Opteon™ XP40
Refrigerant

Transport Properties of Opteon™ XP40 (R-449A) SI Units

Physical Properties

Molecular Weight	87.2	g/mol
Boiling Point at		
One Atmosphere	-45.7	°C
Critical Temperature	82.1	°C
Critical Pressure	4499.7	kPa
Critical Density	479.4	kg/m³
Critical Volume	0.0021	m³/kg
Ozone Depletion Potential	0	
Global Warming Potential (AR4)	1397	
ASHRAE Standard 34 Safety Rating	A1	

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™ XP40 (R-449A)

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]
-40	1.3049	0.7892	1.1872	315.4	9.519	0.0024	0.0200	111.86	8.960	755.1	155.4	15.75
-39	1.3068	0.7931	1.1879	311.2	9.565	0.0023	0.0192	111.34	9.029	750.4	155.6	15.58
-38	1.3088	0.7969	1.1886	307.1	9.611	0.0023	0.0184	110.82	9.099	745.8	155.7	15.42
-37	1.3108	0.8008	1.1894	303.0	9.657	0.0023	0.0177	110.30	9.169	741.1	155.8	15.25
-36	1.3128	0.8047	1.1901	299.0	9.703	0.0023	0.0170	109.78	9.240	736.4	155.9	15.08
-35	1.3149	0.8087	1.1910	295.0	9.749	0.0022	0.0164	109.27	9.310	731.7	156.1	14.92
-34	1.3170	0.8127	1.1918	291.2	9.795	0.0022	0.0157	108.75	9.382	727.0	156.2	14.76
-33	1.3192	0.8168	1.1927	287.4	9.841	0.0022	0.0151	108.24	9.453	722.3	156.3	14.59
-32	1.3214	0.8209	1.1936	283.6	9.886	0.0022	0.0146	107.72	9.525	717.6	156.4	14.43
-31	1.3237	0.8250	1.1946	279.9	9.932	0.0021	0.0140	107.21	9.597	712.9	156.5	14.26
-30	1.3260	0.8291	1.1956	276.3	9.977	0.0021	0.0135	106.69	9.669	708.2	156.6	14.10
-29	1.3283	0.8333	1.1966	272.7	10.023	0.0021	0.0130	106.18	9.742	703.5	156.7	13.94
-28	1.3307	0.8376	1.1976	269.2	10.068	0.0021	0.0126	105.67	9.815	698.8	156.7	13.78
-27	1.3331	0.8419	1.1987	265.8	10.113	0.0021	0.0121	105.16	9.888	694.1	156.8	13.62
-26	1.3355	0.8462	1.1998	262.4	10.159	0.0020	0.0117	104.65	9.962	689.3	156.9	13.45
-25	1.3380	0.8506	1.2010	259.0	10.204	0.0020	0.0113	104.14	10.036	684.6	157.0	13.29
-24	1.3406	0.8550	1.2022	255.7	10.249	0.0020	0.0109	103.63	10.110	679.9	157.0	13.13
-23	1.3432	0.8595	1.2035	252.5	10.294	0.0020	0.0105	103.13	10.185	675.2	157.1	12.97
-22	1.3458	0.8640	1.2047	249.3	10.339	0.0020	0.0101	102.62	10.260	670.5	157.1	12.81
-21	1.3485	0.8685	1.2061	246.2	10.384	0.0019	0.0098	102.12	10.336	665.7	157.1	12.65
-20	1.3512	0.8731	1.2074	243.1	10.429	0.0019	0.0095	101.61	10.412	661.0	157.2	12.50
-19	1.3540	0.8778	1.2088	240.0	10.474	0.0019	0.0091	101.11	10.489	656.3	157.2	12.34
-18	1.3568	0.8824	1.2103	237.0	10.519	0.0019	0.0088	100.61	10.566	651.5	157.2	12.18
-17	1.3597	0.8872	1.2118	234.1	10.563	0.0019	0.0085	100.11	10.643	646.8	157.2	12.02
-16	1.3626	0.8920	1.2133	231.2	10.608	0.0018	0.0083	99.61	10.721	642.1	157.2	11.87
-15	1.3656	0.8968	1.2149	228.3	10.653	0.0018	0.0080	99.11	10.800	637.3	157.2	11.71
-14	1.3686	0.9017	1.2166	225.4	10.697	0.0018	0.0077	98.61	10.879	632.6	157.2	11.55
-13	1.3717	0.9067	1.2183	222.7	10.742	0.0018	0.0075	98.11	10.958	627.8	157.2	11.40
-12	1.3748	0.9117	1.2200	219.9	10.786	0.0018	0.0073	97.62	11.038	623.0	157.2	11.24
-11	1.3780	0.9168	1.2218	217.2	10.830	0.0018	0.0070	97.12	11.119	618.3	157.2	11.09
-10	1.3813	0.9219	1.2236	214.5	10.875	0.0017	0.0068	96.63	11.200	613.5	157.1	10.93
-9	1.3846	0.9271	1.2256	211.9	10.919	0.0017	0.0066	96.13	11.282	608.7	157.1	10.78
-8	1.3880	0.9323	1.2275	209.3	10.963	0.0017	0.0064	95.64	11.365	603.9	157.1	10.63
-7	1.3914	0.9376	1.2295	206.7	11.007	0.0017	0.0062	95.15	11.448	599.2	157.0	10.47
-6	1.3949	0.9430	1.2316	204.1	11.052	0.0017	0.0060	94.66	11.532	594.4	156.9	10.32
-5	1.3985	0.9485	1.2338	201.6	11.096	0.0017	0.0058	94.17	11.616	589.6	156.9	10.17
-4	1.4021	0.9540	1.2360	199.2	11.140	0.0016	0.0057	93.69	11.702	584.8	156.8	10.02
-3	1.4058	0.9596	1.2383	196.7	11.183	0.0016	0.0055	93.20	11.788	580.0	156.7	9.87
-2	1.4096	0.9652	1.2406	194.3	11.227	0.0016	0.0053	92.72	11.875	575.2	156.6	9.72
-1	1.4135	0.9710	1.2431	192.0	11.271	0.0016	0.0052	92.23	11.962	570.4	156.5	9.57
0	1.4174	0.9768	1.2456	189.6	11.315	0.0016	0.0050	91.75	12.051	565.5	156.4	9.42
1	1.4214	0.9827	1.2482	187.3	11.359	0.0016	0.0049	91.27	12.140	560.7	156.3	9.27
2	1.4255	0.9887	1.2508	185.0	11.402	0.0016	0.0047	90.79	12.231	555.9	156.2	9.12
3	1.4297	0.9947	1.2536	182.7	11.446	0.0015	0.0046	90.31	12.322	551.0	156.0	8.97
4	1.4339	1.0009	1.2564	180.5	11.490	0.0015	0.0045	89.83	12.414	546.2	155.9	8.82
5	1.4383	1.0072	1.2593	178.3	11.533	0.0015	0.0043	89.35	12.507	541.3	155.8	8.68
6	1.4427	1.0135	1.2624	176.1	11.577	0.0015	0.0042	88.87	12.602	536.5	155.6	8.53
7	1.4473	1.0200	1.2655	174.0	11.620	0.0015	0.0041	88.40	12.697	531.6	155.4	8.38
8	1.4519	1.0266	1.2687	171.8	11.663	0.0015	0.0040	87.92	12.794	526.8	155.3	8.24
9	1.4566	1.0333	1.2721	169.7	11.707	0.0015	0.0039	87.45	12.892	521.9	155.1	8.09
10	1.4615	1.0401	1.2755	167.6	11.750	0.0014	0.0038	86.97	12.991	517.0	154.9	7.95
11	1.4664	1.0470	1.2791	165.6	11.793	0.0014	0.0037	86.50	13.092	512.1	154.7	7.81
12	1.4715	1.0541	1.2828	163.5	11.836	0.0014	0.0036	86.03	13.193	507.2	154.5	7.66
13	1.4767	1.0613	1.2866	161.5	11.880	0.0014	0.0035	85.56	13.297	502.3	154.3	7.52
14	1.4820	1.0687	1.2906	159.5	11.924	0.0014	0.0034	85.09	13.402	497.4	154.1	7.38
15	1.4874	1.0762	1.2947	157.6	11.967	0.0014	0.0033	84.63	13.508	492.4	153.8	7.24
16	1.4930	1.0839	1.2989	155.6	12.012	0.0014	0.0032	84.16	13.616	487.5	153.6	7.10
17	1.4987	1.0917	1.3033	153.7	12.058	0.0014	0.0031	83.69	13.726	482.6	153.4	6.96

