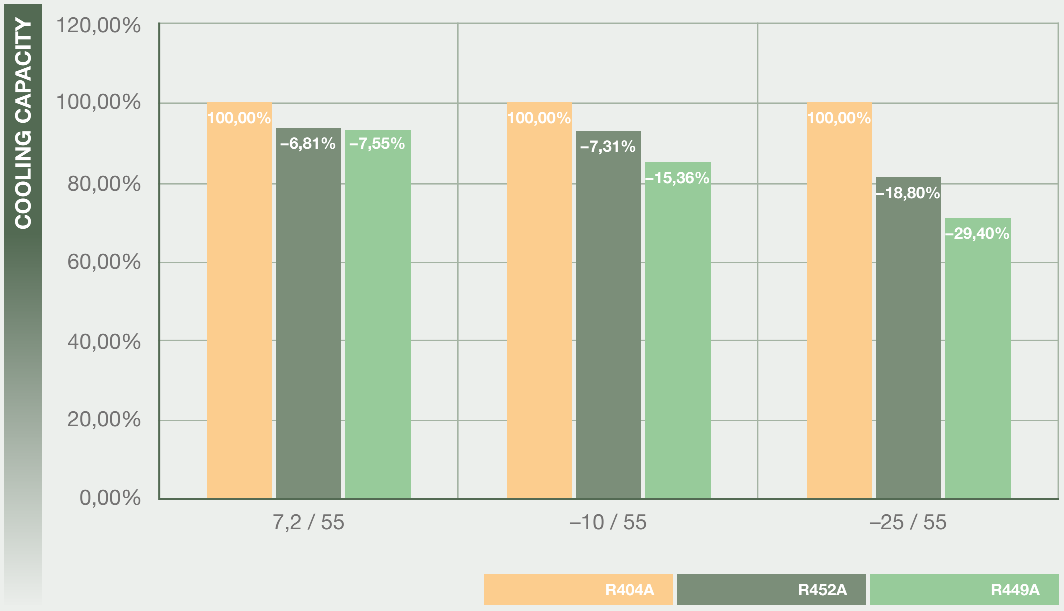
At this moment there are no alternatives for the R404A in the market that can meet the F-Gas Regulation after 2022; these new refrigerant blends are only a transitional solution

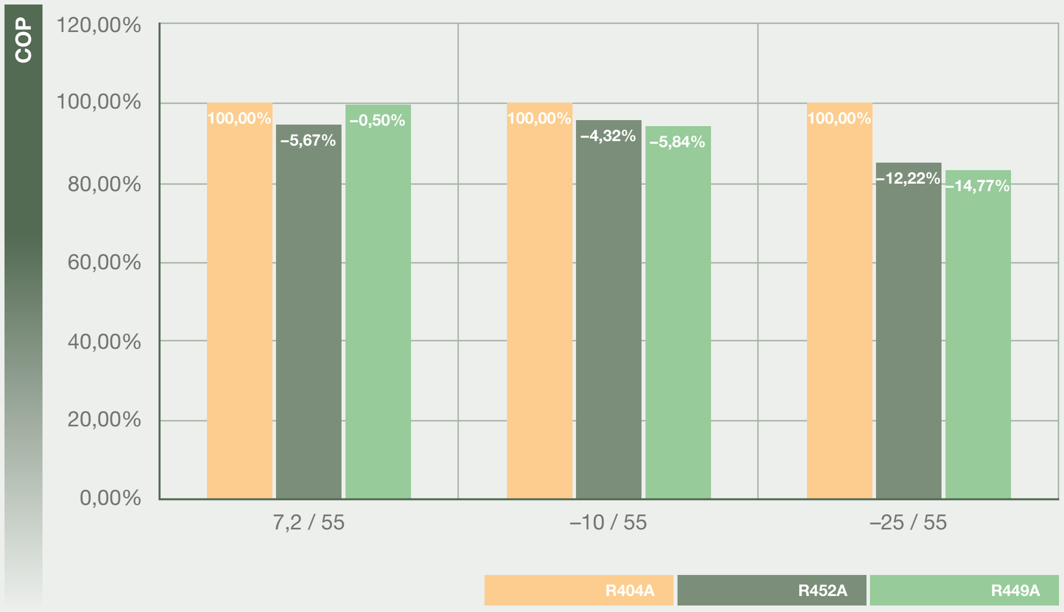
Test Results

The following table (see Table 2) shows the results obtained in Huayi Compressor Barcelona laboratories with these two alternatives for R404A.

