



# Opteon™ XP44

Refrigerant

## Transport Properties of Opteon™ XP44 (R-452A) SI Units

### Physical Properties

Molecular Weight	103.5 g/mole
Boiling Point at	
One Atmosphere	-47.0 °C
Critical Temperature	74.9 °C
Critical Pressure	4001.5 kPa
Critical Density	496.26 kg/m <sup>3</sup>
Critical Volume	0.0020 m <sup>3</sup> /kg
Ozone Depletion Potential	0
Global Warming Potential (AR5)	1945
ASHRAE Standard 34 Safety Rating	A1

### Units and Factors

t	= temperature in °C
P	= pressure in kiloPascals absolute (kPa [abs])
C <sub>p</sub>	= Heat capacity at constant pressure in kJ/(kg-K)
C <sub>v</sub>	= Heat capacity at constant volume in kJ/(kg-K)
C <sub>p</sub> /C <sub>v</sub>	= Heat capacity ratio (dimensionless)
μ	= Viscosity in μPa-sec
v	= Kinematic viscosity in cm <sup>2</sup> /sec
k	= Thermal conductivity in mW/(m-K)
c	= Velocity of sound in m/sec
γ	= Surface Tension in mN/m
h <sub>f</sub>	= enthalpy of saturated liquid in kJ/kg
s <sub>f</sub>	= entropy of saturated liquid 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 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™ XP44 (R-452A)  
Saturation Properties - Transport Properties Table

Temp °C	Heat Capacity, $c_p$ [kJ/kg-K]		$c_p/c_v$	Viscosity [ $\mu$ Pa-sec]		Kinematic Viscosity [cm <sup>2</sup> /sec]		Thermal Conductivity [mW/m-K]		Vel. of Sound [m/sec]		Surface Tension [mN/m]
	Liquid	Vapor		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	
	-40	1.2007	0.7611	1.1616	328.7	9.848	0.0024	0.0149	95.69	9.120	687.6	140.3
-39	1.2031	0.7646	1.1623	323.9	9.891	0.0023	0.0143	95.22	9.190	682.9	140.4	14.54
-38	1.2055	0.7681	1.1630	319.3	9.935	0.0023	0.0138	94.75	9.259	678.2	140.5	14.37
-37	1.2080	0.7716	1.1637	314.7	9.978	0.0023	0.0132	94.28	9.329	673.5	140.6	14.21
-36	1.2105	0.7752	1.1645	310.2	10.021	0.0023	0.0128	93.82	9.399	668.8	140.7	14.05
-35	1.2131	0.7787	1.1653	305.8	10.064	0.0022	0.0123	93.35	9.470	664.1	140.8	13.89
-34	1.2157	0.7824	1.1661	301.5	10.107	0.0022	0.0118	92.88	9.541	659.4	140.8	13.73
-33	1.2183	0.7860	1.1669	297.2	10.151	0.0022	0.0114	92.42	9.612	654.7	140.9	13.57
-32	1.2209	0.7897	1.1678	293.1	10.194	0.0022	0.0110	91.96	9.683	650.0	141.0	13.40
-31	1.2236	0.7934	1.1687	289.0	10.237	0.0021	0.0106	91.49	9.755	645.4	141.1	13.25
-30	1.2263	0.7972	1.1697	285.0	10.280	0.0021	0.0102	91.03	9.826	640.7	141.1	13.09
-29	1.2290	0.8010	1.1707	281.0	10.323	0.0021	0.0099	90.57	9.899	636.0	141.2	12.93
-28	1.2317	0.8048	1.1717	277.2	10.366	0.0021	0.0095	90.11	9.971	631.3	141.2	12.77
-27	1.2345	0.8087	1.1727	273.4	10.409	0.0020	0.0092	89.65	10.044	626.6	141.3	12.61
-26	1.2374	0.8126	1.1738	269.6	10.453	0.0020	0.0089	89.20	10.117	621.9	141.3	12.45
-25	1.2402	0.8165	1.1749	266.0	10.496	0.0020	0.0086	88.74	10.191	617.2	141.3	12.30
-24	1.2431	0.8205	1.1761	262.4	10.539	0.0020	0.0083	88.28	10.265	612.6	141.3	12.14
-23	1.2461	0.8245	1.1773	258.8	10.582	0.0019	0.0080	87.83	10.339	607.9	141.4	11.98
-22	1.2491	0.8285	1.1785	255.3	10.625	0.0019	0.0077	87.37	10.414	603.2	141.4	11.83
-21	1.2521	0.8326	1.1798	251.9	10.668	0.0019	0.0075	86.92	10.489	598.5	141.4	11.67
-20	1.2552	0.8368	1.1811	248.5	10.711	0.0019	0.0072	86.47	10.564	593.8	141.4	11.52
-19	1.2583	0.8409	1.1825	245.2	10.754	0.0019	0.0070	86.02	10.640	589.1	141.4	11.36
-18	1.2614	0.8452	1.1838	241.9	10.796	0.0018	0.0068	85.57	10.717	584.5	141.3	11.21
-17	1.2646	0.8494	1.1853	238.7	10.839	0.0018	0.0066	85.12	10.794	579.8	141.3	11.06
-16	1.2678	0.8537	1.1868	235.5	10.882	0.0018	0.0064	84.67	10.871	575.1	141.3	10.90
-15	1.2711	0.8581	1.1883	232.4	10.925	0.0018	0.0062	84.22	10.949	570.4	141.3	10.75
-14	1.2744	0.8625	1.1899	229.3	10.968	0.0018	0.0060	83.78	11.027	565.7	141.2	10.60
-13	1.2778	0.8669	1.1915	226.3	11.011	0.0018	0.0058	83.33	11.106	561.0	141.2	10.45
-12	1.2813	0.8714	1.1932	223.3	11.054	0.0017	0.0056	82.89	11.185	556.3	141.1	10.30
-11	1.2848	0.8760	1.1950	220.4	11.096	0.0017	0.0054	82.44	11.265	551.6	141.0	10.15
-10	1.2883	0.8806	1.1968	217.5	11.139	0.0017	0.0053	82.00	11.346	546.9	141.0	10.00
-9	1.2919	0.8853	1.1986	214.7	11.182	0.0017	0.0051	81.56	11.427	542.2	140.9	9.85
-8	1.2956	0.8900	1.2005	211.9	11.224	0.0017	0.0049	81.12	11.509	537.5	140.8	9.70
-7	1.2993	0.8947	1.2025	209.1	11.267	0.0016	0.0048	80.68	11.591	532.8	140.7	9.55
-6	1.3031	0.8996	1.2045	206.4	11.310	0.0016	0.0047	80.24	11.674	528.1	140.6	9.40
-5	1.3069	0.9045	1.2066	203.7	11.352	0.0016	0.0045	79.81	11.758	523.4	140.5	9.26
-4	1.3108	0.9094	1.2088	201.0	11.395	0.0016	0.0044	79.37	11.842	518.7	140.4	9.11
-3	1.3148	0.9144	1.2111	198.4	11.438	0.0016	0.0043	78.94	11.928	514.0	140.3	8.96
-2	1.3188	0.9195	1.2134	195.9	11.480	0.0016	0.0041	78.50	12.014	509.3	140.1	8.82
-1	1.3230	0.9247	1.2158	193.3	11.523	0.0016	0.0040	78.07	12.101	504.6	140.0	8.67
0	1.3272	0.9299	1.2183	190.8	11.565	0.0015	0.0039	77.64	12.188	499.8	139.9	8.53
1	1.3315	0.9352	1.2209	188.3	11.608	0.0015	0.0038	77.21	12.277	495.1	139.7	8.38
2	1.3358	0.9406	1.2236	185.9	11.650	0.0015	0.0037	76.78	12.367	490.4	139.5	8.24
3	1.3403	0.9461	1.2264	183.5	11.692	0.0015	0.0036	76.35	12.457	485.6	139.4	8.10
4	1.3448	0.9516	1.2293	181.1	11.735	0.0015	0.0035	75.93	12.549	480.9	139.2	7.95
5	1.3494	0.9573	1.2322	178.7	11.777	0.0015	0.0034	75.50	12.642	476.2	139.0	7.81
6	1.3541	0.9631	1.2353	176.4	11.820	0.0014	0.0033	75.08	12.735	471.4	138.8	7.67
7	1.3590	0.9690	1.2386	174.1	11.862	0.0014	0.0032	74.65	12.830	466.7	138.6	7.53
8	1.3639	0.9750	1.2419	171.8	11.907	0.0014	0.0031	74.23	12.926	461.9	138.4	7.39
9	1.3689	0.9811	1.2454	169.6	11.954	0.0014	0.0030	73.81	13.024	457.2	138.2	7.25
10	1.3740	0.9874	1.2490	167.4	12.001	0.0014	0.0030	73.39	13.122	452.4	137.9	7.11
11	1.3793	0.9938	1.2527	165.2	12.048	0.0014	0.0029	72.97	13.222	447.6	137.7	6.97
12	1.3847	1.0003	1.2566	163.0	12.095	0.0014	0.0028	72.55	13.324	442.9	137.5	6.84
13	1.3901	1.0071	1.2606	160.9	12.142	0.0014	0.0027	72.13	13.427	438.1	137.2	6.70
14	1.3958	1.0140	1.2649	158.8	12.190	0.0013	0.0027	71.71	13.531	433.3	136.9	6.56
15	1.4015	1.0211	1.2692	156.7	12.238	0.0013	0.0026	71.30	13.637	428.5	136.7	6.43
16	1.4074	1.0284	1.2738	154.6	12.286	0.0013	0.0025	70.88	13.745	423.7	136.4	6.29
17	1.4135	1.0359	1.2785	152.6	12.334	0.0013	0.0025	70.47	13.855	418.9	136.1	6.16

