



COMMONLY USED NON-ODS SUBSTITUTE REFRIGERANTS

Post-Kigali Update



ASHRAE Designation	Refrigerant Type	Chemical name	Chemical formula	GWP (100y) ¹	ASHRAE Safety Group Classification ²	HS code ³ (2012)
<i>Single component refrigerants</i>						
R-23	HFC	trifluoromethane	CHF ₃	14 800	A1	2903.39
R-30	chlorocarbon	dichloromethane (methylene chloride)	CH ₂ Cl ₂	9*	B1	2903.39
R-32	HFC	difluoromethane (methylene fluoride)	CH ₂ F ₂	675	A2L	2903.39
R-125	HFC	pentafluoroethane	CHF ₂ CF ₃	3500	A1	2903.39
R-1234yf	Unsaturated HFC (HFO)	2,3,3,3-tetrafluoro-1-propene	CF ₃ CF=CH ₂	<1*	A2L	2903.39
R-1234ze(E)	Unsaturated HFC (HFO)	trans-1,3,3,3-tetrafluoro-1-propene	CF ₃ CH=CHF	<1*	A2L	2903.39
R-134a	HFC	1,1,1,2-tetrafluoroethane	CH ₂ FCF ₃	1430	A1	2903.39
R-143a	HFC	1,1,1-trifluoroethane	CH ₃ CF ₃	4470	A2L	2903.39
R-152a	HFC	1,1-difluoroethane	CH ₃ CHF ₂	124	A2	2903.39
R-600	Hydrocarbon	butane	CH ₃ CH ₂ CH ₂ CH ₃	4*	A3	2901.10 ⁴
R-600a	Hydrocarbon	2-methylpropane (isobutane)	CH(CH ₃) ₂ CH ₃	~20*	A3	2901.10 ⁴
R-290	Hydrocarbon	propane	CH ₃ CH ₂ CH ₃	5*	A3	2711.12
R-717	Inorganic compound	ammonia	NH ₃	0*	B2L	2814.10
R-744	Inorganic compound	carbon dioxide	CO ₂	1*	A1	2811.21

1. Global Warming Potential, Montreal Protocol, Annex C (post Kigali Amendment 2016) and values marked * are from: WMO Scientific Assessment Report 2014; Report of the Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee 2014 Assessment

2. A1 = Lower toxicity, no flame propagation (non-flammable); B1 = Higher toxicity, no flame propagation (non-flammable); A2 = Lower toxicity, flammable; A2L = Lower toxicity, lower flammability; B2L = Higher toxicity, lower flammability.

3. World Customs Organization Harmonized Commodity Description and Coding System, also known as the Harmonized System (HS)

4. 2901.10 applies only if the concentration of is higher than 95%, otherwise 2711.13 ("Butanes") applies.

ASHRAE Designation	Refrigerant Type	Composition (Composition by %)	GWP (100y) ¹	ASHRAE Safety Group Classification ²	HS code ³ (2012)
<i>Refrigerant blends/mixtures</i>					
R-404A	HFC-containing mixture (non-ODS)	HFC-125/HFC-143a/HFC-134a (44/52/4)	3922	A1	3824.78
R-407A	HFC-containing mixture (non-ODS)	HFC-32/HFC-125/HFC-134a (20/40/40)	2107	A1	3824.78
R-407B	HFC-containing mixture (non-ODS)	HFC-32/HFC-125/HFC-134a (10/70/20)	2804	A1	3824.78
R-407C	HFC-containing mixture (non-ODS)	HFC-32/HFC-125/HFC-134a (23/25/52)	1774	A1	3824.78
R-410A	HFC-containing mixture (non-ODS)	HFC-32/HFC-125 (50/50)	2088	A1	3824.78
R-417A	HFC-containing mixture (non-ODS)	HFC-125/HFC-134a/R-600* (46.6/50/3.4)	2346	A1	3824.78
R-421A	HFC-containing mixture (non-ODS)	HFC-125/HFC-134a (58/42)	2631	A1	3824.78
R-422A	HFC-containing mixture (non-ODS)	HFC-134a/HFC-125/R600a* (11.5/85.1/3.4)	3144	A1	3824.78
R-422D	HFC-containing mixture (non-ODS)	HFC-134a/HFC-125/R600a* (31.5/65.1/3.4)	2730	A1	3824.78
R-507A	HFC-containing mixture (non-ODS)	HFC-125/HFC-143a (50/50)	3985	A1	3824.78
R-508A	HFC-containing mixture (non-ODS)	HFC-23/PFC-116 (39/61)	12 543	A1	3824.78

Prepared by: Ezra Clark/OzonAction

1. Global Warming Potential, calculated from GWP values in Montreal Protocol, Annex C (post Kigali Amendment 2016) and values marked * are from: WMO Scientific Assessment Report 2014; Report of the Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee 2014 Assessment

2. A1 = Lower toxicity, no flame propagation (non-flammable)

3. World Customs Organization Harmonized Commodity Description and Coding System, also known as the Harmonized System (HS)

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