Physical properties (Based on temperature-1)

Temp. [℃]	Press. [kPa]	Density [kg/m³]		Specific volume [m³/kg]		Enthalpy [kJ/kg]			Entropy [kJ/(kg·K)]		C_p [kJ/(kg·K)]	
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Latent H	Liquid	Vapor	Liquid	Vapor
-50	3.492	1549.2	0.28059	0.00064551	3.5639	148.41	344.11	195.70	0.7919	1.6689	0.9761	0.6014
-48	4.015	1544.5	0.31987	0.00064746	3.1263	150.36	345.29	194.93	0.8006	1.6664	0.9807	0.6068
-46	4.602	1539.8	0.36362	0.00064943	2.7501	152.33	346.48	194.15	0.8093	1.6641	0.9853	0.6122
-44	5.260	1535.1	0.41223	0.00065141	2.4258	154.30	347.68	193.38	0.8180	1.6618	0.9899	0.6175
-42	5.996	1530.4	0.46610	0.00065341	2.1455	156.29	348.88	192.59	0.8266	1.6598	0.9944	0.6228
-40	6.817	1525.7	0.52566	0.00065543	1.9024	158.28	350.09	191.81	0.8352	1.6579	0.9990	0.6281
-38	7.729	1521.0	0.59136	0.00065747	1.6910	160.29	351.31	191.02	0.8437	1.6561	1.0034	0.6334
-36	8.742	1516.2	0.66366	0.00065953	1.5068	162.30	352.54	190.24	0.8522	1.6544	1.0079	0.6387
-34	9.862	1511.5	0.74306	0.00066161	1.3458	164.32	353.77	189.45	0.8607	1.6529	1.0123	0.6439
-32	11.10	1506.7	0.83008	0.00066371	1.2047	166.35	355.00	188.65	0.8692	1.6515	1.0167	0.6491
-30	12.46	1501.9	0.92524	0.00066582	1.0808	168.39	356.25	187.86	0.8776	1.6502	1.0211	0.6544
-28	13.97	1497.1	1.0291	0.00066796	0.97172	170.43	357.49	187.06	0.8860	1.6490	1.0255	0.6596
-26	15.61	1492.3	1.1422	0.00067013	0.87547	172.49	358.75	186.26	0.8943	1.6479	1.0298	0.6648
-24	17.41	1487.4	1.2653	0.00067231	0.79034	174.55	360.01	185.46	0.9026	1.6470	1.0342	0.6699
-22	19.39	1482.5	1.3988	0.00067452	0.71489	176.63	361.27	184.64	0.9109	1.6461	1.0385	0.6751
-20	21.54	1477.7	1.5435	0.00067675	0.64787	178.71	362.54	183.83	0.9192	1.6453	1.0428	0.6803
-18	23.88	1472.8	1.7001	0.00067900	0.58822	180.80	363.81	183.01	0.9274	1.6447	1.0470	0.6855
-16	26.42	1467.8	1.8691	0.00068128	0.53501	182.90	365.09	182.19	0.9356	1.6441	1.0513	0.6907
-14	29.19	1462.9	2.0514	0.00068359	0.48747	185.01	366.37	181.36	0.9437	1.6436	1.0555	0.6959
-12	32.18	1457.9	2.2477	0.00068592	0.44490	187.12	367.65	180.53	0.9519	1.6431	1.0597	0.7011
-10	35.42	1452.9	2.4587	0.00068827	0.40672	189.25	368.94	179.69	0.9600	1.6428	1.0639	0.7063
-8	38.91	1447.9	2.6852	0.00069066	0.37241	191.38	370.23	178.85	0.9680	1.6425	1.0681	0.7115
-6	42.68	1442.9	2.9281	0.00069307	0.34152	193.52	371.52	178.00	0.9761	1.6424	1.0723	0.7167
-4	46.74	1437.8	3.1882	0.00069551	0.31366	195.67	372.82	177.15	0.9841	1.6422	1.0765	0.7219