Opteon™ XP44 (R-452A)  
Saturation Properties - Transport Properties Table

Temp °C	Heat Capacity, $c_p$ [kJ/kg-K]		$c_p/c_v$ Vapor	Viscosity [ $\mu$ Pa-sec]		Kinematic Viscosity [cm <sup>2</sup> /sec]		Thermal Conductivity [mW/m-K]		Vel. of Sound [m/sec]		Surface Tension [mN/m]
	Liquid	Vapor		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	
18	1.4197	1.0436	1.2835	150.5	12.383	0.0013	0.0024	70.06	13.967	414.1	135.8	6.02
19	1.4261	1.0515	1.2886	148.5	12.437	0.0013	0.0023	69.65	14.080	409.3	135.5	5.89
20	1.4326	1.0597	1.2940	146.6	12.500	0.0013	0.0023	69.24	14.196	404.5	135.1	5.76
21	1.4394	1.0682	1.2996	144.6	12.564	0.0013	0.0022	68.83	14.314	399.7	134.8	5.63
22	1.4463	1.0770	1.3054	142.6	12.629	0.0012	0.0022	68.42	14.434	394.8	134.5	5.49
23	1.4535	1.0860	1.3115	140.7	12.694	0.0012	0.0021	68.01	14.556	390.0	134.1	5.36
24	1.4609	1.0954	1.3179	138.8	12.760	0.0012	0.0021	67.61	14.681	385.2	133.8	5.23
25	1.4685	1.1051	1.3245	136.9	12.827	0.0012	0.0020	67.20	14.809	380.3	133.4	5.10
26	1.4764	1.1152	1.3315	135.0	12.895	0.0012	0.0020	66.80	14.939	375.4	133.0	4.98
27	1.4845	1.1256	1.3387	133.2	12.964	0.0012	0.0019	66.39	15.073	370.6	132.6	4.85
28	1.4930	1.1365	1.3463	131.3	13.034	0.0012	0.0019	65.99	15.212	365.7	132.2	4.72
29	1.5017	1.1477	1.3543	129.5	13.105	0.0012	0.0018	65.59	15.355	360.8	131.8	4.60
30	1.5108	1.1594	1.3626	127.7	13.178	0.0012	0.0018	65.19	15.501	355.9	131.3	4.47
31	1.5202	1.1716	1.3713	125.9	13.252	0.0011	0.0017	64.79	15.652	350.9	130.9	4.35
32	1.5300	1.1843	1.3805	124.1	13.328	0.0011	0.0017	64.39	15.807	346.0	130.5	4.22
33	1.5401	1.1976	1.3901	122.3	13.406	0.0011	0.0017	63.99	15.967	341.0	130.0	4.10
34	1.5508	1.2114	1.4002	120.6	13.485	0.0011	0.0016	63.59	16.132	336.0	129.5	3.98
35	1.5618	1.2259	1.4108	118.8	13.567	0.0011	0.0016	63.19	16.302	331.0	129.0	3.86
36	1.5734	1.2410	1.4219	117.1	13.650	0.0011	0.0015	62.80	16.477	326.0	128.5	3.73
37	1.5855	1.2568	1.4337	115.4	13.736	0.0011	0.0015	62.40	16.658	320.9	128.0	3.62
38	1.5982	1.2734	1.4461	113.7	13.824	0.0011	0.0015	62.01	16.846	315.8	127.5	3.50
39	1.6115	1.2908	1.4592	112.0	13.915	0.0011	0.0014	61.61	17.040	310.7	126.9	3.38
40	1.6255	1.3090	1.4731	110.3	14.008	0.0011	0.0014	61.22	17.241	305.6	126.4	3.26
41	1.6403	1.3283	1.4878	108.6	14.104	0.0010	0.0014	60.83	17.449	300.4	125.8	3.15
42	1.6558	1.3485	1.5033	106.9	14.204	0.0010	0.0013	60.43	17.666	295.1	125.2	3.03
43	1.6722	1.3699	1.5198	105.2	14.306	0.0010	0.0013	60.04	17.891	289.9	124.6	2.92
44	1.6896	1.3925	1.5374	103.6	14.412	0.0010	0.0013	59.65	18.125	284.5	124.0	2.80
45	1.7080	1.4165	1.5561	101.9	14.522	0.0010	0.0013	59.26	18.368	279.2	123.3	2.69
46	1.7276	1.4418	1.5761	100.3	14.636	0.0010	0.0012	58.87	18.623	273.8	122.7	2.58
47	1.7485	1.4688	1.5975	98.6	14.754	0.0010	0.0012	58.48	18.888	268.3	122.0	2.47
48	1.7708	1.4976	1.6204	97.0	14.877	0.0010	0.0012	58.09	19.166	262.8	121.3	2.36
49	1.7948	1.5284	1.6450	95.3	15.005	0.0010	0.0012	57.70	19.457	257.2	120.6	2.25
50	1.8205	1.5613	1.6715	93.7	15.138	0.0010	0.0011	57.31	19.762	251.6	119.9	2.14
51	1.8483	1.5967	1.7001	92.1	15.277	0.0009	0.0011	56.92	20.083	245.9	119.2	2.04
52	1.8783	1.6348	1.7312	90.4	15.422	0.0009	0.0011	56.54	20.421	240.2	118.4	1.93
53	1.9110	1.6760	1.7649	88.8	15.575	0.0009	0.0011	56.15	20.777	234.4	117.6	1.83
54	1.9468	1.7207	1.8017	87.1	15.734	0.0009	0.0010	55.77	21.153	228.5	116.8	1.73
55	1.9860	1.7695	1.8419	85.5	15.902	0.0009	0.0010	55.38	21.551	222.6	116.0	1.63
56	2.0293	1.8228	1.8862	83.8	16.079	0.0009	0.0010	55.00	21.974	216.6	115.2	1.53
57	2.0775	1.8815	1.9351	82.1	16.266	0.0009	0.0010	54.62	22.424	210.5	114.3	1.43
58	2.1313	1.9465	1.9895	80.4	16.464	0.0009	0.0009	54.25	22.905	204.4	113.4	1.33
59	2.1919	2.0187	2.0501	78.7	16.675	0.0009	0.0009	53.88	23.419	198.1	112.5	1.24
60	2.2608	2.0997	2.1184	77.0	16.899	0.0009	0.0009	53.51	23.971	191.8	111.5	1.14
61	2.3399	2.1911	2.1956	75.2	17.139	0.0009	0.0009	53.16	24.566	185.4	110.5	1.05
62	2.4315	2.2952	2.2839	73.5	17.396	0.0008	0.0009	52.81	25.211	178.9	109.5	0.96
63	2.5392	2.4150	2.3856	71.7	17.674	0.0008	0.0009	52.48	25.913	172.4	108.5	0.87
64	2.6674	2.5543	2.5042	69.8	17.976	0.0008	0.0008	52.16	26.682	165.7	107.4	0.79
65	2.8230	2.7187	2.6442	67.9	18.305	0.0008	0.0008	51.88	27.530	158.8	106.3	0.70
66	3.0156	2.9157	2.8120	65.9	18.668	0.0008	0.0008	51.63	28.472	151.9	105.2	0.62
67	3.2603	3.1562	3.0170	63.9	19.070	0.0008	0.0008	51.44	29.530	144.7	104.0	0.54
68	3.5815	3.4570	3.2731	61.8	19.522	0.0008	0.0008	51.32	30.733	137.4	102.7	0.46
69	4.0210	3.8443	3.6024	59.5	20.037	0.0008	0.0007	51.32	32.123	130.0	101.5	0.39
70	4.6571	4.3625	4.0418	57.2	20.635	0.0008	0.0007	51.27	33.763	122.3	100.1	0.31

