Opteon™ XL40
Refrigerant

Transport Properties of Opteon™ XL40 (R-454A)
SI Units

Physical Properties

Molecular Weight	80.5 g/mol
Boiling Point at	
One Atmosphere	-47.8 °C
Critical Temperature	81.7
Critical Pressure	4627.4 kPa
Critical Density	456.4 kg/m³
Critical Volume	0.0022 m³/kg
Ozone Depletion Potential	0
Global Warming Potential AR4	239
ASHRAE Standard 34 Safety Rating	A2L

Units and Factors

t = temperature in °C
P = pressure in kiloPascals absolute (kPa [abs])
C_P = Heat capacity at constant pressure in kJ/(kg-K)
C_V = Heat capacity at constant volume in kJ/(kg-K)
C_P/C_V = Heat capacity ratio (dimensionless)
μ = Viscosity in μPa-sec
ν = Kinematic viscosity in cm²/sec
k = Thermal conductivity in mW/m-K
c = Velocity of sound in m/sec
γ = Surface Tension in mN/m
h_f = enthalpy of saturated liquid in kJ/kg
s_f = entropy of saturated liquid in kJ/(kg) (K)

One atmosphere = 101.325 kPa
Reference point for enthalpy and entropy:
h_f = 200 kJ/kg at 0°C
s_f = 1 kJ/kg-K at 0°C

This information is based on NIST Standard Database 23, Version 10 (Lemmon, E.W.; Huber, M.L.; McLinden, M.O.; REFPROP Reference Fluid Thermodynamic and Transport Properties - National Institute of Standards and Technology, 2013).

Chemours™

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Opteon™ XL40 (R-454A)

Saturation Properties - Transport Properties Table

Temp	Heat Capacity, c_p [kJ/kg-K]		c_p/c_v	Viscosity [µPa-sec]		Kinematic Viscosity [cm^2/sec]		Thermal Conductivity [mW/m-K]		Vel. of Sound [m/sec]		Surface Tension
°C	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	[mN/m]
-70	1.3086	0.7183	1.1889	386.3	7.507	0.0029	0.0735	133.20	6.948	878.9	155.6	21.62
-69	1.3088	0.7214	1.1889	381.5	7.565	0.0029	0.0697	132.67	7.009	875.2	155.9	21.43
-68	1.3091	0.7245	1.1889	376.7	7.624	0.0029	0.0661	132.14	7.069	871.5	156.1	21.24
-67	1.3095	0.7276	1.1889	372.0	7.682	0.0028	0.0628	131.60	7.130	867.7	156.4	21.06
-66	1.3100	0.7307	1.1890	367.4	7.740	0.0028	0.0596	131.07	7.191	863.9	156.7	20.87
-65	1.3106	0.7339	1.1891	362.8	7.797	0.0028	0.0567	130.53	7.252	860.1	156.9	20.69
-64	1.3113	0.7371	1.1892	358.3	7.855	0.0027	0.0539	129.99	7.313	856.2	157.2	20.50
-63	1.3120	0.7404	1.1893	353.9	7.912	0.0027	0.0513	129.46	7.375	852.3	157.4	20.32
-62	1.3129	0.7437	1.1895	349.5	7.969	0.0027	0.0488	128.92	7.436	848.4	157.7	20.13
-61	1.3138	0.7470	1.1896	344.9	8.026	0.0026	0.0465	128.38	7.498	844.4	157.9	19.95
-60	1.3148	0.7503	1.1898	340.4	8.083	0.0026	0.0444	127.84	7.561	840.4	158.2	19.76
-59	1.3158	0.7537	1.1900	336.0	8.139	0.0026	0.0423	127.30	7.623	836.4	158.4	19.58
-58	1.3170	0.7571	1.1903	331.7	8.195	0.0026	0.0404	126.75	7.686	832.3	158.6	19.39
-57	1.3182	0.7605	1.1905	327.4	8.251	0.0025	0.0385	126.21	7.749	828.2	158.8	19.21
-56	1.3194	0.7640	1.1908	323.2	8.307	0.0025	0.0368	125.67	7.812	824.1	159.1	19.03
-55	1.3208	0.7675	1.1911	319.1	8.363	0.0025	0.0352	125.13	7.876	820.0	159.3	18.84
-54	1.3222	0.7710	1.1914	315.0	8.418	0.0025	0.0336	124.58	7.940	815.8	159.5	18.66
-53	1.3236	0.7746	1.1918	311.0	8.473	0.0024	0.0322	124.04	8.004	811.6	159.7	18.48
-52	1.3251	0.7782	1.1922	307.1	8.528	0.0024	0.0308	123.50	8.068	807.4	159.9	18.29
-51	1.3267	0.7819	1.1926	303.2	8.583	0.0024	0.0295	122.95	8.132	803.2	160.1	18.11
-50	1.3283	0.7855	1.1930	299.4	8.638	0.0024	0.0282	122.41	8.197	799.0	160.3	17.93
-49	1.3300	0.7892	1.1935	295.6	8.692	0.0023	0.0270	121.87	8.262	794.7	160.5	17.75
-48	1.3318	0.7930	1.1939	291.9	8.747	0.0023	0.0259	121.32	8.328	790.4	160.7	17.57
-47	1.3336	0.7967	1.1944	288.3	8.801	0.0023	0.0249	120.78	8.393	786.1	160.8	17.39
-46	1.3354	0.8005	1.1950	284.7	8.855	0.0023	0.0239	120.24	8.459	781.8	161.0	17.21
-45	1.3374	0.8044	1.1955	281.2	8.909	0.0022	0.0229	119.69	8.525	777.5	161.2	17.03
-44	1.3393	0.8082	1.1961	277.7	8.962	0.0022	0.0220	119.15	8.592	773.1	161.3	16.85
-43	1.3413	0.8121	1.1967	274.3	9.016	0.0022	0.0211	118.61	8.658	768.8	161.5	16.67
-42	1.3434	0.8161	1.1973	270.9	9.069	0.0022	0.0203	118.06	8.725	764.4	161.7	16.49
-41	1.3455	0.8200	1.1980	267.6	9.122	0.0021	0.0195	117.52	8.793	760.0	161.8	16.31
-40	1.3477	0.8240	1.1987	264.4	9.175	0.0021	0.0188	116.98	8.860	755.6	161.9	16.13
-39	1.3499	0.8281	1.1994	261.1	9.228	0.0021	0.0181	116.44	8.928	751.2	162.1	15.96
-38	1.3522	0.8321	1.2002	258.0	9.280	0.0021	0.0174	115.90	8.996	746.7	162.2	15.78
-37	1.3545	0.8362	1.2010	254.9	9.333	0.0021	0.0167	115.36	9.065	742.3	162.3	15.60
-36	1.3568	0.8404	1.2018	251.8	9.385	0.0020	0.0161	114.82	9.134	737.9	162.5	15.42
-35	1.3593	0.8446	1.2026	248.7	9.437	0.0020	0.0155	114.28	9.203	733.4	162.6	15.25
-34	1.3617	0.8488	1.2035	245.8	9.489	0.0020	0.0150	113.74	9.273	728.9	162.7	15.07
-33	1.3642	0.8530	1.2044	242.8	9.541	0.0020	0.0144	113.20	9.343	724.4	162.8	14.90
-32	1.3668	0.8573	1.2054	239.9	9.593	0.0020	0.0139	112.66	9.413	719.9	162.9	14.72
-31	1.3694	0.8616	1.2063	237.0	9.644	0.0019	0.0134	112.13	9.484	715.4	163.0	14.55
-30	1.3720	0.8660	1.2073	234.2	9.695	0.0019	0.0130	111.59	9.555	710.9	163.1	14.37
-29	1.3747	0.8704	1.2084	231.4	9.747	0.0019	0.0125	111.06	9.626	706.4	163.1	14.20
-28	1.3775	0.8748	1.2095	228.7	9.798	0.0019	0.0121	110.52	9.698	701.9	163.2	14.03
-27	1.3803	0.8793	1.2106	226.0	9.849	0.0019	0.0117	109.99	9.770	697.3	163.3	13.85
-26	1.3831	0.8838	1.2118	223.3	9.899	0.0019	0.0113	109.45	9.843	692.8	163.3	13.68
-25	1.3860	0.8883	1.2129	220.7	9.950	0.0018	0.0109	108.92	9.916	688.2	163.4	13.51
-24	1.3889	0.8929	1.2142	218.1	10.001	0.0018	0.0105	108.39	9.989	683.6	163.4	13.34
-23	1.3919	0.8976	1.2155	215.5	10.051	0.0018	0.0102	107.86	10.063	679.1	163.5	13.17
-22	1.3950	0.9022	1.2168	213.0	10.101	0.0018	0.0098	107.33	10.138	674.5	163.5	13.00
-21	1.3980	0.9070	1.2181	210.5	10.151	0.0018	0.0095	106.80	10.212	669.9	163.5	12.83
-20	1.4012	0.9117	1.2195	208.0	10.201	0.0018	0.0092	106.27	10.288	665.3	163.6	12.66
-19	1.4044	0.9165	1.2210	205.6	10.251	0.0017	0.0089	105.75	10.364	660.7	163.6	12.49
-18	1.4076	0.9214	1.2225	203.2	10.301	0.0017	0.0086	105.22	10.440	656.0	163.6	12.32
-17	1.4109	0.9263	1.2240	200.8	10.350	0.0017	0.0084	104.70	10.517	651.4	163.6	12.15
-16	1.4143	0.9313	1.2256	198.4	10.400	0.0017	0.0081	104.17	10.594	646.8	163.6	11.99
-15	1.4177	0.9363	1.2272	196.1	10.449	0.0017	0.0079	103.65	10.672	642.1	163.6	11.82
-14	1.4211	0.9413	1.2289	193.9	10.498	0.0017	0.0076	103.13	10.751	637.5	163.6	11.65
-13	1.4247	0.9464	1.2307	191.6	10.547	0.0016	0.0074	102.61	10.830	632.8	163.5	11.49

