



Opteon™ XP40

Refrigerant

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

Physical Properties

Molecular Weight	87.2 g/mole
Boiling Point at One Atmosphere	-46.0 °C
Critical Temperature	81.5 °C
Critical Pressure	4447.0 kPa
Critical Density	465.44 kg/m ³
Critical Volume	0.0021 m ³ /kg
Ozone Depletion Potential	0
Global Warming Potential (AR5)	1282
ASHRAE Standard 34 Safety Rating	A1

Units and Factors

t = temperature in °C
P = pressure in kiloPascals absolute (kPa [abs])
 v_f = volume of saturated liquid in m³/kg
 v_g = volume of saturated vapor in m³/kg
V = volume of superheated vapor in m³/kg
 $d_f = 1/v_f$ = density of saturated liquid in kg/m³
 $d_g = 1/v_g$ = density of saturated vapor in kg/m³
 h_f = enthalpy of saturated liquid in kJ/kg
 h_{fg} = enthalpy of vaporization in kJ/kg
 h_g = enthalpy of saturated vapor in kJ/kg
H = enthalpy of superheated vapor in kJ/kg
 s_f = entropy of saturated liquid in kJ/(kg) (K)
 s_g = entropy of saturated vapor in kJ/(kg) (K)
S = entropy of superheated vapor 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 9.1 (Lemmon, E.W.; Huber, M.L.; McLinden, M.O.; REFPROP Reference Fluid Thermodynamic and Transport Properties - National Institute of Standards and Technology, 2013) using Chemours interaction parameters with R-1234yf.

Opteon™ XP40 (R-449A)
Saturation Properties - Temperature Table

Temp °C	Pressure [kPa]		Volume [m ³ /kg]		Density [kg/m ³]		Enthalpy [kJ/kg]			Entropy [kJ/kg-K]		Temp °C
	Liquid P _f	Vapor P _g	Liquid v _f	Vapor v _g	Liquid ρ _f	Vapor ρ _g	Liquid h _f	Latent h _{fg}	Vapor h _g	Liquid s _f	Vapor s _g	
-60	48.900	33.977	0.000719	0.5861	1391.3	1.706	120.5	244.1	364.5	0.674	1.838	-60
-59	51.698	36.090	0.000720	0.5539	1388.4	1.805	121.7	243.4	365.1	0.680	1.835	-59
-58	54.624	38.308	0.000722	0.5238	1385.4	1.909	123.0	242.7	365.7	0.686	1.832	-58
-57	57.682	40.635	0.000723	0.4956	1382.5	2.018	124.2	242.1	366.3	0.691	1.830	-57
-56	60.876	43.075	0.000725	0.4693	1379.5	2.131	125.5	241.4	366.9	0.697	1.827	-56
-55	64.210	45.632	0.000726	0.4446	1376.6	2.249	126.8	240.8	367.5	0.703	1.825	-55
-54	67.688	48.310	0.000728	0.4214	1373.6	2.373	128.0	240.1	368.1	0.709	1.822	-54
-53	71.315	51.112	0.000730	0.3997	1370.6	2.502	129.3	239.4	368.8	0.715	1.820	-53
-52	75.096	54.045	0.000731	0.3794	1367.6	2.636	130.6	238.8	369.4	0.720	1.817	-52
-51	79.035	57.110	0.000733	0.3602	1364.6	2.776	131.9	238.1	370.0	0.726	1.815	-51
-50	83.137	60.314	0.000734	0.3422	1361.6	2.922	133.1	237.4	370.6	0.732	1.812	-50
-49	87.406	63.660	0.000736	0.3253	1358.6	3.074	134.4	236.7	371.2	0.737	1.810	-49
-48	91.848	67.153	0.000738	0.3094	1355.6	3.232	135.7	236.1	371.8	0.743	1.808	-48
-47	96.466	70.797	0.000739	0.2945	1352.6	3.396	137.0	235.4	372.4	0.749	1.806	-47
-46	101.267	74.597	0.000741	0.2803	1349.6	3.567	138.3	234.7	372.9	0.754	1.803	-46
-45	106.254	78.558	0.000743	0.2670	1346.5	3.745	139.5	234.0	373.5	0.760	1.801	-45
-44	111.434	82.685	0.000744	0.2545	1343.5	3.929	140.8	233.3	374.1	0.766	1.799	-44
-43	116.810	86.982	0.000746	0.2427	1340.4	4.121	142.1	232.6	374.7	0.771	1.797	-43
-42	122.390	91.454	0.000748	0.2315	1337.3	4.320	143.4	231.9	375.3	0.777	1.795	-42
-41	128.176	96.107	0.000749	0.2209	1334.3	4.527	144.7	231.2	375.9	0.782	1.793	-41
-40	134.175	100.945	0.000751	0.2109	1331.2	4.741	146.0	230.5	376.5	0.788	1.791	-40
-39	140.393	105.973	0.000753	0.2015	1328.1	4.963	147.3	229.8	377.1	0.793	1.789	-39
-38	146.834	111.198	0.000755	0.1926	1325.0	5.193	148.6	229.1	377.7	0.799	1.787	-38
-37	153.504	116.623	0.000757	0.1841	1321.8	5.432	149.9	228.4	378.3	0.805	1.785	-37
-36	160.409	122.255	0.000758	0.1761	1318.7	5.679	151.2	227.6	378.8	0.810	1.784	-36
-35	167.554	128.099	0.000760	0.1685	1315.6	5.935	152.5	226.9	379.4	0.815	1.782	-35
-34	174.944	134.160	0.000762	0.1613	1312.4	6.200	153.8	226.2	380.0	0.821	1.780	-34
-33	182.586	140.444	0.000764	0.1545	1309.3	6.474	155.1	225.4	380.6	0.826	1.778	-33
-32	190.485	146.956	0.000766	0.1480	1306.1	6.758	156.4	224.7	381.1	0.832	1.777	-32
-31	198.647	153.703	0.000768	0.1418	1302.9	7.051	157.8	224.0	381.7	0.837	1.775	-31
-30	207.078	160.690	0.000769	0.1360	1299.7	7.354	159.1	223.2	382.3	0.843	1.773	-30
-29	215.784	167.922	0.000771	0.1304	1296.5	7.668	160.4	222.5	382.9	0.848	1.772	-29
-28	224.770	175.406	0.000773	0.1251	1293.3	7.991	161.7	221.7	383.4	0.853	1.770	-28
-27	234.043	183.148	0.000775	0.1201	1290.1	8.326	163.0	220.9	384.0	0.859	1.768	-27
-26	243.609	191.154	0.000777	0.1153	1286.8	8.671	164.4	220.2	384.5	0.864	1.767	-26
-25	253.474	199.429	0.000779	0.1108	1283.6	9.028	165.7	219.4	385.1	0.870	1.765	-25
-24	263.643	207.980	0.000781	0.1064	1280.3	9.396	167.0	218.6	385.7	0.875	1.764	-24
-23	274.124	216.812	0.000783	0.1023	1277.0	9.776	168.4	217.8	386.2	0.880	1.762	-23
-22	284.922	225.934	0.000785	0.0983	1273.7	10.168	169.7	217.1	386.8	0.885	1.761	-22
-21	296.044	235.350	0.000787	0.0946	1270.4	10.572	171.1	216.3	387.3	0.891	1.760	-21
-20	307.495	245.066	0.000789	0.0910	1267.1	10.989	172.4	215.5	387.9	0.896	1.758	-20
-19	319.283	255.091	0.000791	0.0876	1263.8	11.419	173.8	214.7	388.4	0.901	1.757	-19
-18	331.414	265.429	0.000793	0.0843	1260.4	11.862	175.1	213.9	389.0	0.907	1.755	-18
-17	343.894	276.088	0.000796	0.0812	1257.0	12.318	176.5	213.0	389.5	0.912	1.754	-17
-16	356.730	287.073	0.000798	0.0782	1253.6	12.789	177.8	212.2	390.0	0.917	1.753	-16
-15	369.928	298.393	0.000800	0.0753	1250.2	13.273	179.2	211.4	390.6	0.922	1.751	-15
-14	383.495	310.053	0.000802	0.0726	1246.8	13.772	180.5	210.6	391.1	0.928	1.750	-14
-13	397.437	322.061	0.000804	0.0700	1243.4	14.286	181.9	209.7	391.6	0.933	1.749	-13
-12	411.761	334.423	0.000806	0.0675	1239.9	14.815	183.3	208.9	392.2	0.938	1.748	-12
-11	426.475	347.146	0.000809	0.0651	1236.5	15.359	184.7	208.0	392.7	0.943	1.746	-11
-10	441.584	360.238	0.000811	0.0628	1233.0	15.920	186.0	207.2	393.2	0.948	1.745	-10
-9	457.095	373.704	0.000813	0.0606	1229.5	16.496	187.4	206.3	393.7	0.954	1.744	-9
-8	473.015	387.553	0.000816	0.0585	1226.0	17.089	188.8	205.4	394.2	0.959	1.743	-8
-7	489.352	401.792	0.000818	0.0565	1222.4	17.700	190.2	204.6	394.8	0.964	1.742	-7
-6	506.112	416.427	0.000820	0.0546	1218.9	18.327	191.6	203.7	395.3	0.969	1.741	-6
-5	523.301	431.467	0.000823	0.0527	1215.3	18.973	193.0	202.8	395.8	0.974	1.739	-5
-4	540.927	446.918	0.000825	0.0509	1211.7	19.637	194.4	201.9	396.3	0.979	1.738	-4

