



TECHNICAL DATA SHEET

R-454C

Features

R-454C refrigerant gas is a non-azeotropic, slightly flammable HFC+HFO blend, alternative to R-404A for new medium and low temperature applications. Like all HFC+HFO refrigerants it is ozone friendly. Its safety classification is A2L group L2, i.e. it has low toxicity and is slightly flammable.

Some of its main features are:

- The global warming potential (GWP) is approx. 96% lower than R-404A.
- Similar performance to R-404A, slightly lower cooling capacity and higher energy efficiency.
- **Safety classification: A2L / Slightly flammable.**
- Good performance at medium and low temperatures.
- In case of leakage, the equipment can be recharged.
- It is a blend compatible with synthetic POE oils.

Applications

- Alternative to R-404A and R-22 for new medium and low temperature positive displacement and direct expansion installations in commercial and industrial refrigeration applications such as:
 - Hermetically sealed systems
 - Condensing units
 - Refrigerated warehouses
 - Autonomous systems
 - Supermarkets:
 - Centralised systems
 - Cold stores
 - Preparation rooms
- Due to its GWP/GWP of less than 150, it is allowed in new equipment of the following typology from 1 January 2022:
 - Hermetically sealed commercial refrigerators and freezers.
 - Central cooling systems for commercial use ≥ 40 kW.

Working and service conditions

- **R-454C is a mixture**, always transfer in liquid phase, or in full charges if in gas phase.
- Partial recharges are allowed. Such partial recharges must be carried out in the liquid phase.

Lubricants

R-454C is compatible with synthetic polyolester based oils (POE). Please refer to the manufacturer's recommended viscosities for the working range of the equipment. Remember that the THUNDER® POE TL range is available from 22 to 220 ISO viscosity grades.

Environmental Data

None of the components of R-454C contain chlorine, so the product has ODP = 0 (ozone depleting potential).

R-454C has a very low global warming potential (GWP), higher than 96% compared to R-404A, thus reducing CO₂ emissions in case of direct leakage.

Toxicity, safety and storage

R-454C does not exhibit any acute toxicity either orally, by inhalation or by eye contact. It is not considered to be irritating or corrosive to the skin, nor a respiratory sensitizer. As usual, as it has a higher density than air, it can be deposited in low areas of confined spaces and can cause asphyxiation due to oxygen displacement.

Animal studies of its components have shown that repeated exposure does not produce teratogenic (reproductive) effects. Furthermore, it is unlikely to present a carcinogenic risk to man.

R-454C does not contain components that have endocrine disrupting properties according to Article 57(f) of REACH or Commission Delegated Regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

R-454C is slightly flammable according to ASHRAE Standard 34.

Therefore, the safety classification of R-454C is **A2L**.

R-454C cylinders should be stored in cool, ventilated places below 50°C, away from open flames, sparks and heat sources. Avoid storage near the intake of air conditioning units, boilers or open drains.

Components

Chemical name	% by weight	CAS No.	CE No.
2,3,3,3-Tetrafluoroprop-1-ene (R-1234yf)	78,5	754-12-1	468-710-7
Difluoromethane (R-32)	21,5	75-10-5	200-839-4

Physical properties

Property	Units	R-454C	R-404A
Molecular weight	g/mol	90,8	97,6
Liquid density (a 25 °C)	Kg/l	1,042	1,044
Saturated vapour density (a 25 °C)	Kg/l	0,0445	0,0653
Boiling point (a 1 atm)	°C	-45,9	-46,5
Absolute vapour pressure (líquido a 25 °C)	bar	11,91	12,54
Absolute critical pressure	bar	41,5	37,3
Critical temperature	°C	82,4	72
Glide	°C	~6	0,7
LFL (Low Flammable Limit)	Kg/m ³	0,293	Non flammable
Flame speed (23 °C)	cm/s	1,6	--
ODP		0	0
GWP		146 *	3.922 *
Toxicity		No	No

* In accordance with European Regulation 2024/573.