Opteon™ XP44 (R-452A)  
Superheated Vapor - Viscosity Table

Viscosity in  $\mu\text{Pa}\cdot\text{sec}$

Saturation Properties in Light Blue

Temp °C	ABSOLUTE PRESSURE, kPa												
	50	101.325	200	300	400	500	600	800	1000	1500	2000	2500	3000
	-56.9 °C	-43.2 °C	-28.0 °C	-17.8 °C	-10.0 °C	-3.5 °C	2.1 °C	11.3 °C	18.9 °C	33.9 °C	45.4 °C	54.8 °C	62.7 °C
	9.117	9.709	10.366	10.805	11.141	11.417	11.652	12.062	12.432	13.475	14.563	15.863	17.597
-55	9.198												
-50	9.415												
-45	9.632												
-40	9.848	9.848											
-35	10.064	10.064											
-30	10.280	10.280											
-25	10.496	10.496	10.496										
-20	10.711	10.711	10.711										
-15	10.925	10.925	10.925	10.925									
-10	11.139	11.139	11.139	11.139									
-5	11.352	11.352	11.352	11.352	11.352								
0	11.565	11.565	11.565	11.565	11.565	11.565							
5	11.777	11.777	11.777	11.777	11.777	11.777	11.777						
10	11.989	11.989	11.989	11.989	11.989	11.989	11.989						
15	12.199	12.199	12.199	12.199	12.199	12.199	12.204	12.224					
20	12.409	12.409	12.409	12.409	12.410	12.414	12.421	12.441	12.484				
25	12.618	12.618	12.618	12.620	12.623	12.629	12.636	12.657	12.720				
30	12.827	12.827	12.828	12.831	12.836	12.842	12.850	12.876	12.953				
35	13.035	13.035	13.038	13.042	13.047	13.053	13.062	13.107	13.181	13.520			
40	13.242	13.243	13.246	13.251	13.257	13.264	13.282	13.333	13.405	13.722			
45	13.448	13.450	13.454	13.459	13.468	13.484	13.503	13.556	13.627	13.928			
50	13.653	13.655	13.661	13.670	13.684	13.701	13.721	13.775	13.847	14.135	14.687		
55	13.858	13.861	13.870	13.882	13.897	13.915	13.937	13.992	14.064	14.342	14.842	15.860	
60	14.063	14.067	14.078	14.091	14.108	14.127	14.150	14.207	14.279	14.549	15.010	15.851	
65	14.266	14.271	14.284	14.299	14.317	14.338	14.362	14.420	14.493	14.756	15.186	15.915	17.383
70	14.468	14.475	14.488	14.505	14.524	14.547	14.572	14.631	14.704	14.962	15.368	16.018	17.165
75	14.669	14.677	14.692	14.710	14.731	14.754	14.780	14.840	14.914	15.167	15.553	16.145	17.106
80	14.870	14.878	14.894	14.914	14.935	14.959	14.986	15.048	15.122	15.372	15.741	16.287	17.125
85	15.069	15.078	15.095	15.116	15.138	15.164	15.191	15.254	15.329	15.575	15.930	16.440	17.188
90	15.267	15.276	15.295	15.317	15.340	15.366	15.395	15.459	15.534	15.777	16.119	16.599	17.280
95	15.465	15.474	15.494	15.517	15.541	15.568	15.597	15.662	15.737	15.978	16.310	16.765	17.391
100	15.661	15.671	15.692	15.715	15.741	15.768	15.797	15.863	15.939	16.177	16.500	16.934	17.517
105	15.856	15.867	15.889	15.913	15.939	15.967	15.997	16.064	16.140	16.376	16.690	17.106	17.653
110	16.051	16.062	16.084	16.109	16.136	16.165	16.195	16.262	16.339	16.573	16.880	17.280	17.796
115	16.244	16.256	16.279	16.305	16.332	16.361	16.392	16.460	16.537	16.769	17.070	17.455	17.946
120	16.436	16.448	16.473	16.499	16.527	16.556	16.588	16.656	16.733	16.964	17.259	17.632	18.100
125	16.628	16.640	16.665	16.692	16.720	16.750	16.782	16.851	16.928	17.157	17.447	17.809	18.258
130	16.818	16.831	16.856	16.884	16.913	16.943	16.975	17.045	17.122	17.350	17.635	17.986	18.418
135	17.008	17.021	17.047	17.075	17.104	17.135	17.168	17.238	17.315	17.541	17.821	18.164	18.580
140	17.197	17.210	17.236	17.265	17.294	17.326	17.359	17.429	17.506	17.732	18.007	18.342	18.744
145	17.384	17.398	17.425	17.454	17.484	17.515	17.549	17.619	17.697	17.921	18.193	18.520	18.909
150	17.571	17.585	17.612	17.642	17.672	17.704	17.737	17.809	17.886	18.109	18.377	18.697	19.076
155	17.757	17.771	17.799	17.828	17.859	17.892	17.925	17.997	18.074	18.295	18.560	18.874	19.242
160	17.942	17.956	17.985	18.014	18.046	18.078	18.112	18.184	18.261	18.481	18.743	19.051	19.410
165	18.126	18.141	18.169	18.199	18.231	18.263	18.297	18.369	18.447	18.666	18.925	19.227	19.577
170	18.310	18.324	18.353	18.383	18.415	18.448	18.482	18.554	18.632	18.850	19.105	19.402	19.745
175	18.492	18.507	18.536	18.567	18.598	18.631	18.666	18.738	18.815	19.032	19.285	19.577	19.913
180	18.673	18.688	18.718	18.749	18.781	18.814	18.848	18.921	18.998	19.214	19.464	19.752	20.080
185	18.854	18.869	18.899	18.930	18.962	18.996	19.030	19.103	19.180	19.395	19.642	19.926	20.248
190	19.034	19.049	19.079	19.110	19.143	19.176	19.211	19.283	19.361	19.574	19.820	20.099	20.415
195	19.213	19.228	19.258	19.290	19.322	19.356	19.391	19.463	19.540	19.753	19.996	20.272	20.582
200	19.391	19.406	19.437	19.468	19.501	19.535	19.570	19.642	19.719	19.931	20.172	20.444	20.749
205	19.568	19.584	19.614	19.646	19.679	19.713	19.748	19.820	19.897	20.108	20.346	20.615	20.915
210	19.745	19.761	19.791	19.823	19.856	19.890	19.925	19.997	20.074	20.284	20.520	20.786	21.081
215	19.921	19.936	19.967	19.999	20.032	20.066	20.101	20.174	20.250	20.459	20.693	20.955	21.246
220	20.096	20.111	20.142	20.174	20.207	20.241	20.276	20.349	20.425	20.633	20.866	21.125	21.411
225	20.270	20.286	20.317	20.349	20.382	20.416	20.451	20.523	20.600	20.806	21.037	21.293	21.576
230	20.443	20.459	20.490	20.522	20.556	20.590	20.625	20.697	20.773	20.979	21.208	21.461	21.740
235	20.616	20.632	20.663	20.695	20.729	20.763	20.798	20.870	20.946	21.150	21.378	21.628	21.903
240	20.788	20.804	20.835	20.867	20.901	20.935	20.970	21.042	21.117	21.321	21.547	21.795	22.066
245	20.959	20.975	21.006	21.039	21.072	21.106	21.141	21.213	21.288	21.491	21.715	21.961	22.229
250	21.129	21.145	21.177	21.209	21.243	21.277	21.312	21.384	21.459	21.660	21.883	22.126	22.391
255	21.299	21.315	21.347	21.379	21.412	21.446	21.481	21.553	21.628	21.829	22.050	22.291	22.552
260	21.468	21.484	21.516	21.548	21.582	21.616	21.650	21.722	21.797	21.997	22.216	22.454	22.713
265	21.636	21.653	21.684	21.717	21.750	21.784	21.819	21.890	21.965	22.164	22.381	22.618	22.873
270	21.804	21.820	21.852	21.884	21.918	21.951	21.986	22.058	22.132	22.330	22.546	22.780	23.033
275	21.971	21.987	22.019	22.051	22.084	22.118	22.153	22.224	22.298	22.495	22.710	22.942	23.193
280	22.137	22.153	22.185	22.217	22.251	22.285	22.319	22.390	22.464	22.660	22.873	23.104	23.351

