



REFRIGERANT GUIDE

Safety Classifications & Global Warming Potential

This document provides a framework for refrigerant safety classification based on international guidelines for chemical safety and environmental impact.

GENERAL CLASSIFICATION FRAMEWORK FOR REFRIGERANT SAFETY GROUPS

Refrigerants are classified into safety groups based on two primary criteria: **toxicity** and **flammability**. The classification system is structured as follows:

Toxicity

Class A: Refrigerants with no identified toxicity at concentrations below the threshold level (400 ppm).

Class B: Refrigerants with evidence of toxicity at concentrations below the threshold level (400 ppm).

Flammability

Class 1: Refrigerants that do not exhibit flame propagation in air under standard conditions: 14.7 psia (100kPa) and 65°F (18°C).

Class 2: Refrigerants with a lower flammability limit (LFL) above 0.00625 lb/ft³ (0.10kg/m³) at 70°F (21°C) and 14.7 PSIA (100kPa) and a heat of combustion below 8,174 Btu/lb (19,000 kJ/kg)

Class 3: Highly flammable refrigerants, defined as those with an LFL less than 0.00625 lb/ft³ (0.10kg/m³) at 70°F (21°C) and 14.7 PSIA (100kPa) or heat of combustion greater than 8,174 Btu/lb (19,000 kJ/kg).

Table 1: Refrigerant Safety Classifications from ASHRAE Standard 34

	Lower toxicity	Higher Toxicity	
Higher Flammability	A3	B3	LFL ≤ 0.10 kg/m ³ or heat of combustion ≥ 19,000 kJ/kg
Lower Flammability	A2	B2	LFL ≥ 0.10 kg/m ³ and heat of combustion ≤ 19,000 kJ/kg
	A2L*	B2L*	
No Flame Propagation	A1	B1	No LFL based on modified ASTM E681-85 Test
	No identified toxicity at concentrations ≤ 400ppm	Evidence of Toxicity below 400ppm (based on data for TLV-TWA or consistent indices)	

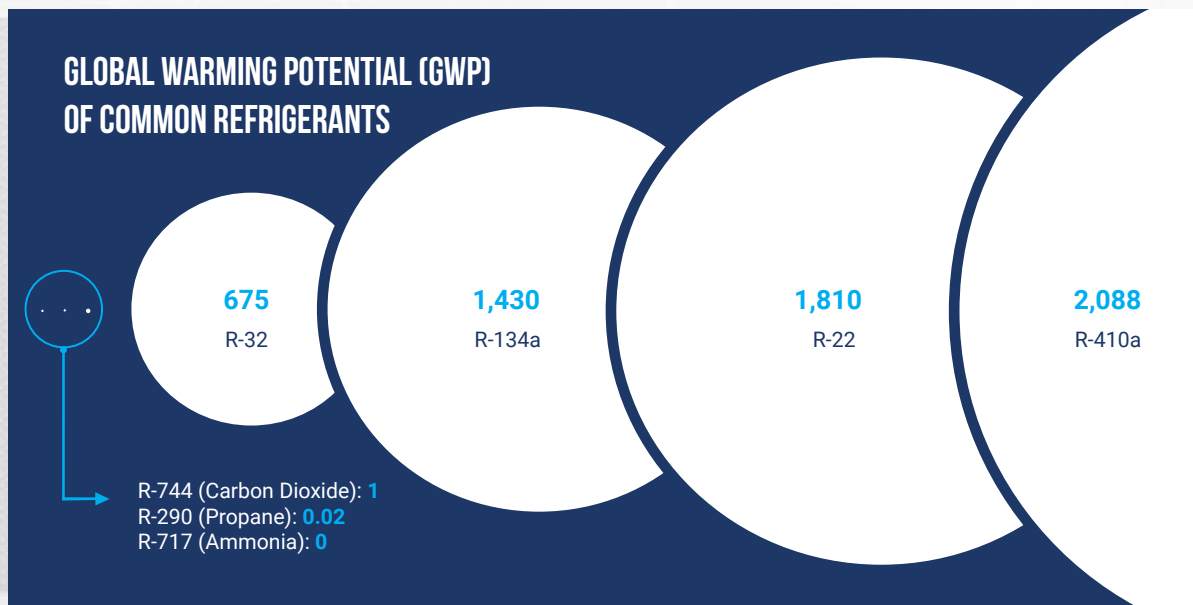
* A2L and B2L are lower flammability refrigerants with a maximum burning velocity of < 10 cm/s

WHAT IS GLOBAL WARMING POTENTIAL?

Several refrigerants are greenhouse gases and contribute to global warming. The degree to which gases trap heat in the atmosphere is measured by the global warming potential (GWP).

