



# Opteon™ XL40

## Refrigerant

### Thermodynamic 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 °C
Critical Pressure	4627.4 kPa
Critical Density	456.4 kg/m <sup>3</sup>
Critical Volume	0.0022 m <sup>3</sup> /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])
v <sub>f</sub>	= volume of saturated liquid in m <sup>3</sup> /kg
v <sub>g</sub>	= volume of saturated vapor in m <sup>3</sup> /kg
V	= volume of superheated vapor in m <sup>3</sup> /kg
d <sub>f</sub>	= 1/v <sub>f</sub> = density of saturated liquid in kg/m <sup>3</sup>
d <sub>g</sub>	= 1/v <sub>g</sub> = density of saturated vapor in kg/m <sup>3</sup>
h <sub>f</sub>	= enthalpy of saturated liquid in kJ/kg
h <sub>fg</sub>	= enthalpy of vaporization in kJ/kg
h <sub>g</sub>	= enthalpy of saturated vapor in kJ/kg
H	= enthalpy of superheated vapor in kJ/kg
s <sub>f</sub>	= entropy of saturated liquid in kJ/(kg) (K)
s <sub>g</sub>	= 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<sub>f</sub> = 200 kJ/kg at 0°C

s<sub>f</sub> = 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).

Opteon™ XL40 (R-454A)

Saturation Properties - Temperature Table

Temp °C	Pressure [kPa]		Volume [m <sup>3</sup> /kg]		Density [kg/m <sup>3</sup> ]		Enthalpy [kJ/kg]			Entropy [kJ/kg-K]		Temp °C
	Liquid P <sub>f</sub>	Vapor P <sub>g</sub>	Liquid v <sub>f</sub>	Vapor v <sub>g</sub>	Liquid d <sub>f</sub>	Vapor d <sub>g</sub>	Liquid h <sub>f</sub>	Latent h <sub>fg</sub>	Vapor h <sub>g</sub>	Liquid s <sub>f</sub>	Vapor s <sub>g</sub>	
-60	53.993	39.228	0.000769	0.5487	1300.3	1.822	117.1	256.5	373.6	0.660	1.884	-60
-59	57.042	41.576	0.000771	0.5197	1297.6	1.924	118.4	255.8	374.2	0.666	1.881	-59
-58	60.227	44.036	0.000772	0.4925	1294.9	2.031	119.7	255.1	374.8	0.672	1.878	-58
-57	63.553	46.613	0.000774	0.4670	1292.2	2.142	121.0	254.4	375.4	0.678	1.875	-57
-56	67.024	49.309	0.000776	0.4430	1289.5	2.257	122.3	253.7	376.0	0.685	1.872	-56
-55	70.644	52.131	0.000777	0.4205	1286.7	2.378	123.7	253.0	376.7	0.691	1.869	-55
-54	74.418	55.080	0.000779	0.3994	1284.0	2.504	125.0	252.3	377.3	0.697	1.867	-54
-53	78.352	58.163	0.000781	0.3795	1281.2	2.635	126.3	251.6	377.9	0.703	1.864	-53
-52	82.448	61.382	0.000782	0.3609	1278.4	2.771	127.6	250.9	378.5	0.709	1.861	-52
-51	86.713	64.743	0.000784	0.3433	1275.7	2.913	129.0	250.2	379.1	0.715	1.859	-51
-50	91.150	68.249	0.000786	0.3267	1272.9	3.061	130.3	249.4	379.7	0.721	1.856	-50
-49	95.766	71.905	0.000787	0.3111	1270.1	3.214	131.6	248.7	380.3	0.726	1.854	-49
-48	100.564	75.717	0.000789	0.2964	1267.3	3.374	133.0	248.0	381.0	0.732	1.851	-48
-47	105.550	79.687	0.000791	0.2825	1264.5	3.539	134.3	247.3	381.6	0.738	1.849	-47
-46	110.729	83.822	0.000793	0.2694	1261.6	3.711	135.6	246.5	382.2	0.744	1.847	-46
-45	116.105	88.125	0.000794	0.2571	1258.8	3.890	137.0	245.8	382.8	0.750	1.844	-45
-44	121.685	92.603	0.000796	0.2454	1255.9	4.075	138.3	245.1	383.4	0.756	1.842	-44
-43	127.473	97.258	0.000798	0.2343	1253.1	4.268	139.7	244.3	384.0	0.762	1.840	-43
-42	133.475	102.098	0.000800	0.2239	1250.2	4.467	141.0	243.6	384.6	0.768	1.838	-42
-41	139.696	107.125	0.000802	0.2140	1247.3	4.674	142.3	242.9	385.2	0.773	1.835	-41
-40	146.142	112.347	0.000804	0.2046	1244.4	4.888	143.7	242.1	385.8	0.779	1.833	-40
-39	152.817	117.768	0.000805	0.1957	1241.5	5.109	145.0	241.4	386.4	0.785	1.831	-39
-38	159.728	123.392	0.000807	0.1873	1238.6	5.339	146.4	240.6	387.0	0.791	1.829	-38
-37	166.880	129.227	0.000809	0.1793	1235.7	5.577	147.8	239.8	387.6	0.796	1.827	-37
-36	174.278	135.276	0.000811	0.1717	1232.8	5.823	149.1	239.1	388.2	0.802	1.825	-36
-35	181.929	141.545	0.000813	0.1646	1229.8	6.077	150.5	238.3	388.8	0.808	1.823	-35
-34	189.838	148.040	0.000815	0.1577	1226.8	6.340	151.8	237.5	389.4	0.813	1.821	-34
-33	198.011	154.767	0.000817	0.1512	1223.9	6.612	153.2	236.7	390.0	0.819	1.820	-33
-32	206.454	161.730	0.000819	0.1451	1220.9	6.893	154.6	236.0	390.5	0.825	1.818	-32
-31	215.173	168.936	0.000821	0.1392	1217.9	7.183	155.9	235.2	391.1	0.830	1.816	-31
-30	224.173	176.391	0.000823	0.1336	1214.9	7.483	157.3	234.4	391.7	0.836	1.814	-30
-29	233.461	184.100	0.000825	0.1283	1211.8	7.793	158.7	233.6	392.3	0.842	1.812	-29
-28	243.043	192.069	0.000827	0.1233	1208.8	8.113	160.1	232.8	392.9	0.847	1.811	-28
-27	252.924	200.305	0.000829	0.1184	1205.7	8.443	161.5	232.0	393.4	0.853	1.809	-27
-26	263.112	208.812	0.000831	0.1138	1202.7	8.784	162.8	231.2	394.0	0.858	1.807	-26
-25	273.611	217.598	0.000834	0.1095	1199.6	9.135	164.2	230.4	394.6	0.864	1.806	-25
-24	284.429	226.668	0.000836	0.1053	1196.5	9.497	165.6	229.5	395.1	0.870	1.804	-24
-23	295.572	236.029	0.000838	0.1013	1193.4	9.871	167.0	228.7	395.7	0.875	1.802	-23
-22	307.045	245.686	0.000840	0.0975	1190.3	10.256	168.4	227.9	396.3	0.881	1.801	-22
-21	318.856	255.647	0.000842	0.0939	1187.1	10.653	169.8	227.0	396.8	0.886	1.799	-21
-20	331.010	265.917	0.000845	0.0904	1184.0	11.062	171.2	226.2	397.4	0.892	1.798	-20
-19	343.514	276.503	0.000847	0.0871	1180.8	11.483	172.6	225.3	398.0	0.897	1.796	-19
-18	356.376	287.412	0.000849	0.0839	1177.6	11.917	174.0	224.5	398.5	0.903	1.795	-18
-17	369.600	298.650	0.000851	0.0809	1174.4	12.364	175.4	223.6	399.1	0.908	1.793	-17
-16	383.193	310.223	0.000854	0.0780	1171.2	12.825	176.9	222.8	399.6	0.914	1.792	-16
-15	397.164	322.139	0.000856	0.0752	1168.0	13.298	178.3	221.9	400.1	0.919	1.790	-15
-14	411.517	334.403	0.000859	0.0725	1164.7	13.786	179.7	221.0	400.7	0.925	1.789	-14
-13	426.259	347.024	0.000861	0.0700	1161.5	14.288	181.1	220.1	401.2	0.930	1.787	-13
-12	441.398	360.007	0.000863	0.0675	1158.2	14.804	182.5	219.2	401.8	0.935	1.786	-12
-11	456.940	373.361	0.000866	0.0652	1154.9	15.335	184.0	218.3	402.3	0.941	1.785	-11
-10	472.891	387.090	0.000868	0.0630	1151.6	15.882	185.4	217.4	402.8	0.946	1.783	-10
-9	489.259	401.204	0.000871	0.0608	1148.2	16.443	186.9	216.5	403.3	0.952	1.782	-9
-8	506.051	415.708	0.000873	0.0588	1144.9	17.021	188.3	215.6	403.9	0.957	1.781	-8
-7	523.273	430.610	0.000876	0.0568	1141.5	17.615	189.8	214.6	404.4	0.962	1.779	-7
-6	540.932	445.918	0.000879	0.0549	1138.1	18.226	191.2	213.7	404.9	0.968	1.778	-6
-5	559.035	461.638	0.000881	0.0530	1134.7	18.854	192.7	212.8	405.4	0.973	1.777	-5
-4	577.589	477.778	0.000884	0.0513	1131.3	19.499	194.1	211.8	405.9	0.979	1.776	-4

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Saturation Properties - Temperature Table