Opteon™ XP44 (R-452A)  
Superheated Vapor - Heat Capacity Table

Heat Capacity,  $C_p$ , in kJ/kg-K

Saturation Properties in Light Blue

Temp °C	ABSOLUTE PRESSURE, kPa												
	50	101.325	200	300	400	500	600	800	1000	1500	2000	2500	3000
	-56.9 °C	-43.2 °C	-28.0 °C	-17.8 °C	-10.0 °C	-3.5 °C	2.1 °C	11.3 °C	18.9 °C	33.9 °C	45.4 °C	54.8 °C	62.7 °C
	0.7067	0.7501	0.8048	0.8460	0.8808	0.9119	0.9408	0.9957	1.0509	1.2097	1.4256	1.7581	2.3810
-55	0.7085												
-50	0.7140												
-45	0.7204												
-40	0.7272	0.7517											
-35	0.7343	0.7555											
-30	0.7416	0.7602											
-25	0.7492	0.7657	0.8041										
-20	0.7568	0.7716	0.8049										
-15	0.7646	0.7779	0.8071	0.8438									
-10	0.7724	0.7845	0.8105	0.8419									
-5	0.7803	0.7913	0.8146	0.8421	0.8749								
0	0.7882	0.7982	0.8193	0.8436	0.8719	0.9056							
5	0.7962	0.8054	0.8245	0.8462	0.8710	0.8997	0.9338						
10	0.8042	0.8126	0.8300	0.8496	0.8715	0.8965	0.9255						
15	0.8121	0.8199	0.8358	0.8536	0.8732	0.8953	0.9204	0.9834					
20	0.8201	0.8273	0.8419	0.8580	0.8758	0.8955	0.9176	0.9714	1.0455				
25	0.8281	0.8347	0.8482	0.8629	0.8790	0.8968	0.9164	0.9632	1.0251				
30	0.8361	0.8422	0.8546	0.8681	0.8828	0.8989	0.9165	0.9577	1.0104				
35	0.8440	0.8497	0.8612	0.8736	0.8871	0.9016	0.9175	0.9542	0.9998	1.1968			
40	0.8520	0.8572	0.8679	0.8794	0.8917	0.9050	0.9194	0.9522	0.9921	1.1512			
45	0.8599	0.8648	0.8746	0.8853	0.8966	0.9088	0.9219	0.9514	0.9867	1.1187			
50	0.8677	0.8723	0.8815	0.8913	0.9018	0.9130	0.9249	0.9517	0.9831	1.0949	1.3226		
55	0.8756	0.8798	0.8884	0.8975	0.9072	0.9175	0.9285	0.9528	0.9809	1.0772	1.2516	1.7423	
60	0.8833	0.8873	0.8953	0.9038	0.9128	0.9223	0.9324	0.9546	0.9799	1.0639	1.2034	1.5084	
65	0.8911	0.8948	0.9023	0.9102	0.9186	0.9274	0.9367	0.9570	0.9800	1.0539	1.1690	1.3843	2.0251
70	0.8988	0.9023	0.9093	0.9167	0.9245	0.9326	0.9413	0.9599	0.9809	1.0466	1.1437	1.3070	1.6647
75	0.9064	0.9097	0.9162	0.9232	0.9305	0.9381	0.9461	0.9633	0.9824	1.0414	1.1247	1.2544	1.4934
80	0.9140	0.9171	0.9232	0.9297	0.9365	0.9436	0.9511	0.9670	0.9846	1.0378	1.1104	1.2168	1.3920
85	0.9215	0.9244	0.9302	0.9363	0.9427	0.9493	0.9563	0.9711	0.9873	1.0356	1.0995	1.1890	1.3249
90	0.9289	0.9317	0.9372	0.9429	0.9489	0.9551	0.9616	0.9754	0.9904	1.0344	1.0913	1.1680	1.2777
95	0.9363	0.9389	0.9441	0.9495	0.9551	0.9610	0.9670	0.9799	0.9938	1.0342	1.0852	1.1519	1.2430
100	0.9436	0.9461	0.9510	0.9561	0.9614	0.9669	0.9726	0.9846	0.9975	1.0347	1.0809	1.1396	1.2168
105	0.9509	0.9532	0.9579	0.9627	0.9677	0.9729	0.9782	0.9895	1.0016	1.0359	1.0778	1.1300	1.1967
110	0.9581	0.9603	0.9647	0.9693	0.9740	0.9789	0.9839	0.9945	1.0058	1.0376	1.0759	1.1227	1.1810
115	0.9652	0.9673	0.9715	0.9758	0.9803	0.9849	0.9897	0.9996	1.0102	1.0398	1.0750	1.1172	1.1688
120	0.9723	0.9743	0.9782	0.9824	0.9866	0.9910	0.9954	1.0048	1.0147	1.0424	1.0748	1.1132	1.1592
125	0.9792	0.9812	0.9849	0.9888	0.9929	0.9970	1.0012	1.0101	1.0194	1.0453	1.0753	1.1103	1.1517
130	0.9862	0.9880	0.9916	0.9953	0.9991	1.0030	1.0071	1.0154	1.0242	1.0484	1.0763	1.1085	1.1460
135	0.9930	0.9947	0.9982	1.0017	1.0053	1.0091	1.0129	1.0208	1.0291	1.0519	1.0778	1.1075	1.1416
140	0.9998	1.0014	1.0047	1.0081	1.0115	1.0151	1.0187	1.0262	1.0341	1.0555	1.0797	1.1071	1.1384
145	1.0064	1.0080	1.0112	1.0144	1.0177	1.0211	1.0245	1.0316	1.0391	1.0593	1.0819	1.1074	1.1362
150	1.0131	1.0146	1.0176	1.0206	1.0238	1.0270	1.0303	1.0371	1.0442	1.0632	1.0845	1.1082	1.1348
155	1.0196	1.0211	1.0239	1.0269	1.0299	1.0329	1.0361	1.0425	1.0492	1.0673	1.0873	1.1094	1.1341
160	1.0261	1.0275	1.0302	1.0330	1.0359	1.0388	1.0418	1.0480	1.0544	1.0715	1.0903	1.1111	1.1339
165	1.0324	1.0338	1.0364	1.0391	1.0419	1.0447	1.0475	1.0534	1.0595	1.0757	1.0935	1.1130	1.1343
170	1.0388	1.0401	1.0426	1.0452	1.0478	1.0505	1.0532	1.0588	1.0646	1.0801	1.0969	1.1152	1.1352
175	1.0450	1.0462	1.0487	1.0512	1.0537	1.0563	1.0589	1.0642	1.0698	1.0845	1.1004	1.1177	1.1364
180	1.0512	1.0524	1.0547	1.0571	1.0595	1.0620	1.0645	1.0696	1.0749	1.0889	1.1040	1.1203	1.1379
185	1.0573	1.0584	1.0606	1.0629	1.0653	1.0676	1.0701	1.0750	1.0800	1.0934	1.1078	1.1232	1.1397
190	1.0633	1.0644	1.0665	1.0687	1.0710	1.0733	1.0756	1.0803	1.0852	1.0979	1.1116	1.1262	1.1418
195	1.0692	1.0703	1.0723	1.0745	1.0766	1.0788	1.0811	1.0856	1.0902	1.1024	1.1155	1.1293	1.1441
200	1.0751	1.0761	1.0781	1.0802	1.0822	1.0844	1.0865	1.0908	1.0953	1.1070	1.1194	1.1326	1.1466
205	1.0809	1.0819	1.0838	1.0858	1.0878	1.0898	1.0919	1.0961	1.1003	1.1115	1.1234	1.1360	1.1492
210	1.0866	1.0875	1.0894	1.0913	1.0933	1.0952	1.0972	1.1012	1.1054	1.1161	1.1274	1.1394	1.1520
215	1.0922	1.0932	1.0950	1.0968	1.0987	1.1006	1.1025	1.1064	1.1103	1.1206	1.1315	1.1429	1.1549
220	1.0978	1.0987	1.1004	1.1022	1.1040	1.1059	1.1077	1.1114	1.1153	1.1252	1.1356	1.1465	1.1579
225	1.1033	1.1042	1.1059	1.1076	1.1093	1.1111	1.1129	1.1165	1.1202	1.1297	1.1397	1.1501	1.1610
230	1.1087	1.1096	1.1112	1.1129	1.1146	1.1163	1.1180	1.1215	1.1250	1.1342	1.1438	1.1538	1.1642
235	1.1141	1.1149	1.1165	1.1181	1.1197	1.1214	1.1231	1.1264	1.1298	1.1387	1.1479	1.1575	1.1675
240	1.1194	1.1202	1.1217	1.1233	1.1249	1.1265	1.1281	1.1313	1.1346	1.1431	1.1520	1.1612	1.1708
245	1.1246	1.1254	1.1269	1.1284	1.1299	1.1315	1.1330	1.1362	1.1394	1.1476	1.1561	1.1650	1.1741
250	1.1298	1.1305	1.1320	1.1334	1.1349	1.1364	1.1379	1.1410	1.1441	1.1520	1.1602	1.1687	1.1775
255	1.1349	1.1356	1.1370	1.1384	1.1399	1.1413	1.1428	1.1457	1.1487	1.1564	1.1643	1.1725	1.1809
260	1.1399	1.1406	1.1419	1.1433	1.1447	1.1461	1.1475	1.1504	1.1533	1.1607	1.1684	1.1763	1.1844
265	1.1448	1.1455	1.1468	1.1482	1.1495	1.1509	1.1523	1.1551	1.1579	1.1650	1.1724	1.1800	1.1878
270	1.1497	1.1504	1.1517	1.1530	1.1543	1.1556	1.1570	1.1597	1.1624	1.1693	1.1765	1.1838	1.1913
275	1.1546	1.1552	1.1565	1.1577	1.1590	1.1603	1.1616	1.1642	1.1668	1.1736	1.1805	1.1876	1.1948
280	1.1593	1.1600	1.1612	1.1624	1.1636	1.1649	1.1662	1.1687	1.1712	1.1778	1.1845	1.1913	1.1983