Opteon™ XL40 (R-454A)

Saturation Properties - Transport Properties Table

Temp	Heat Capacity, c_p [kJ/kg-K]		c_p/c_v	Viscosity [µPa-sec]		Kinematic Viscosity [cm^2/sec]		Thermal Conductivity [mW/m-K]		Vel. of Sound [m/sec]		Surface Tension
°C	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	[mN/m]
-12	1.4282	0.9516	1.2325	189.4	10.596	0.0016	0.0072	102.09	10.909	628.2	163.5	11.32
-11	1.4319	0.9568	1.2343	187.2	10.645	0.0016	0.0069	101.57	10.990	623.5	163.5	11.16
-10	1.4356	0.9621	1.2362	185.0	10.693	0.0016	0.0067	101.06	11.071	618.8	163.4	11.00
-9	1.4393	0.9675	1.2382	182.8	10.742	0.0016	0.0065	100.54	11.153	614.1	163.4	10.83
-8	1.4432	0.9729	1.2402	180.7	10.790	0.0016	0.0063	100.03	11.235	609.4	163.3	10.67
-7	1.4470	0.9783	1.2423	178.6	10.839	0.0016	0.0062	99.51	11.318	604.7	163.2	10.51
-6	1.4510	0.9839	1.2445	176.6	10.887	0.0016	0.0060	99.00	11.402	600.0	163.2	10.35
-5	1.4550	0.9895	1.2467	174.5	10.935	0.0015	0.0058	98.49	11.487	595.3	163.1	10.18
-4	1.4591	0.9952	1.2490	172.5	10.983	0.0015	0.0056	97.98	11.572	590.5	163.0	10.02
-3	1.4633	1.0009	1.2514	170.5	11.031	0.0015	0.0055	97.47	11.659	585.8	162.9	9.86
-2	1.4675	1.0068	1.2538	168.5	11.078	0.0015	0.0053	96.96	11.746	581.0	162.8	9.71
-1	1.4718	1.0127	1.2564	166.5	11.126	0.0015	0.0052	96.46	11.834	576.3	162.7	9.55
0	1.4762	1.0187	1.2590	164.6	11.173	0.0015	0.0050	95.95	11.923	571.5	162.6	9.39
1	1.4807	1.0248	1.2617	162.7	11.221	0.0015	0.0049	95.45	12.013	566.7	162.4	9.23
2	1.4853	1.0310	1.2645	160.8	11.268	0.0014	0.0047	94.95	12.104	562.0	162.3	9.07
3	1.4899	1.0373	1.2673	158.9	11.315	0.0014	0.0046	94.45	12.196	557.2	162.1	8.92
4	1.4946	1.0437	1.2703	157.1	11.362	0.0014	0.0045	93.95	12.289	552.4	162.0	8.76
5	1.4995	1.0502	1.2734	155.3	11.409	0.0014	0.0044	93.45	12.384	547.5	161.8	8.61
6	1.5044	1.0568	1.2765	153.4	11.456	0.0014	0.0042	92.95	12.479	542.7	161.7	8.45
7	1.5094	1.0635	1.2798	151.6	11.503	0.0014	0.0041	92.46	12.576	537.9	161.5	8.30
8	1.5145	1.0704	1.2832	149.9	11.549	0.0014	0.0040	91.96	12.674	533.0	161.3	8.15
9	1.5197	1.0773	1.2867	148.1	11.596	0.0014	0.0039	91.47	12.773	528.2	161.1	8.00
10	1.5251	1.0845	1.2903	146.4	11.642	0.0014	0.0038	90.98	12.874	523.3	160.9	7.84
11	1.5305	1.0917	1.2940	144.7	11.689	0.0013	0.0037	90.49	12.976	518.4	160.7	7.69
12	1.5361	1.0991	1.2979	143.0	11.735	0.0013	0.0036	90.00	13.080	513.6	160.5	7.54
13	1.5418	1.1067	1.3018	141.3	11.783	0.0013	0.0035	89.51	13.185	508.7	160.2	7.39
14	1.5476	1.1144	1.3060	139.6	11.830	0.0013	0.0034	89.03	13.292	503.8	160.0	7.25
15	1.5536	1.1223	1.3103	137.9	11.877	0.0013	0.0033	88.54	13.401	498.8	159.7	7.10
16	1.5596	1.1304	1.3147	136.3	11.924	0.0013	0.0032	88.06	13.512	493.9	159.5	6.95
17	1.5659	1.1386	1.3193	134.7	11.971	0.0013	0.0032	87.58	13.624	489.0	159.2	6.81
18	1.5723	1.1471	1.3240	133.1	12.018	0.0013	0.0031	87.09	13.738	484.0	158.9	6.66
19	1.5788	1.1557	1.3289	131.5	12.065	0.0013	0.0030	86.62	13.855	479.1	158.7	6.52
20	1.5856	1.1646	1.3340	129.9	12.113	0.0012	0.0029	86.14	13.973	474.1	158.4	6.37
21	1.5925	1.1737	1.3393	128.3	12.160	0.0012	0.0028	85.66	14.094	469.1	158.1	6.23
22	1.5996	1.1830	1.3448	126.8	12.207	0.0012	0.0028	85.18	14.218	464.1	157.7	6.09
23	1.6069	1.1926	1.3505	125.2	12.254	0.0012	0.0027	84.71	14.343	459.1	157.4	5.95
24	1.6144	1.2024	1.3564	123.7	12.301	0.0012	0.0026	84.24	14.472	454.1	157.1	5.81
25	1.6221	1.2125	1.3625	122.2	12.348	0.0012	0.0026	83.76	14.603	449.1	156.7	5.67
26	1.6301	1.2229	1.3689	120.7	12.395	0.0012	0.0025	83.29	14.737	444.0	156.4	5.53
27	1.6383	1.2336	1.3756	119.2	12.460	0.0012	0.0024	82.82	14.873	439.0	156.0	5.39
28	1.6468	1.2446	1.3824	117.7	12.526	0.0012	0.0024	82.35	15.013	433.9	155.6	5.25
29	1.6555	1.2560	1.3896	116.2	12.593	0.0012	0.0023	81.89	15.156	428.8	155.2	5.12
30	1.6646	1.2677	1.3971	114.8	12.660	0.0011	0.0023	81.42	15.302	423.7	154.8	4.98
31	1.6740	1.2797	1.4049	113.3	12.727	0.0011	0.0022	80.96	15.452	418.6	154.4	4.85
32	1.6837	1.2922	1.4130	111.9	12.795	0.0011	0.0022	80.49	15.605	413.5	154.0	4.71
33	1.6937	1.3051	1.4215	110.5	12.864	0.0011	0.0021	80.03	15.763	408.4	153.6	4.58
34	1.7042	1.3185	1.4303	109.1	12.933	0.0011	0.0021	79.57	15.925	403.2	153.1	4.45
35	1.7151	1.3323	1.4396	107.7	13.004	0.0011	0.0020	79.11	16.091	398.0	152.7	4.32
36	1.7264	1.3466	1.4492	106.3	13.075	0.0011	0.0020	78.65	16.263	392.8	152.2	4.19
37	1.7381	1.3614	1.4593	104.9	13.147	0.0011	0.0019	78.19	16.449	387.6	151.7	4.06
38	1.7504	1.3768	1.4699	103.5	13.221	0.0011	0.0019	77.73	16.641	382.4	151.2	3.93
39	1.7632	1.3928	1.4810	102.1	13.295	0.0011	0.0018	77.27	16.840	377.1	150.7	3.81
40	1.7766	1.4095	1.4926	100.7	13.371	0.0011	0.0018	76.82	17.045	371.8	150.2	3.68
41	1.7906	1.4268	1.5048	99.4	13.449	0.0011	0.0018	76.36	17.257	366.5	149.7	3.56
42	1.8052	1.4449	1.5177	98.0	13.528	0.0010	0.0017	75.91	17.477	361.1	149.1	3.44
43	1.8206	1.4638	1.5312	96.7	13.609	0.0010	0.0017	75.45	17.704	355.7	148.6	3.31
44	1.8368	1.4836	1.5454	95.3	13.692	0.0010	0.0016	75.00	17.940	350.3	148.0	3.19
45	1.8537	1.5042	1.5604	94.0	13.777	0.0010	0.0016	74.55	18.185	344.8	147.4	3.07