-2	51.10	1432.7	3.4663	0.00069798	0.28850	197.83	374.12	176.29	0.9921	1.6422	1.0807	0.7272
0	55.78	1427.6	3.7633	0.00070048	0.26573	200.00	375.42	175.42	1.0000	1.6422	1.0848	0.7324
2	60.79	1422.4	4.0801	0.00070301	0.24509	202.18	376.72	174.54	1.0079	1.6423	1.0890	0.7377
4	66.17	1417.3	4.4177	0.00070558	0.22636	204.36	378.03	173.67	1.0158	1.6424	1.0931	0.7430
6	71.91	1412.1	4.7770	0.00070818	0.20934	206.55	379.33	172.78	1.0237	1.6426	1.0973	0.7484
8	78.04	1406.8	5.1590	0.00071081	0.19384	208.75	380.64	171.89	1.0315	1.6429	1.1015	0.7537
10	84.58	1401.6	5.5647	0.00071348	0.17970	210.96	381.94	170.98	1.0393	1.6432	1.1056	0.7591
12	91.54	1396.3	5.9952	0.00071618	0.16680	213.18	383.25	170.07	1.0471	1.6436	1.1098	0.7645
14	98.95	1391.0	6.4515	0.00071892	0.15500	215.41	384.56	169.15	1.0549	1.6440	1.1140	0.7699
14.618	101.3	1389.3	6.5980	0.00071977	0.15156	216.10	384.97	168.87	1.0573	1.6441	1.1152	0.7716
16	106.8	1385.6	6.9348	0.00072170	0.14420	217.64	385.87	168.23	1.0626	1.6444	1.1181	0.7754
18	115.2	1380.2	7.4461	0.00072451	0.13430	219.88	387.18	167.30	1.0703	1.6449	1.1223	0.7809
20	124.0	1374.8	7.9867	0.00072737	0.12521	222.14	388.49	166.35	1.0780	1.6455	1.1265	0.7865
22	133.4	1369.4	8.5577	0.00073027	0.11685	224.40	389.80	165.40	1.0857	1.6461	1.1307	0.7921
24	143.3	1363.9	9.1604	0.00073321	0.10917	226.66	391.10	164.44	1.0933	1.6467	1.1350	0.7977
26	153.8	1358.3	9.7961	0.00073620	0.10208	228.94	392.41	163.47	1.1009	1.6474	1.1392	0.8034
28	164.9	1352.8	10.466	0.00073923	0.095548	231.23	393.72	162.49	1.1085	1.6481	1.1435	0.8091
30	176.6	1347.1	11.171	0.00074231	0.089514	233.52	395.02	161.50	1.1161	1.6488	1.1478	0.8149
32	188.9	1341.5	11.914	0.00074544	0.083935	235.82	396.32	160.50	1.1236	1.6496	1.1521	0.8207
34	201.9	1335.8	12.695	0.00074862	0.078771	238.14	397.62	159.48	1.1311	1.6504	1.1565	0.8266
36	215.6	1330.0	13.516	0.00075185	0.073987	240.46	398.92	158.46	1.1386	1.6512	1.1609	0.8326
38	229.9	1324.3	14.378	0.00075514	0.069549	242.79	400.22	157.43	1.1461	1.6521	1.1653	0.8386
40	245.0	1318.4	15.284	0.00075848	0.065429	245.13	401.51	156.38	1.1536	1.6530	1.1698	0.8447
42	260.8	1312.5	16.234	0.00076188	0.061599	247.47	402.80	155.33	1.1610	1.6539	1.1743	0.8509
44	277.4	1306.6	17.231	0.00076533	0.058036	249.83	404.09	154.26	1.1684	1.6548	1.1789	0.8572
46	294.8	1300.6	18.276	0.00076885	0.054718	252.20	405.37	153.17	1.1758	1.6558	1.1835	0.8635
48	313.0	1294.6	19.371	0.00077244	0.051625	254.57	406.65	152.08	1.1832	1.6567	1.1882	0.8700