Opteon™ XP44 (R-452A)  
Superheated Vapor - Heat Capacity Ratio Table

Heat Capacity Ratio,  $C_p/C_v$

Saturation Properties in Light Blue

Temp °C	ABSOLUTE PRESSURE, kPa												
	50	101.325	200	300	400	500	600	800	1000	1500	2000	2500	3000
	-56.9 °C	-43.2 °C	-28.0 °C	-17.8 °C	-10.0 °C	-3.5 °C	2.1 °C	11.3 °C	18.9 °C	33.9 °C	45.4 °C	54.8 °C	62.7 °C
-55	1.1539	1.1596	1.1717	1.1841	1.1968	1.2100	1.2237	1.2539	1.2882	1.3989	1.5633	1.8325	2.3567
-50	1.1522												
-45	1.1480												
-40	1.1442												
-35	1.1408	1.1560											
-30	1.1377	1.1510											
-25	1.1348	1.1466											
-20	1.1321	1.1427	1.1672										
-15	1.1295	1.1391	1.1606										
-10	1.1272	1.1358	1.1549	1.1790									
-5	1.1249	1.1327	1.1498	1.1708									
0	1.1228	1.1299	1.1453	1.1638	1.1863								
5	1.1209	1.1273	1.1412	1.1577	1.1773	1.2011							
10	1.1190	1.1249	1.1375	1.1523	1.1696	1.1901	1.2149						
15	1.1172	1.1226	1.1341	1.1475	1.1628	1.1808	1.2021						
20	1.1155	1.1205	1.1310	1.1431	1.1568	1.1727	1.1912	1.2394					
25	1.1138	1.1185	1.1281	1.1391	1.1515	1.1656	1.1818	1.2229	1.2823				
30	1.1123	1.1166	1.1255	1.1355	1.1467	1.1593	1.1737	1.2091	1.2582				
35	1.1108	1.1148	1.1230	1.1321	1.1423	1.1537	1.1665	1.1974	1.2387				
40	1.1094	1.1130	1.1206	1.1291	1.1384	1.1487	1.1601	1.1874	1.2226	1.3858			
45	1.1080	1.1114	1.1185	1.1262	1.1347	1.1441	1.1544	1.1786	1.2091	1.3383			
50	1.1067	1.1099	1.1164	1.1236	1.1314	1.1399	1.1493	1.1709	1.1976	1.3031			
55	1.1054	1.1084	1.1145	1.1211	1.1283	1.1362	1.1447	1.1641	1.1876	1.2759	1.4662		
60	1.1042	1.1070	1.1127	1.1188	1.1255	1.1327	1.1405	1.1580	1.1790	1.2541	1.3980	1.8185	
65	1.1030	1.1056	1.1109	1.1167	1.1229	1.1295	1.1366	1.1526	1.1714	1.2363	1.3501	1.6089	
70	1.1018	1.1043	1.1093	1.1147	1.1204	1.1265	1.1331	1.1477	1.1646	1.2214	1.3144	1.4956	2.0473
75	1.1008	1.1031	1.1078	1.1128	1.1181	1.1238	1.1299	1.1433	1.1586	1.2088	1.2865	1.4229	1.7302
80	1.0997	1.1019	1.1063	1.1110	1.1160	1.1213	1.1269	1.1392	1.1532	1.1979	1.2642	1.3716	1.5761
85	1.0987	1.1007	1.1049	1.1093	1.1140	1.1189	1.1241	1.1355	1.1483	1.1884	1.2457	1.3333	1.4822
90	1.0977	1.0996	1.1035	1.1077	1.1121	1.1167	1.1215	1.1321	1.1438	1.1801	1.2302	1.3033	1.4181
95	1.0967	1.0986	1.1023	1.1062	1.1103	1.1146	1.1191	1.1289	1.1397	1.1727	1.2170	1.2791	1.3711
100	1.0958	1.0975	1.1010	1.1047	1.1086	1.1126	1.1169	1.1260	1.1360	1.1661	1.2056	1.2591	1.3349
105	1.0949	1.0966	1.0999	1.1033	1.1070	1.1108	1.1148	1.1233	1.1326	1.1601	1.1956	1.2424	1.3061
110	1.0940	1.0956	1.0987	1.1020	1.1055	1.1091	1.1128	1.1207	1.1294	1.1547	1.1868	1.2281	1.2826
115	1.0932	1.0947	1.0976	1.1008	1.1040	1.1074	1.1109	1.1184	1.1265	1.1499	1.1790	1.2157	1.2630
120	1.0924	1.0938	1.0966	1.0996	1.1027	1.1058	1.1092	1.1162	1.1237	1.1454	1.1720	1.2049	1.2463
125	1.0916	1.0929	1.0956	1.0984	1.1013	1.1044	1.1075	1.1141	1.1212	1.1413	1.1657	1.1954	1.2321
130	1.0908	1.0921	1.0946	1.0973	1.1001	1.1030	1.1059	1.1121	1.1188	1.1376	1.1600	1.1870	1.2197