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Saturation Properties - Transport Properties Table

Temp	Heat Capacity, c_p [kJ/kg-K]		c_p/c_v	Viscosity [µPa-sec]		Kinematic Viscosity [cm^2/sec]		Thermal Conductivity [mW/m-K]		Vel. of Sound [m/sec]		Surface Tension
°C	Liquid	Vapor	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	[mN/m]
46	1.8716	1.5259	1.5762	92.7	13.864	0.0010	0.0016	74.10	18.440	339.3	146.8	2.95
47	1.8905	1.5487	1.5930	91.3	13.953	0.0010	0.0015	73.64	18.704	333.8	146.2	2.83
48	1.9104	1.5726	1.6107	90.0	14.045	0.0010	0.0015	73.19	18.980	328.2	145.6	2.71
49	1.9315	1.5978	1.6295	88.7	14.139	0.0010	0.0015	72.74	19.266	322.6	145.0	2.60
50	1.9539	1.6244	1.6495	87.4	14.236	0.0010	0.0014	72.29	19.565	316.9	144.3	2.48
51	1.9776	1.6525	1.6707	86.1	14.335	0.0010	0.0014	71.84	19.877	311.2	143.6	2.37
52	2.0029	1.6822	1.6934	84.7	14.438	0.0010	0.0014	71.40	20.203	305.4	142.9	2.26
53	2.0299	1.7138	1.7175	83.4	14.544	0.0009	0.0013	70.95	20.544	299.6	142.2	2.15
54	2.0587	1.7474	1.7434	82.1	14.654	0.0009	0.0013	70.50	20.902	293.7	141.5	2.04
55	2.0896	1.7833	1.7711	80.8	14.768	0.0009	0.0013	70.06	21.276	287.8	140.8	1.93
56	2.1229	1.8216	1.8009	79.5	14.886	0.0009	0.0012	69.61	21.670	281.8	140.0	1.82
57	2.1587	1.8626	1.8330	78.2	15.009	0.0009	0.0012	69.17	22.083	275.8	139.2	1.72
58	2.1975	1.9068	1.8676	76.8	15.136	0.0009	0.0012	68.72	22.519	269.7	138.4	1.62
59	2.2396	1.9544	1.9052	75.5	15.269	0.0009	0.0012	68.28	22.979	263.6	137.6	1.52
60	2.2855	2.0059	1.9459	74.2	15.408	0.0009	0.0011	67.84	23.465	257.5	136.8	1.42
61	2.3358	2.0619	1.9904	72.8	15.553	0.0009	0.0011	67.41	23.979	251.3	135.9	1.33
62	2.3910	2.1229	2.0391	71.5	15.706	0.0009	0.0011	66.97	24.525	245.0	135.1	1.24
63	2.4521	2.1898	2.0926	70.1	15.866	0.0009	0.0011	66.54	25.105	238.7	134.2	1.14
64	2.5200	2.2633	2.1517	68.8	16.034	0.0009	0.0010	66.12	25.723	232.4	133.2	1.05
65	2.5960	2.3448	2.2173	67.4	16.212	0.0009	0.0010	65.70	26.384	226.0	132.3	0.97
66	2.6816	2.4354	2.2904	66.0	16.401	0.0008	0.0010	65.29	27.092	219.6	131.3	0.88
67	2.7789	2.5369	2.3726	64.6	16.602	0.0008	0.0010	64.89	27.853	213.1	130.3	0.80
68	2.8904	2.6515	2.4655	63.2	16.816	0.0008	0.0010	64.50	28.674	206.6	129.3	0.72
69	3.0195	2.7820	2.5715	61.7	17.046	0.0008	0.0009	64.13	29.563	200.0	128.3	0.64
70	3.1708	2.9320	2.6934	60.3	17.294	0.0008	0.0009	63.78	30.532	193.4	127.2	0.56
71	3.3506	3.1063	2.8353	58.8	17.563	0.0008	0.0009	63.46	31.591	186.7	126.1	0.49
72	3.5678	3.3115	3.0025	57.2	17.856	0.0008	0.0009	63.18	32.758	179.9	124.9	0.42
73	3.8355	3.5568	3.2023	55.6	18.178	0.0008	0.0008	62.95	34.054	173.0	123.7	0.36
74	4.1733	3.8557	3.4458	54.0	18.537	0.0008	0.0008	62.80	35.506	166.1	122.5	0.29
75	4.6126	4.2282	3.7489	52.3	18.939	0.0008	0.0008	62.75	37.153	159.1	121.2	0.23
76	5.2063	4.7059	4.1371	50.5	19.400	0.0008	0.0008	62.84	39.049	151.9	119.9	0.18
77	6.0499	5.3420	4.6530	48.5	19.937	0.0007	0.0008	63.13	41.278	144.7	118.4	0.13
78	7.3332	6.2332	5.3739	46.4	20.581	0.0007	0.0007	63.72	43.975	137.3	117.0	0.09
79	9.4812	7.5773	6.4573	44.0	21.391	0.0007	0.0007	64.80	47.382	129.7	115.4	0.05

Opteon™ XL40 (R-454A)