Temp °C	Pressure [kPa]		Volume [m <sup>3</sup> /kg]		Density [kg/m <sup>3</sup> ]		Enthalpy [kJ/kg]			Entropy [kJ/kg-K]		Temp °C
	Liquid P <sub>f</sub>	Vapor P <sub>g</sub>	Liquid v <sub>f</sub>	Vapor v <sub>g</sub>	Liquid d <sub>f</sub>	Vapor d <sub>g</sub>	Liquid h <sub>f</sub>	Latent h <sub>fg</sub>	Vapor h <sub>g</sub>	Liquid s <sub>f</sub>	Vapor s <sub>g</sub>	
-3	596.602	494.346	0.000887	0.0496	1127.8	20.162	195.6	210.8	406.4	0.984	1.774	-3
-2	616.080	511.348	0.000889	0.0480	1124.3	20.843	197.1	209.9	406.9	0.989	1.773	-2
-1	636.030	528.793	0.000892	0.0464	1120.9	21.543	198.5	208.9	407.4	0.995	1.772	-1
0	656.459	546.688	0.000895	0.0449	1117.3	22.262	200.0	207.9	407.9	1.000	1.771	0
1	677.375	565.041	0.000898	0.0435	1113.8	23.001	201.5	206.9	408.4	1.005	1.770	1
2	698.785	583.860	0.000901	0.0421	1110.2	23.760	203.0	205.9	408.9	1.011	1.768	2
3	720.695	603.151	0.000904	0.0408	1106.7	24.539	204.5	204.9	409.4	1.016	1.767	3
4	743.114	622.925	0.000907	0.0395	1103.1	25.340	205.9	203.9	409.8	1.021	1.766	4
5	766.048	643.187	0.000910	0.0382	1099.4	26.162	207.4	202.8	410.3	1.027	1.765	5
6	789.505	663.947	0.000913	0.0370	1095.8	27.006	208.9	201.8	410.8	1.032	1.764	6
7	813.491	685.213	0.000916	0.0359	1092.1	27.873	210.5	200.8	411.2	1.037	1.763	7
8	838.015	706.992	0.000919	0.0348	1088.4	28.763	212.0	199.7	411.7	1.043	1.762	8
9	863.084	729.294	0.000922	0.0337	1084.7	29.677	213.5	198.6	412.1	1.048	1.760	9
10	888.705	752.126	0.000925	0.0327	1080.9	30.615	215.0	197.5	412.6	1.053	1.759	10
11	914.886	775.498	0.000928	0.0317	1077.1	31.579	216.5	196.5	413.0	1.058	1.758	11
12	941.634	799.416	0.000932	0.0307	1073.3	32.568	218.1	195.4	413.4	1.064	1.757	12
13	968.956	823.892	0.000935	0.0298	1069.5	33.583	219.6	194.2	413.8	1.069	1.756	13
14	996.861	848.932	0.000938	0.0289	1065.6	34.626	221.1	193.1	414.3	1.074	1.755	14
15	1025.355	874.546	0.000942	0.0280	1061.7	35.696	222.7	192.0	414.7	1.080	1.754	15
16	1054.447	900.743	0.000945	0.0272	1057.8	36.795	224.2	190.8	415.1	1.085	1.753	16
17	1084.144	927.531	0.000949	0.0264	1053.8	37.923	225.8	189.7	415.5	1.090	1.752	17
18	1114.453	954.921	0.000953	0.0256	1049.8	39.082	227.4	188.5	415.9	1.096	1.751	18
19	1145.383	982.921	0.000956	0.0248	1045.8	40.271	228.9	187.3	416.3	1.101	1.749	19
20	1176.941	1011.540	0.000960	0.0241	1041.7	41.492	230.5	186.1	416.6	1.106	1.748	20
21	1209.135	1040.789	0.000964	0.0234	1037.6	42.746	232.1	184.9	417.0	1.111	1.747	21
22	1241.973	1070.676	0.000968	0.0227	1033.5	44.033	233.7	183.7	417.4	1.117	1.746	22
23	1275.462	1101.212	0.000972	0.0220	1029.3	45.355	235.3	182.4	417.7	1.122	1.745	23
24	1309.611	1132.407	0.000976	0.0214	1025.1	46.713	236.9	181.2	418.1	1.127	1.744	24
25	1344.427	1164.269	0.000980	0.0208	1020.9	48.108	238.5	179.9	418.4	1.132	1.743	25
26	1379.918	1196.810	0.000984	0.0202	1016.6	49.540	240.1	178.6	418.7	1.138	1.742	26
27	1416.093	1230.040	0.000988	0.0196	1012.3	51.012	241.7	177.3	419.1	1.143	1.741	27
28	1452.959	1263.969	0.000992	0.0190	1007.9	52.524	243.4	176.0	419.4	1.148	1.739	28
29	1490.525	1298.608	0.000997	0.0185	1003.5	54.077	245.0	174.7	419.7	1.154	1.738	29
30	1528.798	1333.967	0.001001	0.0180	999.0	55.674	246.6	173.4	420.0	1.159	1.737	30
31	1567.787	1370.058	0.001006	0.0174	994.5	57.314	248.3	172.0	420.3	1.164	1.736	31
32	1607.500	1406.891	0.001010	0.0169	990.0	59.001	249.9	170.6	420.5	1.170	1.735	32
33	1647.945	1444.479	0.001015	0.0165	985.4	60.735	251.6	169.2	420.8	1.175	1.734	33
34	1689.130	1482.831	0.001020	0.0160	980.7	62.518	253.3	167.8	421.1	1.180	1.732	34
35	1731.064	1521.961	0.001025	0.0155	976.0	64.351	255.0	166.4	421.3	1.186	1.731	35
36	1773.755	1561.880	0.001030	0.0151	971.2	66.238	256.7	164.9	421.5	1.191	1.730	36
37	1817.212	1602.600	0.001035	0.0147	966.4	68.178	258.4	163.4	421.8	1.196	1.729	37
38	1861.443	1644.134	0.001040	0.0142	961.5	70.176	260.1	161.9	422.0	1.202	1.727	38
39	1906.456	1686.494	0.001045	0.0138	956.6	72.232	261.8	160.4	422.2	1.207	1.726	39
40	1952.260	1729.693	0.001051	0.0135	951.6	74.349	263.5	158.8	422.3	1.212	1.725	40
41	1998.863	1773.745	0.001057	0.0131	946.5	76.530	265.2	157.3	422.5	1.218	1.724	41
42	2046.274	1818.663	0.001062	0.0127	941.4	78.776	267.0	155.7	422.7	1.223	1.722	42
43	2094.502	1864.460	0.001068	0.0123	936.1	81.092	268.8	154.0	422.8	1.229	1.721	43
44	2143.556	1911.152	0.001074	0.0120	930.8	83.480	270.5	152.4	422.9	1.234	1.719	44
45	2193.443	1958.751	0.001081	0.0116	925.5	85.942	272.3	150.7	423.0	1.239	1.718	45
46	2244.173	2007.275	0.001087	0.0113	920.0	88.483	274.1	149.0	423.1	1.245	1.717	46
47	2295.755	2056.737	0.001094	0.0110	914.4	91.106	275.9	147.3	423.2	1.250	1.715	47
48	2348.197	2107.154	0.001100	0.0107	908.8	93.815	277.8	145.5	423.3	1.256	1.713	48
49	2401.508	2158.542	0.001107	0.0104	903.0	96.614	279.6	143.7	423.3	1.261	1.712	49
50	2455.697	2210.917	0.001115	0.0100	897.2	99.508	281.4	141.9	423.3	1.267	1.710	50
51	2510.772	2264.298	0.001122	0.0098	891.2	102.501	283.3	140.0	423.3	1.273	1.709	51
52	2566.744	2318.702	0.001130	0.0095	885.2	105.600	285.2	138.1	423.3	1.278	1.707	52
53	2623.619	2374.149	0.001138	0.0092	878.9	108.809	287.1	136.1	423.2	1.284	1.705	53

**Opteon™ XL40 (R-454A)**

**Saturation Properties - Temperature Table**

Temp °C	Pressure [kPa]		Volume [m <sup>3</sup> /kg]		Density [kg/m <sup>3</sup> ]		Enthalpy [kJ/kg]			Entropy [kJ/kg-K]		Temp °C
	Liquid p <sub>f</sub>	Vapor p <sub>g</sub>	Liquid v <sub>f</sub>	Vapor v <sub>g</sub>	Liquid d <sub>f</sub>	Vapor d <sub>g</sub>	Liquid h <sub>f</sub>	Latent h <sub>fg</sub>	Vapor h <sub>g</sub>	Liquid s <sub>f</sub>	Vapor s <sub>g</sub>	
54	2681.408	2430.657	0.001146	0.0089	872.6	112.136	289.0	134.1	423.2	1.290	1.703	54
55	2740.120	2488.247	0.001155	0.0087	866.1	115.587	291.0	132.1	423.1	1.295	1.702	55
56	2799.762	2546.940	0.001163	0.0084	859.5	119.170	292.9	130.0	422.9	1.301	1.700	56
57	2860.344	2606.759	0.001173	0.0081	852.8	122.893	294.9	127.9	422.8	1.307	1.698	57
58	2921.874	2667.727	0.001182	0.0079	845.8	126.766	296.9	125.7	422.6	1.313	1.696	58
59	2984.361	2729.870	0.001192	0.0076	838.7	130.799	298.9	123.4	422.4	1.318	1.694	59
60	3047.814	2793.212	0.001203	0.0074	831.4	135.004	301.0	121.1	422.1	1.324	1.691	60
61	3112.240	2857.783	0.001214	0.0072	823.9	139.394	303.1	118.7	421.8	1.330	1.689	61
62	3177.648	2923.613	0.001225	0.0069	816.2	143.983	305.2	116.3	421.5	1.337	1.687	62
63	3244.046	2990.732	0.001237	0.0067	808.2	148.789	307.3	113.8	421.1	1.343	1.684	63
64	3311.439	3059.177	0.001250	0.0065	800.0	153.830	309.5	111.2	420.7	1.349	1.682	64
65	3379.836	3128.984	0.001263	0.0063	791.5	159.129	311.7	108.5	420.2	1.355	1.679	65
66	3449.242	3200.195	0.001278	0.0061	782.7	164.712	314.0	105.7	419.7	1.362	1.676	66
67	3519.663	3272.856	0.001293	0.0059	773.5	170.607	316.3	102.8	419.1	1.368	1.673	67
68	3591.100	3347.016	0.001309	0.0057	764.0	176.851	318.6	99.8	418.4	1.375	1.670	68
69	3663.557	3422.732	0.001326	0.0055	754.0	183.485	321.0	96.7	417.7	1.381	1.666	69
70	3737.032	3500.069	0.001345	0.0052	743.6	190.562	323.5	93.4	416.9	1.388	1.663	70
71	3811.520	3579.102	0.001365	0.0050	732.6	198.145	326.0	89.9	415.9	1.395	1.659	71
72	3887.014	3659.918	0.001387	0.0048	721.0	206.311	328.6	86.3	414.9	1.403	1.655	72
73	3963.495	3742.621	0.001411	0.0046	708.7	215.164	331.4	82.4	413.8	1.410	1.650	73
74	4040.936	3827.340	0.001438	0.0044	695.5	224.835	334.2	78.2	412.4	1.418	1.645	74
75	4119.290	3914.237	0.001468	0.0042	681.2	235.505	337.2	73.8	410.9	1.426	1.640	75

# Opteon™ XL40 (R-454A)

## Superheated Vapor - Constant Pressure Tables

V = Volume in m<sup>3</sup>/kg

H = Enthalpy in kJ/kg

S = Entropy in kJ/kg-K

Saturation Properties in Light Blue

ABSOLUTE PRESSURE, kPa													
Temp °C	10			20			30			40			Temp °C
	-80.70			-70.83			-64.47			-59.67			
	V	H	S	V	H	S	V	H	S	V	H	S	
	1.9710	360.6	1.959	1.0303	366.8	1.919	0.0007	89.9	0.526	0.0007	89.9	0.526	
-80	1.9785	361.1	1.961										-80
-75	2.0316	364.5	1.979										-75
-70	2.0845	368.0	1.996	1.0348	367.4	1.922							-70
-65	2.1373	371.5	2.013	1.0618	371.0	1.940							-65
-60	2.1900	375.1	2.030	1.0887	374.6	1.957	0.7215	374.1	1.913				-60
-55	2.2425	378.7	2.047	1.1154	378.3	1.974	0.7397	377.8	1.930	0.5518	377.3	1.899	-55
-50	2.2949	382.4	2.064	1.1420	382.0	1.991	0.7577	381.5	1.947	0.5655	381.1	1.916	-50
-45	2.3473	386.1	2.080	1.1686	385.7	2.007	0.7756	385.3	1.964	0.5792	384.9	1.933	-45
-40	2.3996	389.9	2.096	1.1951	389.5	2.024	0.7935	389.1	1.981	0.5927	388.7	1.950	-40
-35	2.4519	393.6	2.113	1.2215	393.3	2.040	0.8113	392.9	1.997	0.6062	392.6	1.966	-35
-30	2.5040	397.5	2.128	1.2478	397.1	2.056	0.8291	396.8	2.013	0.6197	396.5	1.982	-30
-25	2.5562	401.4	2.144	1.2741	401.0	2.072	0.8468	400.7	2.029	0.6331	400.4	1.998	-25
-20	2.6083	405.3	2.160	1.3004	405.0	2.087	0.8644	404.7	2.045	0.6464	404.4	2.014	-20
-15	2.6603	409.2	2.175	1.3266	409.0	2.103	0.8821	408.7	2.060	0.6598	408.4	2.030	-15
-10	2.7124	413.3	2.191	1.3528	413.0	2.119	0.8996	412.7	2.076	0.6730	412.5	2.045	-10
-5	2.7644	417.3	2.206	1.3790	417.1	2.134	0.9172	416.8	2.091	0.6863	416.6	2.061	-5
0	2.8163	421.4	2.221	1.4051	421.2	2.149	0.9347	421.0	2.107	0.6995	420.7	2.076	0
5	2.8683	425.6	2.236	1.4313	425.3	2.164	0.9522	425.1	2.122	0.7127	424.9	2.091	5
10	2.9202	429.7	2.251	1.4574	429.5	2.179	0.9697	429.3	2.137	0.7259	429.1	2.106	10
15	2.9721	434.0	2.266	1.4834	433.8	2.194	0.9872	433.6	2.152	0.7391	433.4	2.121	15
20	3.0240	438.3	2.281	1.5095	438.1	2.209	1.0046	437.9	2.166	0.7522	437.7	2.136	20
25	3.0759	442.6	2.295	1.5355	442.4	2.223	1.0221	442.2	2.181	0.7654	442.1	2.151	25
30	3.1277	446.9	2.310	1.5616	446.8	2.238	1.0395	446.6	2.196	0.7785	446.4	2.165	30
35	3.1796	451.4	2.324	1.5876	451.2	2.252	1.0569	451.0	2.210	0.7916	450.9	2.180	35
40	3.2314	455.8	2.339	1.6136	455.7	2.267	1.0743	455.5	2.224	0.8047	455.4	2.194	40
45	3.2833	460.3	2.353	1.6396	460.2	2.281	1.0917	460.0	2.239	0.8178	459.9	2.209	45
50	3.3351	464.8	2.367	1.6656	464.7	2.295	1.1091	464.6	2.253	0.8308	464.4	2.223	50
55	3.3869	469.4	2.381	1.6916	469.3	2.309	1.1265	469.2	2.267	0.8439	469.0	2.237	55
60	3.4387	474.1	2.395	1.7175	473.9	2.323	1.1438	473.8	2.281	0.8570	473.7	2.251	60
65	3.4905	478.7	2.409	1.7435	478.6	2.337	1.1612	478.5	2.295	0.8700	478.4	2.265	65