Pressure/temperature tables

Temperature °C	Absolute Pressure		Density		Enthalpy		Entropy	
	Bubble bar	Dew bar	Liquid Kg/m ³	Vapour Kg/m ³	Liquid kJ/Kg	Vapour kJ/Kg	Liquid kJ/Kg·K	Vapour kJ/Kg·K
-60	0,49	0,314	1316,2	1,64	120,91	352,25	0,6757	1,7817
-59	0,51	0,333	1313,5	1,73	122,16	352,89	0,6815	1,7794
-58	0,54	0,353	1310,8	1,83	123,41	353,53	0,6873	1,7772
-57	0,57	0,373	1308,2	1,93	124,66	354,18	0,6931	1,7750
-56	0,60	0,395	1305,5	2,03	125,91	354,82	0,6989	1,7729
-55	0,63	0,418	1302,8	2,14	127,17	355,46	0,7046	1,7708
-54	0,67	0,442	1300	2,26	128,42	356,10	0,7104	1,7687
-53	0,70	0,467	1297,3	2,38	129,68	356,74	0,7161	1,7667

Temperature	Absolute Pressure		Density		Enthalpy		Entropy	
°C	Bubble bar	Dew bar	Liquid Kg/m ³	Vapour Kg/m ³	Liquid kJ/Kg	Vapour kJ/Kg	Liquid kJ/Kg·K	Vapour kJ/Kg·K
-52	0,74	0,493	1294,6	2,50	130,94	357,38	0,7218	1,7647
-51	0,78	0,521	1291,9	2,63	132,20	358,02	0,7275	1,7628
-50	0,82	0,549	1289,1	2,77	133,47	358,66	0,7331	1,7609
-49	0,86	0,579	1286,3	2,91	134,73	359,30	0,7388	1,7591
-48	0,90	0,610	1283,6	3,05	136,00	359,93	0,7444	1,7573
-47	0,95	0,643	1280,8	3,21	137,27	360,57	0,7500	1,7555
-46	0,99	0,677	1278	3,36	138,54	361,21	0,7556	1,7538
-45	1,04	0,712	1275,2	3,53	139,82	361,85	0,7612	1,7521
-44	1,09	0,749	1272,4	3,70	141,09	362,48	0,7668	1,7504
-43	1,14	0,787	1269,6	3,87	142,37	363,12	0,7723	1,7488
-42	1,20	0,826	1266,8	4,06	143,65	363,75	0,7778	1,7472
-41	1,25	0,868	1263,9	4,25	144,94	364,39	0,7834	1,7456
-40	1,31	0,911	1261,1	4,44	146,22	365,02	0,7889	1,7441
-39	1,37	0,955	1258,2	4,65	147,51	365,65	0,7944	1,7426
-38	1,43	1,002	1255,3	4,86	148,80	366,28	0,7998	1,7411
-37	1,49	1,050	1252,4	5,08	150,09	366,91	0,8053	1,7397
-36	1,56	1,100	1249,6	5,30	151,39	367,54	0,8108	1,7383
-35	1,63	1,151	1246,6	5,54	152,69	368,17	0,8162	1,7369
-34	1,70	1,205	1243,7	5,78	153,99	368,80	0,8216	1,7356
-33	1,77	1,260	1240,8	6,03	155,29	369,43	0,8270	1,7343
-32	1,85	1,318	1237,9	6,29	156,59	370,05	0,8324	1,7330
-31	1,92	1,378	1234,9	6,56	157,90	370,67	0,8378	1,7317
-30	2,00	1,439	1231,9	6,84	159,21	371,30	0,8432	1,7305
-29	2,09	1,503	1229	7,12	160,53	371,92	0,8486	1,7293
-28	2,17	1,569	1226	7,42	161,84	372,54	0,8539	1,7281
-27	2,26	1,637	1223	7,72	163,16	373,16	0,8593	1,7270
-26	2,35	1,708	1220	8,04	164,48	373,78	0,8646	1,7258
-25	2,44	1,781	1216,9	8,36	165,81	374,39	0,8699	1,7247
-24	2,54	1,856	1213,9	8,70	167,14	375,01	0,8752	1,7237
-23	2,64	1,934	1210,8	9,04	168,47	375,62	0,8805	1,7226
-22	2,74	2,015	1207,8	9,40	169,80	376,23	0,8858	1,7216
-21	2,85	2,097	1204,7	9,77	171,14	376,84	0,8911	1,7205
-20	2,95	2,183	1201,6	10,14	172,48	377,45	0,8963	1,7195
-19	3,06	2,271	1198,5	10,54	173,82	378,06	0,9016	1,7186
-18	3,18	2,362	1195,4	10,94	175,17	378,66	0,9069	1,7176
-17	3,30	2,456	1192,2	11,35	176,52	379,26	0,9121	1,7167
-16	3,42	2,553	1189,1	11,78	177,87	379,86	0,9173	1,7158