Superheated Vapor - Viscosity Table

Viscosity in µPa-sec

Saturation Properties in Light Blue

Temp °C	ABSOLUTE PRESSURE, kPa												
	50	101.325	200	300	400	500	600	800	1000	1500	2000	2500	3000
	-55.8	-42.2	-27.0	-16.9	-9.1	-2.7	2.8	12.0	19.6	34.4	45.9	55.2	63.1
	8.321	9.061	9.847	10.356	10.738	11.047	11.308	11.736	12.094	12.964	13.851	14.792	15.888
-55	8.363												
-50	8.638												
-45	8.909												
-40	9.175	9.175											
-35	9.437	9.437											
-30	9.695	9.695											
-25	9.950	9.950	9.950										
-20	10.201	10.201	10.201										
-15	10.449	10.449	10.449	10.449									
-10	10.693	10.693	10.693	10.693									
-5	10.935	10.935	10.935	10.935	10.935								
0	11.173	11.173	11.173	11.173	11.173	11.173							
5	11.409	11.409	11.409	11.409	11.409	11.409	11.409						
10	11.642	11.642	11.642	11.642	11.642	11.642	11.642						
15	11.873	11.873	11.873	11.873	11.873	11.873	11.873	11.874					
20	12.101	12.101	12.101	12.101	12.101	12.101	12.101	12.104	12.112				
25	12.328	12.328	12.328	12.328	12.328	12.328	12.328	12.332	12.339				
30	12.551	12.551	12.551	12.551	12.551	12.552	12.553	12.558	12.565				
35	12.773	12.773	12.773	12.773	12.774	12.775	12.776	12.781	12.795	12.991			
40	12.993	12.993	12.993	12.994	12.995	12.996	12.997	13.002	13.042	13.226			
45	13.211	13.211	13.212	13.212	13.213	13.215	13.217	13.238	13.281	13.459			
50	13.428	13.428	13.428	13.429	13.430	13.432	13.440	13.472	13.515	13.688	14.013		
55	13.642	13.642	13.643	13.644	13.646	13.655	13.668	13.701	13.745	13.914	14.215		
60	13.855	13.855	13.856	13.858	13.866	13.878	13.892	13.926	13.971	14.138	14.421	14.913	
65	14.066	14.067	14.068	14.075	14.085	14.098	14.112	14.148	14.194	14.360	14.628	15.066	15.871
70	14.276	14.277	14.281	14.290	14.302	14.315	14.330	14.368	14.414	14.579	14.835	15.235	15.899
75	14.485	14.485	14.493	14.503	14.516	14.530	14.546	14.585	14.632	14.796	15.043	15.412	15.988
80	14.692	14.694	14.703	14.714	14.727	14.743	14.760	14.800	14.848	15.011	15.250	15.596	16.109
85	14.898	14.901	14.911	14.924	14.938	14.954	14.971	15.013	15.062	15.224	15.456	15.783	16.249
90	15.103	15.107	15.118	15.131	15.146	15.163	15.181	15.224	15.274	15.436	15.662	15.973	16.402
95	15.307	15.312	15.324	15.337	15.353	15.370	15.390	15.433	15.484	15.645	15.866	16.164	16.565
100	15.510	15.515	15.528	15.542	15.559	15.577	15.596	15.641	15.692	15.853	16.070	16.356	16.733
105	15.711	15.717	15.730	15.746	15.763	15.781	15.802	15.847	15.899	16.060	16.272	16.548	16.905
110	15.912	15.918	15.932	15.948	15.965	15.985	16.005	16.051	16.104	16.265	16.473	16.741	17.081
115	16.111	16.118	16.132	16.149	16.167	16.187	16.208	16.255	16.308	16.468	16.674	16.933	17.259
120	16.309	16.316	16.332	16.349	16.367	16.388	16.409	16.457	16.510	16.670	16.873	17.126	17.439
125	16.507	16.514	16.530	16.548	16.567	16.587	16.609	16.657	16.711	16.871	17.071	17.318	17.619
130	16.703	16.711	16.727	16.745	16.765	16.786	16.808	16.857	16.911	17.070	17.268	17.509	17.801
135	16.899	16.907	16.923	16.942	16.962	16.983	17.006	17.055	17.109	17.268	17.464	17.700	17.983
140	17.094	17.102	17.119	17.138	17.158	17.180	17.203	17.252	17.307	17.465	17.659	17.890	18.165
145	17.287	17.296	17.313	17.333	17.353	17.375	17.399	17.448	17.503	17.661	17.853	18.080	18.348
150	17.481	17.489	17.507	17.527	17.548	17.570	17.593	17.644	17.699	17.856	18.046	18.269	18.530
155	17.673	17.682	17.700	17.720	17.741	17.764	17.787	17.838	17.893	18.050	18.238	18.457	18.713
160	17.864	17.873	17.892	17.912	17.934	17.957	17.980	18.031	18.086	18.243	18.429	18.645	18.895
165	18.055	18.064	18.083	18.104	18.126	18.149	18.173	18.224	18.279	18.435	18.619	18.832	19.077
170	18.246	18.255	18.274	18.295	18.317	18.340	18.364	18.415	18.471	18.627	18.809	19.019	19.259
175	18.435	18.445	18.464	18.485	18.507	18.530	18.555	18.606	18.661	18.817	18.997	19.205	19.440
180	18.624	18.634	18.653	18.674	18.697	18.720	18.745	18.796	18.851	19.006	19.185	19.390	19.621
185	18.813	18.822	18.842	18.863	18.886	18.909	18.934	18.985	19.041	19.195	19.373	19.574	19.802
190	19.000	19.010	19.030	19.052	19.074	19.098	19.122	19.174	19.229	19.383	19.559	19.758	19.982
195	19.188	19.197	19.218	19.239	19.262	19.286	19.310	19.362	19.417	19.570	19.745	19.942	20.162
200	19.374	19.384	19.404	19.426	19.449	19.473	19.497	19.549	19.605	19.757	19.930	20.125	20.342
205	19.560	19.570	19.591	19.613	19.636	19.659	19.684	19.736	19.791	19.943	20.115	20.307	20.521
210	19.746	19.756	19.777	19.799	19.822	19.846	19.870	19.922	19.977	20.128	20.299	20.489	20.700
215	19.931	19.941	19.962	19.984	20.007	20.031	20.056	20.108	20.163	20.313	20.482	20.670	20.878
220	20.116	20.126	20.147	20.169	20.192	20.216	20.241	20.293	20.347	20.497	20.665	20.851	21.056
225	20.300	20.310	20.331	20.354	20.377	20.401	20.425	20.477	20.532	20.681	20.847	21.032	21.234
230	20.484	20.494	20.515	20.538	20.561	20.585	20.609	20.661	20.715	20.864	21.029	21.212	21.412
235	20.668	20.678	20.699	20.721	20.744	20.768	20.793	20.844	20.899	21.046	21.210	21.391	21.589
240	20.851	20.861	20.882	20.904	20.927	20.951	20.976	21.027	21.082	21.228	21.391	21.570	21.765
245	21.033	21.044	21.065	21.087	21.110	21.134	21.159	21.210	21.264	21.410	21.572	21.749	21.942
250	21.216	21.226	21.247	21.269	21.292	21.316	21.341	21.392	21.446	21.591	21.752	21.927	22.118
255	21.397	21.408	21.429	21.451	21.474	21.498	21.523	21.574	21.627	21.772	21.931	22.105	22.293
260	21.579	21.589	21.610	21.633	21.656	21.680	21.704	21.755	21.809	21.952	22.110	22.282	22.469
265	21.760	21.771	21.792	21.814	21.837	21.861	21.885	21.936	21.989	22.132	22.289	22.460	22.644
270	21.941	21.952	21.973	21.995	22.018	22.042	22.066	22.117	22.170	22.312	22.467	22.636	22.819
275	22.122	22.132	22.153	22.175	22.198	22.222	22.246	22.297	22.350	22.491	22.645	22.813	22.993
280	22.302	22.312	22.333	22.356	22.379	22.402	22.426	22.477	22.529	22.670	22.823	22.989	23.168

Opteon™ XL40 (R-454A)