  

ABSOLUTE PRESSURE, kPa													
Temp °C	50			60			70			80			Temp °C
	-55.75			-52.42			-49.52			-46.92			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.4373	376.2	1.871	0.3687	378.2	1.862	0.0008	122.7	0.686	0.0008	122.7	0.686	
-55	0.4390	376.8	1.874										-55
-50	0.4502	380.6	1.891	0.3732	380.1	1.871							-50
-45	0.4612	384.4	1.908	0.3826	384.0	1.888	0.3264	383.6	1.871	0.2843	383.1	1.856	-45
-40	0.4722	388.3	1.925	0.3919	387.9	1.905	0.3345	387.5	1.888	0.2914	387.1	1.873	-40
-35	0.4832	392.2	1.942	0.4011	391.9	1.922	0.3425	391.5	1.905	0.2985	391.1	1.890	-35
-30	0.4940	396.2	1.958	0.4103	395.8	1.938	0.3504	395.5	1.921	0.3055	395.1	1.906	-30
-25	0.5049	400.1	1.974	0.4194	399.8	1.955	0.3583	399.5	1.938	0.3125	399.2	1.923	-25
-20	0.5156	404.1	1.990	0.4284	403.8	1.971	0.3661	403.5	1.954	0.3194	403.3	1.939	-20
-15	0.5264	408.2	2.006	0.4374	407.9	1.986	0.3739	407.6	1.970	0.3263	407.3	1.955	-15
-10	0.5371	412.2	2.022	0.4464	412.0	2.002	0.3817	411.7	1.986	0.3331	411.5	1.971	-10
-5	0.5477	416.4	2.037	0.4554	416.1	2.018	0.3894	415.9	2.001	0.3399	415.6	1.987	-5
0	0.5584	420.5	2.053	0.4643	420.3	2.033	0.3971	420.1	2.017	0.3467	419.8	2.002	0
5	0.5690	424.7	2.068	0.4732	424.5	2.048	0.4048	424.3	2.032	0.3534	424.1	2.018	5
10	0.5796	428.9	2.083	0.4821	428.7	2.064	0.4124	428.5	2.047	0.3602	428.3	2.033	10
15	0.5902	433.2	2.098	0.4910	433.0	2.079	0.4201	432.8	2.062	0.3669	432.6	2.048	15
20	0.6008	437.5	2.113	0.4998	437.3	2.093	0.4277	437.2	2.077	0.3736	437.0	2.063	20
25	0.6113	441.9	2.127	0.5086	441.7	2.108	0.4353	441.5	2.092	0.3803	441.4	2.078	25
30	0.6219	446.3	2.142	0.5174	446.1	2.123	0.4429	446.0	2.106	0.3869	445.8	2.092	30
35	0.6324	450.7	2.157	0.5262	450.6	2.137	0.4504	450.4	2.121	0.3936	450.2	2.107	35
40	0.6429	455.2	2.171	0.5350	455.1	2.152	0.4580	454.9	2.136	0.4002	454.8	2.121	40
45	0.6534	459.7	2.185	0.5438	459.6	2.166	0.4655	459.4	2.150	0.4068	459.3	2.136	45
50	0.6639	464.3	2.200	0.5526	464.2	2.180	0.4731	464.0	2.164	0.4134	463.9	2.150	50
55	0.6744	468.9	2.214	0.5613	468.8	2.195	0.4806	468.6	2.178	0.4201	468.5	2.164	55
60	0.6848	473.5	2.228	0.5701	473.4	2.209	0.4881	473.3	2.192	0.4267	473.2	2.178	60
65	0.6953	478.2	2.242	0.5788	478.1	2.223	0.4956	478.0	2.206	0.4332	477.9	2.192	65
70	0.7058	483.0	2.256	0.5876	482.9	2.237	0.5032	482.7	2.220	0.4398	482.6	2.206	70
75	0.7162	487.7	2.269	0.5963	487.6	2.250	0.5107	487.5	2.234	0.4464	487.4	2.220	75
80	0.7267	492.6	2.283	0.6050	492.4	2.264	0.5181	492.3	2.248	0.4530	492.2	2.234	80
85	0.7371	497.4	2.297	0.6137	497.3	2.278	0.5256	497.2	2.262	0.4596	497.1	2.248	85
90	0.7475	502.3	2.310	0.6225	502.2	2.291	0.5331	502.1	2.275	0.4661	502.0	2.261	90

**Opteon™ XL40 (R-454A)**  
**Superheated Vapor - Constant Pressure Tables**

V = Volume in m<sup>3</sup>/kg

H = Enthalpy in kJ/kg

S = Entropy in kJ/kg-K

Saturation Properties in Light Blue

ABSOLUTE PRESSURE, kPa													
Temp °C	90			100			101.325			110			Temp °C
	-44.58			-42.43			-42.16			-40.44			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.2520	383.0	1.843	0.2283	384.3	1.839	0.1603	311.8	1.522	0.0919	245.3	1.226	
-40	0.2579	386.7	1.859	0.2311	386.3	1.847	0.2280	386.3	1.846	0.2092	385.9	1.836	-40
-35	0.2643	390.8	1.876	0.2369	390.4	1.864	0.2337	390.3	1.863	0.2145	390.0	1.853	-35
-30	0.2706	394.8	1.893	0.2427	394.5	1.881	0.2394	394.4	1.880	0.2198	394.1	1.870	-30
-25	0.2769	398.9	1.910	0.2483	398.5	1.898	0.2450	398.5	1.896	0.2250	398.2	1.887	-25
-20	0.2831	403.0	1.926	0.2540	402.7	1.914	0.2505	402.6	1.913	0.2302	402.4	1.904	-20
-15	0.2892	407.1	1.942	0.2596	406.8	1.931	0.2561	406.8	1.929	0.2353	406.5	1.920	-15
-10	0.2953	411.2	1.958	0.2651	411.0	1.946	0.2615	410.9	1.945	0.2404	410.7	1.936	-10
-5	0.3014	415.4	1.974	0.2706	415.1	1.962	0.2670	415.1	1.961	0.2454	414.9	1.952	-5
0	0.3075	419.6	1.989	0.2761	419.4	1.978	0.2724	419.3	1.976	0.2504	419.1	1.967	0
5	0.3135	423.8	2.005	0.2816	423.6	1.993	0.2778	423.6	1.992	0.2554	423.4	1.983	5
10	0.3195	428.1	2.020	0.2870	427.9	2.009	0.2832	427.9	2.007	0.2604	427.7	1.998	10
15	0.3255	432.4	2.035	0.2924	432.2	2.024	0.2885	432.2	2.022	0.2654	432.1	2.013	15
20	0.3315	436.8	2.050	0.2978	436.6	2.039	0.2939	436.6	2.037	0.2703	436.4	2.028	20
25	0.3375	441.2	2.065	0.3032	441.0	2.054	0.2992	441.0	2.052	0.2752	440.8	2.043	25
30	0.3434	445.6	2.080	0.3086	445.5	2.068	0.3045	445.4	2.067	0.2801	445.3	2.058	30
35	0.3493	450.1	2.094	0.3140	449.9	2.083	0.3098	449.9	2.082	0.2850	449.8	2.073	35
40	0.3553	454.6	2.109	0.3193	454.4	2.098	0.3151	454.4	2.096	0.2899	454.3	2.087	40
45	0.3612	459.1	2.123	0.3246	459.0	2.112	0.3203	459.0	2.111	0.2948	458.9	2.102	45
50	0.3671	463.7	2.138	0.3300	463.6	2.126	0.3256	463.6	2.125	0.2996	463.5	2.116	50
55	0.3730	468.4	2.152	0.3353	468.2	2.141	0.3308	468.2	2.139	0.3045	468.1	2.130	55
60	0.3788	473.0	2.166	0.3406	472.9	2.155	0.3361	472.9	2.153	0.3093	472.8	2.145	60
65	0.3847	477.7	2.180	0.3459	477.6	2.169	0.3413	477.6	2.167	0.3141	477.5	2.159	65
70	0.3906	482.5	2.194	0.3512	482.4	2.183	0.3466	482.4	2.181	0.3190	482.3	2.173	70
75	0.3964	487.3	2.208	0.3565	487.2	2.197	0.3518	487.2	2.195	0.3238	487.1	2.187	75
80	0.4023	492.1	2.222	0.3618	492.0	2.210	0.3570	492.0	2.209	0.3286	491.9	2.200	80
85	0.4082	497.0	2.235	0.3670	496.9	2.224	0.3622	496.9	2.223	0.3334	496.8	2.214	85
90	0.4140	501.9	2.249	0.3723	501.8	2.238	0.3674	501.8	2.236	0.3382	501.7	2.228	90
95	0.4198	506.8	2.262	0.3776	506.7	2.251	0.3726	506.7	2.250	0.3430	506.6	2.241	95
100	0.4257	511.8	2.276	0.3828	511.7	2.265	0.3778	511.7	2.263	0.3478	511.6	2.255	100
105	0.4315	516.9	2.289	0.3881	516.8	2.278	0.3830	516.8	2.277	0.3526	516.7	2.268	105

  

ABSOLUTE PRESSURE, kPa													
Temp °C	120			130			140			150			Temp °C
	-38.60			-36.87			-35.24			-33.71			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.1923	386.6	1.830	0.1783	387.7	1.827	0.0952	283.1	1.377	0.0409	208.1	1.054	
-35	0.1959	389.6	1.843	0.1800	389.2	1.834	0.1665	388.8	1.825	0.1588	392.7	1.834	-35
-30	0.2007	393.8	1.860	0.1846	393.4	1.851	0.1708	393.0	1.842	0.1588	392.7	1.834	-30
-25	0.2056	397.9	1.877	0.1891	397.6	1.868	0.1750	397.2	1.859	0.1628	396.9	1.851	-25
-20	0.2103	402.1	1.894	0.1936	401.8	1.885	0.1792	401.5	1.876	0.1667	401.1	1.868	-20
-15	0.2151	406.2	1.910	0.1980	406.0	1.901	0.1833	405.7	1.893	0.1706	405.4	1.885	-15
-10	0.2198	410.4	1.926	0.2023	410.2	1.917	0.1874	409.9	1.909	0.1744	409.6	1.901	-10
-5	0.2244	414.7	1.942	0.2066	414.4	1.933	0.1914	414.2	1.925	0.1782	413.9	1.917	-5
0	0.2291	418.9	1.958	0.2109	418.7	1.949	0.1954	418.4	1.941	0.1820	418.2	1.933	0
5	0.2337	423.2	1.973	0.2152	423.0	1.964	0.1994	422.8	1.956	0.1857	422.5	1.949	5
10	0.2382	427.5	1.989	0.2195	427.3	1.980	0.2034	427.1	1.972	0.1895	426.9	1.964	10
15	0.2428	431.9	2.004	0.2237	431.7	1.995	0.2073	431.5	1.987	0.1932	431.3	1.979	15
20	0.2473	436.2	2.019	0.2279	436.1	2.010	0.2113	435.9	2.002	0.1968	435.7	1.995	20
25	0.2519	440.7	2.034	0.2321	440.5	2.025	0.2152	440.3	2.017	0.2005	440.1	2.010	25
30	0.2564	445.1	2.049	0.2363	445.0	2.040	0.2191	444.8	2.032	0.2042	444.6	2.025	30
35	0.2609	449.6	2.064	0.2405	449.5	2.055	0.2230	449.3	2.047	0.2078	449.1	2.039	35
40	0.2654	454.1	2.078	0.2446	454.0	2.069	0.2268	453.8	2.061	0.2114	453.7	2.054	40
45	0.2698	458.7	2.093	0.2488	458.6	2.084	0.2307	458.4	2.076	0.2150	458.3	2.069	45
50	0.2743	463.3	2.107	0.2529	463.2	2.098	0.2346	463.0	2.090	0.2187	462.9	2.083	50
55	0.2788	468.0	2.121	0.2570	467.8	2.113	0.2384	467.7	2.105	0.2222	467.6	2.097	55
60	0.2832	472.6	2.135	0.2611	472.5	2.127	0.2422	472.4	2.119	0.2258	472.3	2.111	60
65	0.2877	477.4	2.149	0.2653	477.2	2.141	0.2461	477.1	2.133	0.2294	477.0	2.126	65
70	0.2921	482.1	2.163	0.2694	482.0	2.155	0.2499	481.9	2.147	0.2330	481.8	2.140	70
75	0.2965	486.9	2.177	0.2735	486.8	2.169	0.2537	486.7	2.161	0.2366	486.6	2.154	75
80	0.3009	491.8	2.191	0.2775	491.7	2.183	0.2575	491.6	2.175	0.2401	491.4	2.167	80
85	0.3054	496.7	2.205	0.2816	496.6	2.196	0.2613	496.4	2.188	0.2437	496.3	2.181	85
90	0.3098	501.6	2.218	0.2857	501.5	2.210	0.2651	501.4	2.202	0.2472	501.3	2.195	90
95	0.3142	506.5	2.232	0.2898	506.4	2.224	0.2689	506.3	2.216	0.2508	506.2	2.208	95
100	0.3186	511.5	2.246	0.2939	511.4	2.237	0.2727	511.3	2.229	0.2543	511.2	2.222	100
105	0.3230	516.6	2.259	0.2979	516.5	2.251	0.2765	516.4	2.243	0.2578	516.3	2.235	105
110	0.3274	521.7	2.272	0.3020	521.6	2.264	0.2802	521.5	2.256	0.2614	521.4	2.249	110