Physical properties (Based on temperature-2)

Temp. [℃]	Press. [kPa]	Density [kg/m^3]		Specific volume [m^3/kg]		Enthalpy [kJ/kg]			Entropy [kJ/(kg·K)]		C_p [kJ/(kg·K)]	
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Latent H	Liquid	Vapor	Liquid	Vapor
50	332.0	1288.5	20.517	0.00077609	0.048739	256.96	407.93	150.97	1.1905	1.6577	1.1930	0.8765
52	352.0	1282.4	21.718	0.00077981	0.046044	259.35	409.20	149.85	1.1979	1.6587	1.1978	0.8832
54	372.8	1276.2	22.976	0.00078360	0.043524	261.75	410.46	148.71	1.2052	1.6598	1.2027	0.8899
56	394.5	1269.9	24.291	0.00078747	0.041168	264.17	411.73	147.56	1.2125	1.6608	1.2076	0.8968
58	417.2	1263.6	25.667	0.00079141	0.038961	266.59	412.98	146.39	1.2198	1.6619	1.2127	0.9038
60	440.9	1257.2	27.106	0.00079543	0.036892	269.02	414.23	145.21	1.2271	1.6629	1.2178	0.9110
62	465.5	1250.7	28.610	0.00079954	0.034952	271.47	415.47	144.00	1.2343	1.6640	1.2231	0.9183
64	491.2	1244.2	30.183	0.00080374	0.033131	273.92	416.71	142.79	1.2416	1.6651	1.2284	0.9258
66	517.9	1237.6	31.826	0.00080802	0.031420	276.38	417.94	141.56	1.2488	1.6662	1.2339	0.9335
68	545.7	1230.9	33.544	0.00081241	0.029812	278.86	419.16	140.30	1.2560	1.6672	1.2395	0.9413
70	574.7	1224.2	35.338	0.00081689	0.028298	281.34	420.37	139.03	1.2632	1.6683	1.2452	0.9494
72	604.7	1217.3	37.212	0.00082147	0.026873	283.84	421.58	137.74	1.2704	1.6694	1.2511	0.9577
74	635.9	1210.4	39.170	0.00082617	0.025530	286.35	422.78	136.43	1.2775	1.6705	1.2571	0.9663
76	668.4	1203.4	41.215	0.00083097	0.024263	288.87	423.96	135.09	1.2847	1.6716	1.2633	0.9751
78	702.0	1196.3	43.351	0.00083590	0.023068	291.40	425.14	133.74	1.2918	1.6727	1.2696	0.9842
80	736.9	1189.1	45.582	0.00084095	0.021938	293.94	426.31	132.37	1.2990	1.6738	1.2762	0.9936
82	773.1	1181.8	47.913	0.00084614	0.020871	296.49	427.46	130.97	1.3061	1.6749	1.2830	1.0033
84	810.6	1174.5	50.348	0.00085146	0.019862	299.06	428.60	129.54	1.3132	1.6759	1.2900	1.0134
86	849.4	1167.0	52.892	0.00085693	0.018906	301.64	429.73	128.09	1.3203	1.6770	1.2973	1.0240
88	889.6	1159.3	55.551	0.00086255	0.018002	304.24	430.85	126.61	1.3274	1.6780	1.3048	1.0350
90	931.2	1151.6	58.330	0.00086834	0.017144	306.84	431.95	125.11	1.3345	1.6791	1.3126	1.0465
92	974.3	1143.8	61.235	0.00087430	0.016331	309.46	433.04	123.58	1.3416	1.6801	1.3208	1.0585
94	1019	1135.8	64.273	0.00088043	0.015559	312.10	434.11	122.01	1.3487	1.6811	1.3293	1.0711
96	1065	1127.7	67.452	0.00088677	0.014825	314.75	435.17	120.42	1.3558	1.6820	1.3382	1.0844
98	1113	1119.4	70.778	0.00089330	0.014129	317.42	436.20	118.78	1.3629	1.6830	1.3476	1.0984