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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]
18	1.5046	1.0997	1.3078	151.8	12.104	0.0013	0.0030	83.23	13.837	477.6	153.1	6.82
19	1.5106	1.1080	1.3125	149.9	12.149	0.0013	0.0029	82.76	13.951	472.7	152.8	6.68
20	1.5167	1.1164	1.3174	148.0	12.195	0.0013	0.0029	82.30	14.066	467.7	152.6	6.54
21	1.5230	1.1250	1.3225	146.1	12.241	0.0013	0.0028	81.84	14.184	462.7	152.3	6.40
22	1.5295	1.1339	1.3277	144.3	12.286	0.0013	0.0027	81.38	14.303	457.7	152.0	6.26
23	1.5362	1.1430	1.3332	142.5	12.332	0.0013	0.0027	80.92	14.425	452.8	151.7	6.13
24	1.5430	1.1523	1.3389	140.7	12.378	0.0013	0.0026	80.46	14.550	447.8	151.4	5.99
25	1.5501	1.1619	1.3447	138.9	12.424	0.0013	0.0025	80.00	14.677	442.7	151.0	5.86
26	1.5573	1.1718	1.3509	137.1	12.473	0.0013	0.0025	79.54	14.806	437.7	150.7	5.72
27	1.5648	1.1819	1.3572	135.4	12.526	0.0012	0.0024	79.09	14.938	432.7	150.3	5.59
28	1.5725	1.1924	1.3638	133.6	12.580	0.0012	0.0023	78.63	15.073	427.7	150.0	5.46
29	1.5805	1.2032	1.3707	131.9	12.634	0.0012	0.0023	78.18	15.211	422.6	149.6	5.33
30	1.5887	1.2143	1.3779	130.2	12.688	0.0012	0.0022	77.72	15.352	417.5	149.2	5.19
31	1.5972	1.2258	1.3853	128.5	12.754	0.0012	0.0022	77.27	15.496	412.5	148.9	5.06
32	1.6060	1.2377	1.3931	126.8	12.820	0.0012	0.0021	76.82	15.644	407.4	148.5	4.93
33	1.6150	1.2500	1.4012	125.2	12.888	0.0012	0.0021	76.36	15.795	402.3	148.1	4.80
34	1.6244	1.2627	1.4097	123.5	12.956	0.0012	0.0020	75.91	15.951	397.2	147.6	4.67
35	1.6342	1.2759	1.4185	121.9	13.025	0.0012	0.0020	75.46	16.110	392.1	147.2	4.55
36	1.6443	1.2896	1.4278	120.2	13.096	0.0012	0.0019	75.01	16.274	386.9	146.8	4.42
37	1.6548	1.3037	1.4374	118.6	13.167	0.0011	0.0019	74.56	16.445	381.8	146.3	4.29
38	1.6657	1.3184	1.4476	117.0	13.239	0.0011	0.0018	74.12	16.620	376.6	145.8	4.16
39	1.6771	1.3337	1.4582	115.4	13.313	0.0011	0.0018	73.67	16.800	371.4	145.3	4.04
40	1.6890	1.3497	1.4693	113.8	13.388	0.0011	0.0017	73.22	16.987	366.2	144.8	3.91
41	1.7014	1.3663	1.4809	112.2	13.465	0.0011	0.0017	72.78	17.179	360.9	144.3	3.79
42	1.7143	1.3836	1.4932	110.7	13.544	0.0011	0.0017	72.33	17.378	355.7	143.8	3.67
43	1.7278	1.4016	1.5060	109.1	13.624	0.0011	0.0016	71.88	17.584	350.4	143.3	3.54
44	1.7420	1.4205	1.5196	107.6	13.706	0.0011	0.0016	71.44	17.797	345.1	142.7	3.42
45	1.7569	1.4403	1.5339	106.0	13.790	0.0011	0.0016	71.00	18.018	339.8	142.2	3.30
46	1.7725	1.4610	1.5489	104.5	13.877	0.0011	0.0015	70.55	18.247	334.4	141.6	3.18
47	1.7889	1.4828	1.5649	102.9	13.966	0.0010	0.0015	70.11	18.484	329.0	141.0	3.06
48	1.8062	1.5056	1.5817	101.4	14.057	0.0010	0.0015	69.67	18.731	323.5	140.4	2.94
49	1.8245	1.5297	1.5996	99.9	14.151	0.0010	0.0014	69.22	18.988	318.0	139.8	2.83
50	1.8439	1.5551	1.6185	98.4	14.248	0.0010	0.0014	68.78	19.256	312.5	139.2	2.71
51	1.8644	1.5819	1.6386	96.9	14.348	0.0010	0.0014	68.34	19.534	306.9	138.5	2.59
52	1.8862	1.6103	1.6600	95.4	14.451	0.0010	0.0013	67.90	19.825	301.3	137.8	2.48
53	1.9094	1.6405	1.6829	93.9	14.557	0.0010	0.0013	67.46	20.129	295.7	137.2	2.37
54	1.9341	1.6725	1.7073	92.4	14.668	0.0010	0.0013	67.02	20.448	289.9	136.5	2.26
55	1.9606	1.7066	1.7335	90.9	14.783	0.0010	0.0012	66.58	20.781	284.2	135.7	2.15
56	1.9891	1.7430	1.7616	89.4	14.902	0.0010	0.0012	66.14	21.130	278.4	135.0	2.04
57	2.0197	1.7821	1.7918	87.9	15.025	0.0010	0.0012	65.71	21.498	272.5	134.2	1.93
58	2.0527	1.8240	1.8244	86.4	15.154	0.0009	0.0012	65.27	21.884	266.5	133.5	1.82
59	2.0885	1.8692	1.8597	84.9	15.289	0.0009	0.0011	64.83	22.292	260.5	132.7	1.72
60	2.1275	1.9180	1.8980	83.4	15.429	0.0009	0.0011	64.40	22.722	254.4	131.9	1.62
61	2.1702	1.9709	1.9398	81.8	15.577	0.0009	0.0011	63.97	23.177	248.3	131.0	1.52
62	2.2170	2.0286	1.9854	80.3	15.731	0.0009	0.0011	63.54	23.659	242.1	130.2	1.42
63	2.2686	2.0918	2.0356	78.8	15.894	0.0009	0.0010	63.11	24.172	235.8	129.3	1.32
64	2.3260	2.1612	2.0908	77.3	16.065	0.0009	0.0010	62.69	24.717	229.5	128.4	1.22
65	2.3901	2.2378	2.1521	75.7	16.246	0.0009	0.0010	62.27	25.300	223.0	127.5	1.13
66	2.4622	2.3231	2.2204	74.1	16.438	0.0009	0.0010	61.85	25.924	216.5	126.5	1.04
67	2.5440	2.4184	2.2969	72.6	16.642	0.0009	0.0009	61.45	26.594	209.9	125.5	0.95
68	2.6375	2.5258	2.3834	71.0	16.860	0.0009	0.0009	61.05	27.317	203.3	124.5	0.86
69	2.7457	2.6479	2.4817	69.3	17.094	0.0008	0.0009	60.67	28.099	196.5	123.5	0.77
70	2.8721	2.7879	2.5947	67.7	17.345	0.0008	0.0009	60.30	28.950	189.6	122.4	0.69
71	3.0220	2.9502	2.7259	66.0	17.617	0.0008	0.0009	59.96	29.880	182.7	121.3	0.61
72	3.2025	3.1408	2.8799	64.2	17.914	0.0008	0.0008	59.64	30.904	175.6	120.2	0.53
73	3.4241	3.3680	3.0634	62.4	18.239	0.0008	0.0008	59.37	32.039	168.5	119.0	0.45
74	3.7026	3.6435	3.2860	60.6	18.599	0.0008	0.0008	59.17	33.310	161.2	117.8	0.38
75	4.0628	3.9852	3.5616	58.7	19.002	0.0008	0.0008	59.04	34.748	153.8	116.6	0.31