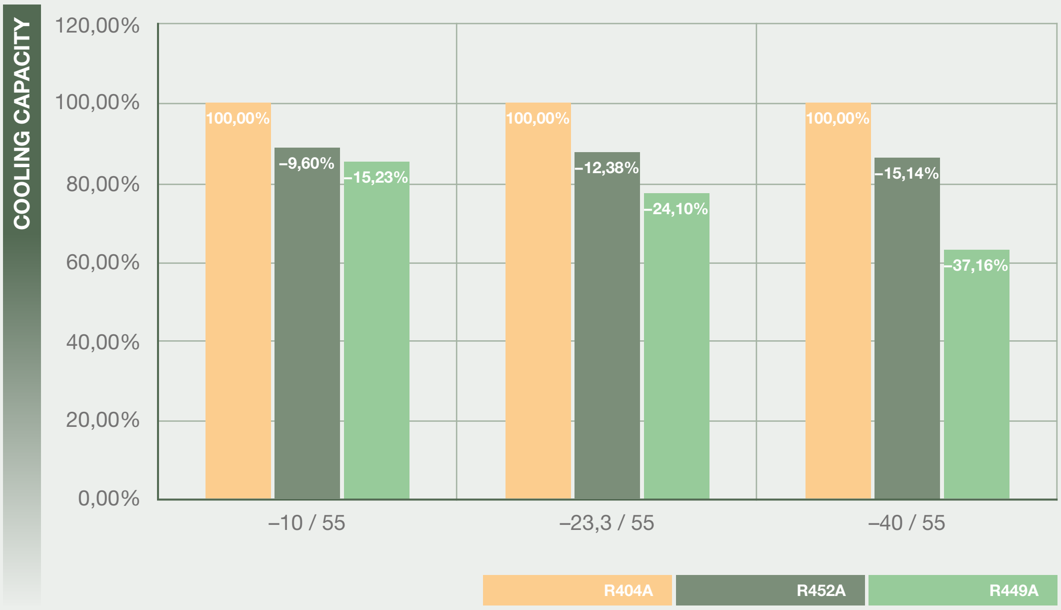
The tests were performed with an LBP and HBP compressor charged with R404A and the low GWP alternatives.

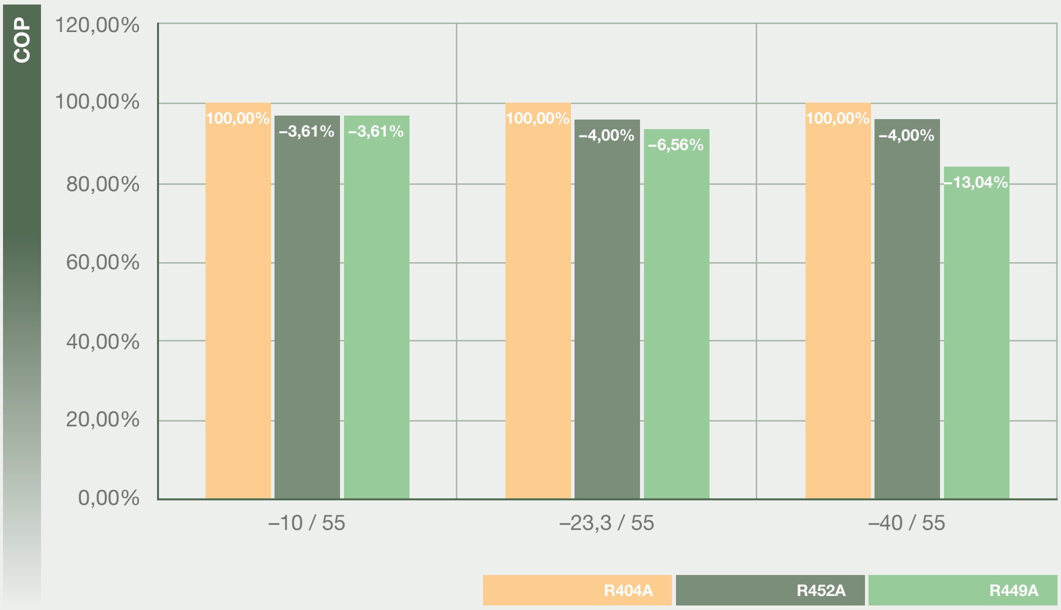
HMBP Compressor





LBP Compressor





Conclusions

R449A

Huayi Compressor Barcelona laboratories cannot consider the **R449A** a one to one drop-in solution for the R404A compressors due to the high discharge temperatures found during the test, this situation can cause motor overheating and overload protector tripping. At this moment the R449A is listed in the EPA SNAP only for low back pressure applications and is pending to be included for high back pressure applications.

The use of this refrigerant means a redesign of the application (increasing the fan air flow, increasing the condenser size, etc…) in order to reduce the discharge temperatures and obtain equivalent results as using R404A. Usage of R449A at MBP applications must be validated case by case and the working envelope of the compressor will be restricted.

R452A

The **R452A** presents a performance more similar to R404A than R449A and could be considered as a drop-in solution. According to the discharges temperatures, it seems that the use of this refrigerant in Cubigel Compressors ® must be validated case by case and the working envelope of the compressor using R452A will be restricted.

The use of the compressors outside the envelope defined by Huayi Compressor Barcelona can cause a reduction in the life and reliability of the compressor.

Huayi Compressor Barcelona Position

Huayi Compressor Barcelona is committed to natural refrigerants (R290 and R600a) as a long-term solution for light commercial refrigeration. HCs are an environmentally friendly, non-toxic, non-ozone-depleting replacement for chlorofluorocarbons CFCs), hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs). From a chemical point of view, hydrocarbon is the simplest organic compound, consisting entirely of hydrogen and carbon. Hydrocarbons are safe, with proper handling.

Since hydrocarbons are flammable (the next draft of the European legislation will consider an increase of the refrigerant charge), some basic safety rules need to be respected by manufacturers, installers and users, which may differ slightly, depending on the application.

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