



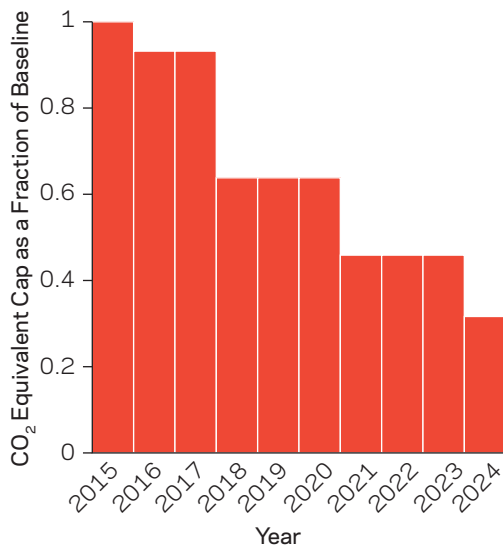
Opteon™ XP40 (R-449A) Refrigerant

The Future Is Clear, The Future Is Opteon™

Product Comparison

What is the problem with R-404A (and R-507A)?

Figure 1. (EU) 517/2014 Phasedown



Regulation (EU) 517/2014, commonly known as the F-Gas II Regulation, came into force on 1st January 2015 across the whole of the European Union. This regulation sets out a number of restrictions and bans on the use of F-Gas in new equipment, service requirements and imposes a phasedown limiting the quantity of carbon dioxide (CO₂) equivalents of F-Gas that can be placed on the market with the introduction of supply quotas. The phasedown is likely to have the most significant impact as over a 15 year period it reduces the quantity of CO₂ equivalents placed on the market to just 21% of the 2009-2012 average value (Figure 1). In addition to the phasedown, effective 1st January 2020 the regulation places a ban on the use of products with a global warming potential (GWP) >2500 in new equipment and even for service of systems with a refrigerant charge above 40 tonnes of CO₂ equivalents

(>10.2 kg of R-404A). This will effectively ban the use of virgin R-404A (GWP = 3922) for commercial applications and therefore users of R 404A will have to find an acceptable alternative or rely on the uncertainty of the availability of recycled/reclaimed R-404A.

Can I wait until 2020 to stop using R-404A (and R-507A)?

If you just consider whether it is legal to continue to use R-404A until 2020 then the answer is yes BUT as is often the case it's not as simple as that. As can be seen in Figure 1, by 2018 there is a 37% drop in the available CO₂ equivalents and this will put severe pressure on the availability of high GWP products such as R-404A. It seems highly probable that, unless high GWP products are replaced by those with much lower GWPs, the quota will be exhausted. In reality, this is unlikely to happen, as low GWP alternatives are already being promoted and F-gas quota pressures are likely to make high GWP products less commercially attractive, driving the required change to lower GWP options. This will in effect remove R-404A from the marketplace well before the 2020 deadline. So although legally R-404A can be used until 2020, every user of R-404A should be planning to replace it with a lower GWP alternative by 2018.

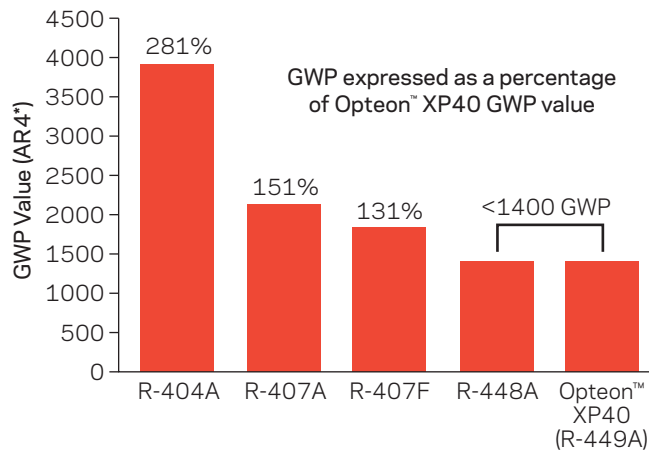


A medium temperature (MT) refrigeration rack from a R-404A/CO₂ hybrid system in a supermarket in Milan was converted to Opteon™ XP40 (R-449A).

What can I use to replace R-404A (and R-507A)?

A number of products have been proposed to replace R-404A (and R-507A) with GWPs >50% lower than R-404A and some of these products will be suitable as an interim option, but the severity of the phasedown dictates that the products with the lowest GWPs are likely to be the best choice for the long term. Figure 2 shows the GWP of R-404A and the options available compared to the GWP of Opteon™ XP40 (R-449A). Even though the GWP of R-407A and R-407F are only >30% higher than Opteon™ XP40, this will become critical as the phasedown progresses and so the only real candidates are the HFO-based blends such as Opteon™ XP40 (R-449A).