The most common global warming potential indicator is GWP100, which measures what impact a gas has over the course of 100 years using CO2 as a benchmark. For example, R134a has a GWP of 1430, which means that the impact of 1 ton of R134a is equal to 1430 tons of CO2 over a 100 year period.

Globally, regulations are being introduced to restrict the use of high GWP refrigerants and encourage the use of low GWP alternatives. In the United States, refrigerant GWP is being regulated at the federal level under the Significant New Alternatives Policy (SNAP), and the Technology Transitions portion of the American Innovation and Manufacturing (AIM) Act, as well as additional policies that vary by state.



REFRIGERANT SPECIFICATIONS TABLE

The below tables are not an exhaustive list of all refrigerants but represents what is currently available across the range of Colmac Coil Software (A+Pro, Hygenair, Coilpro, Dryware). The GWP100 values are primarily from the IPCC AR4 report, the Intergovernmental Panel on Climate Change (IPCC) AR6 report, or manufacturer published information.

Chlorofluorocarbon (CFC) Refrigerants

CFC (Chlorofluorocarbons) are refrigerants comprised of chlorine, fluorine, and carbon. Common CFCs include R-11, R-12, R-13, R-113, R-114 and R-115. CFCs were the first generation of synthetic refrigerants and have been phased out because they contribute to depletion of the ozone layer when released to the atmosphere.

Refrigerant Number	Chemical Name	Safety Group	GWP100
11	Trichlorofluoromethane	A1	4750
12	Dichlorodifluoromethane	A1	10900
12B1	Bromochlorodifluoromethane	n/a	1890
13	Chlorotrifluoromethane	A1	14400
13B1	Bromotrifluoromethane	A1	7140
14	Tetrafluoromethane (Carbon Tetrafluoride)	A1	7390
30	Dichloromethane (Methylene Chloride)	B2	8.7
113	Trichlorotrifluoroethane	A1	6130
114	Dichlorotetrafluoroethane	A1	10000
115	Chloropentafluoroethane	A1	7370
116	Hexafluoroethane	A1	12200

Hydrochlorofluorocarbon (HCFC) Refrigerants

Refrigerant Number	Chemical Name	Safety Group	GWP100
21	Dichlorofluoromethane	B1	160
22	Chlorodifluoromethane	A1	1810
31	Chlorofluoromethane	n/a	79.4
123	Dichlorotrifluoroethane	B1	77
142B	Chlorodifluoroethane	A2	2310

HCFC (Hydrochlorofluorocarbons) are refrigerants comprised of hydrogen, chlorine, fluorine, and carbon. One of the most common HCFC's used in HVAC systems is R-22. HCFCs were introduced to replace CFCs, due to their lower ozone depletion potential. However, they are still harmful to the ozone layer and have mostly been taken out of production.

Hydrofluorocarbon (HFC) Refrigerants

HFC (Hydrofluorocarbons) are refrigerants comprised of hydrogen, fluorine, and carbon. Common examples include R134a, R32, and R152a. HFC's are the third generation of fluorinated refrigerants and do not harm the ozone layer but do contribute to global warming. HFCs are still in use but are in the process of being phased out.

Refrigerant Number	Chemical Name	Safety Group	GWP100
23	Trifluoromethane	A1	14800
32	Difluoromethane	A2	675
41	Fluoromethane (Methyl Fluoride)	n/a	135
125	Pentafluoroethane	A1	3500
134A	Tetrafluoroethane	A1	1430
152A	Difluoroethane	A2	124
227	Heptafluoropropane	n/a	3220
236FA	Hexafluoropropane	A1	9810
245FA	Pentafluoropropane	B1	1030

Hydrofluoroolefin (HFO) Refrigerants

Refrigerant Number	Chemical Name	Safety Group	GWP100
1130 (E)	Transdichloroethylene	B2	5
1224YD (Z)	(Z)ChloroTetrafluoropropene Tetrafluoropropane	A1	1
1233ZD (E)	Trans-chlorotrifluoropropene	A1	4
1234YF	Tetrafluoropropene	A2L	4
1234ZE (E)	Tetrafluoropropene	A2L	7
1336MZZ (Z)	Cis-Hexafluoro-butene	A1	2

HFO (Hydrofluoroolefins) are synthetic organic compounds made of hydrogen, fluorine, and carbon. Praised for virtually zero ozone-depletion potential and very low global-warming potential, HFOs—such as R-1234yf and R-1234ze—are marketed as the latest “environmentally friendlier” refrigerants. Yet atmospheric releases of these gases, and their breakdown products, still carry risks: certain HFOs degrade into trifluoroacetic acid (TFA), a persistent pollutant that can accumulate in surface and drinking water and may harm ecosystems and human health.