Opteon™ XP40 (R-449A)

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]
76	4.5463	4.4207	3.9121	56.6	19.460	0.0008	0.0008	59.04	36.400	146.2	115.2	0.25
77	5.2282	4.9954	4.3736	54.4	19.988	0.0008	0.0008	59.21	38.335	138.5	113.8	0.19
78	6.2568	5.7910	5.0100	52.1	20.613	0.0008	0.0007	59.64	40.663	130.7	112.4	0.13
79	7.9666	6.9690	5.9477	49.5	21.381	0.0007	0.0007	59.99	43.575	122.6	110.8	0.08
80	11.2564	8.9058	7.4793	46.4	22.384	0.0007	0.0007	61.66	47.458	114.5	109.0	0.04

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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
	-53.5	-40.0	-25.0	-14.9	-7.2	-0.8	4.6	13.7	21.3	36.0	47.4	56.7	64.6
	8.891	9.519	10.204	10.655	10.998	11.278	11.517	11.913	12.253	13.097	14.000	14.988	16.177
-50	9.054												
-45	9.287												
-40	9.519												
-35	9.749	9.749											
-30	9.977	9.977											
-25	10.204	10.204	10.204										
-20	10.429	10.429	10.429										
-15	10.653	10.653	10.653										
-10	10.875	10.875	10.875	10.875									
-5	11.096	11.096	11.096	11.096	11.096								
0	11.315	11.315	11.315	11.315	11.315	11.315							
5	11.533	11.533	11.533	11.533	11.533	11.533	11.533						
10	11.750	11.750	11.750	11.750	11.750	11.750	11.750						
15	11.965	11.965	11.965	11.965	11.965	11.965	11.965	11.967					
20	12.180	12.180	12.180	12.180	12.180	12.180	12.180	12.185					
25	12.393	12.393	12.393	12.393	12.393	12.393	12.395	12.402	12.414				
30	12.605	12.605	12.605	12.605	12.605	12.607	12.610	12.617	12.630				
35	12.816	12.816	12.816	12.817	12.818	12.820	12.823	12.831	12.852				
40	13.026	13.026	13.027	13.028	13.030	13.032	13.035	13.046	13.074	13.277			
45	13.235	13.236	13.237	13.238	13.240	13.243	13.246	13.265	13.307	13.502			
50	13.443	13.444	13.445	13.447	13.449	13.453	13.461	13.491	13.536	13.724	14.094		
55	13.651	13.651	13.653	13.655	13.659	13.668	13.681	13.715	13.761	13.945	14.283		
60	13.857	13.858	13.860	13.865	13.874	13.886	13.900	13.935	13.983	14.164	14.479	15.051	
65	14.062	14.064	14.068	14.076	14.087	14.100	14.115	14.153	14.202	14.381	14.678	15.179	16.166
70	14.267	14.269	14.276	14.286	14.298	14.312	14.329	14.369	14.418	14.596	14.879	15.331	16.117
75	14.471	14.474	14.483	14.494	14.508	14.523	14.540	14.582	14.633	14.810	15.081	15.496	16.164
80	14.674	14.678	14.688	14.701	14.715	14.732	14.750	14.794	14.846	15.022	15.284	15.670	16.258
85	14.876	14.881	14.893	14.906	14.922	14.940	14.959	15.004	15.057	15.233	15.487	15.850	16.380
90	15.077	15.083	15.096	15.111	15.127	15.146	15.166	15.212	15.266	15.442	15.689	16.034	16.519
95	15.278	15.284	15.298	15.314	15.332	15.351	15.372	15.419	15.474	15.650	15.891	16.221	16.671
100	15.478	15.485	15.500	15.516	15.535	15.555	15.576	15.625	15.681	15.856	16.093	16.409	16.831
105	15.677	15.684	15.700	15.717	15.737	15.757	15.780	15.829	15.886	16.061	16.294	16.598	16.997
110	15.875	15.883	15.899	15.918	15.938	15.959	15.982	16.033	16.090	16.265	16.494	16.789	17.167
115	16.073	16.081	16.098	16.117	16.138	16.160	16.183	16.235	16.293	16.468	16.693	16.979	17.341
120	16.269	16.278	16.296	16.316	16.337	16.359	16.383	16.436	16.494	16.669	16.892	17.170	17.518
125	16.465	16.474	16.493	16.513	16.535	16.558	16.582	16.636	16.695	16.870	17.089	17.361	17.696
130	16.661	16.670	16.689	16.710	16.732	16.756	16.781	16.835	16.894	17.069	17.286	17.552	17.876
135	16.855	16.865	16.884	16.906	16.929	16.953	16.978	17.033	17.093	17.267	17.482	17.742	18.056
140	17.049	17.059	17.079	17.101	17.124	17.149	17.174	17.230	17.290	17.465	17.677	17.933	18.237
145	17.242	17.252	17.273	17.296	17.319	17.344	17.370	17.426	17.487	17.661	17.872	18.122	18.419
150	17.435	17.445	17.466	17.489	17.513	17.538	17.565	17.621	17.682	17.857	18.065	18.312	18.601
155	17.627	17.637	17.659	17.682	17.707	17.732	17.759	17.816	17.877	18.051	18.258	18.501	18.784
160	17.818	17.829	17.851	17.875	17.899	17.925	17.952	18.009	18.071	18.245	18.450	18.689	18.966
165	18.009	18.020	18.042	18.066	18.091	18.117	18.144	18.202	18.264	18.438	18.641	18.877	19.148
170	18.199	18.210	18.233	18.257	18.282	18.309	18.336	18.394	18.456	18.630	18.831	19.064	19.331
175	18.389	18.400	18.423	18.447	18.473	18.500	18.527	18.585	18.647	18.821	19.021	19.251	19.513
180	18.578	18.589	18.612	18.637	18.663	18.690	18.717	18.776	18.838	19.011	19.210	19.437	19.694
185	18.766	18.778	18.801	18.826	18.852	18.879	18.907	18.966	19.028	19.201	19.398	19.623	19.876
190	18.954	18.966	18.989	19.015	19.041	19.068	19.096	19.155	19.217	19.390	19.586	19.808	20.057
195	19.141	19.153	19.177	19.203	19.229	19.256	19.284	19.343	19.406	19.578	19.773	19.993	20.238
200	19.328	19.340	19.364	19.390	19.416	19.444	19.472	19.531	19.594	19.765	19.959	20.177	20.419
205	19.514	19.526	19.551	19.577	19.603	19.631	19.659	19.718	19.781	19.952	20.145	20.360	20.599
210	19.700	19.712	19.737	19.763	19.790	19.817	19.846	19.905	19.968	20.138	20.330	20.543	20.779
215	19.885	19.898	19.922	19.948	19.975	20.003	20.032	20.091	20.154	20.324	20.514	20.726	20.958
220	20.070	20.082	20.107	20.134	20.161	20.188	20.217	20.277	20.339	20.509	20.698	20.908	21.138
225	20.254	20.267	20.292	20.318	20.345	20.373	20.402	20.461	20.524	20.693	20.882	21.089	21.316
230	20.438	20.451	20.476	20.502	20.529	20.557	20.586	20.646	20.708	20.877	21.064	21.270	21.495
235	20.622	20.634	20.659	20.686	20.713	20.741	20.770	20.830	20.892	21.060	21.246	21.450	21.673
240	20.804	20.817	20.842	20.869	20.896	20.924	20.953	21.013	21.075	21.243	21.428	21.630	21.850
245	20.987	21.000	21.025	21.052	21.079	21.107	21.136	21.196	21.258	21.425	21.609	21.810	22.027
250	21.169	21.182	21.207	21.234	21.261	21.289	21.318	21.378	21.440	21.607	21.789	21.989	22.204
255	21.350	21.363	21.389	21.416	21.443	21.471	21.500	21.560	21.622	21.788	21.970	22.167	22.381
260	21.532	21.545	21.570	21.597	21.624	21.652	21.681	21.741	21.803	21.968	22.149	22.345	22.557
265	21.712	21.725	21.751	21.778	21.805	21.833	21.862	21.922	21.983	22.148	22.328	22.523	22.732
270	21.893	21.906	21.931	21.958	21.986	22.014	22.042	22.102	22.164	22.328	22.507	22.700	22.907
275	22.073	22.086	22.111	22.138	22.166	22.194	22.222	22.282	22.343	22.507	22.685	22.877	23.082
280	22.252	22.265	22.291	22.318	22.345	22.373	22.402	22.461	22.523	22.686	22.863	23.053	23.257
285	22.431	22.444	22.470	22.497	22.524	22.552	22.581	22.640	22.701	22.864	23.040	23.229	23.431