Superheated Vapor - Heat Capacity Table

Heat Capacity, C_p, in kJ/kg-K

Saturation Properties in Light Blue

Temp °C	ABSOLUTE PRESSURE, kPa												
	50	101.325	200	300	400	500	600	800	1000	1500	2000	2500	3000
	-55.8	-42.2	-27.0	-16.9	-9.1	-2.7	2.8	12.0	19.6	34.4	45.9	55.2	63.1
	0.765	0.815	0.879	0.927	0.967	1.003	1.036	1.099	1.161	1.324	1.523	1.791	2.199
-55	0.7651												
-50	0.7679												
-45	0.7722												
-40	0.7776	0.8146											
-35	0.7836	0.8148											
-30	0.7900	0.8170											
-25	0.7969	0.8205	0.8763										
-20	0.8041	0.8250	0.8722										
-15	0.8115	0.8302	0.8710	0.9228									
-10	0.8191	0.8359	0.8717	0.9153									
-5	0.8268	0.8420	0.8739	0.9113	0.9564								
0	0.8347	0.8485	0.8770	0.9098	0.9479	0.9938							
5	0.8428	0.8552	0.8809	0.9100	0.9430	0.9814	1.0273						
10	0.8508	0.8622	0.8855	0.9114	0.9405	0.9735	1.0117						
15	0.8590	0.8694	0.8906	0.9139	0.9397	0.9685	1.0012	1.0834					
20	0.8673	0.8768	0.8961	0.9172	0.9403	0.9658	0.9942	1.0633	1.1579				
25	0.8755	0.8843	0.9019	0.9212	0.9420	0.9647	0.9898	1.0490	1.1264				
30	0.8838	0.8919	0.9081	0.9257	0.9445	0.9650	0.9872	1.0389	1.1039				
35	0.8922	0.8996	0.9145	0.9306	0.9478	0.9663	0.9862	1.0318	1.0874	1.3167			
40	0.9005	0.9074	0.9212	0.9359	0.9517	0.9684	0.9865	1.0270	1.0754	1.2597			
45	0.9089	0.9152	0.9280	0.9416	0.9560	0.9713	0.9877	1.0241	1.0667	1.2196			
50	0.9172	0.9231	0.9349	0.9475	0.9608	0.9748	0.9897	1.0226	1.0605	1.1902	1.4318		
55	0.9255	0.9311	0.9420	0.9537	0.9659	0.9789	0.9925	1.0223	1.0563	1.1684	1.3575		
60	0.9338	0.9390	0.9492	0.9601	0.9714	0.9833	0.9958	1.0231	1.0537	1.1519	1.3058	1.6059	
65	0.9421	0.9470	0.9565	0.9666	0.9771	0.9881	0.9997	1.0246	1.0524	1.1394	1.2681	1.4904	2.0276
70	0.9504	0.9549	0.9638	0.9732	0.9830	0.9933	1.0040	1.0269	1.0523	1.1300	1.2399	1.4139	1.7536
75	0.9586	0.9629	0.9712	0.9800	0.9892	0.9987	1.0086	1.0298	1.0530	1.1229	1.2183	1.3599	1.6018
80	0.9668	0.9708	0.9787	0.9869	0.9954	1.0043	1.0135	1.0332	1.0545	1.1179	1.2017	1.3200	1.5045
85	0.9750	0.9787	0.9861	0.9938	1.0019	1.0101	1.0187	1.0370	1.0567	1.1144	1.1888	1.2896	1.4369
90	0.9831	0.9866	0.9936	1.0009	1.0084	1.0161	1.0242	1.0411	1.0594	1.1123	1.1788	1.2662	1.3874
95	0.9912	0.9945	1.0011	1.0079	1.0150	1.0223	1.0298	1.0456	1.0626	1.1112	1.1712	1.2479	1.3500
100	0.9992	1.0023	1.0085	1.0150	1.0216	1.0285	1.0356	1.0504	1.0662	1.1110	1.1655	1.2335	1.3212
105	1.0071	1.0101	1.0160	1.0221	1.0284	1.0348	1.0415	1.0554	1.0702	1.1117	1.1614	1.2222	1.2985
110	1.0151	1.0179	1.0234	1.0292	1.0352	1.0413	1.0475	1.0606	1.0744	1.1130	1.1585	1.2133	1.2806
115	1.0229	1.0256	1.0309	1.0363	1.0420	1.0477	1.0536	1.0659	1.0789	1.1149	1.1568	1.2065	1.2663
120	1.0307	1.0332	1.0383	1.0435	1.0488	1.0542	1.0598	1.0714	1.0837	1.1172	1.1560	1.2013	1.2549
125	1.0384	1.0408	1.0456	1.0506	1.0556	1.0608	1.0661	1.0771	1.0886	1.1200	1.1560	1.1975	1.2460
130	1.0461	1.0484	1.0529	1.0576	1.0625	1.0674	1.0724	1.0828	1.0936	1.1232	1.1566	1.1949	1.2389
135	1.0537	1.0559	1.0602	1.0647	1.0693	1.0740	1.0787	1.0886	1.0989	1.1266	1.1579	1.1932	1.2335
140	1.0612	1.0633	1.0675	1.0717	1.0761	1.0805	1.0851	1.0944	1.1042	1.1304	1.1596	1.1924	1.2294
145	1.0686	1.0707	1.0746	1.0787	1.0829	1.0871	1.0915	1.1004	1.1096	1.1344	1.1618	1.1923	1.2264
150	1.0760	1.0780	1.0818	1.0857	1.0897	1.0937	1.0978	1.1063	1.1151	1.1385	1.1643	1.1928	1.2244
155	1.0833	1.0852	1.0889	1.0926	1.0964	1.1003	1.1042	1.1123	1.1207	1.1429	1.1672	1.1939	1.2232
160	1.0906	1.0924	1.0959	1.0995	1.1031	1.1068	1.1106	1.1183	1.1263	1.1474	1.1703	1.1954	1.2227
165	1.0978	1.0995	1.1029	1.1063	1.1098	1.1133	1.1169	1.1243	1.1319	1.1520	1.1737	1.1973	1.2229
170	1.1049	1.1065	1.1098	1.1131	1.1164	1.1198	1.1233	1.1303	1.1376	1.1567	1.1773	1.1995	1.2235
175	1.1119	1.1135	1.1166	1.1198	1.1230	1.1263	1.1296	1.1364	1.1433	1.1615	1.1811	1.2021	1.2247
180	1.1189	1.1204	1.1234	1.1265	1.1296	1.1327	1.1359	1.1424	1.1490	1.1664	1.1850	1.2049	1.2262
185	1.1258	1.1273	1.1301	1.1331	1.1361	1.1391	1.1421	1.1484	1.1547	1.1714	1.1891	1.2080	1.2280
190	1.1326	1.1340	1.1368	1.1396	1.1425	1.1454	1.1484	1.1543	1.1605	1.1764	1.1933	1.2112	1.2302
195	1.1393	1.1407	1.1434	1.1461	1.1489	1.1517	1.1545	1.1603	1.1662	1.1814	1.1976	1.2146	1.2326
200	1.1460	1.1473	1.1499	1.1526	1.1552	1.1579	1.1607	1.1662	1.1719	1.1865	1.2020	1.2182	1.2353
205	1.1526	1.1539	1.1564	1.1590	1.1615	1.1641	1.1668	1.1721	1.1776	1.1916	1.2064	1.2219	1.2382
210	1.1592	1.1604	1.1628	1.1653	1.1678	1.1703	1.1728	1.1780	1.1832	1.1967	1.2109	1.2257	1.2412
215	1.1656	1.1668	1.1692	1.1715	1.1740	1.1764	1.1788	1.1838	1.1889	1.2019	1.2155	1.2296	1.2444
220	1.1720	1.1732	1.1754	1.1777	1.1801	1.1824	1.1848	1.1896	1.1945	1.2070	1.2201	1.2336	1.2478
225	1.1783	1.1795	1.1817	1.1839	1.1861	1.1884	1.1907	1.1953	1.2000	1.2121	1.2247	1.2377	1.2512
230	1.1846	1.1857	1.1878	1.1900	1.1922	1.1944	1.1966	1.2011	1.2056	1.2173	1.2293	1.2419	1.2548
235	1.1908	1.1918	1.1939	1.1960	1.1981	1.2002	1.2024	1.2067	1.2111	1.2224	1.2340	1.2460	1.2585
240	1.1969	1.1979	1.1999	1.2019	1.2040	1.2061	1.2081	1.2123	1.2166	1.2275	1.2387	1.2503	1.2622
245	1.2029	1.2039	1.2059	1.2078	1.2098	1.2118	1.2139	1.2179	1.2220	1.2326	1.2434	1.2545	1.2660
250	1.2089	1.2099	1.2118	1.2137	1.2156	1.2176	1.2195	1.2235	1.2274	1.2376	1.2481	1.2588	1.2698
255	1.2148	1.2157	1.2176	1.2194	1.2213	1.2232	1.2251	1.2289	1.2328	1.2427	1.2528	1.2631	1.2737
260	1.2206	1.2216	1.2233	1.2252	1.2270	1.2288	1.2307	1.2344	1.2381	1.2477	1.2574	1.2674	1.2777
265	1.2264	1.2273	1.2290	1.2308	1.2326	1.2344	1.2362	1.2398	1.2434	1.2527	1.2621	1.2718	1.2816
270	1.2321	1.2330	1.2347	1.2364	1.2381	1.2399	1.2416	1.2451	1.2486	1.2576	1.2668	1.2761	1.2856
275	1.2378	1.2386	1.2403	1.2419	1.2436	1.2453	1.2470	1.2504	1.2538	1.2625	1.2714	1.2805	1.2897
280	1.2434	1.2442	1.2458	1.2474	1.2490	1.2507	1.2523	1.2556	1.2590	1.2674	1.2760	1.2848	1.2937

Opteon™ XL40 (R-454A)