Temperature	Absolute Pressure		Density		Enthalpy		Entropy	
°C	Bubble bar	Dew bar	Liquid Kg/m ³	Vapour Kg/m ³	Liquid kJ/Kg	Vapour kJ/Kg	Liquid kJ/Kg·K	Vapour kJ/Kg·K
-15	3,54	2,652	1185,9	12,22	179,23	380,46	0,9226	1,7149
-14	3,67	2,755	1182,7	12,67	180,59	381,06	0,9278	1,7140
-13	3,80	2,860	1179,5	13,14	181,95	381,65	0,9330	1,7131
-12	3,93	2,969	1176,3	13,61	183,32	382,24	0,9382	1,7123
-11	4,07	3,081	1173,1	14,11	184,69	382,84	0,9434	1,7115
-10	4,21	3,196	1169,8	14,61	186,06	383,42	0,9486	1,7106
-9	4,36	3,314	1166,5	15,13	187,44	384,01	0,9537	1,7098
-8	4,51	3,436	1163,3	15,67	188,82	384,59	0,9589	1,7091
-7	4,66	3,561	1160	16,22	190,21	385,17	0,9641	1,7083
-6	4,82	3,689	1156,6	16,79	191,59	385,75	0,9692	1,7075
-5	4,98	3,821	1153,3	17,37	192,98	386,32	0,9744	1,7068
-4	5,14	3,957	1149,9	17,97	194,38	386,90	0,9795	1,7061
-3	5,31	4,096	1146,6	18,59	195,78	387,47	0,9846	1,7054
-2	5,48	4,239	1143,2	19,22	197,18	388,03	0,9898	1,7047
-1	5,66	4,386	1139,7	19,87	198,59	388,60	0,9949	1,7040
0	5,84	4,537	1136,3	20,54	200,00	389,16	1,0000	1,7033
1	6,02	4,692	1132,9	21,22	201,41	389,71	1,0051	1,7026
2	6,21	4,850	1129,4	21,93	202,83	390,27	1,0102	1,7020
3	6,41	5,013	1125,9	22,65	204,26	390,82	1,0153	1,7013
4	6,60	5,180	1122,4	23,39	205,68	391,37	1,0204	1,7007
5	6,81	5,351	1118,8	24,15	207,11	391,91	1,0255	1,7000
6	7,01	5,526	1115,2	24,94	208,55	392,45	1,0306	1,6994
7	7,23	5,706	1111,7	25,74	209,99	392,99	1,0357	1,6988
8	7,44	5,890	1108	26,57	211,43	393,52	1,0407	1,6982
9	7,66	6,078	1104,4	27,41	212,88	394,05	1,0458	1,6976
10	7,89	6,271	1100,7	28,28	214,34	394,57	1,0509	1,6970
11	8,12	6,469	1097,1	29,18	215,79	395,09	1,0559	1,6964
12	8,36	6,672	1093,3	30,09	217,26	395,61	1,0610	1,6958
13	8,60	6,879	1089,6	31,03	218,72	396,12	1,0661	1,6952
14	8,84	7,091	1085,8	32,00	220,19	396,63	1,0711	1,6946
15	9,10	7,308	1082	32,99	221,67	397,13	1,0762	1,6941
16	9,35	7,530	1078,2	34,01	223,15	397,63	1,0812	1,6935
17	9,61	7,758	1074,4	35,05	224,64	398,12	1,0863	1,6929
18	9,88	7,990	1070,5	36,12	226,13	398,61	1,0913	1,6923