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Temp °C	Pressure [kPa]		Volume [m ³ /kg]		Density [kg/m ³]		Enthalpy [kJ/kg]			Entropy [kJ/kg-K]		Temp °C
	Liquid P _f	Vapor P _g	Liquid v _f	Vapor v _g	Liquid ρ _f	Vapor ρ _g	Liquid h _f	Latent h _{fg}	Vapor h _g	Liquid s _f	Vapor s _g	
-3	558.997	462.788	0.000828	0.0492	1208.1	20.319	195.8	201.0	396.8	0.985	1.737	-3
-2	577.519	479.084	0.000830	0.0476	1204.4	21.020	197.2	200.1	397.3	0.990	1.736	-2
-1	596.498	495.814	0.000833	0.0460	1200.8	21.742	198.6	199.2	397.7	0.995	1.735	-1
0	615.942	512.986	0.000835	0.0445	1197.1	22.483	200.0	198.2	398.2	1.000	1.734	0
1	635.859	530.607	0.000838	0.0430	1193.4	23.244	201.4	197.3	398.7	1.005	1.733	1
2	656.255	548.685	0.000841	0.0416	1189.7	24.027	202.8	196.3	399.2	1.010	1.732	2
3	677.137	567.228	0.000843	0.0403	1185.9	24.831	204.3	195.4	399.7	1.015	1.731	3
4	698.514	586.244	0.000846	0.0390	1182.1	25.657	205.7	194.4	400.1	1.020	1.730	4
5	720.392	605.741	0.000849	0.0377	1178.3	26.506	207.1	193.5	400.6	1.026	1.729	5
6	742.778	625.726	0.000851	0.0365	1174.5	27.378	208.6	192.5	401.0	1.031	1.728	6
7	765.681	646.208	0.000854	0.0354	1170.7	28.274	210.0	191.5	401.5	1.036	1.727	7
8	789.107	667.196	0.000857	0.0343	1166.8	29.193	211.5	190.5	402.0	1.041	1.726	8
9	813.063	688.696	0.000860	0.0332	1162.9	30.138	212.9	189.5	402.4	1.046	1.725	9
10	837.558	710.719	0.000863	0.0321	1159.0	31.109	214.4	188.5	402.8	1.051	1.724	10
11	862.599	733.272	0.000866	0.0311	1155.0	32.105	215.8	187.5	403.3	1.056	1.723	11
12	888.193	756.363	0.000869	0.0302	1151.0	33.128	217.3	186.4	403.7	1.061	1.722	12
13	914.348	780.002	0.000872	0.0293	1147.0	34.179	218.8	185.4	404.1	1.066	1.721	13
14	941.072	804.196	0.000875	0.0284	1143.0	35.259	220.2	184.3	404.5	1.071	1.720	14
15	968.371	828.956	0.000878	0.0275	1138.9	36.367	221.7	183.3	405.0	1.076	1.719	15
16	996.255	854.289	0.000881	0.0267	1134.8	37.505	223.2	182.2	405.4	1.081	1.718	16
17	1024.730	880.204	0.000884	0.0259	1130.6	38.674	224.7	181.1	405.8	1.086	1.717	17
18	1053.804	906.711	0.000888	0.0251	1126.4	39.874	226.2	180.0	406.2	1.091	1.716	18
19	1083.486	933.819	0.000891	0.0243	1122.2	41.106	227.7	178.9	406.5	1.096	1.715	19
20	1113.783	961.536	0.000894	0.0236	1118.0	42.372	229.2	177.7	406.9	1.102	1.714	20
21	1144.702	989.873	0.000898	0.0229	1113.7	43.672	230.7	176.6	407.3	1.107	1.713	21
22	1176.253	1018.839	0.000901	0.0222	1109.4	45.006	232.2	175.5	407.7	1.112	1.712	22
23	1208.442	1048.443	0.000905	0.0216	1105.0	46.378	233.7	174.3	408.0	1.117	1.711	23
24	1241.277	1078.695	0.000909	0.0209	1100.6	47.786	235.3	173.1	408.4	1.122	1.710	24
25	1274.768	1109.605	0.000912	0.0203	1096.2	49.232	236.8	171.9	408.7	1.127	1.709	25
26	1308.921	1141.183	0.000916	0.0197	1091.7	50.718	238.3	170.7	409.1	1.132	1.708	26
27	1343.745	1173.438	0.000920	0.0191	1087.2	52.245	239.9	169.5	409.4	1.137	1.707	27
28	1379.249	1206.382	0.000924	0.0186	1082.6	53.814	241.4	168.3	409.7	1.142	1.706	28
29	1415.440	1240.024	0.000928	0.0180	1078.0	55.425	243.0	167.0	410.0	1.147	1.705	29
30	1452.326	1274.375	0.000932	0.0175	1073.3	57.082	244.6	165.8	410.3	1.152	1.704	30
31	1489.916	1309.445	0.000936	0.0170	1068.6	58.784	246.1	164.5	410.6	1.157	1.703	31
32	1528.219	1345.246	0.000940	0.0165	1063.9	60.535	247.7	163.2	410.9	1.162	1.702	32
33	1567.242	1381.788	0.000944	0.0160	1059.0	62.334	249.3	161.9	411.2	1.167	1.701	33
34	1606.994	1419.082	0.000949	0.0156	1054.2	64.184	250.9	160.5	411.5	1.172	1.700	34
35	1647.484	1457.141	0.000953	0.0151	1049.3	66.087	252.5	159.2	411.7	1.178	1.699	35
36	1688.720	1495.975	0.000958	0.0147	1044.3	68.045	254.1	157.8	412.0	1.183	1.698	36
37	1730.711	1535.596	0.000962	0.0143	1039.2	70.058	255.8	156.4	412.2	1.188	1.697	37
38	1773.465	1576.016	0.000967	0.0139	1034.1	72.131	257.4	155.0	412.4	1.193	1.696	38
39	1816.992	1617.247	0.000972	0.0135	1029.0	74.264	259.0	153.6	412.6	1.198	1.695	39
40	1861.299	1659.303	0.000977	0.0131	1023.7	76.461	260.7	152.1	412.8	1.203	1.693	40
41	1906.396	1702.195	0.000982	0.0127	1018.4	78.723	262.3	150.7	413.0	1.208	1.692	41
42	1952.292	1745.936	0.000987	0.0123	1013.1	81.054	264.0	149.2	413.2	1.213	1.691	42
43	1998.995	1790.540	0.000992	0.0120	1007.6	83.456	265.7	147.7	413.3	1.219	1.690	43
44	2046.515	1836.020	0.000998	0.0116	1002.1	85.931	267.4	146.1	413.5	1.224	1.689	44
45	2094.860	1882.391	0.001004	0.0113	996.5	88.485	269.1	144.5	413.6	1.229	1.687	45
46	2144.041	1929.666	0.001009	0.0110	990.8	91.119	270.8	142.9	413.7	1.234	1.686	46
47	2194.065	1977.861	0.001015	0.0107	985.0	93.837	272.5	141.3	413.8	1.239	1.685	47
48	2244.943	2026.989	0.001021	0.0103	979.1	96.644	274.2	139.7	413.9	1.245	1.683	48
49	2296.684	2077.068	0.001028	0.0100	973.1	99.544	276.0	138.0	414.0	1.250	1.682	49
50	2349.297	2128.113	0.001034	0.0098	967.0	102.541	277.7	136.3	414.0	1.255	1.681	50
51	2402.791	2180.140	0.001041	0.0095	960.8	105.641	279.5	134.5	414.0	1.261	1.679	51
52	2457.176	2233.167	0.001048	0.0092	954.5	108.848	281.3	132.7	414.0	1.266	1.678	52
53	2512.465	2287.211	0.001055	0.0089	948.0	112.169	283.1	130.9	414.0	1.271	1.676	53