Figure 2. Potential R-404A Alternative



*Inter-governmental Panel for Climate Change (IPCC) Assessment Report 4 (AR4)

Why should I choose Opteon™ XP40?

Opteon™ XP40 (R-449A) was commercially launched in October 2014 by Chemours (formerly DuPont) and quickly became the market leading low GWP R-404A replacement. Both before and since the product launch many supermarket chains in Germany, Spain, Italy, Belgium, Austria, UK, France, Greece and the Netherlands have installed Opteon™ XP40 in both low temperature and medium temperature applications. The results from trials were consistently good with energy savings recorded ranging from 2-3% in the low temperature systems to 8-11% in the medium temperature systems. As a result of the excellent results the major retailer Ahold of the Netherlands launched a roll-out of Opteon™ XP40 across their R-507A estate with more than 200 stores involved in the Opteon™ XP40 retrofit program.

In addition all major compressor manufacturers are qualifying Opteon™ XP40 and early in 2015 both Bitzer and Emerson added Opteon™ XP40 to their compressor selection software. Other manufacturers such as Dorin and Frascold have also completed qualification and have compressors available for use with Opteon™ XP40 and many others are expected to follow in the near future. Component manufacturers such as the heat exchanger manufacturer Guntner also have Opteon™ XP40 included in their selection software and control manufacturers such as Danfoss have made control parameters available allowing use in new equipment design as well.

As a result of the rapid adoption of Opteon™ XP40, a wide distribution network has been established across Europe and Opteon™ XP40 is now firmly established as the market leader.



After extensive practical trials, a Dutch retailer is converting the refrigeration systems in some 200 of its supermarkets to Opteon™ XP40 (R-449A).

How does Opteon™ XP40 compare with the competitive product R-448A?

As can be seen in Tables 1 and 2, the cooling capacity and energy efficiency of both products are very similar, but Table 3 shows Opteon™ XP40 has a more favourable compressor discharge temperature, smaller temperature glide, slightly lower condensing pressure, and a slightly improved pressure ratio compared to R-448A.

Table 1. Low temperature (-35°C mean evaporating temperature) performance comparison

Product	Cooling Capacity ¹			C.O.P. ¹		
	Data Source			Data Source		
	Refprop ²	Bitzer ³	Emerson ⁴	Refprop ²	Bitzer ³	Emerson ⁴
Opteon™ XP40 (R-449A)	100	100	100	100	100	100
R-448A	101	101	98	100	101	98

Table 2. Medium temperature (-15°C mean evaporating temperature) performance comparison

Product	Cooling Capacity ¹			C.O.P. ¹		
	Data Source			Data Source		
	Refprop ²	Bitzer ³	Emerson ⁴	Refprop ²	Bitzer ³	Emerson ⁴
Opteon™ XP40 (R-449A)	100	100	100	100	100	100
R-448A	101	101	100	100	100	100

Table 3. Property comparison at low (35°C) and medium (-15°C) mean evaporator temperature conditions

Product	Low Temperature				Medium Temperature		
	Discharge Temperature ³	Glide ²	Condensing Pressure ²	Pressure Ratio ²	Discharge Temperature ³	Glide ²	Pressure Ratio ²
Opteon™ XP40 (R-449A)	118.0°C	3.6K	16.59bar	12.95	94.0°C	3.9K	5.56
R-448A	119.2°C	4.0K	16.66bar	13.09	94.6°C	4.3K	5.60

¹Expressed as a percentage of the Opteon™ XP40 value.

²NIST Standard Reference Database 23, Beta version 9.11 (April 24, 2014), DLL version number 9.1104 with updated fluid files available on request from www.opteon.com., Liquid subcooling=5K, total suction superheat=20K, useful superheat=5K, condensing temp=40°C, isentropic efficiency 0.7.

³Bitzer Software v6.4.3rev1302, Compressor model 6HE-28Y, Liquid subcooling=0K, total suction superheat=20K, useful superheat=5K, condensing temp=40°C.

⁴Emerson Software version 1.0.46(2), Database Version: April 10, 2015, compressor model ZS19KAE-TF5, Liquid subcooling=5K, total suction superheat=20K, useful superheat=5K, condensing temp=40°C.

Opteon™ XP40 - The Market Leader

Taking into account the excellent performance, large amount of practical experience, the widespread availability and the superior properties, it's no wonder Opteon™ XP40 has become the leading nonflammable low GWP alternative to R-404A.

For More Information

To receive further information regarding Opteon™ XP40 as an alternative to R-404A and R-507A, or for more information about other refrigerants from Chemours, call:
 Europe: +41 22 719 1500
 North America: (800) 235-7882
 Or visit us at Opteon.com

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