Opteon™ XP40 (R-449A)

Superheated Vapor - Heat Capacity Table

Heat Capacity, C_p, in kJ/kg-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	-53.5 °C	-40.0 °C	-25.0 °C	-14.9 °C	-7.2 °C	-0.8 °C	4.6 °C	13.7 °C	21.3 °C	36.0 °C	47.4 °C	56.7 °C	64.6 °C
	0.741	0.789	0.851	0.897	0.937	0.972	1.005	1.067	1.127	1.290	1.491	1.770	2.208
-50	0.7422												
-45	0.7454												
-40	0.7499												
-35	0.7553	0.7875											
-30	0.7612	0.7884											
-25	0.7676	0.7911	0.8505										
-20	0.7744	0.7949	0.8438										
-15	0.7813	0.7996	0.8410										
-10	0.7885	0.8048	0.8407	0.8865									
-5	0.7959	0.8106	0.8421	0.8806	0.9294								
0	0.8034	0.8166	0.8447	0.8778	0.9179	0.9684							
5	0.8110	0.8230	0.8482	0.8772	0.9111	0.9520	1.0029						
10	0.8187	0.8297	0.8523	0.8780	0.9074	0.9416	0.9826						
15	0.8265	0.8365	0.8571	0.8801	0.9058	0.9352	0.9693	1.0587					
20	0.8343	0.8435	0.8622	0.8830	0.9059	0.9315	0.9606	1.0335					
25	0.8422	0.8506	0.8678	0.8866	0.9071	0.9298	0.9551	1.0164	1.0996				
30	0.8501	0.8579	0.8736	0.8907	0.9093	0.9296	0.9519	1.0045	1.0727				
35	0.8580	0.8652	0.8797	0.8954	0.9122	0.9305	0.9504	0.9963	1.0538				
40	0.8659	0.8726	0.8860	0.9004	0.9158	0.9323	0.9502	0.9908	1.0402	1.2375			
45	0.8739	0.8801	0.8924	0.9057	0.9198	0.9349	0.9510	0.9873	1.0304	1.1908			
50	0.8819	0.8876	0.8991	0.9113	0.9243	0.9381	0.9528	0.9854	1.0234	1.1576	1.4253		
55	0.8898	0.8952	0.9058	0.9172	0.9291	0.9418	0.9552	0.9847	1.0186	1.1332	1.3365		
60	0.8977	0.9027	0.9127	0.9232	0.9343	0.9459	0.9582	0.9851	1.0155	1.1150	1.2769	1.6192	
65	0.9057	0.9103	0.9196	0.9294	0.9397	0.9504	0.9618	0.9863	1.0139	1.1012	1.2344	1.4774	2.1620
70	0.9136	0.9179	0.9266	0.9357	0.9453	0.9553	0.9657	0.9883	1.0133	1.0909	1.2032	1.3881	1.7806
75	0.9215	0.9256	0.9337	0.9422	0.9511	0.9604	0.9701	0.9908	1.0137	1.0832	1.1797	1.3270	1.5925
80	0.9293	0.9332	0.9408	0.9488	0.9571	0.9657	0.9747	0.9939	1.0149	1.0776	1.1617	1.2829	1.4790
85	0.9371	0.9408	0.9479	0.9554	0.9632	0.9712	0.9796	0.9974	1.0167	1.0737	1.1478	1.2500	1.4031
90	0.9449	0.9483	0.9551	0.9621	0.9694	0.9769	0.9847	1.0013	1.0192	1.0711	1.1371	1.2249	1.3489
95	0.9527	0.9559	0.9622	0.9689	0.9757	0.9828	0.9901	1.0055	1.0221	1.0697	1.1290	1.2055	1.3088
100	0.9604	0.9634	0.9694	0.9757	0.9821	0.9887	0.9956	1.0100	1.0254	1.0693	1.1229	1.1903	1.2782
105	0.9680	0.9709	0.9766	0.9825	0.9885	0.9948	1.0012	1.0147	1.0291	1.0696	1.1184	1.1784	1.2544
110	0.9757	0.9784	0.9838	0.9893	0.9951	1.0009	1.0070	1.0197	1.0331	1.0707	1.1152	1.1691	1.2357
115	0.9833	0.9858	0.9909	0.9962	1.0016	1.0072	1.0129	1.0248	1.0374	1.0723	1.1132	1.1619	1.2209
120	0.9908	0.9932	0.9981	1.0031	1.0082	1.0134	1.0188	1.0300	1.0419	1.0744	1.1122	1.1565	1.2092
125	0.9983	1.0006	1.0052	1.0099	1.0148	1.0198	1.0249	1.0354	1.0466	1.0770	1.1120	1.1525	1.1999
130	1.0057	1.0079	1.0123	1.0168	1.0214	1.0261	1.0310	1.0409	1.0514	1.0800	1.1124	1.1496	1.1927
