Promouvoir une attitude responsable

HVAC

AIR-TO-WATER AND WATER-TO-WATER SOLUTIONS - STATIONARY RESIDENTIAL HEATING AND COOLING

POSSIBLE SOLUTIONS

DESIGN OF THE SYSTEM
(ACCORDING TO EN 378 GUIDANCE)

	R-454C	R-290	R-744 (CO_2)
Class III In technical room or open range *(Full cooling piping)*	Monobloc air-to-water heat pump	Monobloc air-to-water heat pump	
Class II Compressor in technical room or open range *(indoor evaporator)*	Split air-to-water heat pump	Split air-to-water heat pump	
Class I Indoor *(Full cooling piping)*	Monobloc heat pump and household thermodynamic water-heater	Monobloc heat pump and household thermodynamic water-heater	Household thermodynamic water-heater

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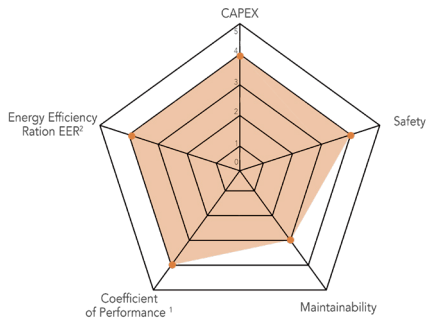
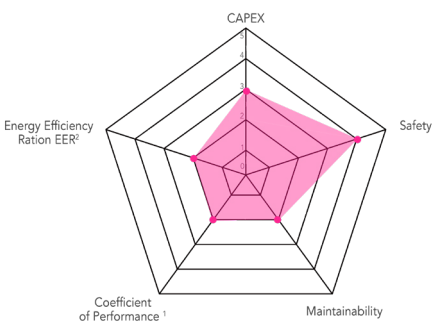
	R-454C	R-290	R-744 (CO_2)
Refrigerant type (HFC/HFO/HC/Inorganic)	HFC/HFO	HC	Inorganic
GWP (according to F-Gas UE/2024/573)	146	0.02	1
Safety classification Lower Flammability Level LFL	A2L - 0.293 kg/m^3	A3 - 0.038 kg/m^3	A1
Classification (according to Pressure Equipment Directive PED)	1	1	2
F-gas 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 (theoritical) [1]	7.8	7.9	6.8
Energy Efficiency Ratio EER (theoritical) [2]	5.7	5.7	4.8
Technology readiness (prototyping, field test, availablity)	• Class 1 and 3 : available • Class 2 : under development	• Class 1 and 3 : available • Class 2 : under development	Available

[1] *Air-to-Water systems HFC/HFO : Tk = 36°C - To = 2°C - SC = 5K - SR = 3K - Isentropic efficiency = 100%*
CO_2 : gas-cooler inlet pressure = 75barA - Gas-cooler outlet temperature = 30°C - To = 2°C - SC = 5K - Isentropic efficiency = 100% - Transcritical CO_2 with ejector
[2] *Air-to-Water systems HFC/HFO : Tk = 45°C - To = 5°C - SC = 5K - SR = 3K - Isentropic efficiency = 100%*
CO_2 : gas-cooler inlet pressure = 86barA - Gas-cooler outlet temperature = 35°C - To = 5°C - SC = 5K - Isentropic efficiency = 100% - Transcritical CO_2 with ejector

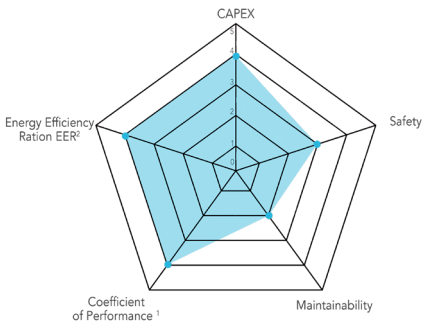
R-454C



R-744 (CO_2)



R-290



CONCLUSION

Class I : Most of the indoor units are thermodynamic water-heaters, which development is today mainly focused on R-290 technology. Some manufacturers have also channeled R&D efforts to R-454C and even R-744, though a minority. R-290 and R-454C water-to-water heat pumps are also available, but due to higher flammability levels, specific ventilation may be required in accordance with EN 378 and IEC 60335-2-40 regulations.

Class II and III : The use of flammable refrigerants has led to two technical solutions : «outdoor monobloc» type of products (EN378 Class III), already available on the market and «split block» type of products (EN378 Class II), which are under development to replace current solutions using R-32.

Données recueillies par
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