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54	2568.662	2342.291	0.001062	0.0086	941.5	115.610	284.9	129.1	414.0	1.277	1.674	54
55	2625.779	2398.425	0.001070	0.0084	934.7	119.179	286.8	127.2	413.9	1.282	1.673	55
56	2683.826	2455.635	0.001078	0.0081	927.9	122.882	288.6	125.2	413.8	1.288	1.671	56
57	2742.812	2513.941	0.001086	0.0079	920.8	126.729	290.5	123.2	413.7	1.293	1.669	57
58	2802.748	2573.365	0.001095	0.0076	913.6	130.729	292.4	121.2	413.6	1.299	1.668	58
59	2863.643	2633.930	0.001103	0.0074	906.3	134.893	294.3	119.1	413.4	1.304	1.666	59
60	2925.507	2695.661	0.001113	0.0072	898.7	139.232	296.3	116.9	413.2	1.310	1.664	60
61	2988.349	2758.583	0.001122	0.0070	890.9	143.759	298.2	114.7	413.0	1.316	1.662	61
62	3052.179	2822.728	0.001133	0.0067	882.9	148.490	300.2	112.5	412.7	1.321	1.659	62
63	3117.006	2888.119	0.001143	0.0065	874.6	153.441	302.3	110.1	412.4	1.327	1.657	63
64	3182.838	2954.792	0.001155	0.0063	866.0	158.632	304.3	107.7	412.0	1.333	1.655	64
65	3249.685	3022.780	0.001167	0.0061	857.2	164.084	306.4	105.2	411.6	1.339	1.652	65
66	3317.553	3092.121	0.001179	0.0059	848.0	169.824	308.5	102.6	411.2	1.345	1.650	66
67	3386.449	3162.858	0.001193	0.0057	838.4	175.881	310.7	100.0	410.7	1.351	1.647	67
68	3456.379	3235.034	0.001207	0.0055	828.4	182.291	312.9	97.2	410.1	1.357	1.644	68
69	3527.346	3308.702	0.001223	0.0053	818.0	189.098	315.2	94.2	409.4	1.364	1.641	69
70	3599.350	3383.920	0.001239	0.0051	807.0	196.352	317.5	91.2	408.7	1.370	1.638	70
71	3672.390	3460.755	0.001257	0.0049	795.4	204.117	319.9	88.0	407.9	1.377	1.635	71
72	3746.456	3539.285	0.001277	0.0047	783.1	212.473	322.4	84.6	407.0	1.384	1.631	72
73	3821.535	3619.602	0.001299	0.0045	769.9	221.522	325.0	81.0	405.9	1.391	1.627	73
74	3897.595	3701.821	0.001323	0.0043	755.7	231.400	327.7	77.1	404.8	1.399	1.622	74
75	3974.589	3786.086	0.001351	0.0041	740.2	242.290	330.5	72.9	403.4	1.406	1.617	75
76	4052.434	3872.587	0.001383	0.0039	723.0	254.453	333.5	68.3	401.8	1.415	1.612	76
77	4130.986	3961.590	0.001421	0.0037	703.6	268.283	336.8	63.2	400.0	1.424	1.605	77
78	4209.967	4053.496	0.001468	0.0035	681.0	284.419	340.4	57.3	397.7	1.434	1.598	78
79	4288.774	4148.988	0.001531	0.0033	653.1	304.039	344.6	50.3	394.9	1.445	1.589	79
80	4365.740	4249.490	0.001626	0.0030	614.9	329.798	350.0	41.0	391.1	1.460	1.577	80

Opteon™ XP40 (R-449A)
Superheated Vapor - Constant Pressure Tables

V = Volume in m³/kg

H = Enthalpy in kJ/kg

S = Entropy in kJ/kg-K

Saturation Properties in Light Blue

ABSOLUTE PRESSURE, kPa													
Temp °C	320			330			340			350			Temp °C
	-13.17 °C			-12.35 °C			-11.56 °C			-10.78 °C			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0704	391.6	1.749	0.0684	392.0	1.748	0.0664	392.4	1.747	0.0646	392.8	1.746	
-10	0.0717	394.4	1.760	0.0693	394.1	1.756	0.0670	393.8	1.753	0.0649	393.5	1.749	-10
-5	0.0736	398.9	1.777	0.0711	398.6	1.773	0.0688	398.3	1.770	0.0667	398.1	1.766	-5
0	0.0754	403.3	1.793	0.0729	403.1	1.790	0.0706	402.8	1.786	0.0684	402.6	1.783	0
5	0.0772	407.7	1.809	0.0747	407.5	1.806	0.0723	407.3	1.802	0.0701	407.1	1.799	5
10	0.0790	412.2	1.825	0.0764	412.0	1.822	0.0740	411.7	1.818	0.0717	411.5	1.815	10
15	0.0808	416.6	1.841	0.0782	416.4	1.837	0.0757	416.2	1.834	0.0734	416.0	1.830	15
20	0.0825	421.0	1.856	0.0798	420.8	1.852	0.0773	420.6	1.849	0.0750	420.5	1.846	20
25	0.0842	425.5	1.871	0.0815	425.3	1.868	0.0790	425.1	1.864	0.0766	424.9	1.861	25
30	0.0859	429.9	1.886	0.0832	429.8	1.882	0.0806	429.6	1.879	0.0782	429.4	1.876	30
35	0.0876	434.4	1.900	0.0848	434.3	1.897	0.0822	434.1	1.894	0.0797	433.9	1.891	35
40	0.0893	438.9	1.915	0.0865	438.8	1.912	0.0838	438.6	1.908	0.0813	438.5	1.905	40
45	0.0909	443.5	1.929	0.0881	443.3	1.926	0.0854	443.2	1.923	0.0828	443.0	1.920	45
50	0.0926	448.0	1.943	0.0897	447.9	1.940	0.0869	447.7	1.937	0.0843	447.6	1.934	50
55	0.0942	452.6	1.958	0.0913	452.5	1.954	0.0885	452.3	1.951	0.0858	452.2	1.948	55
60	0.0959	457.2	1.972	0.0929	457.1	1.968	0.0900	457.0	1.965	0.0873	456.8	1.962	60
65	0.0975	461.8	1.985	0.0944	461.7	1.982	0.0916	461.6	1.979	0.0888	461.5	1.976	65
70	0.0991	466.5	1.999	0.0960	466.4	1.996	0.0931	466.3	1.993	0.0903	466.2	1.990	70
75	0.1007	471.2	2.013	0.0976	471.1	2.009	0.0946	471.0	2.006	0.0918	470.9	2.003	75
80	0.1023	476.0	2.026	0.0991	475.9	2.023	0.0961	475.7	2.020	0.0933	475.6	2.017	80
85	0.1039	480.7	2.040	0.1007	480.6	2.036	0.0976	480.5	2.033	0.0948	480.4	2.030	85
90	0.1055	485.5	2.053	0.1022	485.4	2.050	0.0991	485.3	2.047	0.0962	485.2	2.044	90
95	0.1071	490.4	2.066	0.1038	490.3	2.063	0.1006	490.2	2.060	0.0977	490.1	2.057	95
100	0.1087	495.2	2.079	0.1053	495.1	2.076	0.1021	495.0	2.073	0.0991	495.0	2.070	100
105	0.1102	500.1	2.092	0.1068	500.0	2.089	0.1036	500.0	2.086	0.1006	499.9	2.083	105
110	0.1118	505.1	2.105	0.1084	505.0	2.102	0.1051	504.9	2.099	0.1020	504.8	2.096	110
115	0.1134	510.0	2.118	0.1099	510.0	2.115	0.1066	509.9	2.112	0.1035	509.8	2.109	115
120	0.1150	515.0	2.131	0.1114	515.0	2.128	0.1081	514.9	2.125	0.1049	514.8	2.122	120
125	0.1165	520.1	2.144	0.1129	520.0	2.141	0.1095	519.9	2.138	0.1063	519.8	2.135	125
130	0.1181	525.2	2.156	0.1144	525.1	2.153	0.1110	525.0	2.150	0.1078	524.9	2.147	130
135	0.1196	530.3	2.169	0.1159	530.2	2.166	0.1125	530.1	2.163	0.1092	530.0	2.160	135

ABSOLUTE PRESSURE, kPa													
Temp °C	360			370			380			390			Temp °C
	-10.02 °C			-9.27 °C			-8.54 °C			-7.83 °C			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0629	393.2	1.745	0.0612	393.6	1.744	0.0596	394.0	1.744	0.0582	394.3	1.743	
-10	0.0629	393.2	1.745	0.0612	393.6	1.744	0.0596	394.0	1.744	0.0582	394.3	1.743	-10
-5	0.0646	397.8	1.763	0.0627	397.5	1.759	0.0608	397.2	1.756	0.0591	397.0	1.753	-5
0	0.0663	402.3	1.779	0.0643	402.1	1.776	0.0625	401.8	1.773	0.0607	401.6	1.770	0
5	0.0680	406.8	1.796	0.0660	406.6	1.792	0.0641	406.4	1.789	0.0623	406.1	1.786	5
10	0.0696	411.3	1.812	0.0676	411.1	1.808	0.0656	410.9	1.805	0.0638	410.6	1.802	10
15	0.0712	415.8	1.827	0.0691	415.6	1.824	0.0672	415.4	1.821	0.0653	415.2	1.818	15
20	0.0728	420.3	1.843	0.0707	420.1	1.840	0.0687	419.9	1.837	0.0668	419.7	1.834	20
25	0.0743	424.8	1.858	0.0722	424.6	1.855	0.0702	424.4	1.852	0.0682	424.2	1.849	25
30	0.0759	429.3	1.873	0.0737	429.1	1.870	0.0716	428.9	1.867	0.0697	428.7	1.864	30
35	0.0774	433.8	1.888	0.0752	433.6	1.885	0.0731	433.5	1.882	0.0711	433.3	1.879	35
40	0.0789	438.3	1.902	0.0767	438.2	1.899	0.0745	438.0	1.896	0.0725	437.9	1.894	40
45	0.0804	442.9	1.917	0.0781	442.7	1.914	0.0760	442.6	1.911	0.0739	442.4	1.908	45
50	0.0819	447.5	1.931	0.0796	447.3	1.928	0.0774	447.2	1.925	0.0753	447.0	1.922	50
55	0.0834	452.1	1.945	0.0810	451.9	1.942	0.0788	451.8	1.939	0.0767	451.7	1.937	55
60	0.0848	456.7	1.959	0.0824	456.6	1.956	0.0802	456.4	1.953	0.0780	456.3	1.951	60
65	0.0863	461.4	1.973	0.0839	461.2	1.970	0.0816	461.1	1.967	0.0794	461.0	1.965	65
70	0.0877	466.1	1.987	0.0853	465.9	1.984	0.0829	465.8	1.981	0.0807	465.7	1.978	70
75	0.0892	470.8	2.001	0.0867	470.7	1.998	0.0843	470.6	1.995	0.0821	470.4	1.992	75
80	0.0906	475.5	2.014	0.0881	475.4	2.011	0.0857	475.3	2.008	0.0834	475.2	2.006	80
85	0.0920	480.3	2.028	0.0895	480.2	2.025	0.0871	480.1	2.022	0.0847	480.0	2.019	85
90	0.0935	485.1	2.041	0.0909	485.0	2.038	0.0884	484.9	2.035	0.0861	484.8	2.033	90
95	0.0949	490.0	2.054	0.0923	489.9	2.051	0.0898	489.8	2.049	0.0874	489.7	2.046	95
100	0.0963	494.9	2.067	0.0936	494.8	2.065	0.0911	494.7	2.062	0.0887	494.6	2.059	100
105	0.0977	499.8	2.080	0.0950	499.7	2.078	0.0925	499.6	2.075	0.0900	499.5	2.072	105
110	0.0991	504.7	2.093	0.0964	504.6	2.091	0.0938	504.6	2.088	0.0913	504.5	2.085	110
115	0.1005	509.7	2.106	0.0978	509.6	2.104	0.0951	509.5	2.101	0.0926	509.5	2.098	115
120	0.1019	514.7	2.119	0.0991	514.6	2.116	0.0965	514.6	2.114	0.0939	514.5	2.111	120
125	0.1033	519.8	2.132	0.1005	519.7	2.129	0.0978	519.6	2.126	0.0952	519.5	2.124	125
130	0.1047	524.8	2.145	0.1018	524.8	2.142	0.0991	524.7	2.139	0.0965	524.6	2.137	130
135	0.1061	530.0	2.157	0.1032	529.9	2.154	0.1004	529.8	2.152	0.0978	529.7	2.149	135