100	1162	1111.0	74.261	0.00090006	0.013466	320.10	437.22	117.12	1.3700	1.6839	1.3575	1.1132
102	1212	1102.5	77.910	0.00090705	0.012835	322.80	438.22	115.42	1.3771	1.6848	1.3678	1.1290
104	1265	1093.7	81.734	0.00091429	0.012235	325.51	439.20	113.69	1.3842	1.6856	1.3788	1.1458
106	1319	1084.8	85.745	0.00092179	0.011663	328.25	440.15	111.90	1.3913	1.6864	1.3904	1.1637
108	1375	1075.7	89.954	0.00092958	0.011117	331.00	441.08	110.08	1.3984	1.6872	1.4028	1.1829
110	1432	1066.5	94.376	0.00093768	0.010596	333.78	441.98	108.20	1.4055	1.6879	1.4161	1.2035
112	1492	1056.9	99.024	0.00094612	0.010099	336.57	442.85	106.28	1.4126	1.6886	1.4302	1.2259
114	1553	1047.2	103.92	0.00095491	0.0096232	339.39	443.70	104.31	1.4198	1.6892	1.4455	1.2501
116	1616	1037.2	109.07	0.00096410	0.0091685	342.23	444.51	102.28	1.4269	1.6898	1.4621	1.2765
118	1681	1027.0	114.50	0.00097372	0.0087333	345.09	445.28	100.19	1.4341	1.6903	1.4800	1.3054
120	1748	1016.5	120.25	0.00098380	0.0083163	347.98	446.02	98.04	1.4413	1.6907	1.4997	1.3372
122	1817	1005.6	126.32	0.00099441	0.0079165	350.90	446.72	95.82	1.4485	1.6910	1.5213	1.3725
124	1888	994.4	132.76	0.0010056	0.0075326	353.85	447.37	93.52	1.4558	1.6913	1.5453	1.4119
126	1961	982.9	139.59	0.0010174	0.0071638	356.83	447.97	91.14	1.4631	1.6915	1.5721	1.4561
128	2037	970.9	146.86	0.0010299	0.0068090	359.85	448.52	88.67	1.4705	1.6915	1.6023	1.5062
130	2115	958.5	154.63	0.0010433	0.0064671	362.91	449.01	86.10	1.4779	1.6914	1.6366	1.5635
132	2194	945.6	162.94	0.0010576	0.0061373	366.01	449.43	83.42	1.4853	1.6912	1.6763	1.6298
134	2277	932.1	171.87	0.0010729	0.0058184	369.16	449.77	80.61	1.4929	1.6909	1.7226	1.7074
136	2361	917.9	181.50	0.0010895	0.0055095	372.37	450.03	77.66	1.5005	1.6903	1.7776	1.7997
138	2448	902.9	191.96	0.0011075	0.0052094	375.64	450.19	74.55	1.5083	1.6896	1.8442	1.9115
140	2538	887.0	203.39	0.0011274	0.0049167	378.99	450.23	71.24	1.5162	1.6886	1.9269	2.0499
142	2630	870.0	215.98	0.0011495	0.0046301	382.44	450.13	67.69	1.5242	1.6873	2.0328	2.2264
144	2726	851.5	230.02	0.0011744	0.0043474	385.99	449.85	63.86	1.5325	1.6856	2.1739	2.4600
146	2824	831.2	245.93	0.0012031	0.0040662	389.70	449.35	59.65	1.5411	1.6834	2.3722	2.7853
148	2924	808.3	264.38	0.0012372	0.0037824	393.60	448.54	54.94	1.5501	1.6805	2.6733	3.2732
150	3029	781.6	286.59	0.0012794	0.0034893	397.80	447.27	49.47	1.5597	1.6766	3.1891	4.0943
152	3136	748.3	315.23	0.0013363	0.0031723	402.52	445.24	42.72	1.5705	1.6710	4.2871	5.7970
154	3248	699.7	358.74	0.0014291	0.0027875	408.43	441.46	33.03	1.5840	1.6613	8.2795	11.698