135	1.0131	1.0152	1.0194	1.0236	1.0280	1.0325	1.0371	1.0465	1.0564	1.0832	1.1135	1.1478	1.1870
140	1.0204	1.0224	1.0264	1.0305	1.0347	1.0389	1.0433	1.0522	1.0616	1.0868	1.1150	1.1468	1.1828
145	1.0277	1.0296	1.0334	1.0373	1.0413	1.0453	1.0495	1.0580	1.0668	1.0906	1.1171	1.1466	1.1797
150	1.0349	1.0368	1.0404	1.0441	1.0479	1.0517	1.0557	1.0638	1.0722	1.0946	1.1195	1.1470	1.1776
155	1.0421	1.0438	1.0473	1.0508	1.0545	1.0582	1.0619	1.0696	1.0776	1.0989	1.1222	1.1479	1.1763
160	1.0492	1.0509	1.0542	1.0576	1.0610	1.0646	1.0681	1.0755	1.0831	1.1032	1.1252	1.1493	1.1757
165	1.0562	1.0578	1.0610	1.0643	1.0676	1.0710	1.0744	1.0814	1.0886	1.1077	1.1285	1.1511	1.1758
170	1.0632	1.0648	1.0678	1.0709	1.0741	1.0773	1.0806	1.0873	1.0942	1.1124	1.1320	1.1533	1.1764
175	1.0702	1.0717	1.0746	1.0776	1.0806	1.0837	1.0868	1.0932	1.0998	1.1171	1.1358	1.1558	1.1775
180	1.0770	1.0785	1.0813	1.0842	1.0871	1.0900	1.0930	1.0992	1.1055	1.1220	1.1396	1.1586	1.1790
185	1.0839	1.0852	1.0879	1.0907	1.0935	1.0964	1.0992	1.1051	1.1111	1.1269	1.1437	1.1616	1.1808
190	1.0906	1.0920	1.0946	1.0972	1.0999	1.1026	1.1054	1.1110	1.1168	1.1318	1.1478	1.1649	1.1830
195	1.0973	1.0986	1.1011	1.1037	1.1063	1.1089	1.1116	1.1170	1.1225	1.1369	1.1521	1.1683	1.1855
200	1.1040	1.1052	1.1076	1.1101	1.1126	1.1151	1.1177	1.1229	1.1282	1.1419	1.1565	1.1719	1.1882
205	1.1106	1.1118	1.1141	1.1165	1.1189	1.1213	1.1238	1.1288	1.1339	1.1471	1.1610	1.1756	1.1911
210	1.1171	1.1183	1.1205	1.1228	1.1251	1.1275	1.1298	1.1346	1.1395	1.1522	1.1655	1.1795	1.1942
215	1.1236	1.1247	1.1269	1.1291	1.1313	1.1336	1.1359	1.1405	1.1452	1.1574	1.1701	1.1835	1.1975
220	1.1300	1.1311	1.1332	1.1353	1.1375	1.1397	1.1419	1.1463	1.1509	1.1626	1.1748	1.1876	1.2009
225	1.1364	1.1374	1.1394	1.1415	1.1436	1.1457	1.1478	1.1521	1.1565	1.1678	1.1795	1.1917	1.2045
230	1.1427	1.1437	1.1457	1.1477	1.1497	1.1517	1.1538	1.1579	1.1621	1.1730	1.1842	1.1960	1.2081
235	1.1489	1.1499	1.1518	1.1537	1.1557	1.1577	1.1596	1.1637	1.1677	1.1782	1.1890	1.2003	1.2119
240	1.1551	1.1561	1.1579	1.1598	1.1617	1.1636	1.1655	1.1694	1.1733	1.1834	1.1938	1.2046	1.2158
245	1.1613	1.1622	1.1640	1.1658	1.1676	1.1695	1.1713	1.1751	1.1789	1.1886	1.1986	1.2090	1.2197
250	1.1674	1.1683	1.1700	1.1717	1.1735	1.1753	1.1771	1.1807	1.1844	1.1938	1.2035	1.2135	1.2237
255	1.1734	1.1743	1.1759	1.1776	1.1794	1.1811	1.1828	1.1863	1.1899	1.1990	1.2083	1.2179	1.2278
260	1.1794	1.1802	1.1818	1.1835	1.1852	1.1868	1.1885	1.1919	1.1954	1.2042	1.2132	1.2224	1.2320
265	1.1853	1.1861	1.1877	1.1893	1.1909	1.1925	1.1942	1.1975	1.2008	1.2093	1.2180	1.2270	1.2361
270	1.1912	1.1920	1.1935	1.1951	1.1966	1.1982	1.1998	1.2030	1.2062	1.2145	1.2229	1.2315	1.2403
275	1.1970	1.1978	1.1993	1.2008	1.2023	1.2038	1.2054	1.2085	1.2116	1.2196	1.2277	1.2361	1.2446
280	1.2028	1.2035	1.2050	1.2064	1.2079	1.2094	1.2109	1.2139	1.2170	1.2247	1.2326	1.2407	1.2489
285	1.2085	1.2092	1.2106	1.2121	1.2135	1.2150	1.2164	1.2193	1.2223	1.2298	1.2374	1.2452	1.2532