Hydrocarbon (HC) Refrigerants

Refrigerant Number	Chemical Name	Safety Group	GWP100
50	Methane	A3	25
170	Ethane	A3	0.437
290	Propane	A3	0.02
600	Butane	A3	0.006
600A	Isobutane	A3	3
601	n-Pentane	A3	5
601A	Isopentane	A3	5
1150	Ethene (ethylene)	A3	3.7
1270	Propene (propylene)	A3	1.8

HC (Hydrocarbons) are compounds of hydrogen and carbon, byproducts of crude oil. They have low global warming potential and no ozone depletion potential, but high flammability is a concern. Examples include R290 (propane) and R600 (butane).

Zeotropic Refrigerant Blends

Refrigerant Number	Composition (Mass %)	Safety Group	GWP 100	Type	Glide (°F) @ 50 PSIA	Glide (°F) @ 250 PSIA
401A	53% R-22, 13% R-152A, 34% R-124	A1	1182	HFC/HCFC	9.5	7.1
402A	60% R-125, 2% R290, 38% R-22	A1	2788	HFC/HCFC	2.8	1.7
404A	44% R-125, 52% R-143a, 4% R-134a	A1	3922	HFC	1.1	0.6
407A	20% R-32, 40% R-125, 40% R-134a	A1	2107	HFC	10.6	7.9
407C	23% R-32, 25% R-125, 52% R-134a	A1	1774	HFC	11.6	8.9
407E	25% R-32, 15% R-125, 60% R-134a	A1	1642	HFC	11.9	9.2
407F	30% R-32, 30% R-125, 40% R-134a	A1	1825	HFC	10.6	8.1
410A	50% R-32, 50% R-125	A1	2088	HFC	0.2	0.2
413A	9% R-218, 88% R-134a, 3% R-600a	A2	2053	HFC/HC	6.9	3.3
417A	46.6% R-125, 50% R-134a, 3.4% R-600	A1	2346	HFC/HC	7.5	4.7
438A	8.5% R32, 45% R125, 44.2% R134a, 1.7% R600, 0.6% R601a	A1	2265	HFC/HC	10.1	7.3
448A	26% R32, 26% R125, 21% R134a, 20% R1234yf, 7% R1234ze	A1	1387	HFC/HFO	10.6	8.6
449A	25.7% R134a, 25.3% R1234yf, 24.7% R-125, 24.3% R32	A1	1397	HFC/HFO	9.8	7.9
450A	42% R134a, 58% R1234ze	A1	547	HFC/HFO	1.2	1.0
454A	65% R1234yf, 35% R32	A2L	239	HFC/HFO	10.3	9.1
454B	68.9% R32, 31.1% R1234yf	A2L	467	HFC/HFO	2.1	2.4
454C	78.5% R1234yf, 21.5% R32	A2L	148	HFC/HFO	14.1	12.0
455A	75.5% R1234yf, 21.5% R32, 3% R744	A2L	146	HFC/HFO	22.2	17.7
457A	70% R-1234yf, 18% R-32, 12% R-152A,	A2L	139	HFC/HFO	12.6	10.5

Zeotropic Refrigerant Blends

are mixtures of two or more compounds with different boiling points. In a process known as refrigerant glide, zeotropic blends will evaporate and condense over a range of temperatures.

Azeotropic Refrigerant Blends

Refrigerant Number	Composition (Mass %)	Safety Group	GWP100	Type
500	73.8% R-12, 26.2% R-152a	A1	8077	CFC
502	48.8% R-22, 51.2% R-115	A1	4657	HCFC/HFC
503	40% R-23, 60% R-13	n/a	14560	HFC/CFC
507A	50% R-125, 50% R-143a	A1	3985	HFC
508A	39% R-23, 61% R-116	A1	13214	HFC/CFC
508B	46% R-23, 54% R-116	A1	13396	HFC/CFC
513A	56% R-134a, 44% R-1234yf	A1	630	HCF/HFO
516A	77.5% R1234yf, 14% R152a, 8.5% R134a	A2L	140	HFC/HFO

Azeotropic Refrigerant Blends

are mixtures of two or more compounds that evaporate and condense at the same temperature. Azeotropic blends act like pure substances

Natural Refrigerants

Natural Refrigerants are compounds that occur in nature and have zero to low global warming potential and zero ozone depletion potential. Examples include ammonia (R-717), CO₂ (R-744), natural hydrocarbons, and water.

Refrigerant Number	Chemical Name	Safety Group	GWP100
702	Hydrogen	A3	11
704	Helium	A1	0
717	Ammonia	B2	0
718	Water	A1	0
744	Carbon dioxide	A1	1