Opteon™ XP40 (R-449A)
Superheated Vapor - Constant Pressure Tables

V = Volume in m³/kg

H = Enthalpy in kJ/kg

S = Entropy in kJ/kg-K

Saturation Properties in Light Blue

ABSOLUTE PRESSURE, kPa													
Temp °C	400			425			450			475			Temp °C
	-7.12 °C			-5.43 °C			-3.80 °C			-2.25 °C			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0567	394.7	1.742	0.0535	395.5	1.740	0.0506	396.4	1.738	0.0480	397.1	1.736	
-5	0.0574	396.7	1.749	0.0536	396.0	1.741							-5
0	0.0590	401.3	1.766	0.0551	400.6	1.759	0.0517	400.0	1.751	0.0486	399.3	1.744	0
5	0.0605	405.9	1.783	0.0566	405.3	1.776	0.0531	404.7	1.768	0.0500	404.0	1.762	5
10	0.0620	410.4	1.799	0.0581	409.9	1.792	0.0545	409.3	1.785	0.0513	408.7	1.778	10
15	0.0635	415.0	1.815	0.0595	414.4	1.808	0.0558	413.9	1.801	0.0526	413.4	1.795	15
20	0.0650	419.5	1.831	0.0608	419.0	1.824	0.0572	418.5	1.817	0.0539	418.0	1.811	20
25	0.0664	424.0	1.846	0.0622	423.6	1.839	0.0585	423.1	1.832	0.0551	422.6	1.826	25
30	0.0678	428.6	1.861	0.0635	428.1	1.854	0.0598	427.7	1.848	0.0564	427.3	1.842	30
35	0.0692	433.1	1.876	0.0649	432.7	1.869	0.0610	432.3	1.863	0.0576	431.9	1.857	35
40	0.0706	437.7	1.891	0.0662	437.3	1.884	0.0623	436.9	1.878	0.0588	436.5	1.872	40
45	0.0720	442.3	1.905	0.0675	441.9	1.899	0.0635	441.5	1.892	0.0600	441.2	1.886	45
50	0.0733	446.9	1.920	0.0688	446.5	1.913	0.0647	446.2	1.907	0.0611	445.8	1.901	50
55	0.0747	451.5	1.934	0.0700	451.2	1.927	0.0660	450.9	1.921	0.0623	450.5	1.915	55
60	0.0760	456.2	1.948	0.0713	455.9	1.942	0.0672	455.6	1.935	0.0634	455.2	1.930	60
65	0.0773	460.9	1.962	0.0726	460.6	1.956	0.0684	460.3	1.949	0.0646	460.0	1.944	65
70	0.0786	465.6	1.976	0.0738	465.3	1.969	0.0695	465.0	1.963	0.0657	464.7	1.958	70
75	0.0800	470.3	1.990	0.0751	470.1	1.983	0.0707	469.8	1.977	0.0668	469.5	1.971	75
80	0.0813	475.1	2.003	0.0763	474.8	1.997	0.0719	474.6	1.991	0.0680	474.3	1.985	80
85	0.0826	479.9	2.017	0.0775	479.6	2.010	0.0731	479.4	2.004	0.0691	479.1	1.999	85
90	0.0839	484.7	2.030	0.0788	484.5	2.024	0.0742	484.2	2.018	0.0702	484.0	2.012	90
95	0.0851	489.6	2.043	0.0800	489.4	2.037	0.0754	489.1	2.031	0.0713	488.9	2.026	95
100	0.0864	494.5	2.057	0.0812	494.3	2.050	0.0765	494.0	2.044	0.0724	493.8	2.039	100
105	0.0877	499.4	2.070	0.0824	499.2	2.063	0.0777	499.0	2.058	0.0735	498.7	2.052	105
110	0.0890	504.4	2.083	0.0836	504.2	2.076	0.0788	503.9	2.071	0.0746	503.7	2.065	110
115	0.0903	509.4	2.096	0.0848	509.2	2.089	0.0800	509.0	2.084	0.0756	508.7	2.078	115
120	0.0915	514.4	2.108	0.0860	514.2	2.102	0.0811	514.0	2.096	0.0767	513.8	2.091	120
125	0.0928	519.5	2.121	0.0872	519.3	2.115	0.0822	519.1	2.109	0.0778	518.9	2.104	125
130	0.0941	524.5	2.134	0.0884	524.4	2.128	0.0834	524.2	2.122	0.0789	524.0	2.117	130
135	0.0953	529.7	2.147	0.0896	529.5	2.140	0.0845	529.3	2.135	0.0799	529.1	2.129	135
140	0.0966	534.8	2.159	0.0908	534.6	2.153	0.0856	534.5	2.147	0.0810	534.3	2.142	140

ABSOLUTE PRESSURE, kPa													
Temp °C	500			525			550			575			Temp °C
	-0.75 °C			0.68 °C			2.07 °C			3.41 °C			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0456	397.9	1.735	0.0435	398.6	1.733	0.0415	399.2	1.732	0.0397	399.9	1.730	
0	0.0458	398.6	1.737										0
5	0.0472	403.4	1.755	0.0446	402.8	1.748	0.0423	402.1	1.742	0.0401	401.4	1.736	5
10	0.0484	408.1	1.772	0.0458	407.6	1.766	0.0435	407.0	1.760	0.0413	406.3	1.754	10
15	0.0497	412.8	1.788	0.0471	412.3	1.782	0.0446	411.7	1.776	0.0424	411.2	1.771	15
20	0.0509	417.5	1.804	0.0482	417.0	1.798	0.0458	416.5	1.793	0.0436	416.0	1.787	20
25	0.0521	422.2	1.820	0.0494	421.7	1.814	0.0469	421.2	1.809	0.0447	420.7	1.803	25
30	0.0533	426.8	1.836	0.0505	426.4	1.830	0.0480	425.9	1.824	0.0457	425.5	1.819	30
35	0.0545	431.5	1.851	0.0517	431.1	1.845	0.0491	430.6	1.840	0.0468	430.2	1.834	35
40	0.0556	436.1	1.866	0.0528	435.7	1.860	0.0502	435.3	1.855	0.0478	434.9	1.850	40
45	0.0568	440.8	1.881	0.0539	440.4	1.875	0.0512	440.0	1.870	0.0488	439.7	1.865	45
50	0.0579	445.5	1.895	0.0549	445.1	1.890	0.0523	444.8	1.884	0.0498	444.4	1.879	50
55	0.0590	450.2	1.910	0.0560	449.8	1.904	0.0533	449.5	1.899	0.0508	449.2	1.894	55
60	0.0601	454.9	1.924	0.0571	454.6	1.919	0.0543	454.3	1.913	0.0518	453.9	1.908	60
65	0.0612	459.6	1.938	0.0581	459.3	1.933	0.0553	459.0	1.928	0.0528	458.7	1.923	65
70	0.0623	464.4	1.952	0.0591	464.1	1.947	0.0563	463.8	1.942	0.0537	463.5	1.937	70
75	0.0633	469.2	1.966	0.0602	468.9	1.961	0.0573	468.6	1.956	0.0547	468.3	1.951	75
80	0.0644	474.0	1.980	0.0612	473.7	1.974	0.0583	473.5	1.969	0.0556	473.2	1.965	80
85	0.0655	478.9	1.993	0.0622	478.6	1.988	0.0593	478.3	1.983	0.0566	478.1	1.978	85
90	0.0665	483.7	2.007	0.0632	483.5	2.002	0.0602	483.2	1.997	0.0575	483.0	1.992	90
95	0.0676	488.6	2.020	0.0642	488.4	2.015	0.0612	488.1	2.010	0.0584	487.9	2.005	95
100	0.0686	493.6	2.033	0.0652	493.3	2.028	0.0622	493.1	2.023	0.0593	492.9	2.019	100
105	0.0697	498.5	2.047	0.0662	498.3	2.042	0.0631	498.1	2.037	0.0603	497.8	2.032	105
110	0.0707	503.5	2.060	0.0672	503.3	2.055	0.0641	503.1	2.050	0.0612	502.9	2.045	110
115	0.0717	508.5	2.073	0.0682	508.3	2.068	0.0650	508.1	2.063	0.0621	507.9	2.058	115
120	0.0728	513.6	2.086	0.0692	513.4	2.081	0.0660	513.2	2.076	0.0630	513.0	2.071	120
125	0.0738	518.7	2.099	0.0702	518.5	2.094	0.0669	518.3	2.089	0.0639	518.1	2.084	125
130	0.0748	523.8	2.111	0.0712	523.6	2.106	0.0678	523.4	2.102	0.0648	523.2	2.097	130
135	0.0759	528.9	2.124	0.0721	528.7	2.119	0.0688	528.6	2.114	0.0657	528.4	2.110	135
140	0.0769	534.1	2.137	0.0731	533.9	2.132	0.0697	533.7	2.127	0.0666	533.6	2.122	140
145	0.0779	539.3	2.149	0.0741	539.1	2.144	0.0706	539.0	2.139	0.0675	538.8	2.135	145