**Opteon™ XL40 (R-454A)**  
**Superheated Vapor - Constant Pressure Tables**

V = Volume in m<sup>3</sup>/kg

H = Enthalpy in kJ/kg

S = Entropy in kJ/kg-K

Saturation Properties in Light Blue

ABSOLUTE PRESSURE, kPa													
Temp °C	160			170			180			190			Temp °C
	-32.25			-30.86			-29.53			-28.26			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.1466	390.4	1.818	0.1384	391.2	1.816	0.0870	310.2	1.476	0.0569	261.3	1.270	
-30	0.1483	392.3	1.826	0.1390	391.9	1.819							-30
-25	0.1520	396.6	1.843	0.1426	396.2	1.836	0.1342	395.9	1.829	0.1267	395.6	1.823	-25
-20	0.1558	400.8	1.860	0.1461	400.5	1.853	0.1376	400.2	1.846	0.1299	399.9	1.840	-20
-15	0.1594	405.1	1.877	0.1496	404.8	1.870	0.1409	404.5	1.863	0.1331	404.2	1.857	-15
-10	0.1631	409.4	1.893	0.1530	409.1	1.886	0.1441	408.8	1.880	0.1362	408.6	1.873	-10
-5	0.1666	413.7	1.910	0.1564	413.4	1.903	0.1474	413.2	1.896	0.1393	412.9	1.890	-5
0	0.1702	418.0	1.926	0.1598	417.7	1.919	0.1506	417.5	1.912	0.1423	417.3	1.906	0
5	0.1737	422.3	1.941	0.1632	422.1	1.934	0.1538	421.9	1.928	0.1454	421.6	1.922	5
10	0.1773	426.7	1.957	0.1665	426.5	1.950	0.1569	426.3	1.944	0.1484	426.0	1.937	10
15	0.1807	431.1	1.972	0.1698	430.9	1.965	0.1601	430.7	1.959	0.1513	430.5	1.953	15
20	0.1842	435.5	1.987	0.1731	435.3	1.981	0.1632	435.1	1.974	0.1543	434.9	1.968	20
25	0.1877	440.0	2.003	0.1763	439.8	1.996	0.1663	439.6	1.989	0.1573	439.4	1.983	25
30	0.1911	444.4	2.017	0.1796	444.3	2.011	0.1693	444.1	2.004	0.1602	443.9	1.998	30
35	0.1945	449.0	2.032	0.1828	448.8	2.026	0.1724	448.6	2.019	0.1631	448.5	2.013	35
40	0.1979	453.5	2.047	0.1860	453.4	2.040	0.1755	453.2	2.034	0.1660	453.1	2.028	40
45	0.2013	458.1	2.062	0.1893	458.0	2.055	0.1785	457.8	2.049	0.1689	457.7	2.043	45
50	0.2047	462.8	2.076	0.1925	462.6	2.069	0.1815	462.5	2.063	0.1718	462.3	2.057	50
55	0.2081	467.4	2.090	0.1957	467.3	2.084	0.1846	467.2	2.078	0.1747	467.0	2.072	55
60	0.2115	472.1	2.105	0.1988	472.0	2.098	0.1876	471.9	2.092	0.1775	471.7	2.086	60
65	0.2149	476.9	2.119	0.2020	476.7	2.112	0.1906	476.6	2.106	0.1804	476.5	2.100	65
70	0.2182	481.7	2.133	0.2052	481.5	2.126	0.1936	481.4	2.120	0.1832	481.3	2.114	70
75	0.2216	486.5	2.147	0.2083	486.4	2.140	0.1966	486.2	2.134	0.1861	486.1	2.128	75
80	0.2249	491.3	2.160	0.2115	491.2	2.154	0.1996	491.1	2.148	0.1889	491.0	2.142	80
85	0.2283	496.2	2.174	0.2146	496.1	2.168	0.2026	496.0	2.162	0.1917	495.9	2.156	85
90	0.2316	501.2	2.188	0.2178	501.1	2.181	0.2055	501.0	2.175	0.1946	500.9	2.170	90
95	0.2349	506.1	2.202	0.2209	506.0	2.195	0.2085	505.9	2.189	0.1974	505.8	2.183	95
100	0.2382	511.1	2.215	0.2241	511.1	2.209	0.2115	511.0	2.203	0.2002	510.9	2.197	100
105	0.2416	516.2	2.229	0.2272	516.1	2.222	0.2144	516.0	2.216	0.2030	515.9	2.210	105
110	0.2449	521.3	2.242	0.2303	521.2	2.235	0.2174	521.1	2.229	0.2058	521.0	2.224	110
115	0.2482	526.4	2.255	0.2335	526.3	2.249	0.2203	526.2	2.243	0.2086	526.1	2.237	115

ABSOLUTE PRESSURE, kPa													
Temp °C	200			210			220			230			Temp °C
	-27.04			-25.86			-24.73			-23.64			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.1186	393.4	1.809	0.1132	394.1	1.807	0.0777	327.1	1.531	0.0577	289.4	1.376	
-25	0.1199	395.2	1.816	0.1138	394.9	1.810							-25
-20	0.1230	399.6	1.834	0.1167	399.3	1.828	0.1110	398.9	1.822	0.1059	398.6	1.816	-20
-15	0.1260	403.9	1.851	0.1196	403.6	1.845	0.1139	403.3	1.839	0.1086	403.0	1.834	-15
-10	0.1290	408.3	1.867	0.1225	408.0	1.862	0.1166	407.7	1.856	0.1112	407.5	1.851	-10
-5	0.1320	412.6	1.884	0.1254	412.4	1.878	0.1193	412.1	1.872	0.1139	411.9	1.867	-5
0	0.1349	417.0	1.900	0.1282	416.8	1.894	0.1220	416.5	1.889	0.1164	416.3	1.884	0
5	0.1378	421.4	1.916	0.1309	421.2	1.910	0.1247	421.0	1.905	0.1190	420.7	1.900	5
10	0.1407	425.8	1.932	0.1337	425.6	1.926	0.1273	425.4	1.921	0.1215	425.2	1.916	10
15	0.1435	430.3	1.947	0.1364	430.1	1.942	0.1300	429.9	1.936	0.1241	429.7	1.931	15
20	0.1463	434.7	1.963	0.1391	434.6	1.957	0.1325	434.4	1.952	0.1266	434.2	1.947	20
25	0.1491	439.2	1.978	0.1418	439.1	1.972	0.1351	438.9	1.967	0.1290	438.7	1.962	25
30	0.1519	443.8	1.993	0.1445	443.6	1.987	0.1377	443.4	1.982	0.1315	443.2	1.977	30
35	0.1547	448.3	2.008	0.1471	448.2	2.002	0.1402	448.0	1.997	0.1339	447.8	1.992	35
40	0.1575	452.9	2.022	0.1498	452.8	2.017	0.1428	452.6	2.012	0.1364	452.4	2.007	40
45	0.1602	457.5	2.037	0.1524	457.4	2.032	0.1453	457.2	2.027	0.1388	457.1	2.022	45
50	0.1630	462.2	2.052	0.1550	462.0	2.046	0.1478	461.9	2.041	0.1412	461.8	2.036	50
55	0.1657	466.9	2.066	0.1577	466.7	2.061	0.1503	466.6	2.056	0.1436	466.5	2.051	55
60	0.1685	471.6	2.080	0.1603	471.5	2.075	0.1528	471.3	2.070	0.1460	471.2	2.065	60
65	0.1712	476.4	2.095	0.1629	476.2	2.089	0.1553	476.1	2.084	0.1484	476.0	2.079	65
70	0.1739	481.2	2.109	0.1654	481.1	2.103	0.1578	480.9	2.098	0.1508	480.8	2.093	70
75	0.1766	486.0	2.123	0.1680	485.9	2.117	0.1602	485.8	2.112	0.1531	485.7	2.107	75
80	0.1793	490.9	2.137	0.1706	490.8	2.131	0.1627	490.7	2.126	0.1555	490.5	2.121	80
85	0.1820	495.8	2.150	0.1732	495.7	2.145	0.1652	495.6	2.140	0.1579	495.5	2.135	85
90	0.1847	500.7	2.164	0.1757	500.6	2.159	0.1676	500.5	2.154	0.1602	500.4	2.149	90
95	0.1874	505.7	2.178	0.1783	505.6	2.172	0.1701	505.5	2.167	0.1626	505.4	2.163	95
100	0.1900	510.8	2.191	0.1809	510.7	2.186	0.1725	510.6	2.181	0.1649	510.5	2.176	100
105	0.1927	515.8	2.205	0.1834	515.7	2.200	0.1750	515.6	2.195	0.1672	515.5	2.190	105
110	0.1954	520.9	2.218	0.1860	520.8	2.213	0.1774	520.7	2.208	0.1696	520.6	2.203	110
115	0.1981	526.1	2.231	0.1885	526.0	2.226	0.1798	525.9	2.221	0.1719	525.8	2.216	115
120	0.2007	531.2	2.245	0.1911	531.1	2.239	0.1823	531.1	2.235	0.1742	531.0	2.230	120

**Opteon™ XL40 (R-454A)**  
**Superheated Vapor - Constant Pressure Tables**

V = Volume in m<sup>3</sup>/kg

H = Enthalpy in kJ/kg

S = Entropy in kJ/kg-K

Saturation Properties in Light Blue

ABSOLUTE PRESSURE, kPa													
Temp °C	240			250			260			270			Temp °C
	-22.59			-21.56			-20.57			-19.61			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0997	395.9	1.802	0.0959	396.5	1.800	0.0696	338.9	1.567	0.0551	307.7	1.440	
-20	0.1011	398.3	1.811	0.0967	397.9	1.806	0.0927	397.6	1.801				-20
-15	0.1037	402.7	1.828	0.0992	402.4	1.823	0.0951	402.1	1.818	0.0913	401.8	1.813	-15
-10	0.1063	407.2	1.845	0.1017	406.9	1.840	0.0975	406.6	1.835	0.0936	406.3	1.831	-10
-5	0.1088	411.6	1.862	0.1042	411.4	1.857	0.0999	411.1	1.852	0.0960	410.8	1.848	-5
0	0.1113	416.1	1.878	0.1066	415.8	1.874	0.1023	415.6	1.869	0.0982	415.3	1.864	0
5	0.1138	420.5	1.895	0.1090	420.3	1.890	0.1046	420.1	1.885	0.1005	419.8	1.881	5
10	0.1162	425.0	1.911	0.1114	424.8	1.906	0.1068	424.5	1.901	0.1027	424.3	1.897	10
15	0.1187	429.5	1.926	0.1137	429.3	1.922	0.1091	429.1	1.917	0.1049	428.9	1.913	15
20	0.1211	434.0	1.942	0.1160	433.8	1.937	0.1113	433.6	1.933	0.1070	433.4	1.928	20
25	0.1234	438.5	1.957	0.1183	438.3	1.952	0.1136	438.1	1.948	0.1092	438.0	1.944	25
30	0.1258	443.1	1.972	0.1206	442.9	1.968	0.1158	442.7	1.963	0.1113	442.6	1.959	30
35	0.1282	447.7	1.987	0.1229	447.5	1.983	0.1180	447.3	1.978	0.1134	447.2	1.974	35
40	0.1305	452.3	2.002	0.1251	452.1	1.998	0.1201	452.0	1.993	0.1155	451.8	1.989	40
45	0.1328	456.9	2.017	0.1274	456.8	2.012	0.1223	456.6	2.008	0.1176	456.5	2.004	45
50	0.1352	461.6	2.032	0.1296	461.5	2.027	0.1244	461.3	2.023	0.1197	461.2	2.018	50
55	0.1375	466.3	2.046	0.1318	466.2	2.041	0.1266	466.1	2.037	0.1218	465.9	2.033	55
60	0.1398	471.1	2.060	0.1340	471.0	2.056	0.1287	470.8	2.052	0.1238	470.7	2.047	60
65	0.1421	475.9	2.075	0.1362	475.7	2.070	0.1308	475.6	2.066	0.1259	475.5	2.062	65
70	0.1443	480.7	2.089	0.1384	480.6	2.084	0.1330	480.4	2.080	0.1279	480.3	2.076	70
75	0.1466	485.5	2.103	0.1406	485.4	2.098	0.1351	485.3	2.094	0.1300	485.2	2.090	75
80	0.1489	490.4	2.117	0.1428	490.3	2.112	0.1372	490.2	2.108	0.1320	490.1	2.104	80
85	0.1511	495.4	2.131	0.1450	495.3	2.126	0.1393	495.1	2.122	0.1340	495.0	2.118	85
90	0.1534	500.3	2.144	0.1472	500.2	2.140	0.1414	500.1	2.136	0.1360	500.0	2.132	90
95	0.1557	505.3	2.158	0.1493	505.2	2.154	0.1435	505.1	2.149	0.1380	505.0	2.145	95
100	0.1579	510.4	2.172	0.1515	510.3	2.167	0.1456	510.2	2.163	0.1401	510.1	2.159	100
105	0.1602	515.4	2.185	0.1536	515.3	2.181	0.1476	515.2	2.177	0.1421	515.2	2.172	105
110	0.1624	520.5	2.199	0.1558	520.5	2.194	0.1497	520.4	2.190	0.1441	520.3	2.186	110
115	0.1646	525.7	2.212	0.1580	525.6	2.208	0.1518	525.5	2.203	0.1461	525.4	2.199	115
120	0.1669	530.9	2.225	0.1601	530.8	2.221	0.1539	530.7	2.217	0.1481	530.6	2.213	120
125	0.1691	536.1	2.238	0.1622	536.0	2.234	0.1559	535.9	2.230	0.1501	535.8	2.226	125