135	1.0900	1.0913	1.0937	1.0963	1.0989	1.1016	1.1044	1.1103	1.1166	1.1341	1.1548	1.1794	1.2088
140	1.0893	1.0905	1.0928	1.0953	1.0978	1.1003	1.1030	1.1086	1.1145	1.1309	1.1501	1.1726	1.1992
145	1.0886	1.0897	1.0920	1.0943	1.0967	1.0991	1.1016	1.1069	1.1125	1.1279	1.1457	1.1665	1.1906
150	1.0879	1.0890	1.0911	1.0934	1.0956	1.0980	1.1004	1.1054	1.1106	1.1251	1.1418	1.1609	1.1830
155	1.0873	1.0883	1.0903	1.0924	1.0946	1.0968	1.0991	1.1039	1.1089	1.1225	1.1381	1.1558	1.1760
160	1.0866	1.0876	1.0896	1.0916	1.0937	1.0958	1.0980	1.1025	1.1072	1.1201	1.1347	1.1511	1.1698
165	1.0860	1.0869	1.0888	1.0907	1.0927	1.0948	1.0968	1.1011	1.1056	1.1178	1.1315	1.1468	1.1641
170	1.0854	1.0863	1.0881	1.0899	1.0918	1.0938	1.0958	1.0999	1.1041	1.1157	1.1285	1.1429	1.1589
175	1.0848	1.0857	1.0874	1.0892	1.0910	1.0928	1.0947	1.0986	1.1027	1.1137	1.1258	1.1392	1.1541
180	1.0842	1.0850	1.0867	1.0884	1.0901	1.0919	1.0937	1.0975	1.1014	1.1118	1.1232	1.1358	1.1497
185	1.0836	1.0844	1.0860	1.0877	1.0894	1.0911	1.0928	1.0964	1.1001	1.1100	1.1208	1.1327	1.1456
190	1.0831	1.0839	1.0854	1.0870	1.0886	1.0902	1.0919	1.0953	1.0988	1.1083	1.1185	1.1297	1.1419
195	1.0825	1.0833	1.0848	1.0863	1.0878	1.0894	1.0910	1.0943	1.0977	1.1066	1.1164	1.1269	1.1384
200	1.0820	1.0827	1.0842	1.0856	1.0871	1.0886	1.0902	1.0933	1.0966	1.1051	1.1144	1.1244	1.1351
205	1.0815	1.0822	1.0836	1.0850	1.0864	1.0879	1.0894	1.0924	1.0955	1.1037	1.1125	1.1219	1.1321
210	1.0810	1.0817	1.0830	1.0844	1.0858	1.0872	1.0886	1.0915	1.0945	1.1023	1.1107	1.1196	1.1292
215	1.0805	1.0812	1.0825	1.0838	1.0851	1.0865	1.0878	1.0906	1.0935	1.1010	1.1090	1.1175	1.1266
220	1.0801	1.0807	1.0819	1.0832	1.0845	1.0858	1.0871	1.0898	1.0925	1.0997	1.1073	1.1155	1.1241
225	1.0796	1.0802	1.0814	1.0826	1.0839	1.0851	1.0864	1.0890	1.0916	1.0985	1.1058	1.1135	1.1217
230	1.0792	1.0798	1.0809	1.0821	1.0833	1.0845	1.0857	1.0882	1.0907	1.0974	1.1043	1.1117	1.1195
235	1.0787	1.0793	1.0804	1.0816	1.0827	1.0839	1.0850	1.0874	1.0899	1.0963	1.1030	1.1100	1.1174
240	1.0783	1.0789	1.0799	1.0810	1.0821	1.0833	1.0844	1.0867	1.0891	1.0952	1.1016	1.1084	1.1154
245	1.0779	1.0784	1.0795	1.0805	1.0816	1.0827	1.0838	1.0860	1.0883	1.0942	1.1004	1.1068	1.1135
250	1.0775	1.0780	1.0790	1.0800	1.0811	1.0821	1.0832	1.0854	1.0876	1.0932	1.0991	1.1053	1.1118
255	1.0771	1.0776	1.0786	1.0796	1.0806	1.0816	1.0826	1.0847	1.0868	1.0923	1.0980	1.1039	1.1101
260	1.0767	1.0772	1.0781	1.0791	1.0801	1.0811	1.0821	1.0841	1.0861	1.0914	1.0969	1.1026	1.1085
265	1.0763	1.0768	1.0777	1.0787	1.0796	1.0806	1.0815	1.0835	1.0854	1.0905	1.0958	1.1013	1.1069
270	1.0760	1.0764	1.0773	1.0782	1.0791	1.0801	1.0810	1.0829	1.0848	1.0897	1.0948	1.1000	1.1055
275	1.0756	1.0760	1.0769	1.0778	1.0787	1.0796	1.0805	1.0823	1.0842	1.0889	1.0938	1.0989	1.1041
280	1.0752	1.0757	1.0765	1.0774	1.0782	1.0791	1.0800	1.0818	1.0835	1.0881	1.0929	1.0977	1.1028
285	1.0749	1.0753	1.0761	1.0770	1.0778	1.0787	1.0795	1.0812	1.0830	1.0874	1.0920	1.0967	1.1015