Opteon™ XP40 (R-449A)
Superheated Vapor - Constant Pressure Tables

V = Volume in m³/kg

H = Enthalpy in kJ/kg

S = Entropy in kJ/kg-K

Saturation Properties in Light Blue

ABSOLUTE PRESSURE, kPa													
Temp °C	600			625			650			675			Temp °C
	4.71 °C			5.96 °C			7.18 °C			8.37 °C			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0381	400.5	1.729	0.0366	401.0	1.728	0.0352	401.6	1.727	0.0339	402.1	1.725	
5	0.0382	400.7	1.730										5
10	0.0393	405.7	1.748	0.0375	405.1	1.742	0.0358	404.4	1.737	0.0342	403.8	1.731	10
15	0.0404	410.6	1.765	0.0386	410.0	1.760	0.0369	409.4	1.754	0.0353	408.8	1.749	15
20	0.0415	415.4	1.782	0.0396	414.9	1.776	0.0379	414.4	1.771	0.0363	413.8	1.766	20
25	0.0426	420.2	1.798	0.0407	419.7	1.793	0.0389	419.2	1.788	0.0372	418.7	1.783	25
30	0.0436	425.0	1.814	0.0417	424.5	1.809	0.0399	424.1	1.804	0.0382	423.6	1.799	30
35	0.0446	429.8	1.829	0.0426	429.3	1.824	0.0408	428.9	1.820	0.0391	428.4	1.815	35
40	0.0456	434.5	1.845	0.0436	434.1	1.840	0.0418	433.7	1.835	0.0401	433.3	1.830	40
45	0.0466	439.3	1.860	0.0446	438.9	1.855	0.0427	438.5	1.850	0.0410	438.1	1.846	45
50	0.0476	444.0	1.874	0.0455	443.7	1.870	0.0436	443.3	1.865	0.0418	442.9	1.861	50
55	0.0485	448.8	1.889	0.0464	448.5	1.884	0.0445	448.1	1.880	0.0427	447.8	1.876	55
60	0.0495	453.6	1.904	0.0473	453.3	1.899	0.0454	452.9	1.895	0.0436	452.6	1.890	60
65	0.0504	458.4	1.918	0.0483	458.1	1.913	0.0463	457.8	1.909	0.0444	457.4	1.905	65
70	0.0513	463.2	1.932	0.0492	462.9	1.928	0.0471	462.6	1.923	0.0453	462.3	1.919	70
75	0.0523	468.1	1.946	0.0500	467.8	1.942	0.0480	467.5	1.937	0.0461	467.2	1.933	75
80	0.0532	472.9	1.960	0.0509	472.6	1.955	0.0488	472.4	1.951	0.0469	472.1	1.947	80
85	0.0541	477.8	1.974	0.0518	477.5	1.969	0.0497	477.3	1.965	0.0477	477.0	1.961	85
90	0.0550	482.7	1.987	0.0527	482.5	1.983	0.0505	482.2	1.979	0.0486	481.9	1.975	90
95	0.0559	487.7	2.001	0.0535	487.4	1.996	0.0514	487.2	1.992	0.0494	486.9	1.988	95
100	0.0568	492.6	2.014	0.0544	492.4	2.010	0.0522	492.1	2.006	0.0502	491.9	2.002	100
105	0.0576	497.6	2.027	0.0552	497.4	2.023	0.0530	497.2	2.019	0.0510	496.9	2.015	105
110	0.0585	502.6	2.041	0.0561	502.4	2.036	0.0538	502.2	2.032	0.0518	502.0	2.028	110
115	0.0594	507.7	2.054	0.0569	507.5	2.049	0.0547	507.3	2.045	0.0525	507.0	2.041	115
120	0.0603	512.8	2.067	0.0578	512.6	2.063	0.0555	512.4	2.058	0.0533	512.1	2.054	120
125	0.0611	517.9	2.080	0.0586	517.7	2.075	0.0563	517.5	2.071	0.0541	517.3	2.067	125
130	0.0620	523.0	2.093	0.0595	522.8	2.088	0.0571	522.6	2.084	0.0549	522.4	2.080	130
135	0.0629	528.2	2.105	0.0603	528.0	2.101	0.0579	527.8	2.097	0.0557	527.6	2.093	135
140	0.0637	533.4	2.118	0.0611	533.2	2.114	0.0587	533.0	2.110	0.0564	532.8	2.106	140
145	0.0646	538.6	2.131	0.0619	538.4	2.126	0.0595	538.3	2.122	0.0572	538.1	2.118	145
150	0.0655	543.9	2.143	0.0628	543.7	2.139	0.0603	543.5	2.135	0.0580	543.4	2.131	150

ABSOLUTE PRESSURE, kPa													
Temp °C	700			725			750			775			Temp °C
	9.52 °C			10.64 °C			11.73 °C			12.79 °C			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0326	402.6	1.724	0.0315	403.1	1.723	0.0304	403.6	1.722	0.0294	404.0	1.721	
10	0.0327	403.1	1.726										10
15	0.0338	408.2	1.744	0.0324	407.6	1.739	0.0311	407.0	1.734	0.0299	406.4	1.729	15
20	0.0348	413.3	1.761	0.0334	412.7	1.756	0.0321	412.1	1.752	0.0308	411.6	1.747	20
25	0.0357	418.2	1.778	0.0343	417.7	1.773	0.0330	417.2	1.769	0.0317	416.6	1.764	25
30	0.0367	423.1	1.794	0.0352	422.6	1.790	0.0339	422.2	1.785	0.0326	421.7	1.781	30
35	0.0376	428.0	1.810	0.0361	427.5	1.806	0.0347	427.1	1.801	0.0335	426.6	1.797	35
40	0.0385	432.9	1.826	0.0370	432.4	1.822	0.0356	432.0	1.817	0.0343	431.6	1.813	40
45	0.0393	437.7	1.841	0.0378	437.3	1.837	0.0364	436.9	1.833	0.0351	436.5	1.829	45
50	0.0402	442.6	1.856	0.0387	442.2	1.852	0.0372	441.8	1.848	0.0359	441.4	1.844	50
55	0.0410	447.4	1.871	0.0395	447.0	1.867	0.0380	446.7	1.863	0.0367	446.3	1.859	55
60	0.0419	452.3	1.886	0.0403	451.9	1.882	0.0388	451.6	1.878	0.0375	451.2	1.874	60
65	0.0427	457.1	1.900	0.0411	456.8	1.896	0.0396	456.5	1.892	0.0382	456.1	1.889	65
70	0.0435	462.0	1.915	0.0419	461.7	1.911	0.0404	461.4	1.907	0.0390	461.1	1.903	70
75	0.0443	466.9	1.929	0.0427	466.6	1.925	0.0412	466.3	1.921	0.0397	466.0	1.917	75
80	0.0451	471.8	1.943	0.0435	471.5	1.939	0.0419	471.2	1.935	0.0405	471.0	1.931	80
85	0.0459	476.7	1.957	0.0442	476.5	1.953	0.0427	476.2	1.949	0.0412	475.9	1.945	85
90	0.0467	481.7	1.971	0.0450	481.4	1.967	0.0434	481.2	1.963	0.0419	480.9	1.959	90
95	0.0475	486.7	1.984	0.0458	486.4	1.980	0.0442	486.2	1.977	0.0426	485.9	1.973	95
100	0.0483	491.7	1.998	0.0465	491.4	1.994	0.0449	491.2	1.990	0.0434	490.9	1.987	100
105	0.0491	496.7	2.011	0.0473	496.5	2.007	0.0456	496.2	2.004	0.0441	496.0	2.000	105
110	0.0498	501.7	2.024	0.0480	501.5	2.021	0.0463	501.3	2.017	0.0448	501.1	2.013	110
115	0.0506	506.8	2.037	0.0488	506.6	2.034	0.0471	506.4	2.030	0.0455	506.2	2.027	115
120	0.0513	511.9	2.051	0.0495	511.7	2.047	0.0478	511.5	2.043	0.0462	511.3	2.040	120
125	0.0521	517.1	2.064	0.0502	516.9	2.060	0.0485	516.7	2.056	0.0469	516.5	2.053	125
130	0.0529	522.2	2.076	0.0510	522.0	2.073	0.0492	521.8	2.069	0.0475	521.7	2.066	130
135	0.0536	527.4	2.089	0.0517	527.2	2.086	0.0499	527.1	2.082	0.0482	526.9	2.078	135
140	0.0544	532.7	2.102	0.0524	532.5	2.098	0.0506	532.3	2.095	0.0489	532.1	2.091	140
145	0.0551	537.9	2.115	0.0531	537.7	2.111	0.0513	537.6	2.107	0.0496	537.4	2.104	145
150	0.0558	543.2	2.127	0.0539	543.0	2.123	0.0520	542.9	2.120	0.0503	542.7	2.117	150
155	0.0566	548.5	2.140	0.0546	548.3	2.136	0.0527	548.2	2.132	0.0509	548.0	2.129	155

