

R-449A



SPÉCIFICATIONS SELON NORME AHRI 700

CARACTÉRISTIQUES STANDARD	CONFORMITÉ EN LIMITE DE TOLÉRANCE
Composition nominale : R32 : 24,3 % R125 : 24,7 % R1234yf : 25,3 % R134a : 25,7 %	23,3 % ≤ R32 ≤ 26,3 % 24,5 % ≤ R125 ≤ 25,7 % 24,3 % ≤ R1234yf ≤ 25,5 % 25,5 % ≤ R134a ≤ 26,7 %
Pureté	≥ 99,5 % poids
Teneur en eau	≤ 10 ppm poids
Acidité (HCl)	≤ 1 ppm (poids)
Teneur en incondensables (phase gazeuse)	≤ 1,5 % volume
Résidus haute ébullition	≤ 0,01 % volume

PROPRIÉTÉS PHYSIQUES

Nom	Difluoromethane 24,3% en poids Pentafluoroethane 24,7% en poids 2,3,3,3-Tétrafluoroprop-1-ene 25,3% en poids 1,1,1,2- Tetrafluoroethane 25,7% en poids
Formule chimique	$\text{CHF}_2-\text{F}_2 / \text{CHF}_2-\text{CF}_3 / \text{CF}_3-\text{CF}=\text{CH}_2 / \text{CF}_3-\text{CH}_2\text{F}$
Température d'ébullition à 1,013 bar	- 46 °C
Température critique	82,07 °C
Potentiel de Réchauffement Global (GWP)	1 397 (selon IPCC 2007 Fourth Assesment Report)
Classe de sécurité	A1
Potentiel d'action sur l'ozone	Nul
Limites d'inflammabilité dans l'air	Aucune
Lubrifiant	Alkyl-Benzène, POE (PolyolEster)

SUBSTITUTION

- R-404A
- R-407A
- R-507
- R-407F

DIFFÉRENTES APPELLATIONS DU MARCHÉ

- OPTEON™ XP40

R-449A

TABLE THERMODYNAMIQUE

Température (°C)	Liquide	Vapeur	Liquide	Vapeur	Liquide	Vapeur	Liquide	Vapeur
	Pression (bar abs)	Pression (bar abs)	Densité (kg/m ³)	Densité (kg/m ³)	Enthalpie (kJ/kg)	Enthalpie (kJ/kg)	Entropie (kJ/kg-K)	Entropie (kJ/kg-K)
-80	0.1394	0.086357	1448.8	0.47264	95.566	352.28	0.55127	1.9066
-79	0.1495	0.09325	1446	0.50795	96.799	352.89	0.55763	1.9025
-78	0.16019	0.10059	1443.2	0.5454	98.034	353.5	0.56397	1.8985
-77	0.17151	0.10842	1440.3	0.58508	99.269	354.11	0.57028	1.8945
-76	0.18348	0.11673	1437.5	0.62708	100.51	354.73	0.57656	1.8906
-75	0.19613	0.12558	1434.6	0.67152	101.74	355.34	0.58282	1.8868
-74	0.20949	0.13497	1431.8	0.71849	102.98	355.95	0.58905	1.8831
-73	0.22359	0.14493	1428.9	0.76809	104.22	356.56	0.59526	1.8795
-72	0.23845	0.15549	1426.1	0.82044	105.46	357.18	0.60144	1.8759
-71	0.25412	0.16669	1423.2	0.87565	106.7	357.79	0.60759	1.8724
-70	0.27062	0.17853	1420.3	0.93384	107.95	358.4	0.61372	1.869
-69	0.28799	0.19106	1417.4	0.99512	109.19	359.01	0.61983	1.8656
-68	0.30625	0.20431	1414.6	1.0596	110.44	359.63	0.62591	1.8623
-67	0.32545	0.2183	1411.7	1.1274	111.69	360.24	0.63197	1.859
-66	0.34562	0.23306	1408.8	1.1987	112.94	360.85	0.63801	1.8558
-65	0.36679	0.24863	1405.9	1.2736	114.19	361.46	0.64402	1.8527
-64	0.389	0.26504	1403	1.3521	115.44	362.07	0.65001	1.8496
-63	0.41228	0.28233	1400.1	1.4345	116.69	362.68	0.65598	1.8466
-62	0.43669	0.30052	1397.1	1.521	117.95	363.29	0.66193	1.8437
-61	0.46225	0.31965	1394.2	1.6115	119.2	363.9	0.66786	1.8408
-60	0.489	0.33977	1391.3	1.7063	120.46	364.51	0.67376	1.838
-59	0.51698	0.3609	1388.4	1.8055	121.72	365.12	0.67965	1.8352
-58	0.54624	0.38307	1385.4	1.9092	122.98	365.73	0.68551	1.8324
-57	0.57682	0.40635	1382.5	2.0177	124.24	366.33	0.69136	1.8298
-56	0.60876	0.43075	1379.5	2.131	125.51	366.94	0.69718	1.8271
-55	0.6421	0.45632	1376.6	2.2494	126.77	367.54	0.70299	1.8245
-54	0.67688	0.4831	1373.6	2.3729	128.04	368.15	0.70878	1.822
-53	0.71315	0.51112	1370.6	2.5017	129.31	368.75	0.71455	1.8195
-52	0.75096	0.54045	1367.6	2.636	130.58	369.36	0.7203	1.8171
-51	0.79035	0.5711	1364.6	2.776	131.86	369.96	0.72603	1.8147
-50	0.83137	0.60314	1361.6	2.9219	133.13	370.56	0.73174	1.8123
-49	0.87406	0.6366	1358.6	3.0737	134.41	371.16	0.73744	1.81
-48	0.91848	0.67153	1355.6	3.2318	135.69	371.76	0.74312	1.8077
-47	0.96466	0.70797	1352.6	3.3962	136.97	372.35	0.74878	1.8055
-46	1.0127	0.74597	1349.6	3.5671	138.25	372.95	0.75442	1.8033
-45	1.0625	0.78558	1346.5	3.7448	139.54	373.54	0.76005	1.8012