Opteon™ XP44 (R-452A)  
Superheated Vapor - Thermal Conductivity Table

Thermal Conductivity in mW/m-K

Saturation Properties in Light Blue

Temp °C	ABSOLUTE PRESSURE, kPa												
	50	101.325	200	300	400	500	600	800	1000	1500	2000	2500	3000
	-56.9 °C	-43.2 °C	-28.0 °C	-17.8 °C	-10.0 °C	-3.5 °C	2.1 °C	11.3 °C	18.9 °C	33.9 °C	45.4 °C	54.8 °C	62.7 °C
-55	8.105												
-50	8.433												
-45	8.764												
-40	9.100	9.114											
-35	9.439	9.452											
-30	9.781	9.794											
-25	10.127	10.139	10.177										
-20	10.477	10.488	10.523										
-15	10.830	10.841	10.873	10.926									
-10	11.186	11.197	11.228	11.276									
-5	11.546	11.556	11.586	11.630	11.694								
0	11.909	11.919	11.947	11.989	12.047	12.126							
5	12.276	12.286	12.313	12.351	12.405	12.476	12.571						
10	12.646	12.656	12.682	12.718	12.768	12.833	12.917						
15	13.020	13.030	13.054	13.089	13.135	13.195	13.271	13.492					
20	13.397	13.407	13.431	13.464	13.507	13.562	13.632	13.827	14.134				
25	13.778	13.787	13.811	13.842	13.883	13.934	13.998	14.174	14.438				
30	14.162	14.171	14.194	14.225	14.263	14.311	14.370	14.529	14.761				
35	14.549	14.559	14.581	14.611	14.647	14.693	14.747	14.893	15.099	16.145			
40	14.940	14.950	14.972	15.000	15.035	15.078	15.129	15.264	15.454	16.339			
45	15.335	15.344	15.366	15.393	15.427	15.468	15.518	15.645	15.820	16.588			
50	15.733	15.742	15.764	15.791	15.825	15.865	15.912	16.033	16.195	16.874	18.353		
55	16.134	16.144	16.166	16.194	16.227	16.266	16.312	16.427	16.578	17.188	18.402	21.409	
60	16.540	16.550	16.573	16.601	16.633	16.672	16.717	16.827	16.969	17.524	18.554	20.708	
65	16.949	16.959	16.983	17.011	17.044	17.082	17.126	17.232	17.367	17.876	18.771	20.451	24.467
70	17.361	17.372	17.397	17.426	17.459	17.497	17.540	17.642	17.771	18.243	19.035	20.411	23.123
75	17.777	17.789	17.815	17.844	17.877	17.915	17.957	18.058	18.181	18.622	19.333	20.497	22.547
80	18.196	18.209	18.236	18.266	18.300	18.338	18.380	18.478	18.597	19.012	19.657	20.666	22.311
85	18.619	18.632	18.660	18.692	18.726	18.764	18.806	18.902	19.018	19.410	20.001	20.892	22.264
90	19.045	19.059	19.088	19.121	19.156	19.194	19.236	19.331	19.443	19.817	20.364	21.161	22.335
95	19.475	19.490	19.520	19.553	19.589	19.628	19.670	19.764	19.874	20.231	20.740	21.462	22.488
100	19.908	19.923	19.955	19.989	20.026	20.065	20.107	20.201	20.309	20.652	21.130	21.789	22.700
105	20.344	20.361	20.394	20.429	20.466	20.506	20.549	20.642	20.748	21.079	21.530	22.138	22.956
110	20.784	20.801	20.836	20.872	20.910	20.951	20.994	21.087	21.191	21.513	21.940	22.505	23.247
115	21.227	21.245	21.281	21.318	21.358	21.399	21.442	21.535	21.639	21.952	22.359	22.886	23.567
120	21.674	21.693	21.730	21.768	21.808	21.850	21.894	21.988	22.091	22.396	22.786	23.281	23.909
125	22.124	22.144	22.182	22.222	22.263	22.305	22.350	22.444	22.546	22.846	23.220	23.688	24.271
130	22.578	22.598	22.637	22.678	22.720	22.764	22.809	22.904	23.006	23.300	23.662	24.106	24.651
135	23.035	23.056	23.096	23.138	23.181	23.226	23.271	23.367	23.469	23.759	24.109	24.533	25.045
140	23.495	23.517	23.558	23.602	23.646	23.691	23.737	23.834	23.936	24.223	24.563	24.968	25.451
145	23.959	23.981	24.024	24.068	24.114	24.160	24.207	24.304	24.407	24.691	25.023	25.412	25.870
150	24.426	24.449	24.493	24.538	24.585	24.632	24.680	24.778	24.881	25.164	25.488	25.863	26.299
155	24.897	24.920	24.965	25.012	25.059	25.107	25.156	25.256	25.359	25.640	25.958	26.321	26.738
160	25.371	25.395	25.441	25.489	25.537	25.586	25.635	25.737	25.841	26.121	26.433	26.786	27.186
165	25.849	25.873	25.920	25.969	26.018	26.068	26.118	26.221	26.326	26.605	26.913	27.257	27.641
170	26.329	26.354	26.403	26.452	26.503	26.553	26.604	26.708	26.815	27.094	27.398	27.733	28.105
175	26.814	26.839	26.889	26.939	26.990	27.042	27.094	27.199	27.307	27.586	27.888	28.216	28.576
180	27.302	27.328	27.378	27.430	27.482	27.534	27.587	27.693	27.802	28.083	28.381	28.703	29.053
185	27.793	27.819	27.871	27.923	27.976	28.029	28.083	28.191	28.301	28.583	28.879	29.196	29.537
190	28.287	28.315	28.367	28.420	28.474	28.528	28.582	28.692	28.803	29.086	29.382	29.694	30.027