Opteon™ XP40 (R-449A)
Superheated Vapor - Constant Pressure Tables

V = Volume in m³/kg

H = Enthalpy in kJ/kg

S = Entropy in kJ/kg-K

Saturation Properties in Light Blue

ABSOLUTE PRESSURE, kPa													
Temp °C	800			900			1000			1100			Temp °C
	13.83 °C			17.75 °C			21.35 °C			24.69 °C			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0285	404.5	1.720	0.0253	406.1	1.716	0.0227	407.4	1.713	0.0205	408.6	1.710	
15	0.0287	405.7	1.724										15
20	0.0297	411.0	1.742	0.0257	408.5	1.725							20
25	0.0306	416.1	1.760	0.0265	413.9	1.743	0.0233	411.5	1.727	0.0205	409.0	1.711	25
30	0.0314	421.2	1.777	0.0273	419.1	1.760	0.0240	417.0	1.745	0.0213	414.7	1.730	30
35	0.0323	426.2	1.793	0.0281	424.3	1.777	0.0248	422.3	1.762	0.0220	420.2	1.748	35
40	0.0331	431.1	1.809	0.0289	429.4	1.794	0.0255	427.5	1.779	0.0227	425.6	1.765	40
45	0.0339	436.1	1.825	0.0296	434.4	1.810	0.0262	432.7	1.795	0.0234	430.9	1.782	45
50	0.0347	441.0	1.840	0.0303	439.5	1.825	0.0269	437.9	1.811	0.0240	436.2	1.798	50
55	0.0354	446.0	1.855	0.0310	444.5	1.841	0.0275	443.0	1.827	0.0246	441.4	1.814	55
60	0.0362	450.9	1.870	0.0317	449.5	1.856	0.0282	448.1	1.843	0.0253	446.6	1.830	60
65	0.0369	455.8	1.885	0.0324	454.5	1.871	0.0288	453.1	1.858	0.0259	451.7	1.845	65
70	0.0377	460.8	1.899	0.0331	459.5	1.885	0.0294	458.2	1.873	0.0264	456.9	1.861	70
75	0.0384	465.7	1.914	0.0338	464.5	1.900	0.0301	463.3	1.887	0.0270	462.0	1.875	75
80	0.0391	470.7	1.928	0.0344	469.5	1.914	0.0307	468.3	1.902	0.0276	467.2	1.890	80
85	0.0398	475.6	1.942	0.0351	474.5	1.928	0.0313	473.4	1.916	0.0281	472.3	1.905	85
90	0.0405	480.6	1.956	0.0357	479.6	1.942	0.0318	478.5	1.930	0.0287	477.4	1.919	90
95	0.0412	485.7	1.969	0.0363	484.7	1.956	0.0324	483.6	1.944	0.0292	482.6	1.933	95
100	0.0419	490.7	1.983	0.0370	489.7	1.970	0.0330	488.7	1.958	0.0298	487.7	1.947	100
105	0.0426	495.8	1.996	0.0376	494.8	1.983	0.0336	493.9	1.972	0.0303	492.9	1.961	105
110	0.0433	500.9	2.010	0.0382	500.0	1.997	0.0341	499.0	1.985	0.0308	498.1	1.974	110
115	0.0440	506.0	2.023	0.0388	505.1	2.010	0.0347	504.2	1.998	0.0313	503.3	1.988	115
120	0.0447	511.1	2.036	0.0394	510.3	2.023	0.0353	509.4	2.012	0.0319	508.6	2.001	120
125	0.0453	516.3	2.049	0.0400	515.5	2.037	0.0358	514.6	2.025	0.0324	513.8	2.014	125
130	0.0460	521.5	2.062	0.0406	520.7	2.050	0.0364	519.9	2.038	0.0329	519.1	2.028	130
135	0.0467	526.7	2.075	0.0412	525.9	2.063	0.0369	525.2	2.051	0.0334	524.4	2.041	135
140	0.0473	531.9	2.088	0.0418	531.2	2.075	0.0375	530.4	2.064	0.0339	529.7	2.054	140
145	0.0480	537.2	2.101	0.0424	536.5	2.088	0.0380	535.8	2.077	0.0344	535.0	2.066	145
150	0.0486	542.5	2.113	0.0430	541.8	2.101	0.0385	541.1	2.090	0.0349	540.4	2.079	150
155	0.0493	547.8	2.126	0.0436	547.2	2.113	0.0391	546.5	2.102	0.0354	545.8	2.092	155
160	0.0499	553.2	2.138	0.0442	552.6	2.126	0.0396	551.9	2.115	0.0359	551.2	2.104	160

ABSOLUTE PRESSURE, kPa													
Temp °C	1200			1300			1400			1500			Temp °C
	27.81 °C			30.73 °C			33.49 °C			36.10 °C			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0187	409.7	1.706	0.0171	410.5	1.703	0.0158	411.3	1.701	0.0147	412.0	1.698	
30	0.0190	412.2	1.715										30
35	0.0197	418.0	1.734	0.0177	415.7	1.720	0.0160	413.2	1.707				35
40	0.0204	423.6	1.752	0.0184	421.5	1.739	0.0167	419.3	1.726	0.0152	416.9	1.714	40
45	0.0210	429.1	1.769	0.0190	427.1	1.757	0.0173	425.1	1.745	0.0158	423.0	1.733	45
50	0.0216	434.5	1.786	0.0196	432.7	1.774	0.0179	430.8	1.763	0.0163	428.9	1.751	50
55	0.0222	439.8	1.802	0.0202	438.1	1.791	0.0184	436.4	1.780	0.0169	434.6	1.769	55
60	0.0228	445.1	1.818	0.0207	443.5	1.807	0.0190	441.9	1.796	0.0174	440.3	1.786	60
65	0.0234	450.3	1.834	0.0213	448.9	1.823	0.0195	447.4	1.813	0.0179	445.8	1.803	65
70	0.0239	455.5	1.849	0.0218	454.2	1.839	0.0200	452.8	1.828	0.0184	451.3	1.819	70
75	0.0245	460.7	1.864	0.0223	459.4	1.854	0.0205	458.1	1.844	0.0189	456.8	1.834	75
80	0.0250	465.9	1.879	0.0228	464.7	1.869	0.0210	463.5	1.859	0.0193	462.2	1.850	80
85	0.0255	471.1	1.894	0.0233	470.0	1.884	0.0214	468.8	1.874	0.0198	467.6	1.865	85
90	0.0260	476.3	1.908	0.0238	475.2	1.898	0.0219	474.1	1.889	0.0202	472.9	1.880	90
95	0.0266	481.5	1.922	0.0243	480.5	1.913	0.0224	479.4	1.903	0.0207	478.3	1.895	95
100	0.0271	486.7	1.936	0.0248	485.7	1.927	0.0228	484.7	1.918	0.0211	483.6	1.909	100
105	0.0276	492.0	1.950	0.0252	491.0	1.941	0.0232	490.0	1.932	0.0215	489.0	1.923	105
110	0.0280	497.2	1.964	0.0257	496.2	1.955	0.0237	495.3	1.946	0.0219	494.3	1.937	110
115	0.0285	502.4	1.978	0.0261	501.5	1.968	0.0241	500.6	1.960	0.0223	499.7	1.951	115
120	0.0290	507.7	1.991	0.0266	506.8	1.982	0.0245	505.9	1.973	0.0227	505.1	1.965	120
125	0.0295	513.0	2.005	0.0270	512.1	1.995	0.0250	511.3	1.987	0.0231	510.4	1.979	125
130	0.0300	518.3	2.018	0.0275	517.5	2.009	0.0254	516.7	2.000	0.0235	515.8	1.992	130
135	0.0304	523.6	2.031	0.0279	522.8	2.022	0.0258	522.0	2.013	0.0239	521.2	2.005	135
140	0.0309	529.0	2.044	0.0284	528.2	2.035	0.0262	527.4	2.026	0.0243	526.7	2.019	140
145	0.0314	534.3	2.057	0.0288	533.6	2.048	0.0266	532.9	2.040	0.0247	532.1	2.032	145
150	0.0318	539.7	2.070	0.0292	539.0	2.061	0.0270	538.3	2.052	0.0251	537.6	2.045	150
155	0.0323	545.1	2.082	0.0297	544.4	2.074	0.0274	543.8	2.065	0.0255	543.1	2.057	155
160	0.0327	550.6	2.095	0.0301	549.9	2.086	0.0278	549.2	2.078	0.0258	548.6	2.070	160
165	0.0332	556.0	2.108	0.0305	555.4	2.099	0.0282	554.8	2.091	0.0262	554.1	2.083	165
170	0.0336	561.5	2.120	0.0309	560.9	2.111	0.0286	560.3	2.103	0.0266	559.7	2.096	170
175	0.0341	567.1	2.132	0.0313	566.4	2.124	0.0290	565.8	2.116	0.0270	565.2	2.108	175

