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HVAC

AIR-TO-AIR SOLUTIONS - TERTIARY SECTOR HEATING AND COOLING

POSSIBLE SOLUTIONS

DESIGN OF THE SYSTEM

(ACCORDING TO EN 378 GUIDANCE)

Class III

In technical room or open range (Full cooling piping)

Class II

Compressor in technical room or open range
(Indoor evaporator)

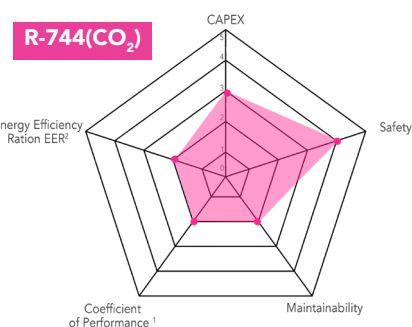
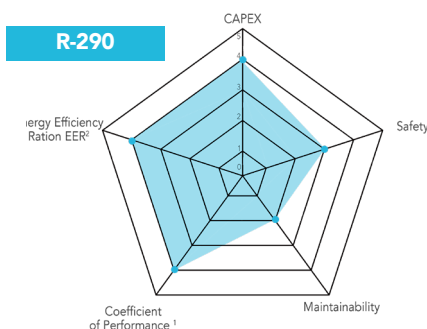
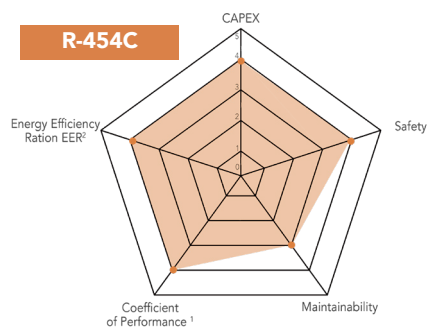
	R-454C	R-290	R-744 (CO ₂)
		Rooftop	
	DRV	• Air-to-water heat pump / Aircon • DRV	DRV
Refrigerant type (HFC/HFO/HC/Inorganic)	HFC/HFO	HC	Inorganic
GWP (according to F-Gas UE/2024/573)	146	0.02	1
Safety classification Lower Flammability Level LFL	A2L - 0.293 kg/m ³	A3 - 0.038 kg/m ³	A1
Classification (according to Pressure Equipment Directive PED)	1	1	2
F-gas quotas	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
Coefficient of Performance COP (theoretical) ¹	7.0	7.1	6.2
Energy Efficiency Ratio EER (theoretical) ²	5.1	5.2	4.2
Technology readiness (prototyping, field test, availability)	Under development	Under development	Under development

¹ Tk = 40°C - To = 2°C - SC = 5K - SR = 3K - Isentropic efficiency = 100%

CO₂ : gas-cooler inlet pressure = 79barA - Gas-cooler outlet temperature = 32°C - To = 2°C - SC = 5K - Isentropic efficiency = 100% - Transcritical CO₂ with ejector

² Tk = 45°C - To = 2°C - SC = 5K - SR = 3K - Isentropic efficiency = 100%

CO₂ : gas-cooler inlet pressure = 91barA - Gas-cooler outlet temperature = 37°C - To = 2°C - SC = 5K - Isentropic efficiency = 100% - Transcritical CO₂ with ejector



CONCLUSION

Class II and III : Flammability is the main blocking point to a wider spread of low-GWP refrigerants. R-410A and R-32 are the most commonly-used in wall-mounted monobloc units dedicated to office air treatment. R-290 rooftops do also exist, though only marginally. R-744 solutions are often showcased at trade fairs, although they are hardly available from a commercial perspective; it can be assumed, that manufacturers are developing them. There are ongoing field tests with R-744 and R-290 DRV. Would R-744 struggle to develop, R-454C units could eventually find their way in this segment.