Superheated Vapor - Heat Capacity Ratio Table

Heat Capacity Ratio, C_p/C_v

Saturation Properties in Light Blue

Temp °C	ABSOLUTE PRESSURE, kPa												
	50	101.325	200	300	400	500	600	800	1000	1500	2000	2500	3000
	-55.8	-42.2	-27.0	-16.9	-9.1	-2.7	2.8	12.0	19.6	34.4	45.9	55.2	63.1
	1.191	1.197	1.211	1.224	1.238	1.252	1.267	1.298	1.332	1.434	1.574	1.777	2.100
-55	1.1900												
-50	1.1848												
-45	1.1801												
-40	1.1758	1.1943											
-35	1.1719	1.1881											
-30	1.1683	1.1826											
-25	1.1649	1.1777	1.2069										
-20	1.1618	1.1732	1.1988										
-15	1.1588	1.1691	1.1918	1.2201									
-10	1.1560	1.1654	1.1857	1.2102									
-5	1.1534	1.1619	1.1802	1.2018	1.2278								
0	1.1509	1.1587	1.1752	1.1945	1.2171	1.2443							
5	1.1485	1.1556	1.1706	1.1879	1.2079	1.2313	1.2594						
10	1.1463	1.1528	1.1665	1.1821	1.1999	1.2204	1.2444						
15	1.1441	1.1501	1.1626	1.1768	1.1927	1.2108	1.2317	1.2849					
20	1.1420	1.1476	1.1591	1.1720	1.1864	1.2025	1.2208	1.2662	1.3296				
25	1.1401	1.1452	1.1558	1.1676	1.1806	1.1951	1.2113	1.2506	1.3032				
30	1.1382	1.1429	1.1527	1.1636	1.1754	1.1885	1.2030	1.2374	1.2819				
35	1.1363	1.1408	1.1499	1.1598	1.1707	1.1825	1.1956	1.2261	1.2644	1.4282			
40	1.1346	1.1387	1.1471	1.1564	1.1663	1.1771	1.1890	1.2162	1.2496	1.3821			
45	1.1329	1.1368	1.1446	1.1531	1.1623	1.1722	1.1830	1.2074	1.2369	1.3472			
50	1.1313	1.1349	1.1422	1.1501	1.1586	1.1677	1.1775	1.1996	1.2259	1.3195	1.5018		
55	1.1297	1.1331	1.1399	1.1473	1.1552	1.1636	1.1726	1.1927	1.2162	1.2971	1.4401		
60	1.1282	1.1314	1.1378	1.1446	1.1520	1.1597	1.1680	1.1864	1.2076	1.2783	1.3946	1.6294	
65	1.1267	1.1297	1.1357	1.1421	1.1490	1.1562	1.1638	1.1807	1.1999	1.2624	1.3594	1.5335	1.9634
70	1.1253	1.1281	1.1338	1.1398	1.1461	1.1529	1.1599	1.1754	1.1930	1.2486	1.3312	1.4672	1.7401
75	1.1239	1.1266	1.1319	1.1376	1.1435	1.1498	1.1564	1.1707	1.1867	1.2367	1.3080	1.4181	1.6122
80	1.1226	1.1251	1.1301	1.1354	1.1410	1.1469	1.1530	1.1663	1.1810	1.2262	1.2885	1.3799	1.5272
85	1.1213	1.1237	1.1284	1.1334	1.1387	1.1441	1.1499	1.1622	1.1758	1.2168	1.2718	1.3493	1.4660
90	1.1201	1.1223	1.1268	1.1315	1.1364	1.1416	1.1469	1.1584	1.1710	1.2084	1.2575	1.3241	1.4195
95	1.1188	1.1210	1.1252	1.1297	1.1343	1.1392	1.1442	1.1549	1.1666	1.2009	1.2449	1.3030	1.3827
100	1.1177	1.1197	1.1237	1.1279	1.1323	1.1369	1.1416	1.1516	1.1625	1.1941	1.2338	1.2850	1.3529
105	1.1165	1.1185	1.1223	1.1263	1.1304	1.1347	1.1392	1.1486	1.1587	1.1879	1.2240	1.2694	1.3281
110	1.1154	1.1173	1.1209	1.1247	1.1286	1.1327	1.1369	1.1457	1.1552	1.1822	1.2152	1.2559	1.3071
115	1.1144	1.1161	1.1196	1.1232	1.1269	1.1307	1.1347	1.1430	1.1519	1.1770	1.2072	1.2439	1.2892
120	1.1133	1.1150	1.1183	1.1217	1.1252	1.1289	1.1326	1.1405	1.1488	1.1722	1.2000	1.2333	1.2736
125	1.1123	1.1139	1.1170	1.1203	1.1236	1.1271	1.1306	1.1381	1.1459	1.1678	1.1935	1.2238	1.2600
130	1.1113	1.1128	1.1158	1.1189	1.1221	1.1254	1.1288	1.1358	1.1432	1.1637	1.1875	1.2153	1.2480
135	1.1104	1.1118	1.1147	1.1176	1.1207	1.1238	1.1270	1.1336	1.1406	1.1599	1.1820	1.2076	1.2372
140	1.1094	1.1108	1.1136	1.1164	1.1193	1.1222	1.1253	1.1316	1.1382	1.1563	1.1769	1.2005	1.2276
145	1.1085	1.1099	1.1125	1.1152	1.1179	1.1208	1.1237	1.1296	1.1359	1.1530	1.1723	1.1941	1.2190
150	1.1077	1.1089	1.1114	1.1140	1.1167	1.1194	1.1221	1.1278	1.1338	1.1499	1.1679	1.1882	1.2111
155	1.1068	1.1080	1.1104	1.1129	1.1154	1.1180	1.1206	1.1260	1.1317	1.1469	1.1639	1.1828	1.2039
160	1.1060	1.1072	1.1094	1.1118	1.1142	1.1167	1.1192	1.1244	1.1297	1.1442	1.1601	1.1778	1.1974
165	1.1052	1.1063	1.1085	1.1108	1.1131	1.1154	1.1178	1.1228	1.1279	1.1416	1.1566	1.1731	1.1914
170	1.1044	1.1055	1.1076	1.1098	1.1120	1.1142	1.1165	1.1212	1.1261	1.1391	1.1533	1.1688	1.1858
175	1.1036	1.1047	1.1067	1.1088	1.1109	1.1131	1.1153	1.1198	1.1244	1.1368	1.1502	1.1648	1.1807
180	1.1029	1.1039	1.1058	1.1078	1.1099	1.1119	1.1140	1.1183	1.1228	1.1346	1.1473	1.1611	1.1760
185	1.1021	1.1031	1.1050	1.1069	1.1089	1.1109	1.1129	1.1170	1.1213	1.1325	1.1445	1.1575	1.1716
190	1.1014	1.1024	1.1042	1.1060	1.1079	1.1098	1.1117	1.1157	1.1198	1.1305	1.1419	1.1542	1.1674
195	1.1007	1.1016	1.1034	1.1052	1.1070	1.1088	1.1107	1.1145	1.1184	1.1286	1.1395	1.1511	1.1636
200	1.1001	1.1009	1.1026	1.1043	1.1061	1.1078	1.1096	1.1133	1.1170	1.1268	1.1372	1.1482	1.1600
205	1.0994	1.1002	1.1018	1.1035	1.1052	1.1069	1.1086	1.1121	1.1157	1.1250	1.1349	1.1455	1.1566
210	1.0988	1.0996	1.1011	1.1027	1.1043	1.1060	1.1076	1.1110	1.1144	1.1234	1.1328	1.1428	1.1534
215	1.0981	1.0989	1.1004	1.1020	1.1035	1.1051	1.1067	1.1099	1.1132	1.1218	1.1309	1.1404	1.1504
220	1.0975	1.0983	1.0997	1.1012	1.1027	1.1042	1.1058	1.1089	1.1121	1.1203	1.1290	1.1380	1.1476
225	1.0969	1.0976	1.0990	1.1005	1.1019	1.1034	1.1049	1.1079	1.1109	1.1189	1.1271	1.1358	1.1449
230	1.0963	1.0970	1.0984	1.0998	1.1012	1.1026	1.1040	1.1069	1.1099	1.1175	1.1254	1.1337	1.1423
235	1.0958	1.0964	1.0978	1.0991	1.1005	1.1018	1.1032	1.1060	1.1088	1.1161	1.1238	1.1317	1.1399
240	1.0952	1.0959	1.0971	1.0984	1.0997	1.1011	1.1024	1.1051	1.1078	1.1149	1.1222	1.1298	1.1376
245	1.0947	1.0953	1.0965	1.0978	1.0991	1.1003	1.1016	1.1042	1.1069	1.1136	1.1207	1.1279	1.1355
250	1.0941	1.0948	1.0959	1.0972	1.0984	1.0996	1.1009	1.1034	1.1059	1.1124	1.1192	1.1262	1.1334
255	1.0936	1.0942	1.0954	1.0965	1.0977	1.0989	1.1001	1.1026	1.1050	1.1113	1.1178	1.1245	1.1314
260	1.0931	1.0937	1.0948	1.0959	1.0971	1.0982	1.0994	1.1018	1.1041	1.1102	1.1165	1.1229	1.1295
265	1.0926	1.0932	1.0943	1.0954	1.0965	1.0976	1.0987	1.1010	1.1033	1.1091	1.1152	1.1214	1.1277
270	1.0921	1.0927	1.0937	1.0948	1.0959	1.0970	1.0980	1.1002	1.1025	1.1081	1.1139	1.1199	1.1260
275	1.0917	1.0922	1.0932	1.0942	1.0953	1.0963	1.0974	1.0995	1.1017	1.1071	1.1127	1.1185	1.1244
280	1.0912	1.0917	1.0927	1.0937	1.0947	1.0957	1.0968	1.0988	1.1009	1.1062	1.1116	1.1171	1.1228