Temperature	Absolute Pressure		Density		Enthalpy		Entropy	
°C	Bubble bar	Dew bar	Liquid Kg/m ³	Vapour Kg/m ³	Liquid kJ/Kg	Vapour kJ/Kg	Liquid kJ/Kg·K	Vapour kJ/Kg·K
19	10,15	8,228	1066,6	37,22	227,63	399,09	1,0964	1,6918
20	10,43	8,471	1062,6	38,35	229,13	399,57	1,1014	1,6912
21	10,71	8,719	1058,7	39,51	230,63	400,04	1,1064	1,6906
22	11,00	8,973	1054,7	40,70	232,15	400,51	1,1115	1,6901
23	11,30	9,232	1050,6	41,92	233,66	400,97	1,1165	1,6895
24	11,60	9,498	1046,6	43,17	235,19	401,42	1,1216	1,6889
25	11,91	9,769	1042,4	44,45	236,72	401,87	1,1266	1,6884
26	12,22	10,050	1038,3	45,77	238,25	402,31	1,1316	1,6878
27	12,54	10,330	1034,1	47,13	239,79	402,74	1,1367	1,6872
28	12,86	10,620	1029,9	48,52	241,34	403,17	1,1417	1,6866
29	13,19	10,910	1025,6	49,95	242,89	403,59	1,1467	1,6860
30	13,53	11,210	1021,4	51,41	244,45	404,01	1,1518	1,6854
31	13,87	11,520	1017	52,92	246,01	404,41	1,1568	1,6848
32	14,22	11,840	1012,6	54,46	247,59	404,81	1,1619	1,6842
33	14,57	12,160	1008,2	56,05	249,16	405,20	1,1669	1,6836
34	14,93	12,480	1003,7	57,68	250,75	405,59	1,172	1,6830
35	15,30	12,820	999,22	59,36	252,34	405,96	1,177	1,6823
36	15,68	13,160	994,65	61,08	253,94	406,33	1,1821	1,6817
37	16,06	13,500	990,04	62,85	255,55	406,68	1,1872	1,6810
38	16,44	13,860	985,37	64,67	257,17	407,03	1,1922	1,6804
39	16,84	14,220	980,64	66,54	258,79	407,37	1,1973	1,6797
40	17,24	14,590	975,86	68,47	260,42	407,70	1,2024	1,6790
41	17,65	14,970	971,02	70,45	262,06	408,01	1,2075	1,6783
42	18,06	15,350	966,12	72,48	263,71	408,32	1,2126	1,6775
43	18,48	15,740	961,16	74,58	265,37	408,62	1,2177	1,6768
44	18,91	16,140	956,13	76,73	267,04	408,90	1,2229	1,6760
45	19,35	16,550	951,02	78,95	268,71	409,17	1,228	1,6752
46	19,79	16,960	945,85	81,24	270,40	409,43	1,2331	1,6744
47	20,24	17,380	940,6	83,60	272,10	409,68	1,2383	1,6736
48	20,70	17,820	935,27	86,03	273,81	409,92	1,2435	1,6727
49	21,17	18,250	929,86	88,53	275,52	410,13	1,2487	1,6718
50	21,64	18,700	924,35	91,12	277,26	410,34	1,2539	1,6709
51	22,12	19,160	918,76	93,78	279,00	410,53	1,2591	1,6700
52	22,61	19,620	913,07	96,54	280,75	410,70	1,2643	1,6690

Temperature	Absolute Pressure		Density		Enthalpy		Entropy	
°C	Bubble bar	Dew bar	Liquid Kg/m ³	Vapour Kg/m ³	Liquid kJ/Kg	Vapour kJ/Kg	Liquid kJ/Kg·K	Vapour kJ/Kg·K
53	31,06	30,25	839,80	115,5	296,91	461,52	1,3148	1,8208
54	31,76	30,95	833,21	119,2	299,11	460,97	1,3212	1,8173
55	32,47	31,66	826,47	123,0	301,33	460,38	1,3278	1,8137
56	33,20	32,38	819,55	126,9	303,59	459,75	1,3344	1,8100
57	33,94	33,12	812,45	131,1	305,88	459,07	1,3411	1,8062
58	34,69	33,87	805,15	135,4	308,20	458,34	1,3478	1,8023
59	35,45	34,63	797,64	139,9	310,56	457,55	1,3546	1,7983
60	36,23	35,41	789,89	144,6	312,96	456,71	1,3615	1,7941

Data calculated using Refprop v.10.0

Las The pressure-temperature tables for the refrigerant indicate liquid to bubble point and vapour to dew point.

Bubble temperature: Temperature at which the liquid refrigerant begins to evaporate (appearance of the first bubble) at a given pressure. Below this temperature the refrigerant liquid is considered to be sub-cooled.

Vapour dew point: Temperature at which the gaseous refrigerant (vapour) starts to condense (first drop or dew appearance) at the given pressure. Above this temperature, the refrigerant vapour is considered to be superheated.

Superheated steam: To determine the evaporator superheat, measure the suction line temperature and pressure in the pipe at the outlet of the evaporator. Using the P/T tables determine the vapour dew point temperature, which corresponds to the measured suction pressure. Subtract the measured temperature from the temperature determined using the P/T tables, the difference found is the evaporator superheat.

Subcooling in the coolant: To determine the subcooling, measure the temperature and suction line pressure in the condenser outlet pipe. Using the P/T tables determine the temperature at the bubble point, which corresponds to the pressure measured at the condenser outlet. Subtract the measured temperature from the temperature determined using the P/T tables, the difference found is the condenser subcooling.

Note: In order to more accurately adjust the calculations for all those zeotropic gases, determine the evaporating and condensing temperatures by taking the midpoint between the bubble and dew temperatures.

Mollier diagram