Opteon™ XP40 (R-449A)

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
	-53.5 °C	-40.0 °C	-25.0 °C	-14.9 °C	-7.2 °C	-0.8 °C	4.6 °C	13.7 °C	21.3 °C	36.0 °C	47.4 °C	56.7 °C	64.6 °C
	1.180	1.187	1.201	1.215	1.229	1.243	1.258	1.290	1.324	1.428	1.571	1.782	2.128
-50	1.1768												
-45	1.1722												
-40	1.1680												
-35	1.1642	1.1808											
-30	1.1607	1.1753											
-25	1.1575	1.1704	1.2010										
-20	1.1545	1.1660	1.1925										
-15	1.1516	1.1620	1.1852										
-10	1.1490	1.1583	1.1790	1.2046									
-5	1.1465	1.1550	1.1734	1.1957	1.2233								
0	1.1441	1.1518	1.1684	1.1881	1.2117	1.2408							
5	1.1418	1.1489	1.1639	1.1815	1.2021	1.2267	1.2568						
10	1.1397	1.1462	1.1598	1.1756	1.1937	1.2150	1.2403						
15	1.1376	1.1436	1.1561	1.1703	1.1864	1.2050	1.2267	1.2836					
20	1.1356	1.1411	1.1526	1.1655	1.1800	1.1964	1.2153	1.2630					
25	1.1338	1.1388	1.1494	1.1611	1.1742	1.1889	1.2055	1.2463	1.3024				
30	1.1320	1.1367	1.1464	1.1571	1.1690	1.1822	1.1969	1.2323	1.2791				
35	1.1302	1.1346	1.1435	1.1534	1.1643	1.1762	1.1893	1.2205	1.2603				
40	1.1285	1.1326	1.1409	1.1500	1.1599	1.1707	1.1826	1.2102	1.2446	1.3868			
45	1.1269	1.1307	1.1384	1.1469	1.1559	1.1658	1.1766	1.2012	1.2313	1.3474			
50	1.1254	1.1289	1.1361	1.1439	1.1523	1.1613	1.1711	1.1933	1.2198	1.3171	1.5192		
55	1.1239	1.1272	1.1339	1.1411	1.1489	1.1572	1.1661	1.1862	1.2098	1.2929	1.4468		
60	1.1225	1.1256	1.1318	1.1385	1.1457	1.1534	1.1616	1.1798	1.2010	1.2730	1.3956	1.6628	
65	1.1211	1.1240	1.1298	1.1361	1.1428	1.1499	1.1574	1.1741	1.1932	1.2563	1.3571	1.5471	2.0917
70	1.1197	1.1224	1.1279	1.1338	1.1400	1.1466	1.1536	1.1688	1.1862	1.2421	1.3268	1.4714	1.7855
75	1.1184	1.1210	1.1261	1.1316	1.1374	1.1435	1.1500	1.1641	1.1799	1.2298	1.3023	1.4172	1.6301
80	1.1171	1.1196	1.1244	1.1296	1.1350	1.1407	1.1467	1.1597	1.1742	1.2191	1.2819	1.3761	1.5331
85	1.1159	1.1182	1.1228	1.1276	1.1327	1.1380	1.1436	1.1556	1.1690	1.2096	1.2647	1.3437	1.4658
90	1.1147	1.1169	1.1212	1.1258	1.1305	1.1355	1.1407	1.1519	1.1642	1.2011	1.2500	1.3174	1.4158
95	1.1136	1.1156	1.1197	1.1240	1.1285	1.1331	1.1380	1.1484	1.1598	1.1936	1.2372	1.2956	1.3771
100	1.1124	1.1144	1.1182	1.1223	1.1265	1.1309	1.1355	1.1452	1.1558	1.1867	1.2260	1.2771	1.3459
105	1.1114	1.1132	1.1169	1.1207	1.1247	1.1288	1.1331	1.1422	1.1520	1.1805	1.2161	1.2613	1.3204
110	1.1103	1.1121	1.1155	1.1191	1.1229	1.1268	1.1308	1.1394	1.1486	1.1749	1.2072	1.2476	1.2989
115	1.1093	1.1109	1.1142	1.1177	1.1212	1.1249	1.1287	1.1367	1.1453	1.1697	1.1993	1.2355	1.2807
120	1.1083	1.1099	1.1130	1.1163	1.1196	1.1231	1.1267	1.1342	1.1423	1.1650	1.1921	1.2249	1.2649
125	1.1073	1.1088	1.1118	1.1149	1.1181	1.1214	1.1248	1.1319	1.1395	1.1606	1.1856	1.2154	1.2512
130	1.1064	1.1078	1.1106	1.1136	1.1166	1.1197	1.1230	1.1297	1.1368	1.1566	1.1797	1.2069	1.2391
135	1.1054	1.1068	1.1095	1.1123	1.1152	1.1182	1.1212	1.1276	1.1343	1.1528	1.1742	1.1992	1.2284
140	1.1045	1.1059	1.1084	1.1111	1.1139	1.1167	1.1196	1.1256	1.1319	1.1493	1.1692	1.1922	1.2188
145	1.1037	1.1049	1.1074	1.1099	1.1126	1.1152	1.1180	1.1237	1.1297	1.1460	1.1646	1.1859	1.2102
150	1.1028	1.1040	1.1064	1.1088	1.1113	1.1139	1.1165	1.1219	1.1276	1.1430	1.1604	1.1801	1.2024
155	1.1020	1.1031	1.1054	1.1077	1.1101	1.1125	1.1150	1.1202	1.1256	1.1401	1.1564	1.1747	1.1953
160	1.1012	1.1023	1.1044	1.1067	1.1090	1.1113	1.1137	1.1185	1.1237	1.1374	1.1527	1.1698	1.1888
165	1.1004	1.1015	1.1035	1.1057	1.1078	1.1101	1.1123	1.1170	1.1218	1.1349	1.1493	1.1652	1.1829
170	1.0996	1.1007	1.1026	1.1047	1.1068	1.1089	1.1110	1.1155	1.1201	1.1325	1.1460	1.1610	1.1775
175	1.0989	1.0999	1.1018	1.1037	1.1057	1.1078	1.1098	1.1141	1.1185	1.1302	1.1430	1.1571	1.1724
180	1.0982	1.0991	1.1009	1.1028	1.1047	1.1067	1.1086	1.1127	1.1169	1.1280	1.1402	1.1534	1.1678
185	1.0974	1.0983	1.1001	1.1019	1.1037	1.1056	1.1075	1.1114	1.1154	1.1260	1.1375	1.1500	1.1635
190	1.0968	1.0976	1.0993	1.1010	1.1028	1.1046	1.1064	1.1101	1.1140	1.1241	1.1350	1.1467	1.1594
195	1.0961	1.0969	1.0985	1.1002	1.1019	1.1036	1.1054	1.1089	1.1126	1.1222	1.1326	1.1437	1.1557
200	1.0954	1.0962	1.0978	1.0994	1.1010	1.1027	1.1043	1.1077	1.1113	1.1205	1.1303	1.1409	1.1521
205	1.0948	1.0955	1.0970	1.0986	1.1002	1.1017	1.1033	1.1066	1.1100	1.1188	1.1282	1.1382	1.1488
210	1.0941	1.0949	1.0963	1.0978	1.0993	1.1008	1.1024	1.1055	1.1088	1.1172	1.1261	1.1357	1.1457
215	1.0935	1.0942	1.0956	1.0971	1.0985	1.1000	1.1015	1.1045	1.1076	1.1157	1.1242	1.1333	1.1428
220	1.0929	1.0936	1.0950	1.0963	1.0977	1.0992	1.1006	1.1035	1.1065	1.1142	1.1224	1.1310	1.1401
225	1.0923	1.0930	1.0943	1.0956	1.0970	1.0983	1.0997	1.1025	1.1054	1.1128	1.1206	1.1288	1.1375
230	1.0917	1.0924	1.0936	1.0949	1.0962	1.0976	1.0989	1.1016	1.1043	1.1114	1.1189	1.1268	1.1350
235	1.0912	1.0918	1.0930	1.0943	1.0955	1.0968	1.0981	1.1007	1.1033	1.1102	1.1173	1.1248	1.1327
240	1.0906	1.0912	1.0924	1.0936	1.0948	1.0960	1.0973	1.0998	1.1023	1.1089	1.1158	1.1230	1.1304
245	1.0901	1.0907	1.0918	1.0930	1.0941	1.0953	1.0965	1.0989	1.1014	1.1077	1.1143	1.1212	1.1283
250	1.0896	1.0901	1.0912	1.0923	1.0935	1.0946	1.0958	1.0981	1.1005	1.1066	1.1129	1.1195	1.1263
255	1.0890	1.0896	1.0907	1.0917	1.0928	1.0939	1.0951	1.0973	1.0996	1.1055	1.1116	1.1179	1.1244
260	1.0885	1.0891	1.0901	1.0911	1.0922	1.0933	1.0943	1.0965	1.0987	1.1044	1.1103	1.1163	1.1226
265	1.0880	1.0885	1.0895	1.0906	1.0916	1.0926	1.0937	1.0958	1.0979	1.1034	1.1090	1.1148	1.1209
270	1.0875	1.0880	1.0890	1.0900	1.0910	1.0920	1.0930	1.0950	1.0971	1.1024	1.1078	1.1134	1.1192
275	1.0871	1.0876	1.0885	1.0894	1.0904	1.0914	1.0924	1.0943	1.0963	1.1014	1.1067	1.1120	1.1176
280	1.0866	1.0871	1.0880	1.0889	1.0898	1.0908	1.0917	1.0936	1.0956	1.1005	1.1055	1.1107	1.1161
285	1.0861	1.0866	1.0875	1.0884	1.0893	1.0902	1.0911	1.0930	1.0948	1.0996	1.1045	1.1095	1.1146

Opteon™ XP40 (R-449A)