Opteon™ XP40 (R-449A)
Superheated Vapor - Constant Pressure Tables

V = Volume in m³/kg

H = Enthalpy in kJ/kg

S = Entropy in kJ/kg-K

Saturation Properties in Light Blue

ABSOLUTE PRESSURE, kPa													
Temp °C	1600			1700			1800			1900			Temp °C
	38.58 °C			40.95 °C			43.21 °C			45.37 °C			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0136	412.5	1.695	0.0127	413.0	1.692	0.0119	413.4	1.690	0.0112	413.7	1.687	
40	0.0138	414.4	1.701										40
45	0.0144	420.8	1.721	0.0132	418.4	1.709	0.0121	415.9	1.697				45
50	0.0150	426.9	1.740	0.0138	424.8	1.729	0.0127	422.5	1.718	0.0117	420.2	1.707	50
55	0.0155	432.8	1.758	0.0143	430.9	1.748	0.0132	428.9	1.738	0.0123	426.8	1.727	55
60	0.0160	438.6	1.776	0.0148	436.8	1.766	0.0137	435.0	1.756	0.0128	433.1	1.747	60
65	0.0165	444.3	1.793	0.0153	442.6	1.783	0.0142	440.9	1.774	0.0132	439.2	1.765	65
70	0.0170	449.8	1.809	0.0158	448.3	1.800	0.0147	446.8	1.791	0.0137	445.2	1.782	70
75	0.0175	455.4	1.825	0.0162	454.0	1.816	0.0151	452.5	1.808	0.0141	451.0	1.799	75
80	0.0179	460.9	1.841	0.0167	459.5	1.832	0.0155	458.2	1.824	0.0145	456.8	1.816	80
85	0.0183	466.3	1.856	0.0171	465.1	1.848	0.0159	463.8	1.840	0.0149	462.5	1.832	85
90	0.0188	471.8	1.871	0.0175	470.6	1.863	0.0163	469.3	1.855	0.0153	468.1	1.847	90
95	0.0192	477.2	1.886	0.0179	476.0	1.878	0.0167	474.9	1.870	0.0157	473.7	1.863	95
100	0.0196	482.6	1.901	0.0183	481.5	1.893	0.0171	480.4	1.885	0.0161	479.3	1.878	100
105	0.0200	488.0	1.915	0.0187	486.9	1.907	0.0175	485.9	1.900	0.0164	484.8	1.892	105
110	0.0204	493.4	1.929	0.0190	492.4	1.922	0.0178	491.4	1.914	0.0168	490.4	1.907	110
115	0.0208	498.8	1.943	0.0194	497.8	1.936	0.0182	496.9	1.928	0.0171	495.9	1.921	115
120	0.0212	504.2	1.957	0.0198	503.3	1.950	0.0186	502.4	1.942	0.0175	501.4	1.935	120
125	0.0216	509.6	1.971	0.0202	508.7	1.963	0.0189	507.8	1.956	0.0178	507.0	1.949	125
130	0.0219	515.0	1.984	0.0205	514.2	1.977	0.0193	513.3	1.970	0.0181	512.5	1.963	130
135	0.0223	520.4	1.998	0.0209	519.6	1.990	0.0196	518.8	1.983	0.0185	518.0	1.977	135
140	0.0227	525.9	2.011	0.0212	525.1	2.004	0.0199	524.3	1.997	0.0188	523.6	1.990	140
145	0.0230	531.4	2.024	0.0216	530.6	2.017	0.0203	529.9	2.010	0.0191	529.1	2.004	145
150	0.0234	536.9	2.037	0.0219	536.1	2.030	0.0206	535.4	2.023	0.0194	534.7	2.017	150
155	0.0238	542.4	2.050	0.0223	541.7	2.043	0.0209	541.0	2.036	0.0197	540.3	2.030	155
160	0.0241	547.9	2.063	0.0226	547.2	2.056	0.0213	546.5	2.049	0.0200	545.9	2.043	160
165	0.0245	553.4	2.076	0.0229	552.8	2.069	0.0216	552.1	2.062	0.0204	551.5	2.056	165
170	0.0248	559.0	2.088	0.0233	558.4	2.081	0.0219	557.7	2.075	0.0207	557.1	2.069	170
175	0.0252	564.6	2.101	0.0236	564.0	2.094	0.0222	563.4	2.088	0.0210	562.8	2.081	175
180	0.0255	570.2	2.113	0.0239	569.6	2.107	0.0225	569.0	2.100	0.0213	568.4	2.094	180
185	0.0259	575.9	2.126	0.0243	575.3	2.119	0.0228	574.7	2.113	0.0216	574.1	2.106	185

ABSOLUTE PRESSURE, kPa													
Temp °C	2000			2100			2200			2300			Temp °C
	47.45 °C			49.45 °C			51.38 °C			53.23 °C			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0105	413.9	1.684	0.0099	414.0	1.681	0.0094	414.0	1.679	0.0089	414.0	1.676	
50	0.0108	417.6	1.696	0.0100	414.8	1.684							50
55	0.0114	424.5	1.717	0.0105	422.2	1.706	0.0098	419.6	1.696	0.0091	416.9	1.684	55
60	0.0119	431.1	1.737	0.0111	429.0	1.727	0.0103	426.8	1.717	0.0096	424.5	1.707	60
65	0.0123	437.4	1.756	0.0115	435.5	1.747	0.0108	433.6	1.737	0.0101	431.5	1.728	65
70	0.0128	443.5	1.774	0.0120	441.8	1.765	0.0112	440.0	1.756	0.0105	438.2	1.748	70
75	0.0132	449.5	1.791	0.0124	447.9	1.783	0.0116	446.3	1.775	0.0109	444.6	1.766	75
80	0.0136	455.3	1.808	0.0128	453.9	1.800	0.0120	452.4	1.792	0.0113	450.8	1.784	80
85	0.0140	461.1	1.824	0.0132	459.8	1.816	0.0124	458.4	1.809	0.0117	456.9	1.801	85
90	0.0144	466.9	1.840	0.0135	465.6	1.832	0.0128	464.3	1.825	0.0121	462.9	1.818	90
95	0.0147	472.5	1.855	0.0139	471.3	1.848	0.0131	470.1	1.841	0.0124	468.8	1.834	95
100	0.0151	478.2	1.870	0.0142	477.0	1.863	0.0135	475.9	1.857	0.0127	474.7	1.850	100
105	0.0155	483.8	1.885	0.0146	482.7	1.879	0.0138	481.6	1.872	0.0131	480.5	1.865	105
110	0.0158	489.4	1.900	0.0149	488.3	1.893	0.0141	487.3	1.887	0.0134	486.2	1.880	110
115	0.0161	494.9	1.915	0.0152	493.9	1.908	0.0144	493.0	1.902	0.0137	491.9	1.895	115
120	0.0165	500.5	1.929	0.0156	499.6	1.922	0.0147	498.6	1.916	0.0140	497.6	1.910	120
125	0.0168	506.1	1.943	0.0159	505.2	1.936	0.0151	504.3	1.930	0.0143	503.3	1.924	125
130	0.0171	511.6	1.957	0.0162	510.8	1.950	0.0154	509.9	1.944	0.0146	509.0	1.938	130
135	0.0174	517.2	1.970	0.0165	516.4	1.964	0.0156	515.5	1.958	0.0149	514.7	1.952	135
140	0.0177	522.8	1.984	0.0168	522.0	1.978	0.0159	521.2	1.972	0.0152	520.4	1.966	140
145	0.0180	528.3	1.997	0.0171	527.6	1.991	0.0162	526.8	1.986	0.0154	526.0	1.980	145
150	0.0184	533.9	2.011	0.0174	533.2	2.005	0.0165	532.5	1.999	0.0157	531.7	1.993	150
155	0.0187	539.5	2.024	0.0177	538.8	2.018	0.0168	538.1	2.012	0.0160	537.4	2.007	155
160	0.0190	545.2	2.037	0.0180	544.5	2.031	0.0171	543.8	2.025	0.0163	543.1	2.020	160
165	0.0193	550.8	2.050	0.0183	550.1	2.044	0.0174	549.5	2.038	0.0165	548.8	2.033	165
170	0.0195	556.5	2.063	0.0185	555.8	2.057	0.0176	555.2	2.051	0.0168	554.5	2.046	170
175	0.0198	562.1	2.075	0.0188	561.5	2.070	0.0179	560.9	2.064	0.0171	560.2	2.059	175
180	0.0201	567.8	2.088	0.0191	567.2	2.082	0.0182	566.6	2.077	0.0173	566.0	2.072	180
185	0.0204	573.5	2.101	0.0194	572.9	2.095	0.0184	572.3	2.090	0.0176	571.7	2.084	185
190	0.0207	579.3	2.113	0.0197	578.7	2.107	0.0187	578.1	2.102	0.0178	577.5	2.097	190
195	0.0210	585.0	2.125	0.0199	584.4	2.120	0.0190	583.9	2.114	0.0181	583.3	2.109	195