R-449A

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	Pression (bar abs)	Pression (bar abs)	Densité (kg/m ³)	Densité (kg/m ³)	Enthalpie (kJ/kg)	Enthalpie (kJ/kg)	Entropie (kJ/kg-K)	Entropie (kJ/kg-K)
-44	1.1143	0.82685	1343.5	3.9294	140.82	374.14	0.76567	1.7991
-43	1.1681	0.86982	1340.4	4.1211	142.11	374.73	0.77126	1.797
-42	1.2239	0.91454	1337.3	4.3201	143.4	375.32	0.77684	1.795
-41	1.2818	0.96107	1334.3	4.5266	144.7	375.91	0.78241	1.793
-40	1.3418	1.0094	1331.2	4.7408	145.99	376.5	0.78796	1.791
-39	1.4039	1.0597	1328.1	4.963	147.29	377.08	0.79349	1.7891
-38	1.4683	1.112	1325	5.1932	148.59	377.67	0.79901	1.7872
-37	1.535	1.1662	1321.8	5.4318	149.89	378.25	0.80451	1.7853
-36	1.6041	1.2226	1318.7	5.679	151.2	378.83	0.81001	1.7835
-35	1.6755	1.281	1315.6	5.9349	152.5	379.41	0.81548	1.7817
-34	1.7494	1.3416	1312.4	6.1998	153.81	379.99	0.82094	1.7799
-33	1.8259	1.4044	1309.3	6.474	155.13	380.57	0.82639	1.7782
-32	1.9049	1.4696	1306.1	6.7576	156.44	381.14	0.83183	1.7765
-31	1.9865	1.537	1302.9	7.0509	157.76	381.72	0.83725	1.7748
-30	2.0708	1.6069	1299.7	7.3541	159.07	382.29	0.84266	1.7732
-29	2.1578	1.6792	1296.5	7.6675	160.4	382.86	0.84806	1.7716
-28	2.2477	1.7541	1293.3	7.9914	161.72	383.42	0.85344	1.77
-27	2.3404	1.8315	1290.1	8.3259	163.05	383.99	0.85881	1.7684
-26	2.4361	1.9115	1286.8	8.6714	164.38	384.55	0.86417	1.7669
-25	2.5347	1.9943	1283.6	9.0281	165.71	385.11	0.86952	1.7654
-24	2.6364	2.0798	1280.3	9.3963	167.04	385.67	0.87486	1.7639
-23	2.7412	2.1681	1277	9.7762	168.38	386.22	0.88018	1.7624
-22	2.8492	2.2593	1273.7	10.168	169.72	386.78	0.88549	1.761
-21	2.9604	2.3535	1270.4	10.572	171.06	387.33	0.8908	1.7595
-20	3.075	2.4507	1267.1	10.989	172.41	387.88	0.89609	1.7581
-19	3.1928	2.5509	1263.8	11.419	173.76	388.42	0.90137	1.7568
-18	3.3141	2.6543	1260.4	11.862	175.11	388.97	0.90664	1.7554
-17	3.4389	2.7609	1257	12.318	176.47	389.51	0.9119	1.7541
-16	3.5673	2.8707	1253.6	12.789	177.82	390.04	0.91715	1.7528
-15	3.6993	2.9839	1250.2	13.273	179.18	390.58	0.92239	1.7515
-14	3.8349	3.1005	1246.8	13.772	180.55	391.11	0.92762	1.7502
-13	3.9744	3.2206	1243.4	14.286	181.92	391.64	0.93285	1.7489
-12	4.1176	3.3442	1239.9	14.815	183.29	392.17	0.93806	1.7477
-11	4.2647	3.4715	1236.5	15.359	184.66	392.69	0.94326	1.7465
-10	4.4158	3.6024	1233	15.92	186.04	393.21	0.94846	1.7453
-9	4.5709	3.737	1229.5	16.496	187.42	393.73	0.95365	1.7441