  

ABSOLUTE PRESSURE, kPa													
Temp °C	280			290			300			310			Temp °C
	-18.68			-17.77			-16.88			-16.02			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0860	398.1	1.796	0.0832	398.6	1.794	0.0628	347.8	1.592	0.0517	320.9	1.484	
-15	0.0878	401.5	1.809	0.0844	401.2	1.804	0.0814	400.9	1.800	0.0785	400.5	1.795	-15
-10	0.0900	406.0	1.826	0.0867	405.7	1.822	0.0835	405.5	1.817	0.0806	405.2	1.813	-10
-5	0.0923	410.6	1.843	0.0888	410.3	1.839	0.0856	410.0	1.835	0.0827	409.7	1.830	-5
0	0.0945	415.1	1.860	0.0910	414.8	1.856	0.0877	414.6	1.851	0.0847	414.3	1.847	0
5	0.0966	419.6	1.876	0.0931	419.4	1.872	0.0898	419.1	1.868	0.0867	418.9	1.864	5
10	0.0988	424.1	1.892	0.0952	423.9	1.888	0.0918	423.7	1.884	0.0886	423.5	1.880	10
15	0.1009	428.7	1.908	0.0972	428.4	1.904	0.0938	428.2	1.900	0.0906	428.0	1.896	15
20	0.1030	433.2	1.924	0.0993	433.0	1.920	0.0958	432.8	1.916	0.0925	432.6	1.912	20
25	0.1051	437.8	1.939	0.1013	437.6	1.935	0.0977	437.4	1.931	0.0944	437.2	1.928	25
30	0.1071	442.4	1.955	0.1033	442.2	1.951	0.0997	442.0	1.947	0.0963	441.9	1.943	30
35	0.1092	447.0	1.970	0.1053	446.8	1.966	0.1016	446.7	1.962	0.0982	446.5	1.958	35
40	0.1112	451.7	1.985	0.1072	451.5	1.981	0.1035	451.3	1.977	0.1000	451.2	1.973	40
45	0.1133	456.3	2.000	0.1092	456.2	1.996	0.1054	456.0	1.992	0.1019	455.9	1.988	45
50	0.1153	461.0	2.014	0.1112	460.9	2.010	0.1073	460.8	2.007	0.1037	460.6	2.003	50
55	0.1173	465.8	2.029	0.1131	465.6	2.025	0.1092	465.5	2.021	0.1055	465.4	2.017	55
60	0.1193	470.6	2.043	0.1150	470.4	2.039	0.1111	470.3	2.036	0.1074	470.2	2.032	60
65	0.1212	475.4	2.058	0.1169	475.2	2.054	0.1129	475.1	2.050	0.1092	475.0	2.046	65
70	0.1232	480.2	2.072	0.1189	480.1	2.068	0.1148	480.0	2.064	0.1110	479.8	2.061	70
75	0.1252	485.1	2.086	0.1208	485.0	2.082	0.1166	484.8	2.078	0.1128	484.7	2.075	75
80	0.1272	490.0	2.100	0.1227	489.9	2.096	0.1185	489.8	2.092	0.1145	489.6	2.089	80
85	0.1291	494.9	2.114	0.1246	494.8	2.110	0.1203	494.7	2.106	0.1163	494.6	2.103	85
90	0.1311	499.9	2.128	0.1264	499.8	2.124	0.1221	499.7	2.120	0.1181	499.6	2.116	90
95	0.1330	504.9	2.141	0.1283	504.8	2.138	0.1240	504.7	2.134	0.1199	504.6	2.130	95
100	0.1350	510.0	2.155	0.1302	509.9	2.151	0.1258	509.8	2.147	0.1216	509.7	2.144	100
105	0.1369	515.1	2.169	0.1321	515.0	2.165	0.1276	514.9	2.161	0.1234	514.8	2.157	105
110	0.1388	520.2	2.182	0.1340	520.1	2.178	0.1294	520.0	2.174	0.1251	519.9	2.171	110
115	0.1408	525.3	2.195	0.1358	525.2	2.192	0.1312	525.2	2.188	0.1269	525.1	2.184	115
120	0.1427	530.5	2.209	0.1377	530.4	2.205	0.1330	530.4	2.201	0.1286	530.3	2.198	120
125	0.1446	535.8	2.222	0.1395	535.7	2.218	0.1348	535.6	2.214	0.1304	535.5	2.211	125
130	0.1465	541.0	2.235	0.1414	540.9	2.231	0.1366	540.9	2.228	0.1321	540.8	2.224	130

**Opteon™ XL40 (R-454A)**  
**Superheated Vapor - Constant Pressure Tables**

V = Volume in m<sup>3</sup>/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
	-15.18			-14.36			-13.55			-12.77			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0757	400.1	1.791	0.0735	400.5	1.789	0.0572	354.9	1.610	0.0482	331.1	1.516	
-15	0.0758	400.2	1.791										-15
-10	0.0778	404.9	1.809	0.0752	404.6	1.805	0.0728	404.3	1.801	0.0705	404.0	1.797	-10
-5	0.0798	409.5	1.826	0.0772	409.2	1.822	0.0747	408.9	1.819	0.0724	408.6	1.815	-5
0	0.0818	414.1	1.843	0.0791	413.8	1.839	0.0766	413.6	1.836	0.0742	413.3	1.832	0
5	0.0838	418.6	1.860	0.0810	418.4	1.856	0.0785	418.2	1.852	0.0760	417.9	1.849	5
10	0.0857	423.2	1.876	0.0829	423.0	1.872	0.0803	422.8	1.869	0.0778	422.6	1.865	10
15	0.0876	427.8	1.892	0.0848	427.6	1.889	0.0821	427.4	1.885	0.0796	427.2	1.881	15
20	0.0895	432.4	1.908	0.0866	432.2	1.904	0.0839	432.0	1.901	0.0813	431.8	1.897	20
25	0.0913	437.0	1.924	0.0884	436.9	1.920	0.0856	436.7	1.917	0.0830	436.5	1.913	25
30	0.0931	441.7	1.939	0.0902	441.5	1.936	0.0874	441.3	1.932	0.0847	441.1	1.929	30
35	0.0950	446.3	1.954	0.0919	446.2	1.951	0.0891	446.0	1.947	0.0864	445.8	1.944	35
40	0.0968	451.0	1.970	0.0937	450.9	1.966	0.0908	450.7	1.962	0.0881	450.5	1.959	40
45	0.0986	455.7	1.984	0.0954	455.6	1.981	0.0925	455.4	1.977	0.0897	455.3	1.974	45
50	0.1003	460.5	1.999	0.0972	460.3	1.996	0.0942	460.2	1.992	0.0914	460.0	1.989	50
55	0.1021	465.2	2.014	0.0989	465.1	2.010	0.0959	464.9	2.007	0.0930	464.8	2.004	55
60	0.1039	470.0	2.028	0.1006	469.9	2.025	0.0976	469.8	2.021	0.0947	469.6	2.018	60
65	0.1056	474.8	2.043	0.1023	474.7	2.039	0.0992	474.6	2.036	0.0963	474.5	2.033	65
70	0.1074	479.7	2.057	0.1040	479.6	2.054	0.1009	479.5	2.050	0.0979	479.3	2.047	70
75	0.1091	484.6	2.071	0.1057	484.5	2.068	0.1025	484.4	2.064	0.0995	484.2	2.061	75
80	0.1109	489.5	2.085	0.1074	489.4	2.082	0.1042	489.3	2.078	0.1011	489.2	2.075	80
85	0.1126	494.5	2.099	0.1091	494.4	2.096	0.1058	494.3	2.092	0.1027	494.2	2.089	85
90	0.1143	499.5	2.113	0.1108	499.4	2.110	0.1074	499.3	2.106	0.1043	499.2	2.103	90
95	0.1160	504.5	2.127	0.1124	504.4	2.123	0.1090	504.3	2.120	0.1058	504.2	2.117	95
100	0.1177	509.6	2.140	0.1141	509.5	2.137	0.1107	509.4	2.134	0.1074	509.3	2.131	100
105	0.1195	514.7	2.154	0.1158	514.6	2.151	0.1123	514.5	2.147	0.1090	514.4	2.144	105
110	0.1212	519.8	2.167	0.1174	519.7	2.164	0.1139	519.6	2.161	0.1106	519.5	2.158	110
115	0.1229	525.0	2.181	0.1191	524.9	2.178	0.1155	524.8	2.174	0.1121	524.7	2.171	115
120	0.1246	530.2	2.194	0.1207	530.1	2.191	0.1171	530.0	2.188	0.1137	529.9	2.184	120
125	0.1262	535.4	2.207	0.1224	535.3	2.204	0.1187	535.3	2.201	0.1152	535.2	2.198	125
130	0.1279	540.7	2.221	0.1240	540.6	2.217	0.1203	540.5	2.214	0.1168	540.5	2.211	130

  

