Promouvoir une attitude responsable

COMMERCIAL REFRIGERATION

APPLICATION : FOODSERVICE AND PROFESSIONAL KITCHEN

POSSIBLE SOLUTIONS

DESIGN OF THE SYSTEM
(ACCORDING TO EN 378 GUIDANCE)

		R-454C / R-455A	R-1234yf	R-290
Class III In technical room or open range *(Full cooling piping)*	Medium temperature			
	Low temperature			
Class II Compressor in technical room or open range *(indoor evaporator)*	Medium temperature	Single-unit condensing unit	Single-unit condensing unit	
	Low temperature	Single-unit condensing unit		
Class I Indoor *(Full cooling piping)*	Medium temperature	Plugin unit	Plugin unit	Plugin unit
	Low temperature	Plugin unit		Plugin unit

		R-744 (CO_2)
Class III In technical room or open range *(Full cooling piping)*	Medium temperature	
	Low temperature	
Class II Compressor in technical room or open range *(indoor evaporator)*	Medium temperature	Small CO_2 skid
	Low temperature	Small CO_2 skid
Class I Indoor *(Full cooling piping)*	Medium temperature	Plugin unit
	Low temperature	Plugin unit

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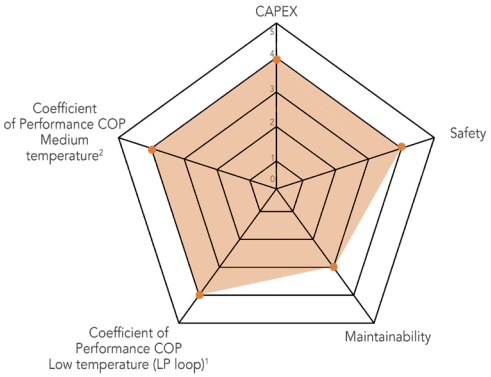
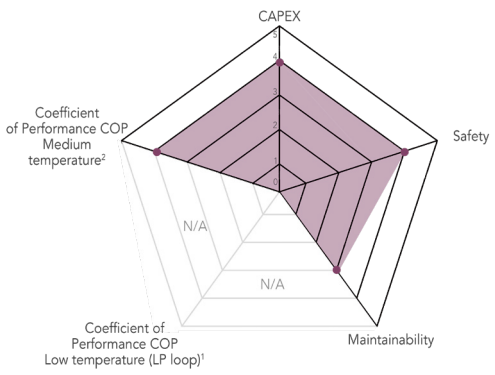
	R-454C / R-455A	R-1234yf	R-290	R-744 (CO_2)
Refrigerant type (HFC/HFO/HC/Inorganic)	HFC/HFO	HFO	HC	Inorganic
GWP (according to F-Gas UE/2024/573)	146	0.5	0.02	1
Safety classification Lower Flammability Level LFL	R-454C: A2L - 0.293 kg/m³ R-455A: A2L - 0.431 kg/m³	A2L - 0.289 kg/m³	A3 - 0.038 kg/m³	A1
Classification (according to Pressure Equipment Directive PED)	1	1	1	2
F-gas quotas	Applicable	Non-applicable	Non-applicable	Non-applicable
Specific regulatory constraints	++	++	+++	++
Maintenance complexity (training, safety, tooling, Personal Protection Equipment PPE ..)	Training is mandatory Specific tooling PPE	Training is mandatory Specific tooling PPE	Training is mandatory Specific tooling PPE	Training is mandatory Specific tooling PPE
Coefficient of Performance COP (theoritical) - Medium temperature[1]	3.8	3.8	3.9	2.9
Coefficient of Performance COP (theoritical) - Low temperature[2]	Single stage : 2.2	Not applicable	Single stage : 2.2	R-455A / R-744 Cascade : 2.3 Transcritical CO_2 : 1.8
Technology readiness (prototyping, field test, availablity)	Available	Available	Available	Available

[1] HFC/HFO / HFO / HC : Tk = 45°C - To = -10°C - SC = 5K - SR = 10K - Isentropic efficiency = 100%
CO_2 : gas-cooler inlet pressure = 95barA - Gas-cooler outlet temperature = 37°C - To = -10°C - SC = 5K - Isentropic efficiency = 100% - Transcritical CO_2 with ejector
[2] HFC/HFO / HFO / HC : Tk = 45°C - To = -30°C - SC = 5K - SR = 5K - Isentropic efficiency = 100%
CO_2 cascade layout, with R-455A HP loop : Tk = 45°C - To = -5°C - SC et SR = 5K - Isentropic efficiency = 100% / LP loop with R-744 (CO2) : Tk = 0°C - To = -30°C - SC and SR = 5K - Isentropic efficiency = 100%
Transcritical CO_2 with ejector : Gas-cooler inlet pressure = 95barA - Gas-cooler outlet temperature = 37°C - To = -30°C - SC = 5K - Isentropic efficiency = 100%

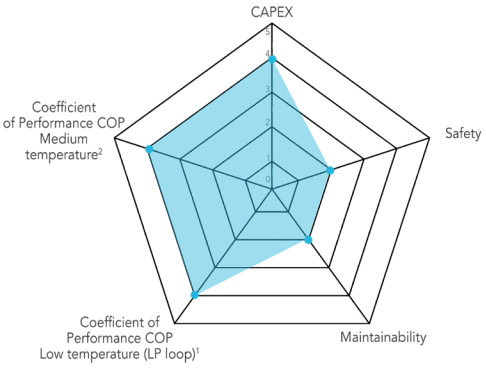
R-454C / R-455A



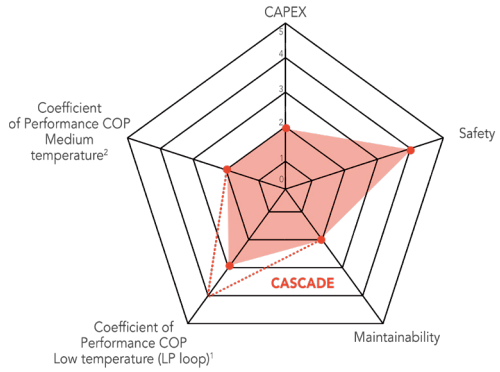
R-1234yf



R-290



R-744 (CO_2)



CONCLUSION

Class I : R-290 is the main solution for plugin units, with about 80% of newly-installed units
Class II : A2L is the preferred solution, due to higer level of installation complexity of CO_2 in this range of cooling capacity

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