R-449A

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-8	4.7302	3.8755	1226	17,089	188,8	394,24	0,95883	1,7429
-7	4.8935	4.0179	1222,4	17,7	190,19	394,75	0,964	1,7417
-6	5.0611	4.1643	1218,9	18,327	191,58	395,26	0,96916	1,7406
-5	5.233	4.3147	1215,3	18,973	192,97	395,76	0,97432	1,7395
-4	5.4093	4.4692	1211,7	19,637	194,37	396,26	0,97947	1,7384
-3	5.59	4.6279	1208,1	20,319	195,77	396,76	0,98461	1,7372
-2	5.7752	4.7908	1204,4	21,02	197,18	397,25	0,98975	1,7362
-1	5.965	4.9581	1200,8	21,742	198,59	397,74	0,99488	1,7351
0	6.1594	5.1299	1197,1	22,483	200	398,23	1	1,734
1	6.3586	5.3061	1193,4	23,244	201,42	398,71	1,0051	1,7329
2	6.5625	5.4869	1189,7	24,027	202,84	399,19	1,0102	1,7319
3	6.7714	5.6723	1185,9	24,831	204,26	399,66	1,0153	1,7309
4	6.9851	5.8624	1182,1	25,657	205,69	400,13	1,0204	1,7298
5	7.2039	6.0574	1178,3	26,506	207,13	400,59	1,0255	1,7288
6	7.4278	6.2573	1174,5	27,378	208,56	401,05	1,0306	1,7278
7	7.6568	6.4621	1170,7	28,274	210	401,5	1,0357	1,7268
8	7.8911	6.672	1166,8	29,193	211,45	401,95	1,0408	1,7258
9	8.1306	6.887	1162,9	30,138	212,9	402,4	1,0459	1,7248
10	8.3756	7.1072	1159	31,109	214,36	402,84	1,0509	1,7238
11	8.626	7.3327	1155	32,105	215,82	403,27	1,056	1,7228
12	8.8819	7.5636	1151	33,128	217,28	403,7	1,0611	1,7218
13	9.1435	7,8	1147	34,179	218,75	404,12	1,0661	1,7209
14	9.4107	8,042	1143	35,259	220,23	404,54	1,0712	1,7199
15	9.6837	8,2896	1138,9	36,367	221,7	404,96	1,0763	1,7189
16	9.9625	8,5429	1134,8	37,505	223,19	405,36	1,0813	1,7179
17	10.247	8,802	1130,6	38,674	224,68	405,76	1,0864	1,717
18	10.538	9,0671	1126,4	39,874	226,17	406,16	1,0914	1,716
19	10.835	9,3382	1122,2	41,106	227,67	406,54	1,0965	1,715
20	11.138	9,6154	1118	42,372	229,18	406,93	1,1015	1,7141
21	11.447	9,8987	1113,7	43,672	230,69	407,3	1,1066	1,7131
22	11.763	10,188	1109,4	45,006	232,21	407,67	1,1116	1,7121
23	12.084	10,484	1105	46,378	233,73	408,03	1,1167	1,7112
24	12.413	10,787	1100,6	47,786	235,26	408,38	1,1218	1,7102
25	12.748	11,096	1096,2	49,232	236,8	408,72	1,1268	1,7092
26	13.089	11,412	1091,7	50,718	238,34	409,06	1,1319	1,7082
27	13.437	11,734	1087,2	52,245	239,89	409,39	1,1369	1,7072