Opteon™ XP40 (R-449A)
Superheated Vapor - Constant Pressure Tables

V = Volume in m³/kg

H = Enthalpy in kJ/kg

S = Entropy in kJ/kg-K

Saturation Properties in Light Blue

ABSOLUTE PRESSURE, kPa													
Temp °C	2400			2600			2800			3000			Temp °C
	55.03 °C			58.44 °C			61.65 °C			64.67 °C			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0084	413.9	1.673	0.0075	413.5	1.667	0.0068	412.8	1.660	0.0062	411.8	1.653	
60	0.0089	422.0	1.697	0.0077	416.3	1.675							60
65	0.0094	429.4	1.719	0.0083	424.6	1.700	0.0072	419.2	1.679	0.0062	412.5	1.656	65
70	0.0099	436.3	1.739	0.0087	432.2	1.722	0.0077	427.6	1.704	0.0068	422.4	1.684	70
75	0.0103	442.9	1.758	0.0092	439.2	1.742	0.0081	435.2	1.726	0.0072	430.8	1.709	75
80	0.0107	449.3	1.777	0.0095	445.9	1.762	0.0085	442.4	1.746	0.0077	438.5	1.731	80
85	0.0111	455.5	1.794	0.0099	452.4	1.780	0.0089	449.2	1.766	0.0080	445.8	1.751	85
90	0.0114	461.6	1.811	0.0103	458.7	1.797	0.0093	455.8	1.784	0.0084	452.7	1.770	90
95	0.0118	467.6	1.827	0.0106	464.9	1.814	0.0096	462.2	1.801	0.0087	459.3	1.789	95
100	0.0121	473.5	1.843	0.0109	471.0	1.831	0.0099	468.5	1.818	0.0090	465.8	1.806	100
105	0.0124	479.3	1.859	0.0112	477.0	1.847	0.0102	474.6	1.835	0.0093	472.2	1.823	105
110	0.0127	485.1	1.874	0.0115	483.0	1.862	0.0105	480.7	1.851	0.0096	478.4	1.839	110
115	0.0130	490.9	1.889	0.0118	488.9	1.878	0.0108	486.7	1.866	0.0099	484.5	1.855	115
120	0.0133	496.7	1.904	0.0121	494.7	1.893	0.0111	492.7	1.881	0.0101	490.6	1.871	120
125	0.0136	502.4	1.918	0.0124	500.5	1.907	0.0113	498.6	1.896	0.0104	496.7	1.886	125
130	0.0139	508.1	1.933	0.0126	506.3	1.922	0.0116	504.5	1.911	0.0107	502.6	1.901	130
135	0.0142	513.8	1.947	0.0129	512.1	1.936	0.0118	510.4	1.926	0.0109	508.6	1.916	135
140	0.0144	519.5	1.961	0.0132	517.9	1.950	0.0121	516.2	1.940	0.0111	514.5	1.930	140
145	0.0147	525.2	1.974	0.0134	523.7	1.964	0.0123	522.1	1.954	0.0114	520.4	1.944	145
150	0.0150	531.0	1.988	0.0137	529.4	1.978	0.0126	527.9	1.968	0.0116	526.3	1.958	150
155	0.0152	536.7	2.001	0.0139	535.2	1.991	0.0128	533.7	1.981	0.0118	532.2	1.972	155
160	0.0155	542.4	2.015	0.0142	541.0	2.005	0.0130	539.5	1.995	0.0121	538.1	1.986	160
165	0.0158	548.1	2.028	0.0144	546.7	2.018	0.0133	545.4	2.008	0.0123	544.0	1.999	165
170	0.0160	553.9	2.041	0.0147	552.5	2.031	0.0135	551.2	2.022	0.0125	549.9	2.013	170
175	0.0163	559.6	2.054	0.0149	558.3	2.044	0.0137	557.0	2.035	0.0127	555.7	2.026	175
180	0.0165	565.4	2.067	0.0151	564.1	2.057	0.0140	562.9	2.048	0.0129	561.6	2.039	180
185	0.0168	571.2	2.079	0.0154	570.0	2.070	0.0142	568.8	2.061	0.0131	567.5	2.052	185
190	0.0170	577.0	2.092	0.0156	575.8	2.082	0.0144	574.6	2.073	0.0133	573.5	2.065	190
195	0.0173	582.8	2.104	0.0158	581.6	2.095	0.0146	580.5	2.086	0.0136	579.4	2.078	195
200	0.0175	588.6	2.117	0.0161	587.5	2.107	0.0148	586.4	2.099	0.0138	585.3	2.090	200
205	0.0178	594.5	2.129	0.0163	593.4	2.120	0.0150	592.3	2.111	0.0140	591.3	2.103	205
ABSOLUTE PRESSURE, kPa													
Temp °C	3200			3400			3600			3800			Temp °C
	67.52 °C			70.21 °C			72.76 °C			75.16 °C			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0056	410.4	1.646	0.0051	408.6	1.637	0.0046	406.2	1.628	0.0041	403.2	1.616	
70	0.0059	416.1	1.663										70
75	0.0064	425.9	1.691	0.0057	420.1	1.671	0.0049	412.9	1.647				75
80	0.0069	434.3	1.715	0.0061	429.7	1.698	0.0055	424.3	1.680	0.0048	418.0	1.659	80
85	0.0073	442.1	1.737	0.0065	438.1	1.722	0.0059	433.7	1.706	0.0053	428.8	1.689	85
90	0.0076	449.4	1.757	0.0069	445.8	1.743	0.0063	442.1	1.729	0.0057	437.9	1.714	90
95	0.0079	456.3	1.776	0.0072	453.2	1.763	0.0066	449.8	1.750	0.0060	446.2	1.737	95
100	0.0082	463.0	1.794	0.0076	460.2	1.782	0.0069	457.1	1.770	0.0064	453.9	1.758	100
105	0.0085	469.6	1.811	0.0078	466.9	1.800	0.0072	464.2	1.789	0.0067	461.3	1.777	105
110	0.0088	476.0	1.828	0.0081	473.5	1.817	0.0075	471.0	1.807	0.0069	468.3	1.796	110
115	0.0091	482.3	1.845	0.0084	480.0	1.834	0.0078	477.6	1.824	0.0072	475.1	1.814	115
120	0.0093	488.5	1.861	0.0086	486.3	1.850	0.0080	484.1	1.841	0.0074	481.8	1.831	120
125	0.0096	494.6	1.876	0.0089	492.6	1.866	0.0083	490.5	1.857	0.0077	488.4	1.847	125
130	0.0098	500.7	1.891	0.0091	498.8	1.882	0.0085	496.8	1.872	0.0079	494.8	1.863	130
135	0.0101	506.8	1.906	0.0094	504.9	1.897	0.0087	503.1	1.888	0.0081	501.2	1.879	135
140	0.0103	512.8	1.921	0.0096	511.0	1.912	0.0089	509.3	1.903	0.0083	507.5	1.894	140
145	0.0105	518.8	1.935	0.0098	517.1	1.926	0.0091	515.4	1.918	0.0086	513.7	1.909	145
150	0.0108	524.7	1.949	0.0100	523.1	1.941	0.0094	521.5	1.932	0.0088	519.9	1.924	150
155	0.0110	530.7	1.963	0.0102	529.2	1.955	0.0096	527.6	1.947	0.0090	526.0	1.939	155
160	0.0112	536.6	1.977	0.0104	535.2	1.969	0.0098	533.7	1.961	0.0092	532.2	1.953	160
165	0.0114	542.6	1.991	0.0106	541.2	1.983	0.0100	539.7	1.975	0.0093	538.3	1.967	165
170	0.0116	548.5	2.004	0.0108	547.1	1.996	0.0101	545.8	1.988	0.0095	544.4	1.981	170
175	0.0118	554.4	2.018	0.0110	553.1	2.010	0.0103	551.8	2.002	0.0097	550.5	1.994	175
180	0.0120	560.4	2.031	0.0112	559.1	2.023	0.0105	557.8	2.015	0.0099	556.5	2.008	180
185	0.0122	566.3	2.044	0.0114	565.1	2.036	0.0107	563.9	2.028	0.0101	562.6	2.021	185
190	0.0124	572.3	2.057	0.0116	571.1	2.049	0.0109	569.9	2.042	0.0103	568.7	2.034	190
195	0.0126	578.2	2.069	0.0118	577.1	2.062	0.0111	575.9	2.054	0.0104	574.8	2.047	195
200	0.0128	584.2	2.082	0.0120	583.1	2.075	0.0113	582.0	2.067	0.0106	580.9	2.060	200
205	0.0130	590.2	2.095	0.0122	589.1	2.087	0.0114	588.0	2.080	0.0108	586.9	2.073	205
210	0.0132	596.2	2.107	0.0124	595.1	2.100	0.0116	594.1	2.093	0.0109	593.0	2.086	210
215	0.0134	602.2	2.120	0.0125	601.2	2.112	0.0118	600.2	2.105	0.0111	599.1	2.098	215

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