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	-53.5 °C	-40.0 °C	-25.0 °C	-14.9 °C	-7.2 °C	-0.8 °C	4.6 °C	13.7 °C	21.3 °C	36.0 °C	47.4 °C	56.7 °C	64.6 °C
	8.047	8.960	10.035	10.805	11.431	11.977	12.472	13.374	14.215	16.277	18.576	21.386	25.076
-50	8.272												
-45	8.600												
-40	8.932												
-35	9.268	9.294											
-30	9.608	9.632											
-25	9.952	9.975	10.036										
-20	10.301	10.321	10.377										
-15	10.653	10.672	10.724										
-10	11.008	11.027	11.075	11.144									
-5	11.368	11.386	11.431	11.494	11.581								
0	11.732	11.749	11.791	11.849	11.928	12.033							
5	12.100	12.116	12.156	12.210	12.281	12.375	12.497						
10	12.472	12.487	12.524	12.575	12.640	12.724	12.832						
15	12.848	12.862	12.897	12.944	13.005	13.081	13.178	13.452					
20	13.227	13.241	13.274	13.318	13.374	13.444	13.532	13.773					
25	13.611	13.624	13.655	13.697	13.749	13.814	13.893	14.108	14.428				
30	13.998	14.011	14.041	14.080	14.128	14.188	14.261	14.454	14.734				
35	14.390	14.402	14.430	14.467	14.512	14.568	14.635	14.811	15.058				
40	14.785	14.797	14.824	14.858	14.901	14.953	15.015	15.175	15.396	16.402			
45	15.184	15.195	15.221	15.254	15.294	15.343	15.400	15.547	15.747	16.615			
50	15.587	15.598	15.623	15.654	15.692	15.737	15.791	15.927	16.110	16.873	18.506		
55	15.995	16.005	16.029	16.058	16.094	16.137	16.188	16.315	16.484	17.164	18.504		
60	16.406	16.416	16.439	16.467	16.502	16.543	16.591	16.710	16.867	17.480	18.615	20.951	
65	16.821	16.831	16.853	16.881	16.915	16.954	16.999	17.112	17.258	17.815	18.799	20.631	24.907
70	17.240	17.250	17.273	17.300	17.332	17.370	17.413	17.520	17.657	18.168	19.034	20.538	23.473
75	17.663	17.674	17.696	17.723	17.754	17.791	17.833	17.934	18.063	18.534	19.307	20.580	22.815
80	18.091	18.101	18.124	18.151	18.182	18.217	18.257	18.354	18.476	18.913	19.609	20.710	22.510
85	18.522	18.533	18.556	18.583	18.613	18.648	18.687	18.780	18.895	19.303	19.936	20.903	22.405
90	18.957	18.968	18.992	19.019	19.049	19.083	19.121	19.211	19.321	19.702	20.282	21.143	22.427
95	19.396	19.408	19.432	19.459	19.489	19.523	19.560	19.647	19.752	20.111	20.645	21.419	22.537
100	19.839	19.851	19.876	19.903	19.934	19.967	20.004	20.088	20.189	20.528	21.023	21.725	22.712
105	20.286	20.298	20.324	20.352	20.382	20.415	20.451	20.534	20.631	20.953	21.413	22.054	22.936
110	20.737	20.750	20.776	20.804	20.835	20.868	20.904	20.984	21.079	21.385	21.816	22.405	23.199
115	21.191	21.205	21.232	21.260	21.291	21.325	21.360	21.440	21.531	21.824	22.228	22.773	23.495
120	21.650	21.664	21.692	21.721	21.752	21.785	21.821	21.899	21.989	22.270	22.651	23.157	23.816
125	22.112	22.127	22.156	22.186	22.217	22.250	22.286	22.364	22.451	22.722	23.083	23.554	24.161
130	22.579	22.594	22.623	22.654	22.686	22.719	22.755	22.832	22.918	23.180	23.522	23.964	24.525
135	23.049	23.065	23.095	23.127	23.159	23.193	23.228	23.305	23.390	23.644	23.970	24.385	24.906
140	23.523	23.539	23.570	23.603	23.636	23.670	23.706	23.782	23.866	24.113	24.425	24.817	25.302
145	24.001	24.018	24.050	24.083	24.117	24.152	24.188	24.263	24.346	24.587	24.887	25.258	25.712
150	24.483	24.500	24.533	24.567	24.602	24.637	24.674	24.749	24.831	25.067	25.356	25.708	26.135
155	24.969	24.986	25.020	25.055	25.090	25.127	25.164	25.240	25.320	25.552	25.831	26.167	26.570
160	25.459	25.476	25.511	25.546	25.583	25.620	25.657	25.734	25.815	26.042	26.312	26.634	27.014
165	25.952	25.970	26.006	26.042	26.079	26.116	26.155	26.233	26.314	26.537	26.800	27.108	27.469
170	26.450	26.468	26.504	26.541	26.579	26.617	26.656	26.735	26.817	27.036	27.293	27.589	27.933
175	26.951	26.970	27.007	27.045	27.083	27.122	27.161	27.241	27.324	27.541	27.791	28.078	28.406
180	27.456	27.476	27.513	27.552	27.591	27.630	27.670	27.751	27.835	28.053	28.295	28.572	28.887
185	27.965	27.985	28.023	28.063	28.102	28.142	28.183	28.265	28.349	28.568	28.804	29.074	29.376
190	28.478	28.498	28.538	28.577	28.618	28.658	28.699	28.783	28.868	29.088	29.321	29.581	29.872
195	28.995	29.016	29.055	29.096	29.137	29.178	29.220	29.304	29.390	29.611	29.844	30.094	30.376
200	29.516	29.537	29.577	29.619	29.660	29.702	29.744	29.829	29.916	30.138	30.371	30.615	30.887
205	30.041	30.062	30.103	30.145	30.187	30.230	30.272	30.358	30.446	30.670	30.902	31.145	31.404
210	30.569	30.591	30.633	30.675	30.718	30.761	30.804	30.891	30.979	31.205	31.438	31.679	31.931
215	31.102	31.124	31.166	31.209	31.253	31.296	31.340	31.428	31.517	31.744	31.977	32.218	32.467
220	31.638	31.660	31.703	31.747	31.791	31.835	31.879	31.969	32.058	32.286	32.520	32.760	33.007
225	32.178	32.201	32.244	32.289	32.333	32.378	32.423	32.513	32.604	32.833	33.067	33.307	33.552
230	32.722	32.745	32.789	32.835	32.880	32.925	32.970	33.061	33.153	33.383	33.618	33.857	34.101
235	33.270	33.293	33.338	33.384	33.430	33.475	33.521	33.613	33.705	33.938	34.173	34.412	34.655
240	33.822	33.846	33.891	33.937	33.984	34.030	34.076	34.169	34.262	34.496	34.731	34.970	35.212
245	34.378	34.402	34.448	34.495	34.541	34.588	34.635	34.729	34.822	35.057	35.294	35.532	35.773
250	34.937	34.962	35.008	35.056	35.103	35.150	35.198	35.292	35.387	35.623	35.860	36.098	36.338
255	35.501	35.525	35.573	35.621	35.668	35.716	35.764	35.859	35.955	36.192	36.430	36.668	36.906
260	36.068	36.093	36.141	36.189	36.238	36.286	36.334	36.430	36.526	36.765	37.003	37.240	37.478
265	36.640	36.665	36.713	36.762	36.811	36.859	36.908	37.005	37.101	37.341	37.579	37.815	38.050
270	37.215	37.240	37.289	37.339	37.388	37.437	37.486	37.584	37.681	37.923	38.162	38.400	38.635
275	37.794	37.820	37.869	37.919	37.969	38.019	38.068	38.167	38.265	38.508	38.749	38.988	39.224
280	38.377	38.403	38.453	38.503	38.554	38.604	38.654	38.753	38.853	39.098	39.340	39.580	39.817
285	38.964	38.990	39.040	39.091	39.142	39.193	39.243	39.344	39.444	39.691	39.935	40.176	40.413

Opteon™ XP40 (R-449A)