ABSOLUTE PRESSURE, kPa													
Temp °C	360			370			380			390			Temp °C
	-12.00			-11.25			-10.51			-9.79			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0676	401.8	1.786	0.0658	402.2	1.785	0.0524	360.7	1.624	0.0451	339.3	1.540	
-10	0.0683	403.7	1.793	0.0662	403.4	1.790	0.0643	403.0	1.786				-10
-5	0.0702	408.4	1.811	0.0681	408.1	1.807	0.0661	407.8	1.804	0.0642	407.5	1.800	-5
0	0.0720	413.0	1.828	0.0698	412.8	1.825	0.0678	412.5	1.821	0.0659	412.3	1.818	0
5	0.0737	417.7	1.845	0.0716	417.5	1.842	0.0695	417.2	1.838	0.0676	417.0	1.835	5
10	0.0755	422.3	1.862	0.0733	422.1	1.858	0.0712	421.9	1.855	0.0692	421.7	1.852	10
15	0.0772	427.0	1.878	0.0750	426.8	1.875	0.0728	426.6	1.871	0.0708	426.3	1.868	15
20	0.0789	431.6	1.894	0.0766	431.4	1.891	0.0745	431.2	1.887	0.0724	431.0	1.884	20
25	0.0806	436.3	1.910	0.0783	436.1	1.906	0.0761	435.9	1.903	0.0740	435.7	1.900	25
30	0.0822	441.0	1.925	0.0799	440.8	1.922	0.0777	440.6	1.919	0.0755	440.4	1.916	30
35	0.0839	445.7	1.941	0.0815	445.5	1.937	0.0792	445.3	1.934	0.0771	445.1	1.931	35
40	0.0855	450.4	1.956	0.0831	450.2	1.953	0.0808	450.0	1.950	0.0786	449.9	1.946	40
45	0.0871	455.1	1.971	0.0847	455.0	1.968	0.0823	454.8	1.965	0.0801	454.6	1.962	45
50	0.0887	459.9	1.986	0.0862	459.7	1.983	0.0839	459.6	1.979	0.0816	459.4	1.976	50
55	0.0903	464.7	2.000	0.0878	464.5	1.997	0.0854	464.4	1.994	0.0831	464.2	1.991	55
60	0.0919	469.5	2.015	0.0893	469.4	2.012	0.0869	469.2	2.009	0.0846	469.1	2.006	60
65	0.0935	474.3	2.029	0.0909	474.2	2.026	0.0884	474.1	2.023	0.0860	473.9	2.020	65
70	0.0951	479.2	2.044	0.0924	479.1	2.041	0.0899	479.0	2.038	0.0875	478.8	2.035	70
75	0.0966	484.1	2.058	0.0939	484.0	2.055	0.0914	483.9	2.052	0.0889	483.8	2.049	75
80	0.0982	489.1	2.072	0.0954	489.0	2.069	0.0928	488.8	2.066	0.0904	488.7	2.063	80
85	0.0997	494.0	2.086	0.0970	493.9	2.083	0.0943	493.8	2.080	0.0918	493.7	2.077	85
90	0.1013	499.1	2.100	0.0985	498.9	2.097	0.0958	498.8	2.094	0.0933	498.7	2.091	90
95	0.1028	504.1	2.114	0.1000	504.0	2.111	0.0973	503.9	2.108	0.0947	503.8	2.105	95
100	0.1044	509.2	2.127	0.1015	509.1	2.124	0.0987	509.0	2.121	0.0961	508.9	2.119	100
105	0.1059	514.3	2.141	0.1029	514.2	2.138	0.1002	514.1	2.135	0.0975	514.0	2.132	105
110	0.1074	519.4	2.155	0.1044	519.3	2.152	0.1016	519.2	2.149	0.0989	519.2	2.146	110
115	0.1089	524.6	2.168	0.1059	524.5	2.165	0.1031	524.4	2.162	0.1004	524.3	2.159	115
120	0.1104	529.8	2.181	0.1074	529.7	2.178	0.1045	529.7	2.175	0.1018	529.6	2.173	120
125	0.1120	535.1	2.195	0.1089	535.0	2.192	0.1059	534.9	2.189	0.1032	534.8	2.186	125
130	0.1135	540.4	2.208	0.1103	540.3	2.205	0.1074	540.2	2.202	0.1046	540.1	2.199	130
135	0.1150	545.7	2.221	0.1118	545.6	2.218	0.1088	545.5	2.215	0.1060	545.4	2.212	135

**Opteon™ XL40 (R-454A)**  
**Superheated Vapor - Constant Pressure Tables**

V = Volume in m<sup>3</sup>/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
	-9.08			-7.37			-5.74			-4.17			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0610	403.3	1.782	0.0575	404.2	1.780	0.0297	302.8	1.393	0.0120	233.9	1.130	
-5	0.0624	407.2	1.797	0.0583	406.5	1.789	0.0546	405.8	1.781				-5
0	0.0641	412.0	1.815	0.0599	411.3	1.806	0.0562	410.6	1.799	0.0528	410.0	1.791	0
5	0.0657	416.7	1.832	0.0615	416.1	1.824	0.0577	415.5	1.816	0.0543	414.8	1.809	5
10	0.0673	421.4	1.848	0.0630	420.8	1.841	0.0591	420.3	1.833	0.0557	419.7	1.826	10
15	0.0689	426.1	1.865	0.0645	425.6	1.857	0.0606	425.0	1.850	0.0571	424.5	1.843	15
20	0.0705	430.8	1.881	0.0660	430.3	1.874	0.0620	429.8	1.866	0.0585	429.3	1.859	20
25	0.0720	435.5	1.897	0.0675	435.1	1.890	0.0634	434.6	1.882	0.0598	434.1	1.876	25
30	0.0735	440.2	1.913	0.0689	439.8	1.905	0.0648	439.3	1.898	0.0611	438.9	1.892	30
35	0.0750	445.0	1.928	0.0703	444.5	1.921	0.0662	444.1	1.914	0.0624	443.7	1.907	35
40	0.0765	449.7	1.943	0.0717	449.3	1.936	0.0675	448.9	1.929	0.0637	448.5	1.923	40
45	0.0780	454.5	1.959	0.0731	454.1	1.951	0.0688	453.7	1.945	0.0650	453.3	1.938	45
50	0.0795	459.3	1.973	0.0745	458.9	1.966	0.0702	458.5	1.960	0.0662	458.2	1.953	50
55	0.0809	464.1	1.988	0.0759	463.7	1.981	0.0715	463.4	1.975	0.0675	463.0	1.968	55
60	0.0824	468.9	2.003	0.0773	468.6	1.996	0.0728	468.3	1.989	0.0687	467.9	1.983	60
65	0.0838	473.8	2.017	0.0786	473.5	2.010	0.0741	473.2	2.004	0.0700	472.8	1.998	65
70	0.0852	478.7	2.032	0.0800	478.4	2.025	0.0754	478.1	2.018	0.0712	477.8	2.012	70
75	0.0866	483.6	2.046	0.0813	483.3	2.039	0.0766	483.0	2.033	0.0724	482.7	2.026	75
80	0.0880	488.6	2.060	0.0827	488.3	2.053	0.0779	488.0	2.047	0.0736	487.7	2.041	80
85	0.0895	493.6	2.074	0.0840	493.3	2.067	0.0792	493.0	2.061	0.0748	492.8	2.055	85
90	0.0909	498.6	2.088	0.0853	498.4	2.081	0.0804	498.1	2.075	0.0760	497.8	2.069	90
95	0.0922	503.7	2.102	0.0867	503.4	2.095	0.0817	503.2	2.089	0.0772	502.9	2.083	95
100	0.0936	508.8	2.116	0.0880	508.5	2.109	0.0829	508.3	2.103	0.0784	508.0	2.097	100
105	0.0950	513.9	2.129	0.0893	513.7	2.123	0.0842	513.4	2.116	0.0796	513.2	2.110	105
110	0.0964	519.1	2.143	0.0906	518.8	2.136	0.0854	518.6	2.130	0.0808	518.4	2.124	110
115	0.0978	524.3	2.156	0.0919	524.0	2.150	0.0866	523.8	2.143	0.0820	523.6	2.137	115
120	0.0992	529.5	2.170	0.0932	529.3	2.163	0.0879	529.0	2.157	0.0831	528.8	2.151	120
125	0.1005	534.7	2.183	0.0945	534.5	2.176	0.0891	534.3	2.170	0.0843	534.1	2.164	125
130	0.1019	540.0	2.196	0.0958	539.8	2.190	0.0903	539.6	2.183	0.0855	539.4	2.177	130
135	0.1033	545.4	2.209	0.0971	545.2	2.203	0.0915	545.0	2.197	0.0866	544.8	2.191	135
140	0.1046	550.7	2.223	0.0983	550.5	2.216	0.0928	550.3	2.210	0.0878	550.1	2.204	140

  

ABSOLUTE PRESSURE, kPa													
Temp °C	500			525			550			575			Temp °C
	-2.66			-1.22			0.18			1.53			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0490	406.6	1.774	0.0467	407.3	1.772	0.0276	324.1	1.462	0.0163	273.0	1.271	
0	0.0498	409.3	1.784	0.0471	408.5	1.777				0.0163	273.0	1.271	0
5	0.0512	414.2	1.802	0.0485	413.5	1.795	0.0459	412.9	1.788	0.0436	412.2	1.782	5
10	0.0526	419.1	1.819	0.0498	418.5	1.813	0.0472	417.9	1.806	0.0449	417.2	1.800	10
15	0.0539	423.9	1.836	0.0511	423.4	1.830	0.0485	422.8	1.823	0.0461	422.2	1.817	15
20	0.0552	428.8	1.853	0.0523	428.2	1.846	0.0497	427.7	1.840	0.0473	427.2	1.834	20
25	0.0565	433.6	1.869	0.0536	433.1	1.863	0.0509	432.6	1.857	0.0484	432.1	1.851	25
30	0.0578	438.4	1.885	0.0548	437.9	1.879	0.0521	437.5	1.873	0.0496	437.0	1.867	30
35	0.0591	443.2	1.901	0.0560	442.8	1.895	0.0532	442.4	1.889	0.0507	441.9	1.883	35
40	0.0603	448.1	1.917	0.0572	447.7	1.911	0.0544	447.2	1.905	0.0518	446.8	1.899	40
45	0.0615	452.9	1.932	0.0584	452.5	1.926	0.0555	452.1	1.920	0.0529	451.7	1.915	45
50	0.0627	457.8	1.947	0.0595	457.4	1.941	0.0566	457.0	1.935	0.0540	456.6	1.930	50
55	0.0639	462.7	1.962	0.0607	462.3	1.956	0.0577	462.0	1.951	0.0551	461.6	1.945	55
60	0.0651	467.6	1.977	0.0618	467.2	1.971	0.0588	466.9	1.966	0.0561	466.5	1.960	60
65	0.0663	472.5	1.992	0.0630	472.2	1.986	0.0599	471.8	1.980	0.0572	471.5	1.975	65
70	0.0675	477.5	2.006	0.0641	477.1	2.000	0.0610	476.8	1.995	0.0582	476.5	1.990	70
75	0.0686	482.4	2.021	0.0652	482.1	2.015	0.0621	481.8	2.009	0.0592	481.5	2.004	75
80	0.0698	487.4	2.035	0.0663	487.2	2.029	0.0631	486.9	2.024	0.0603	486.6	2.019	80
85	0.0709	492.5	2.049	0.0674	492.2	2.043	0.0642	491.9	2.038	0.0613	491.6	2.033	85
90	0.0721	497.6	2.063	0.0685	497.3	2.057	0.0653	497.0	2.052	0.0623	496.7	2.047	90
95	0.0732	502.6	2.077	0.0696	502.4	2.071	0.0663	502.1	2.066	0.0633	501.9	2.061	95
100	0.0744	507.8	2.091	0.0707	507.5	2.085	0.0673	507.3	2.080	0.0643	507.0	2.075	100
105	0.0755	512.9	2.105	0.0718	512.7	2.099	0.0684	512.4	2.094	0.0653	512.2	2.089	105
110	0.0766	518.1	2.118	0.0728	517.9	2.113	0.0694	517.6	2.107	0.0663	517.4	2.102	110
115	0.0777	523.3	2.132	0.0739	523.1	2.126	0.0704	522.9	2.121	0.0673	522.7	2.116	115
120	0.0788	528.6	2.145	0.0750	528.4	2.140	0.0715	528.2	2.134	0.0682	527.9	2.129	120
125	0.0800	533.9	2.159	0.0760	533.7	2.153	0.0725	533.5	2.148	0.0692	533.2	2.143	125
130	0.0811	539.2	2.172	0.0771	539.0	2.166	0.0735	538.8	2.161	0.0702	538.6	2.156	130
135	0.0822	544.6	2.185	0.0782	544.4	2.180	0.0745	544.2	2.174	0.0712	544.0	2.169	135
140	0.0833	549.9	2.198	0.0792	549.8	2.193	0.0755	549.6	2.188	0.0721	549.4	2.183	140
145	0.0844	555.4	2.211	0.0803	555.2	2.206	0.0765	555.0	2.201	0.0731	554.8	2.196	145

