



Promouvoir  
une attitude  
responsable

# 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*)

##### Refrigerant type (HFC/HFO/HC/Inorganic)

##### GWP (according to F-Gas UE/2024/573)

##### Safety classification

##### Lower Flammability Level LFL

##### Classification (according to Pressure Equipment Directive PED)

##### F-gas quotas

##### Specific regulatory constraints

##### Maintenance complexity (training, safety, tooling, Personal Protection Equipment PPE ..)

##### Coefficient of Performance COP (theoretical)<sup>1</sup>

##### Energy Efficiency Ratio EER (theoretical)<sup>2</sup>

##### Technology readiness (prototyping, field test, availability)

### R-454C

### R-290

### R-744 (CO<sub>2</sub>)

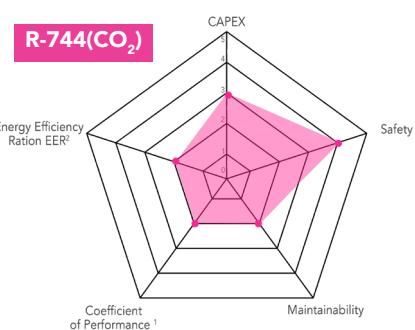
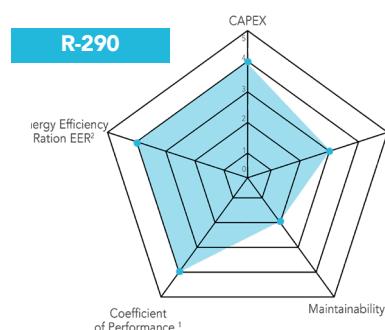
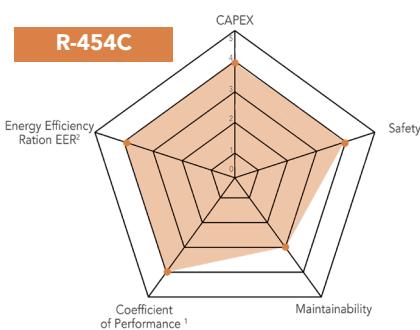
DRV	Rooftop	DRV
• Air-to-water heat pump / Aircon • DRV		
HFC/HFO	HC	Inorganic
146	0.02	1
A2L - 0.293 kg/m <sup>3</sup>	A3 - 0.038 kg/m <sup>3</sup>	A1
1	1	2
Applicable	Non-applicable	Non-applicable
++	+++	++
Training is mandatory Specific tooling PPE	Training is mandatory Specific tooling PPE	Training is mandatory Specific tooling PPE
7.0	7.1	6.2
5.1	5.2	4.2
Under development	Under development	Under development

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

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

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

CO<sub>2</sub> : gas-cooler inlet pressure = 91barA - Gas-cooler outlet temperature = 37°C - To = 2°C - SC = 5K - Isentropic efficiency = 100% - Transcritical CO<sub>2</sub> 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.