

Refrigerant Transition: HFC to HFO Replacement (R404A -> R448A / R449A / R452A)

cBallast · 2026 edition · Transition guide

Why the transition is happening

EU F-Gas Regulation 517/2014 (revised 2024) and UNEP Kigali Amendment progressively withdraw high-GWP HFC refrigerants. Main targets: R404A (GWP 3922), R507A (GWP 3985). HFO-based replacements reduce GWP 60-80% while preserving volumetric capacity and operating pressures close enough for drop-in retrofit on many systems.

R404A replacement blends

Blend	Composition	GWP AR5	Glide K	Marketed as
R404A	R125 44 / R143a 52 / R134a 4	3922	~0.7	-
R448A	R32 26 / R125 26 / R1234yf 20 / R134a 28	1387	~5.5	Solstice N40
R449A	R32 24.3 / R125 24.7 / R1234yf 25.3 / R134a 25.7	1397	~5.0	Opteon XP40
R452A	R32 41 / R125 59 / R134a 20	2141	~3.9	Opteon XP44
R455A	R32 3 / R744 21.5 / R1234yf 75.5	146	~11	Solstice L40X

R410A replacement blends

Blend	Composition	GWP AR5	Safety class
R410A	R32 50 / R125 50	2088	A1 non-flammable
R32	R32 100	675	A2L mildly flammable
R454B	R32 68.9 / R1234yf 31.1	466	A2L mildly flammable
R466A	R32 49 / R125 11.5 / R13I1 39.5	733	A1 non-flammable

Retrofit component compatibility

All HFO/HFC blends listed compatible with POE (polyol ester) oil like R404A / R410A. Mineral and alkylbenzene oils NOT compatible — flush before charge conversion. R404A-marked expansion valve elements may need re-orificing or swap to R448A-marked (mass

flow differs 5-10%). Filter driers rated for HFC compatible with HFO blends; existing DML and DCL driers can stay for a service retrofit.

Glide — practical impact

R448A and R449A have ~5 K temperature glide — evaporation and condensation temperatures at inlet vs outlet differ up to 5 K. Pressure switches set for R404A near-zero glide need re-setting to reflect new bubble/dew-point curve. Verify expansion valve superheat at 6-8 K midpoint superheat rather than R404A default 4-6 K.

EU F-Gas service quota timeline

Year	HFC quota vs 2015	Notable
2015	100%	Baseline
2018	63%	-
2021	45%	R404A ban in new commercial ref < 40 kW
2024	31%	Revised regulation entered force
2027	24%	-
2030	15%	-
2036	4%	Effective end of virgin R404A / R507A supply

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