Physical properties (Based on pressure)

Press. [kPa]	Temp. [℃]	Density [kg/m^3]		Specific volume [m^3/kg]		Enthalpy [kJ/kg]			Entropy [kJ/(kg·K)]		C_p [kJ/(kg·K)]	
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Latent H	Liquid	Vapor	Liquid	Vapor
20	-21.41	1481.1	1.4403	0.00067517	0.69431	177.24	361.64	184.40	0.9134	1.6459	1.0397	0.6767
40	-7.41	1446.4	2.7556	0.00069137	0.36290	192.02	370.61	178.59	0.9704	1.6425	1.0694	0.7130
60	1.69	1423.2	4.0300	0.00070262	0.24814	201.84	376.52	174.68	1.0067	1.6423	1.0884	0.7369
80	8.61	1405.2	5.2809	0.00071162	0.18936	209.43	381.04	171.61	1.0339	1.6430	1.1027	0.7554
100	14.28	1390.2	6.5163	0.00071930	0.15346	215.71	384.74	169.03	1.0560	1.6440	1.1145	0.7707
101.33	14.62	1389.3	6.5980	0.00071977	0.15156	216.10	384.97	168.87	1.0573	1.6441	1.1152	0.7716
150	25.28	1360.3	9.5638	0.00073512	0.10456	228.12	391.94	163.82	1.0982	1.6471	1.1377	0.8013
200	33.71	1336.6	12.580	0.00074816	0.079489	237.80	397.44	159.64	1.1301	1.6503	1.1559	0.8258
250	40.64	1316.5	15.585	0.00075957	0.064164	245.88	401.93	156.05	1.1560	1.6533	1.1713	0.8467
300	46.58	1298.9	18.589	0.00076989	0.053795	252.89	405.74	152.85	1.1780	1.6560	1.1849	0.8654
350	51.81	1283.0	21.600	0.00077945	0.046296	259.12	409.08	149.96	1.1972	1.6586	1.1973	0.8825
400	56.49	1268.3	24.624	0.00078843	0.040612	264.76	412.03	147.27	1.2143	1.6611	1.2089	0.8985
450	60.75	1254.8	27.664	0.00079697	0.036148	269.94	414.70	144.76	1.2298	1.6633	1.2198	0.9137
500	64.67	1242.0	30.724	0.00080516	0.032548	274.74	417.12	142.38	1.2440	1.6654	1.2302	0.9284
550	68.30	1229.9	33.808	0.00081307	0.029579	279.23	419.34	140.11	1.2571	1.6674	1.2403	0.9425
600	71.69	1218.4	36.918	0.00082076	0.027087	283.45	421.40	137.95	1.2693	1.6693	1.2501	0.9564
650	74.88	1207.4	40.055	0.00082826	0.024965	287.45	423.30	135.85	1.2807	1.6710	1.2598	0.9701
700	77.88	1196.7	43.224	0.00083561	0.023135	291.25	425.07	133.82	1.2914	1.6726	1.2693	0.9836
750	80.73	1186.5	46.424	0.00084284	0.021540	294.87	426.73	131.86	1.3016	1.6742	1.2787	0.9971
800	83.44	1176.5	49.660	0.00084997	0.020137	298.35	428.29	129.94	1.3112	1.6756	1.2880	1.0106
850	86.03	1166.8	52.931	0.00085701	0.018892	301.68	429.75	128.07	1.3204	1.6770	1.2974	1.0241
900	88.51	1157.4	56.242	0.00086400	0.017780	304.89	431.13	126.24	1.3292	1.6783	1.3067	1.0378
950	90.88	1148.2	59.592	0.00087094	0.016781	308.00	432.43	124.43	1.3377	1.6795	1.3162	1.0517
1000	93.16	1139.2	62.984	0.00087784	0.015877	311.00	433.67	122.67	1.3458	1.6806	1.3257	1.0657
1200	101.5	1104.6	77.015	0.00090534	0.012984	322.15	437.98	115.83	1.3754	1.6845	1.3653	1.1251
1400	108.9	1071.7	91.885	0.00093313	0.010883	332.23	441.48	109.25	1.4015	1.6875	1.4086	1.1918
1600	115.5	1039.8	107.75	0.00096176	0.0092808	341.51	444.31	102.80	1.4251	1.6896	1.4578	1.2696
1800	121.5	1008.3	124.80	0.00099176	0.0080130	350.18	446.55	96.37	1.4468	1.6910	1.5158	1.3635
2000	127.0	976.79	143.28	0.00102380	0.0069794	358.38	448.26	89.88	1.4669	1.6915	1.5872	1.4811
2200	132.1	944.66	163.54	0.00105860	0.0061148	366.23	449.45	83.22	1.4859	1.6912	1.6792	1.6348
2400	136.9	911.27	186.08	0.00109740	0.0053740	373.83	450.11	76.28	1.5040	1.6900	1.8058	1.8470
2600	141.4	875.65	211.73	0.00114200	0.0047231	381.30	450.18	68.88	1.5216	1.6877	1.9951	2.1637
2800	145.5	836.17	241.96	0.00119590	0.0041329	388.80	449.49	60.69	1.5390	1.6840	2.3182	2.6972
3000	149.5	789.31	280.10	0.00126690	0.0035702	396.63	447.67	51.04	1.5570	1.6778	3.0161	3.8208
3200	153.2	723.43	337.28	0.00138230	0.0029649	405.68	443.42	37.74	1.5777	1.6662	5.7665	8.0249