R-449A

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28	13,792	12,064	1082,6	53,814	241,44	409,71	1,142	1,7062
29	14,154	12,4	1078	55,425	243	410,03	1,1471	1,7052
30	14,523	12,744	1073,3	57,082	244,57	410,33	1,1521	1,7042
31	14,899	13,094	1068,6	58,784	246,15	410,62	1,1572	1,7032
32	15,282	13,452	1063,9	60,535	247,73	410,91	1,1623	1,7022
33	15,672	13,818	1059	62,334	249,32	411,18	1,1674	1,7011
34	16,07	14,191	1054,2	64,184	250,92	411,45	1,1724	1,7001
35	16,475	14,571	1049,3	66,087	252,52	411,71	1,1775	1,699
36	16,887	14,96	1044,3	68,045	254,13	411,95	1,1826	1,6979
37	17,307	15,356	1039,2	70,058	255,76	412,18	1,1877	1,6968
38	17,735	15,76	1034,1	72,131	257,39	412,41	1,1929	1,6957
39	18,17	16,172	1029	74,264	259,03	412,62	1,198	1,6946
40	18,613	16,593	1023,7	76,461	260,68	412,82	1,2031	1,6934
41	19,064	17,022	1018,4	78,723	262,33	413	1,2083	1,6922
42	19,523	17,459	1013,1	81,054	264	413,17	1,2134	1,691
43	19,99	17,905	1007,6	83,456	265,68	413,33	1,2186	1,6898
44	20,465	18,36	1002,1	85,931	267,37	413,48	1,2238	1,6886
45	20,949	18,824	996,48	88,485	269,07	413,61	1,229	1,6873
46	21,44	19,297	990,78	91,119	270,78	413,72	1,2342	1,686
47	21,941	19,779	984,99	93,837	272,5	413,82	1,2394	1,6847
48	22,449	20,27	979,1	96,644	274,24	413,9	1,2447	1,6834
49	22,967	20,771	973,11	99,544	275,99	413,97	1,2499	1,682
50	23,493	21,281	967,02	102,54	277,75	414,01	1,2552	1,6805
51	24,028	21,801	960,82	105,64	279,53	414,04	1,2606	1,6791
52	24,572	22,332	954,5	108,85	281,32	414,05	1,2659	1,6776
53	25,125	22,872	948,05	112,17	283,12	414,03	1,2713	1,676
54	25,687	23,423	941,47	115,61	284,95	414	1,2767	1,6744
55	26,258	23,984	934,75	119,18	286,78	413,94	1,2821	1,6728
56	26,838	24,556	927,88	122,88	288,64	413,85	1,2876	1,6711
57	27,428	25,139	920,85	126,73	290,52	413,74	1,2931	1,6693
58	28,027	25,734	913,65	130,73	292,42	413,6	1,2986	1,6675
59	28,636	26,339	906,26	134,89	294,34	413,43	1,3042	1,6656
60	29,255	26,957	898,68	139,23	296,28	413,22	1,3098	1,6637
61	28,137	25,753	912,46	129,26	296,93	419,81	1,3118	1,6826
62	28,742	26,353	905,23	133,32	298,85	419,65	1,3174	1,6808
63	29,356	26,965	897,8	137,54	300,79	419,47	1,3229	1,6789

R-449A

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	Pression (bar abs)	Pression (bar abs)	Densité (kg/m ³)	Densité (kg/m ³)	Enthalpie (kJ/kg)	Enthalpie (kJ/kg)	Entropie (kJ/kg-K)	Entropie (kJ/kg-K)
64	29,98	27,588	890,16	141,95	302,76	419,25	1,3286	1,6769
65	30,613	28,224	882,31	146,55	304,75	419	1,3343	1,6749
66	31,256	28,872	874,22	151,36	306,77	418,7	1,34	1,6727
67	31,909	29,532	865,87	156,4	308,82	418,37	1,3458	1,6705
68	32,572	30,205	857,23	161,68	310,9	417,99	1,3517	1,6681
69	33,245	30,891	848,27	167,24	313,02	417,56	1,3577	1,6656
70	33,928	31,592	838,97	173,09	315,19	417,07	1,3638	1,663
71	34,621	32,306	829,28	179,28	317,39	416,53	1,3699	1,6602
72	35,324	33,034	819,15	185,83	319,65	415,92	1,3762	1,6573
73	36,038	33,778	808,52	192,8	321,96	415,24	1,3827	1,6542
74	36,761	34,538	797,33	200,24	324,33	414,47	1,3893	1,6509
75	37,495	35,314	785,47	208,22	326,78	413,6	1,396	1,6473
76	38,238	36,107	772,85	216,84	329,32	412,63	1,403	1,6434
77	38,991	36,919	759,29	226,19	331,96	411,52	1,4103	1,6392
78	39,753	37,75	744,6	236,45	334,73	410,26	1,4179	1,6346
79	40,524	38,603	728,48	247,82	337,67	408,8	1,426	1,6294
80	41,302	39,479	710,47	260,6	340,81	407,1	1,4346	1,6236