**Opteon™ XL40 (R-454A)**  
**Superheated Vapor - Constant Pressure Tables**

V = Volume in m<sup>3</sup>/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
	2.84			4.10			5.33			6.52			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0410	409.3	1.768	0.0393	409.9	1.766	0.0252	338.7	1.506	0.0171	297.3	1.354	
5	0.0415	411.5	1.776	0.0396	410.8	1.769							5
10	0.0427	416.6	1.794	0.0407	416.0	1.788	0.0389	415.3	1.782	0.0372	414.7	1.776	10
15	0.0439	421.6	1.811	0.0419	421.0	1.806	0.0400	420.4	1.800	0.0383	419.8	1.794	15
20	0.0451	426.6	1.828	0.0430	426.1	1.823	0.0411	425.5	1.817	0.0394	425.0	1.812	20
25	0.0462	431.6	1.845	0.0441	431.1	1.840	0.0422	430.5	1.834	0.0404	430.0	1.829	25
30	0.0473	436.5	1.862	0.0452	436.0	1.856	0.0433	435.6	1.851	0.0415	435.1	1.846	30
35	0.0484	441.5	1.878	0.0463	441.0	1.873	0.0443	440.5	1.867	0.0425	440.1	1.862	35
40	0.0495	446.4	1.894	0.0473	446.0	1.888	0.0453	445.5	1.883	0.0434	445.1	1.878	40
45	0.0505	451.3	1.909	0.0483	450.9	1.904	0.0463	450.5	1.899	0.0444	450.1	1.894	45
50	0.0516	456.3	1.925	0.0493	455.9	1.920	0.0473	455.5	1.915	0.0454	455.1	1.910	50
55	0.0526	461.2	1.940	0.0503	460.9	1.935	0.0482	460.5	1.930	0.0463	460.1	1.925	55
60	0.0536	466.2	1.955	0.0513	465.8	1.950	0.0492	465.5	1.945	0.0472	465.1	1.941	60
65	0.0546	471.2	1.970	0.0523	470.8	1.965	0.0501	470.5	1.960	0.0481	470.2	1.956	65
70	0.0556	476.2	1.985	0.0533	475.9	1.980	0.0511	475.5	1.975	0.0490	475.2	1.970	70
75	0.0566	481.2	1.999	0.0542	480.9	1.994	0.0520	480.6	1.990	0.0499	480.3	1.985	75
80	0.0576	486.3	2.014	0.0552	486.0	2.009	0.0529	485.7	2.004	0.0508	485.4	2.000	80
85	0.0586	491.4	2.028	0.0561	491.1	2.023	0.0538	490.8	2.018	0.0517	490.5	2.014	85
90	0.0596	496.5	2.042	0.0571	496.2	2.037	0.0547	495.9	2.033	0.0526	495.6	2.028	90
95	0.0605	501.6	2.056	0.0580	501.3	2.051	0.0556	501.1	2.047	0.0535	500.8	2.042	95
100	0.0615	506.8	2.070	0.0589	506.5	2.065	0.0565	506.2	2.061	0.0543	506.0	2.056	100
105	0.0625	512.0	2.084	0.0598	511.7	2.079	0.0574	511.5	2.075	0.0552	511.2	2.070	105
110	0.0634	517.2	2.098	0.0608	516.9	2.093	0.0583	516.7	2.088	0.0561	516.5	2.084	110
115	0.0644	522.4	2.111	0.0617	522.2	2.106	0.0592	522.0	2.102	0.0569	521.7	2.098	115
120	0.0653	527.7	2.125	0.0626	527.5	2.120	0.0601	527.3	2.116	0.0578	527.0	2.111	120
125	0.0662	533.0	2.138	0.0635	532.8	2.133	0.0610	532.6	2.129	0.0586	532.4	2.125	125
130	0.0672	538.4	2.151	0.0644	538.2	2.147	0.0618	538.0	2.142	0.0595	537.7	2.138	130
135	0.0681	543.8	2.165	0.0653	543.5	2.160	0.0627	543.3	2.156	0.0603	543.1	2.151	135
140	0.0690	549.2	2.178	0.0662	549.0	2.173	0.0636	548.8	2.169	0.0611	548.6	2.165	140
145	0.0700	554.6	2.191	0.0671	554.4	2.186	0.0644	554.2	2.182	0.0620	554.0	2.178	145
150	0.0709	560.1	2.204	0.0680	559.9	2.199	0.0653	559.7	2.195	0.0628	559.5	2.191	150

  

ABSOLUTE PRESSURE, kPa													
Temp °C	700			725			750			775			Temp °C
	7.68			8.81			9.91			10.98			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0351	411.5	1.762	0.0339	412.0	1.761	0.0230	349.4	1.536	0.0168	314.2	1.408	
10	0.0356	414.0	1.771	0.0342	413.3	1.765	0.0328	412.6	1.760				10
15	0.0367	419.2	1.789	0.0352	418.6	1.784	0.0338	418.0	1.779	0.0325	417.3	1.773	15
20	0.0378	424.4	1.807	0.0363	423.8	1.802	0.0348	423.2	1.797	0.0335	422.6	1.792	20
25	0.0388	429.5	1.824	0.0373	429.0	1.819	0.0358	428.4	1.814	0.0345	427.9	1.809	25
30	0.0398	434.6	1.841	0.0382	434.1	1.836	0.0368	433.6	1.831	0.0354	433.1	1.827	30
35	0.0408	439.6	1.857	0.0392	439.1	1.853	0.0377	438.7	1.848	0.0363	438.2	1.843	35
40	0.0417	444.6	1.874	0.0401	444.2	1.869	0.0386	443.8	1.864	0.0372	443.3	1.860	40
45	0.0427	449.7	1.890	0.0410	449.3	1.885	0.0395	448.8	1.881	0.0381	448.4	1.876	45
50	0.0436	454.7	1.905	0.0419	454.3	1.901	0.0404	453.9	1.896	0.0389	453.5	1.892	50
55	0.0445	459.7	1.921	0.0428	459.4	1.916	0.0412	459.0	1.912	0.0398	458.6	1.908	55
60	0.0454	464.8	1.936	0.0437	464.4	1.932	0.0421	464.1	1.927	0.0406	463.7	1.923	60
65	0.0463	469.8	1.951	0.0446	469.5	1.947	0.0429	469.1	1.942	0.0414	468.8	1.938	65
70	0.0472	474.9	1.966	0.0454	474.6	1.962	0.0438	474.2	1.957	0.0422	473.9	1.953	70
75	0.0480	480.0	1.981	0.0463	479.7	1.976	0.0446	479.4	1.972	0.0431	479.0	1.968	75
80	0.0489	485.1	1.995	0.0471	484.8	1.991	0.0454	484.5	1.987	0.0438	484.2	1.983	80
85	0.0498	490.2	2.010	0.0479	489.9	2.005	0.0462	489.6	2.001	0.0446	489.3	1.997	85
90	0.0506	495.4	2.024	0.0488	495.1	2.020	0.0470	494.8	2.016	0.0454	494.5	2.012	90
95	0.0515	500.5	2.038	0.0496	500.3	2.034	0.0478	500.0	2.030	0.0462	499.7	2.026	95
100	0.0523	505.7	2.052	0.0504	505.5	2.048	0.0486	505.2	2.044	0.0470	505.0	2.040	100
105	0.0531	511.0	2.066	0.0512	510.7	2.062	0.0494	510.5	2.058	0.0477	510.2	2.054	105
110	0.0540	516.2	2.080	0.0520	516.0	2.076	0.0502	515.7	2.072	0.0485	515.5	2.068	110
115	0.0548	521.5	2.093	0.0528	521.3	2.089	0.0510	521.0	2.085	0.0492	520.8	2.082	115
120	0.0556	526.8	2.107	0.0536	526.6	2.103	0.0518	526.4	2.099	0.0500	526.1	2.095	120
125	0.0564	532.2	2.121	0.0544	531.9	2.117	0.0525	531.7	2.113	0.0508	531.5	2.109	125
130	0.0573	537.5	2.134	0.0552	537.3	2.130	0.0533	537.1	2.126	0.0515	536.9	2.122	130
135	0.0581	542.9	2.147	0.0560	542.7	2.143	0.0541	542.5	2.139	0.0522	542.3	2.136	135
140	0.0589	548.4	2.161	0.0568	548.2	2.157	0.0548	548.0	2.153	0.0530	547.8	2.149	140
145	0.0597	553.8	2.174	0.0576	553.6	2.170	0.0556	553.4	2.166	0.0537	553.3	2.162	145
150	0.0605	559.3	2.187	0.0583	559.1	2.183	0.0563	559.0	2.179	0.0544	558.8	2.175	150
155	0.0613	564.9	2.200	0.0591	564.7	2.196	0.0571	564.5	2.192	0.0552	564.3	2.188	155

**Opteon™ XL40 (R-454A)**  
**Superheated Vapor - Constant Pressure Tables**

V = Volume in m<sup>3</sup>/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
	12.02			15.97			19.60			22.96			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0307	413.4	1.757	0.0272	415.1	1.753	0.0009	218.1	1.064	0.0009	218.1	1.063	
15	0.0313	416.7	1.768										15
20	0.0323	422.0	1.787	0.0279	419.6	1.768	0.0245	417.0	1.750				20
25	0.0332	427.3	1.805	0.0288	425.0	1.787	0.0253	422.7	1.770	0.0224	420.1	1.753	25
30	0.0341	432.5	1.822	0.0297	430.4	1.805	0.0261	428.2	1.788	0.0232	425.9	1.772	30
35	0.0350	437.7	1.839	0.0305	435.7	1.822	0.0269	433.7	1.806	0.0240	431.6	1.791	35
40	0.0359	442.9	1.856	0.0313	441.0	1.839	0.0277	439.1	1.824	0.0247	437.1	1.809	40
45	0.0367	448.0	1.872	0.0321	446.3	1.856	0.0284	444.5	1.840	0.0254	442.6	1.826	45
50	0.0376	453.1	1.888	0.0329	451.5	1.872	0.0292	449.8	1.857	0.0261	448.1	1.843	50
55	0.0384	458.2	1.904	0.0337	456.7	1.888	0.0299	455.1	1.873	0.0267	453.4	1.860	55
60	0.0392	463.3	1.919	0.0344	461.9	1.904	0.0306	460.3	1.889	0.0274	458.8	1.876	60
65	0.0400	468.4	1.934	0.0351	467.0	1.919	0.0312	465.6	1.905	0.0280	464.2	1.892	65
70	0.0408	473.6	1.949	0.0359	472.2	1.934	0.0319	470.9	1.920	0.0287	469.5	1.908	70
75	0.0416	478.7	1.964	0.0366	477.4	1.949	0.0326	476.1	1.936	0.0293	474.8	1.923	75
80	0.0424	483.9	1.979	0.0373	482.7	1.964	0.0332	481.4	1.951	0.0299	480.1	1.938	80
85	0.0431	489.1	1.993	0.0380	487.9	1.979	0.0339	486.7	1.965	0.0305	485.5	1.953	85
90	0.0439	494.2	2.008	0.0387	493.1	1.993	0.0345	492.0	1.980	0.0311	490.8	1.968	90
95	0.0447	499.5	2.022	0.0394	498.4	2.008	0.0351	497.3	1.995	0.0317	496.2	1.983	95
100	0.0454	504.7	2.036	0.0400	503.7	2.022	0.0358	502.6	2.009	0.0322	501.5	1.997	100
105	0.0462	510.0	2.050	0.0407	509.0	2.036	0.0364	507.9	2.023	0.0328	506.9	2.011	105
110	0.0469	515.3	2.064	0.0414	514.3	2.050	0.0370	513.3	2.037	0.0334	512.3	2.026	110
115	0.0476	520.6	2.078	0.0421	519.6	2.064	0.0376	518.7	2.051	0.0339	517.7	2.040	115
120	0.0484	525.9	2.092	0.0427	525.0	2.078	0.0382	524.1	2.065	0.0345	523.2	2.054	120
125	0.0491	531.3	2.105	0.0434	530.4	2.091	0.0388	529.5	2.079	0.0351	528.6	2.067	125
130	0.0498	536.7	2.119	0.0440	535.8	2.105	0.0394	535.0	2.092	0.0356	534.1	2.081	130
135	0.0505	542.1	2.132	0.0447	541.3	2.118	0.0400	540.5	2.106	0.0362	539.6	2.095	135
140	0.0513	547.6	2.145	0.0453	546.8	2.132	0.0406	546.0	2.119	0.0367	545.2	2.108	140
145	0.0520	553.1	2.159	0.0460	552.3	2.145	0.0412	551.5	2.133	0.0372	550.7	2.121	145
150	0.0527	558.6	2.172	0.0466	557.8	2.158	0.0418	557.1	2.146	0.0378	556.3	2.135	150
155	0.0534	564.1	2.185	0.0472	563.4	2.171	0.0423	562.7	2.159	0.0383	561.9	2.148	155
160	0.0541	569.7	2.198	0.0479	569.0	2.184	0.0429	568.3	2.172	0.0388	567.6	2.161	160

  