Transport properties

Temp. [℃]	Thermal conductivity [mW/(m·K)]		Viscosity [μPa·s]		Surface tension [N/m]
	Liquid	Vapor	Liquid	Vapor	
-25	79.37	4.12	350.81	4.05	0.01910
-20	78.37	4.62	341.86	4.45	0.01843
-15	77.37	5.12	332.91	4.85	0.01777
-10	76.37	5.62	323.96	5.25	0.01711
-5	75.37	6.12	315.01	5.65	0.01646
0	74.37	6.62	306.06	6.05	0.01582
5	73.37	7.12	297.11	6.45	0.01517
10	72.37	7.62	288.16	6.85	0.01454
15	71.37	8.12	279.21	7.25	0.01391
20	70.37	8.62	270.26	7.65	0.01329
25	69.37	9.12	261.31	8.05	0.01267
30	68.37	9.62	252.36	8.45	0.01206
35	67.37	10.12	243.41	8.85	0.01146
40	66.37	10.62	234.46	9.25	0.01086
45	65.37	11.12	225.51	9.65	0.01027
50	64.37	11.62	216.56	10.05	0.009683
55	63.37	12.12	207.61	10.45	0.009106
60	62.37	12.62	198.66	10.85	0.008537
65	61.37	13.12	189.71	11.25	0.007976
70	60.37	13.62	180.76	11.65	0.007423
75	59.37	14.12	171.81	12.05	0.006878
80	58.37	14.62	162.86	12.45	0.006343
85	57.37	15.12	153.91	12.85	0.005816
90	56.37	15.62	144.96	13.25	0.005300
95	55.37	16.12	136.01	13.65	0.004794
100	54.37	16.62	127.06	14.05	0.004298
105	53.37	17.12	118.11	14.45	0.003815
110	52.37	17.62	109.16	14.85	0.003344
115	51.37	18.12	100.21	15.25	0.002886
120	50.37	18.62	91.26	15.65	0.002444
125	49.37	19.12	82.31	16.05	0.002017
130	48.37	19.62	73.36	16.45	0.001609
135	47.37	20.12	64.41	16.85	0.001221
140	46.37	20.62	55.46	17.25	0.000858
145	45.37	21.12	46.51	17.65	0.000525
150	44.37	21.62	37.56	18.05	0.000233
155	43.37	22.12	28.61	18.45	0.000012

Thermal conductivity, Viscosity :

Md. Jahangir et al., *International Journal of refrigeration,* (2019) 104, 221-228.

Surface tension:

C. Kondou and Y. Higashi: 1st IIR International Conference on the Application of HFO Refrigerants,

Paper ID 1126, Birmingham, UK (2018)

Handling Precautions:

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