Opteon™ XL40 (R-454A)

Superheated Vapor - Thermal Conductivity Table

Thermal Conductivity in mW/m-K

Saturation Properties in Light Blue

	ABSOLUTE PRESSURE, kPa												
	50	101.325	200	300	400	500	600	800	1000	1500	2000	2500	3000
Temp °C	-55.8	-42.2	-27.0	-16.9	-9.1	-2.7	2.8	12.0	19.6	34.4	45.9	55.2	63.1
	7.828	8.715	9.767	10.526	11.146	11.688	12.181	13.083	13.926	15.998	18.401	21.354	25.187
-55	7.875												
-50	8.186												
-45	8.503												
-40	8.824	8.853											
-35	9.150	9.177											
-30	9.481	9.506											
-25	9.817	9.840	9.902										
-20	10.157	10.178	10.235										
-15	10.502	10.522	10.574	10.651									
-10	10.852	10.870	10.918	10.988									
-5	11.207	11.224	11.267	11.331	11.418								
0	11.566	11.582	11.622	11.680	11.758	11.863							
5	11.930	11.944	11.982	12.035	12.106	12.199	12.321						
10	12.299	12.312	12.347	12.395	12.460	12.544	12.651						
15	12.672	12.684	12.716	12.761	12.820	12.896	12.992	13.264					
20	13.050	13.061	13.091	13.132	13.186	13.255	13.342	13.581	13.947				
25	13.433	13.443	13.470	13.508	13.558	13.621	13.699	13.913	14.229				
30	13.820	13.830	13.855	13.890	13.935	13.993	14.064	14.256	14.533				
35	14.212	14.221	14.244	14.276	14.318	14.371	14.436	14.609	14.854	16.011			
40	14.609	14.617	14.638	14.668	14.706	14.755	14.814	14.971	15.190	16.180			
45	15.010	15.018	15.037	15.064	15.100	15.144	15.198	15.341	15.538	16.416			
50	15.416	15.423	15.441	15.466	15.498	15.539	15.589	15.719	15.902	16.690	18.327		
55	15.827	15.833	15.849	15.872	15.902	15.940	15.988	16.113	16.286	16.995	18.371		
60	16.243	16.248	16.264	16.286	16.316	16.354	16.399	16.518	16.679	17.323	18.509	20.820	
65	16.664	16.670	16.686	16.708	16.737	16.774	16.817	16.930	17.081	17.671	18.712	20.585	24.512
70	17.090	17.096	17.113	17.136	17.164	17.200	17.242	17.350	17.492	18.036	18.962	20.534	23.425
75	17.520	17.528	17.546	17.569	17.597	17.632	17.673	17.777	17.911	18.416	19.248	20.601	22.886
80	17.956	17.964	17.984	18.007	18.036	18.071	18.111	18.211	18.339	18.809	19.565	20.748	22.633
85	18.397	18.406	18.427	18.451	18.481	18.515	18.555	18.651	18.774	19.215	19.906	20.955	22.555
90	18.842	18.852	18.874	18.901	18.931	18.965	19.005	19.099	19.216	19.632	20.268	21.209	22.594
95	19.291	19.303	19.327	19.355	19.386	19.421	19.460	19.553	19.666	20.059	20.648	21.500	22.717
100	19.746	19.758	19.784	19.813	19.846	19.881	19.921	20.013	20.123	20.497	21.045	21.822	22.905
105	20.205	20.218	20.246	20.277	20.310	20.347	20.387	20.478	20.586	20.944	21.457	22.170	23.143
110	20.668	20.683	20.713	20.745	20.780	20.818	20.858	20.950	21.056	21.400	21.882	22.540	23.422
115	21.137	21.153	21.184	21.218	21.254	21.293	21.335	21.426	21.531	21.864	22.320	22.931	23.736
120	21.610	21.627	21.660	21.695	21.733	21.773	21.816	21.908	22.013	22.336	22.769	23.339	24.078
125	22.087	22.106	22.141	22.178	22.217	22.258	22.301	22.395	22.499	22.815	23.229	23.763	24.446
130	22.570	22.589	22.627	22.666	22.706	22.747	22.792	22.887	22.991	23.302	23.698	24.202	24.836
135	23.056	23.077	23.117	23.158	23.199	23.242	23.287	23.384	23.489	23.795	24.177	24.654	25.245
140	23.548	23.569	23.611	23.654	23.698	23.742	23.787	23.885	23.991	24.294	24.664	25.118	25.672
145	24.044	24.066	24.110	24.155	24.200	24.247	24.293	24.391	24.498	24.799	25.159	25.593	26.116
150	24.545	24.568	24.614	24.660	24.708	24.755	24.804	24.903	25.010	25.310	25.662	26.079	26.573
155	25.050	25.075	25.122	25.170	25.219	25.269	25.319	25.421	25.526	25.826	26.172	26.574	27.044
160	25.560	25.585	25.635	25.685	25.736	25.787	25.838	25.943	26.050	26.348	26.688	27.078	27.527
165	26.075	26.101	26.152	26.204	26.256	26.309	26.362	26.470	26.579	26.875	27.211	27.590	28.022
170	26.594	26.621	26.674	26.727	26.781	26.836	26.890	27.001	27.113	27.407	27.740	28.110	28.526
175	27.118	27.146	27.200	27.256	27.311	27.367	27.423	27.536	27.651	27.945	28.274	28.638	29.040
180	27.646	27.675	27.731	27.788	27.845	27.903	27.960	28.076	28.194	28.492	28.815	29.172	29.563
185	28.179	28.209	28.267	28.325	28.384	28.443	28.502	28.621	28.740	29.044	29.361	29.713	30.094
190	28.717	28.748	28.807	28.867	28.927	28.988	29.048	29.169	29.292	29.601	29.916	30.260	30.633
195	29.260	29.291	29.352	29.413	29.475	29.537	29.599	29.723	29.847	30.161	30.480	30.813	31.179
200	29.807	29.839	29.901	29.964	30.027	30.090	30.154	30.280	30.407	30.726	31.049	31.375	31.732
205	30.358	30.391	30.455	30.519	30.584	30.648	30.713	30.842	30.972	31.296	31.622	31.951	32.292
210	30.915	30.948	31.013	31.079	31.145	31.211	31.277	31.409	31.540	31.869	32.199	32.531	32.864
215	31.475	31.510	31.577	31.644	31.711	31.778	31.845	31.980	32.113	32.448	32.781	33.115	33.450
220	32.041	32.076	32.144	32.213	32.282	32.350	32.418	32.555	32.691	33.030	33.367	33.704	34.040
225	32.611	32.647	32.716	32.787	32.856	32.926	32.996	33.135	33.273	33.617	33.958	34.297	34.635
230	33.186	33.223	33.293	33.365	33.436	33.507	33.578	33.719	33.859	34.208	34.553	34.895	35.234
235	33.765	33.803	33.875	33.947	34.020	34.092	34.164	34.308	34.450	34.804	35.152	35.497	35.838
240	34.349	34.388	34.461	34.535	34.608	34.682	34.755	34.901	35.046	35.403	35.756	36.104	36.446
245	34.938	34.977	35.051	35.127	35.202	35.276	35.351	35.498	35.645	36.008	36.364	36.714	37.059
250	35.532	35.571	35.647	35.723	35.799	35.875	35.950	36.101	36.249	36.616	36.976	37.329	37.676
255	36.129	36.170	36.247	36.324	36.401	36.478	36.555	36.707	36.858	37.229	37.593	37.948	38.297
260	36.732	36.773	36.851	36.930	37.008	37.086	37.164	37.318	37.471	37.846	38.213	38.572	38.922
265	37.339	37.381	37.460	37.540	37.619	37.698	37.777	37.933	38.088	38.467	38.836	39.196	39.547
270	37.951	37.993	38.074	38.155	38.235	38.316	38.395	38.553	38.710	39.094	39.467	39.830	40.183
275	38.568	38.610	38.692	38.774	38.856	38.937	39.018	39.178	39.337	39.725	40.102	40.469	40.826
280	39.189	39.232	39.315	39.398	39.481	39.563	39.645	39.807	39.968	40.361	40.742	41.113	41.473