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
	-53.5 °C	-40.0 °C	-25.0 °C	-14.9 °C	-7.2 °C	-0.8 °C	4.6 °C	13.7 °C	21.3 °C	36.0 °C	47.4 °C	56.7 °C	64.6 °C
	153.037	155.409	156.953	157.245	157.014	156.502	155.817	154.133	152.192	146.742	140.787	134.473	127.827
-50	154.30												
-45	156.09												
-40	157.83												
-35	159.54	157.30											
-30	161.21	159.14											
-25	162.86	160.93	156.96										
-20	164.48	162.67	159.00										
-15	166.07	164.38	160.96										
-10	167.65	166.06	162.86	159.40									
-5	169.20	167.70	164.71	161.49	158.05								
0	170.73	169.32	166.50	163.51	160.33	156.93							
5	172.24	170.90	168.26	165.45	162.50	159.37	156.02						
10	173.73	172.47	169.98	167.34	164.58	161.68	158.62						
15	175.21	174.01	171.66	169.18	166.60	163.90	161.06	154.88					
20	176.67	175.53	173.30	170.97	168.54	166.02	163.39	157.73					
25	178.11	177.03	174.92	172.71	170.43	168.07	165.62	160.39	154.60				
30	179.54	178.52	176.51	174.42	172.27	170.06	167.76	162.91	157.61				
35	180.95	179.98	178.08	176.10	174.07	171.98	169.83	165.30	160.42				
40	182.35	181.43	179.62	177.74	175.82	173.85	171.82	167.59	163.07	149.97			
45	183.74	182.86	181.13	179.35	177.53	175.67	173.76	169.79	165.58	153.65			
50	185.11	184.27	182.63	180.94	179.21	177.45	175.64	171.91	167.98	157.03	143.49		
55	186.47	185.67	184.11	182.50	180.86	179.18	177.48	173.96	170.27	160.16	148.10		
60	187.82	187.06	185.57	184.03	182.47	180.88	179.27	175.94	172.48	163.09	152.21	138.68	
65	189.16	188.43	187.01	185.54	184.06	182.55	181.02	177.87	174.61	165.86	155.93	144.14	128.49
70	190.49	189.79	188.43	187.03	185.62	184.18	182.73	179.75	176.67	168.48	159.36	148.88	136.03
75	191.81	191.14	189.84	188.50	187.15	185.79	184.40	181.58	178.67	170.99	162.56	153.10	142.06
80	193.11	192.47	191.23	189.95	188.67	187.36	186.05	183.36	180.61	173.38	165.56	156.94	147.21
85	194.41	193.79	192.60	191.39	190.16	188.91	187.66	185.11	182.50	175.69	168.39	160.48	151.76
90	195.70	195.11	193.97	192.80	191.63	190.44	189.24	186.82	184.34	177.91	171.08	163.78	155.88
95	196.97	196.41	195.32	194.20	193.08	191.95	190.80	188.49	186.14	180.05	173.65	166.87	159.65
100	198.24	197.70	196.65	195.59	194.51	193.43	192.34	190.13	187.89	182.13	176.11	169.80	163.15
105	199.50	198.98	197.98	196.96	195.93	194.89	193.85	191.75	189.61	184.15	178.47	172.57	166.42
110	200.75	200.25	199.29	198.31	197.33	196.33	195.34	193.33	191.30	186.11	180.75	175.22	169.50
115	201.99	201.51	200.59	199.65	198.71	197.76	196.81	194.89	192.95	188.02	182.95	177.75	172.42
120	203.23	202.77	201.88	200.98	200.08	199.17	198.26	196.42	194.57	189.88	185.08	180.19	175.20
125	204.45	204.01	203.16	202.30	201.43	200.56	199.69	197.93	196.16	191.69	187.15	182.53	177.85
130	205.67	205.24	204.43	203.60	202.77	201.93	201.10	199.42	197.73	193.47	189.16	184.79	180.40
135	206.88	206.47	205.69	204.89	204.09	203.29	202.49	200.89	199.27	195.21	191.11	186.98	182.84
140	208.08	207.69	206.94	206.17	205.41	204.64	203.87	202.33	200.79	196.91	193.01	189.10	185.20
145	209.27	208.90	208.18	207.44	206.71	205.97	205.24	203.76	202.29	198.58	194.87	191.16	187.47
150	210.46	210.10	209.41	208.70	208.00	207.29	206.59	205.17	203.76	200.22	196.69	193.17	189.68
155	211.64	211.30	210.63	209.95	209.28	208.60	207.92	206.57	205.21	201.83	198.47	195.12	191.81
160	212.82	212.48	211.84	211.19	210.54	209.89	209.24	207.95	206.65	203.42	200.21	197.02	193.89
165	213.98	213.66	213.05	212.42	211.80	211.17	210.55	209.31	208.07	204.97	201.91	198.88	195.91
170	215.14	214.83	214.24	213.64	213.04	212.45	211.85	210.65	209.46	206.51	203.58	200.70	197.87
175	216.30	216.00	215.43	214.85	214.28	213.71	213.13	211.99	210.85	208.02	205.22	202.48	199.79
180	217.44	217.16	216.61	216.06	215.51	214.95	214.40	213.31	212.21	209.51	206.84	204.22	201.67
185	218.58	218.31	217.79	217.25	216.72	216.19	215.66	214.61	213.56	210.97	208.42	205.93	203.50
190	219.72	219.46	218.95	218.44	217.93	217.42	216.92	215.91	214.90	212.42	209.98	207.60	205.29
195	220.85	220.60	220.11	219.62	219.13	218.64	218.15	217.19	216.22	213.85	211.52	209.25	207.05
200	221.97	221.73	221.26	220.79	220.32	219.85	219.38	218.46	217.53	215.26	213.03	210.87	208.77
205	223.09	222.85	222.41	221.95	221.50	221.05	220.60	219.71	218.83	216.65	214.52	212.46	210.46
210	224.20	223.97	223.54	223.11	222.68	222.24	221.81	220.96	220.11	218.02	215.99	214.02	212.12
215	225.31	225.09	224.68	224.26	223.84	223.43	223.02	222.20	221.38	219.38	217.44	215.56	213.75
220	226.41	226.20	225.80	225.40	225.00	224.60	224.21	223.42	222.64	220.73	218.87	217.08	215.35
225	227.50	227.30	226.92	226.53	226.15	225.77	225.39	224.64	223.89	222.06	220.28	218.57	216.93
230	228.59	228.40	228.03	227.66	227.30	226.93	226.57	225.84	225.13	223.37	221.68	220.04	218.48
235	229.67	229.49	229.14	228.78	228.43	228.08	227.73	227.04	226.35	224.68	223.06	221.50	220.01
240	230.75	230.58	230.24	229.90	229.56	229.22	228.89	228.23	227.57	225.97	224.42	222.93	221.51
245	231.83	231.66	231.33	231.01	230.68	230.36	230.04	229.41	228.78	227.24	225.76	224.35	222.99
250	232.89	232.73	232.42	232.11	231.80	231.49	231.18	230.58	229.97	228.51	227.09	225.74	224.46
255	233.96	233.80	233.51	233.21	232.91	232.61	232.32	231.74	231.16	229.76	228.41	227.12	225.90
260	235.02	234.87	234.58	234.30	234.01	233.73	233.45	232.89	232.34	231.00	229.71	228.49	227.33
265	236.07	235.93	235.66	235.38	235.11	234.84	234.57	234.04	233.51	232.23	231.00	229.84	228.73
270	237.12	236.98	236.72	236.46	236.20	235.94	235.68	235.17	234.67	233.45	232.28	231.17	230.12
275	238.17	238.03	237.79	237.53	237.28	237.04	236.79	236.30	235.82	234.66	233.55	232.49	231.49
280	239.21	239.08	238.84	238.60	238.36	238.13	237.89	237.43	236.97	235.86	234.80	233.79	232.85
285	240.24	240.12	239.89	239.66	239.44	239.21	238.99	238.54	238.11	237.05	236.04	235.09	234.19

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