ABSOLUTE PRESSURE, kPa													
Temp °C	1200			1300			1400			1500			Temp °C
	26.10			29.04			31.81			34.44			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0201	418.8	1.742	0.0185	419.7	1.738	0.0010	240.3	1.138	0.0010	240.2	1.138	
30	0.0207	423.5	1.757	0.0186	420.9	1.742							30
35	0.0215	429.4	1.776	0.0193	427.0	1.762	0.0175	424.5	1.748	0.0159	421.9	1.734	35
40	0.0222	435.1	1.795	0.0200	432.9	1.781	0.0182	430.7	1.768	0.0165	428.3	1.755	40
45	0.0228	440.7	1.813	0.0207	438.7	1.800	0.0188	436.7	1.787	0.0172	434.5	1.775	45
50	0.0235	446.3	1.830	0.0213	444.4	1.817	0.0194	442.5	1.805	0.0178	440.6	1.793	50
55	0.0241	451.8	1.847	0.0219	450.1	1.835	0.0200	448.3	1.823	0.0184	446.5	1.811	55
60	0.0248	457.2	1.863	0.0225	455.6	1.851	0.0206	454.0	1.840	0.0189	452.3	1.829	60
65	0.0254	462.7	1.880	0.0231	461.1	1.868	0.0211	459.6	1.857	0.0194	458.0	1.846	65
70	0.0259	468.1	1.895	0.0237	466.6	1.884	0.0217	465.2	1.873	0.0200	463.7	1.863	70
75	0.0265	473.5	1.911	0.0242	472.1	1.900	0.0222	470.7	1.889	0.0205	469.3	1.879	75
80	0.0271	478.9	1.926	0.0247	477.6	1.915	0.0227	476.2	1.905	0.0210	474.9	1.895	80
85	0.0277	484.3	1.942	0.0253	483.0	1.931	0.0232	481.7	1.920	0.0214	480.5	1.911	85
90	0.0282	489.6	1.957	0.0258	488.5	1.946	0.0237	487.3	1.936	0.0219	486.0	1.926	90
95	0.0288	495.0	1.971	0.0263	493.9	1.961	0.0242	492.8	1.951	0.0224	491.6	1.941	95
100	0.0293	500.5	1.986	0.0268	499.4	1.976	0.0247	498.3	1.966	0.0228	497.1	1.956	100
105	0.0298	505.9	2.000	0.0273	504.8	1.990	0.0252	503.8	1.980	0.0233	502.7	1.971	105
110	0.0304	511.3	2.015	0.0278	510.3	2.004	0.0256	509.3	1.995	0.0238	508.3	1.986	110
115	0.0309	516.8	2.029	0.0283	515.8	2.019	0.0261	514.8	2.009	0.0242	513.8	2.000	115
120	0.0314	522.2	2.043	0.0288	521.3	2.033	0.0266	520.4	2.023	0.0246	519.4	2.014	120
125	0.0319	527.7	2.057	0.0293	526.8	2.047	0.0270	525.9	2.037	0.0251	525.0	2.029	125
130	0.0324	533.3	2.070	0.0298	532.4	2.061	0.0275	531.5	2.051	0.0255	530.6	2.043	130
135	0.0330	538.8	2.084	0.0302	537.9	2.074	0.0279	537.1	2.065	0.0259	536.2	2.056	135
140	0.0335	544.3	2.098	0.0307	543.5	2.088	0.0284	542.7	2.079	0.0263	541.9	2.070	140
145	0.0340	549.9	2.111	0.0312	549.1	2.101	0.0288	548.3	2.092	0.0268	547.5	2.084	145
150	0.0345	555.5	2.124	0.0317	554.8	2.115	0.0293	554.0	2.106	0.0272	553.2	2.097	150
155	0.0350	561.2	2.138	0.0321	560.4	2.128	0.0297	559.7	2.119	0.0276	558.9	2.111	155
160	0.0355	566.8	2.151	0.0326	566.1	2.141	0.0301	565.4	2.132	0.0280	564.7	2.124	160
165	0.0359	572.5	2.164	0.0330	571.8	2.154	0.0306	571.1	2.146	0.0284	570.4	2.137	165
170	0.0364	578.2	2.177	0.0335	577.5	2.167	0.0310	576.9	2.159	0.0288	576.2	2.150	170
175	0.0369	584.0	2.190	0.0339	583.3	2.180	0.0314	582.6	2.172	0.0292	582.0	2.163	175

**Opteon™ XL40 (R-454A)**  
**Superheated Vapor - Constant Pressure Tables**

V = Volume in m<sup>3</sup>/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			2000			Temp °C
	36.94			39.31			41.59			45.85			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0147	421.7	1.729	0.0137	422.2	1.726	0.0021	272.6	1.242	0.0010	258.1	1.195	
40	0.0151	425.8	1.742	0.0138	423.2	1.729							40
45	0.0157	432.3	1.762	0.0144	429.9	1.750	0.0133	427.4	1.738				45
50	0.0163	438.5	1.782	0.0150	436.4	1.770	0.0139	434.1	1.759	0.0119	429.2	1.736	50
55	0.0169	444.6	1.800	0.0156	442.6	1.789	0.0144	440.6	1.779	0.0124	436.2	1.757	55
60	0.0174	450.5	1.818	0.0161	448.7	1.808	0.0150	446.8	1.798	0.0129	442.8	1.777	60
65	0.0180	456.3	1.836	0.0166	454.7	1.826	0.0155	452.9	1.816	0.0134	449.3	1.796	65
70	0.0185	462.1	1.853	0.0171	460.5	1.843	0.0159	458.9	1.833	0.0139	455.5	1.815	70
75	0.0189	467.8	1.869	0.0176	466.3	1.860	0.0164	464.8	1.850	0.0143	461.7	1.833	75
80	0.0194	473.5	1.885	0.0181	472.1	1.876	0.0168	470.7	1.867	0.0148	467.7	1.850	80
85	0.0199	479.2	1.901	0.0185	477.8	1.892	0.0173	476.5	1.883	0.0152	473.7	1.867	85
90	0.0203	484.8	1.917	0.0189	483.5	1.908	0.0177	482.2	1.899	0.0156	479.6	1.883	90
95	0.0208	490.4	1.932	0.0194	489.2	1.924	0.0181	488.0	1.915	0.0160	485.5	1.899	95
100	0.0212	496.0	1.947	0.0198	494.9	1.939	0.0185	493.7	1.931	0.0164	491.3	1.915	100
105	0.0217	501.6	1.962	0.0202	500.5	1.954	0.0189	499.4	1.946	0.0167	497.2	1.930	105
110	0.0221	507.2	1.977	0.0206	506.2	1.969	0.0193	505.1	1.961	0.0171	503.0	1.946	110
115	0.0225	512.8	1.992	0.0210	511.8	1.983	0.0197	510.8	1.975	0.0175	508.7	1.961	115
120	0.0229	518.5	2.006	0.0214	517.5	1.998	0.0201	516.5	1.990	0.0178	514.5	1.975	120
125	0.0233	524.1	2.020	0.0218	523.1	2.012	0.0205	522.2	2.004	0.0182	520.3	1.990	125
130	0.0238	529.7	2.034	0.0222	528.8	2.026	0.0209	527.9	2.019	0.0185	526.1	2.004	130
135	0.0242	535.4	2.048	0.0226	534.5	2.040	0.0212	533.6	2.033	0.0189	531.9	2.019	135
140	0.0246	541.0	2.062	0.0230	540.2	2.054	0.0216	539.4	2.047	0.0192	537.7	2.033	140
145	0.0250	546.7	2.076	0.0234	545.9	2.068	0.0219	545.1	2.061	0.0195	543.5	2.047	145
150	0.0253	552.4	2.089	0.0237	551.7	2.082	0.0223	550.9	2.074	0.0199	549.3	2.061	150
155	0.0257	558.2	2.103	0.0241	557.4	2.095	0.0227	556.6	2.088	0.0202	555.1	2.074	155
160	0.0261	563.9	2.116	0.0245	563.2	2.109	0.0230	562.4	2.101	0.0205	561.0	2.088	160
165	0.0265	569.7	2.129	0.0248	569.0	2.122	0.0234	568.3	2.115	0.0208	566.8	2.101	165
170	0.0269	575.5	2.142	0.0252	574.8	2.135	0.0237	574.1	2.128	0.0212	572.7	2.115	170
175	0.0273	581.3	2.155	0.0256	580.6	2.148	0.0241	579.9	2.141	0.0215	578.6	2.128	175
180	0.0276	587.1	2.168	0.0259	586.5	2.161	0.0244	585.8	2.154	0.0218	584.5	2.141	180
185	0.0280	593.0	2.181	0.0263	592.4	2.174	0.0247	591.7	2.167	0.0221	590.4	2.154	185

  

ABSOLUTE PRESSURE, kPa													
Temp °C	2100			2200			2300			2400			Temp °C
	47.86			49.79			51.66			53.46			
	V	H	S	V	H	S	V	H	S	V	H	S	
	0.0107	423.3	1.714	0.0101	423.3	1.711	0.0029	307.4	1.348	0.0011	277.4	1.255	
50	0.0110	426.5	1.724	0.0101	423.6	1.712							50
55	0.0115	433.8	1.746	0.0107	431.3	1.735	0.0100	428.7	1.724	0.0093	425.8	1.712	55
60	0.0121	440.7	1.767	0.0113	438.5	1.757	0.0105	436.2	1.747	0.0098	433.8	1.736	60
65	0.0126	447.4	1.787	0.0117	445.4	1.777	0.0110	443.3	1.768	0.0103	441.1	1.758	65
70	0.0130	453.8	1.806	0.0122	452.0	1.797	0.0115	450.1	1.788	0.0108	448.1	1.779	70
75	0.0135	460.1	1.824	0.0126	458.4	1.815	0.0119	456.6	1.807	0.0112	454.9	1.798	75
80	0.0139	466.2	1.841	0.0131	464.6	1.833	0.0123	463.1	1.825	0.0116	461.4	1.817	80
85	0.0143	472.3	1.859	0.0135	470.8	1.851	0.0127	469.3	1.843	0.0120	467.8	1.835	85
90	0.0147	478.3	1.875	0.0138	476.9	1.867	0.0131	475.5	1.860	0.0124	474.1	1.853	90
95	0.0151	484.2	1.891	0.0142	482.9	1.884	0.0135	481.6	1.877	0.0128	480.3	1.869	95
100	0.0154	490.1	1.907	0.0146	488.9	1.900	0.0138	487.7	1.893	0.0131	486.4	1.886	100
105	0.0158	496.0	1.923	0.0149	494.8	1.916	0.0142	493.7	1.909	0.0134	492.5	1.902	105
110	0.0162	501.9	1.938	0.0153	500.8	1.931	0.0145	499.6	1.925	0.0138	498.5	1.918	110
115	0.0165	507.7	1.954	0.0156	506.6	1.947	0.0148	505.6	1.940	0.0141	504.5	1.933	115
120	0.0169	513.5	1.968	0.0160	512.5	1.962	0.0152	511.5	1.955	0.0144	510.5	1.949	120
125	0.0172	519.3	1.983	0.0163	518.4	1.977	0.0155	517.4	1.970	0.0147	516.4	1.964	125
130	0.0175	525.2	1.998	0.0166	524.2	1.991	0.0158	523.3	1.985	0.0150	522.3	1.979	130
135	0.0179	531.0	2.012	0.0169	530.1	2.006	0.0161	529.2	1.999	0.0153	528.3	1.993	135
140	0.0182	536.8	2.026	0.0173	535.9	2.020	0.0164	535.1	2.014	0.0156	534.2	2.008	140
145	0.0185	542.6	2.040	0.0176	541.8	2.034	0.0167	541.0	2.028	0.0159	540.1	2.022	145
150	0.0188	548.5	2.054	0.0179	547.7	2.048	0.0170	546.9	2.042	0.0162	546.1	2.036	150
155	0.0191	554.3	2.068	0.0182	553.6	2.062	0.0173	552.8	2.056	0.0165	552.0	2.050	155
160	0.0195	560.2	2.082	0.0185	559.5	2.075	0.0176	558.7	2.070	0.0168	557.9	2.064	160
165	0.0198	566.1	2.095	0.0188	565.4	2.089	0.0179	564.6	2.083	0.0171	563.9	2.077	165
170	0.0201	572.0	2.108	0.0191	571.3	2.102	0.0182	570.6	2.097	0.0173	569.9	2.091	170
175	0.0204	577.9	2.122	0.0194	577.2	2.116	0.0185	576.5	2.110	0.0176	575.9	2.104	175
180	0.0207	583.8	2.135	0.0197	583.2	2.129	0.0187	582.5	2.123	0.0179	581.8	2.118	180
185	0.0210	589.8	2.148	0.0200	589.2	2.142	0.0190	588.5	2.136	0.0182	587.9	2.131	185
190	0.0213	595.8	2.161	0.0202	595.1	2.155	0.0193	594.5	2.149	0.0184	593.9	2.144	190
195	0.0216	601.8	2.174	0.0205	601.2	2.168	0.0196	600.5	2.162	0.0187	599.9	2.157	195

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