Opteon™ XL40 (R-454A)

Superheated Vapor - Velocity of Sound Table

Velocity of Sound in m/sec

Saturation Properties in Light Blue

Temp °C	ABSOLUTE PRESSURE, kPa												
	50	101.325	200	300	400	500	600	800	1000	1500	2000	2500	3000
	-55.8	-42.2	-27.0	-16.9	-9.1	-2.7	2.8	12.0	19.6	34.4	45.9	55.2	63.1
	159.120	161.630	163.272	163.596	163.373	162.859	162.165	160.453	158.477	152.936	146.925	140.616	134.045
-55	159.41												
-50	161.29												
-45	163.13												
-40	164.93	162.49											
-35	166.69	164.43											
-30	168.43	166.32											
-25	170.13	168.16	164.14										
-20	171.81	169.96	166.23										
-15	173.46	171.72	168.24	164.46									
-10	175.09	173.45	170.19	166.68									
-5	176.69	175.15	172.09	168.82	165.34								
0	178.28	176.83	173.94	170.88	167.65	164.23							
5	179.85	178.47	175.75	172.88	169.87	166.70	163.35						
10	181.40	180.09	177.52	174.82	172.00	169.06	165.96						
15	182.93	181.69	179.26	176.71	174.07	171.32	168.44	162.24					
20	184.44	183.27	180.96	178.55	176.07	173.49	170.81	165.10	158.75				
25	185.94	184.82	182.63	180.36	178.01	175.59	173.09	167.79	161.99				
30	187.42	186.36	184.28	182.12	179.91	177.63	175.28	170.34	165.01				
35	188.89	187.88	185.90	183.85	181.76	179.61	177.40	172.78	167.85	153.41			
40	190.34	189.38	187.50	185.55	183.57	181.54	179.45	175.13	170.54	157.44			
45	191.78	190.86	189.07	187.22	185.34	183.41	181.45	177.38	173.09	161.10			
50	193.21	192.33	190.62	188.86	187.07	185.25	183.39	179.56	175.54	164.49	151.14		
55	194.62	193.79	192.15	190.48	188.78	187.04	185.28	181.66	177.90	167.65	155.67		
60	196.03	195.22	193.67	192.07	190.45	188.80	187.13	183.71	180.16	170.62	159.74	146.58	
65	197.42	196.65	195.16	193.64	192.09	190.53	188.94	185.70	182.35	173.44	163.47	151.87	137.13
70	198.80	198.06	196.64	195.18	193.71	192.22	190.71	187.63	184.47	176.12	166.93	156.53	144.12
75	200.17	199.46	198.10	196.71	195.30	193.88	192.45	189.53	186.53	178.68	170.17	160.73	149.93
80	201.52	200.85	199.55	198.22	196.87	195.52	194.15	191.37	188.53	181.14	173.21	164.58	154.98
85	202.87	202.23	200.98	199.71	198.42	197.13	195.82	193.18	190.49	183.51	176.10	168.15	159.50
90	204.21	203.59	202.40	201.18	199.95	198.71	197.47	194.95	192.39	185.79	178.85	171.49	163.61
95	205.54	204.94	203.80	202.63	201.46	200.28	199.09	196.69	194.25	188.00	181.48	174.64	167.41
100	206.86	206.29	205.19	204.07	202.95	201.82	200.68	198.39	196.07	190.14	184.00	177.61	170.94
105	208.17	207.62	206.57	205.49	204.42	203.34	202.25	200.06	197.85	192.23	186.43	180.45	174.26
110	209.47	208.94	207.93	206.90	205.87	204.84	203.80	201.71	199.60	194.25	188.78	183.16	177.39
115	210.76	210.25	209.28	208.30	207.31	206.32	205.33	203.33	201.32	196.23	191.04	185.76	180.37
120	212.04	211.56	210.63	209.68	208.73	207.78	206.83	204.92	203.00	198.15	193.24	188.26	183.21
125	213.32	212.85	211.96	211.05	210.14	209.23	208.32	206.49	204.66	200.04	195.37	190.67	185.92
130	214.58	214.14	213.28	212.41	211.54	210.66	209.79	208.04	206.29	201.88	197.45	193.00	188.53
135	215.84	215.41	214.59	213.75	212.92	212.08	211.24	209.57	207.89	203.69	199.47	195.25	191.04
140	217.09	216.68	215.89	215.09	214.29	213.48	212.68	211.08	209.47	205.46	201.45	197.44	193.46
145	218.34	217.94	217.18	216.41	215.64	214.87	214.10	212.56	211.03	207.19	203.37	199.57	195.81
150	219.58	219.19	218.46	217.72	216.98	216.25	215.51	214.03	212.56	208.90	205.26	201.65	198.08
155	220.80	220.44	219.74	219.03	218.32	217.61	216.90	215.49	214.08	210.57	207.10	203.67	200.29
160	222.03	221.68	221.00	220.32	219.64	218.96	218.28	216.92	215.57	212.22	208.91	205.64	202.43
165	223.24	222.90	222.26	221.60	220.95	220.29	219.64	218.34	217.05	213.84	210.68	207.57	204.52
170	224.45	224.13	223.50	222.87	222.25	221.62	220.99	219.75	218.51	215.44	212.42	209.46	206.56
175	225.65	225.34	224.74	224.14	223.53	222.93	222.33	221.14	219.95	217.01	214.13	211.30	208.55
180	226.85	226.55	225.97	225.39	224.81	224.23	223.66	222.51	221.37	218.56	215.81	213.11	210.49
185	228.04	227.75	227.20	226.64	226.08	225.53	224.97	223.88	222.78	220.09	217.46	214.89	212.39
190	229.22	228.94	228.41	227.88	227.34	226.81	226.28	225.22	224.18	221.60	219.08	216.63	214.25
195	230.40	230.13	229.62	229.11	228.59	228.08	227.57	226.56	225.56	223.09	220.68	218.34	216.08
200	231.57	231.31	230.82	230.33	229.84	229.34	228.86	227.89	226.92	224.56	222.26	220.03	217.87
205	232.73	232.49	232.02	231.54	231.07	230.60	230.13	229.20	228.28	226.01	223.81	221.68	219.62
210	233.89	233.66	233.20	232.75	232.29	231.84	231.39	230.50	229.62	227.45	225.35	223.31	221.35
215	235.05	234.82	234.38	233.95	233.51	233.08	232.65	231.79	230.95	228.87	226.86	224.92	223.05
220	236.19	235.98	235.56	235.14	234.72	234.31	233.89	233.07	232.26	230.28	228.35	226.50	224.71
225	237.33	237.13	236.73	236.32	235.92	235.52	235.13	234.34	233.56	231.66	229.83	228.05	226.35
230	238.47	238.27	237.89	237.50	237.12	236.73	236.35	235.60	234.86	233.04	231.28	229.59	227.97
235	239.60	239.41	239.04	238.67	238.30	237.94	237.57	236.85	236.14	234.40	232.72	231.11	229.56
240	240.73	240.54	240.19	239.84	239.48	239.13	238.78	238.09	237.41	235.75	234.14	232.60	231.13
245	241.85	241.67	241.33	240.99	240.66	240.32	239.99	239.32	238.67	237.08	235.55	234.08	232.68
250	242.96	242.79	242.47	242.14	241.82	241.50	241.18	240.55	239.92	238.40	236.94	235.54	234.21
255	244.07	243.91	243.60	243.29	242.98	242.67	242.37	241.76	241.16	239.71	238.32	236.98	235.71
260	245.18	245.02	244.73	244.43	244.13	243.84	243.54	242.97	242.40	241.01	239.68	238.41	237.20
265	246.28	246.13	245.85	245.56	245.28	245.00	244.72	244.16	243.62	242.29	241.03	239.82	238.67
270	247.37	247.23	246.96	246.69	246.42	246.15	245.88	245.35	244.83	243.57	242.36	241.21	240.12
275	248.47	248.33	248.07	247.81	247.55	247.29	247.04	246.53	246.04	244.83	243.68	242.59	241.55
280	249.55	249.42	249.17	248.93	248.68	248.43	248.19	247.71	247.24	246.09	244.99	243.95	242.97

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