195	28.785	28.813	28.866	28.921	28.975	29.030	29.085	29.196	29.308	29.593	29.888	30.196	30.522
200	29.287	29.315	29.369	29.424	29.480	29.535	29.591	29.703	29.816	30.104	30.399	30.703	31.023
205	29.792	29.820	29.876	29.932	29.988	30.044	30.101	30.214	30.328	30.617	30.913	31.216	31.529
210	30.300	30.329	30.385	30.442	30.499	30.556	30.613	30.728	30.844	31.134	31.430	31.732	32.042
215	30.811	30.841	30.898	30.956	31.014	31.072	31.130	31.246	31.362	31.655	31.951	32.252	32.559
220	31.327	31.357	31.415	31.473	31.532	31.590	31.649	31.766	31.884	32.179	32.475	32.776	33.080
225	31.845	31.876	31.934	31.994	32.053	32.113	32.172	32.291	32.409	32.706	33.003	33.303	33.605
230	32.367	32.398	32.458	32.518	32.578	32.638	32.698	32.818	32.938	33.236	33.534	33.833	34.134
235	32.892	32.924	32.984	33.045	33.106	33.167	33.228	33.349	33.469	33.770	34.069	34.367	34.666
240	33.421	33.453	33.514	33.576	33.638	33.699	33.760	33.883	34.004	34.306	34.606	34.904	35.202
245	33.953	33.985	34.047	34.110	34.172	34.235	34.297	34.420	34.543	34.846	35.147	35.444	35.740
250	34.489	34.521	34.584	34.648	34.711	34.773	34.836	34.960	35.084	35.389	35.690	35.986	36.279
255	35.028	35.061	35.124	35.188	35.252	35.316	35.379	35.504	35.629	35.936	36.237	36.532	36.824
260	35.570	35.604	35.668	35.733	35.797	35.861	35.925	36.052	36.178	36.487	36.790	37.087	37.379
265	36.116	36.150	36.215	36.280	36.346	36.410	36.475	36.603	36.730	37.042	37.346	37.645	37.938
270	36.665	36.699	36.765	36.831	36.897	36.963	37.028	37.157	37.285	37.600	37.906	38.206	38.500
275	37.218	37.252	37.319	37.386	37.452	37.519	37.585	37.715	37.844	38.161	38.469	38.771	39.065
280	37.774	37.809	37.876	37.944	38.011	38.078	38.144	38.276	38.406	38.725	39.036	39.338	39.634

Opteon™ XP44 (R-452A)  
Superheated Vapor - Velocity of Sound Table

Velocity of Sound in m/sec

Saturation Properties in Light Blue

Temp °C	ABSOLUTE PRESSURE, kPa												
	50	101.325	200	300	400	500	600	800	1000	1500	2000	2500	3000
	-56.9 °C	-43.2 °C	-28.0 °C	-17.8 °C	-10.0 °C	-3.5 °C	2.1 °C	11.3 °C	18.9 °C	33.9 °C	45.4 °C	54.8 °C	62.7 °C
	137.78	139.91	141.21	141.33	140.96	140.33	139.53	137.63	135.49	129.57	123.11	116.19	108.78
-55	138.41												
-50	140.07												
-45	141.69												
-40	143.28	141.04											
-35	144.85	142.76											
-30	146.38	144.44											
-25	147.89	146.08	142.36										
-20	149.38	147.68	144.22										
-15	150.85	149.25	146.01	142.49									
-10	152.30	150.79	147.76	144.48									
-5	153.72	152.30	149.46	146.40	143.13								
0	155.13	153.79	151.11	148.25	145.22	141.97							
5	156.52	155.26	152.73	150.05	147.22	144.22	141.01						
10	157.90	156.70	154.32	151.80	149.15	146.36	143.41						
15	159.26	158.12	155.87	153.49	151.02	148.42	145.68	139.72					
20	160.60	159.52	157.39	155.15	152.82	150.39	147.85	142.37	136.19				
25	161.93	160.91	158.89	156.77	154.58	152.30	149.93	144.86	139.25				
30	163.25	162.28	160.36	158.35	156.29	154.15	151.93	147.22	142.08				
35	164.56	163.63	161.80	159.91	157.95	155.94	153.86	149.47	144.73	130.52			
40	165.85	164.96	163.23	161.43	159.58	157.68	155.72	151.62	147.23	134.43			
45	167.13	166.28	164.63	162.92	161.17	159.37	157.53	153.68	149.60	137.95			
50	168.40	167.59	166.02	164.39	162.73	161.03	159.29	155.67	151.86	141.18	127.89		
55	169.65	168.88	167.38	165.83	164.26	162.64	161.00	157.59	154.02	144.17	132.37	116.53	
60	170.90	170.16	168.73	167.26	165.75	164.22	162.67	159.45	156.10	146.97	136.34	123.05	
65	172.13	171.43	170.06	168.66	167.23	165.77	164.30	161.26	158.11	149.61	139.94	128.40	113.08
70	173.36	172.69	171.38	170.04	168.68	167.29	165.89	163.02	160.04	152.11	143.24	133.02	120.50
75	174.58	173.93	172.68	171.40	170.10	168.79	167.45	164.73	161.92	154.48	146.31	137.12	126.41
80	175.78	175.17	173.97	172.75	171.51	170.25	168.98	166.40	163.74	156.76	149.19	140.84	131.44
85	176.98	176.39	175.24	174.07	172.89	171.69	170.49	168.03	165.51	158.94	151.90	144.26	135.86
90	178.17	177.60	176.51	175.39	174.25	173.11	171.96	169.62	167.24	161.04	154.47	147.44	139.85
95	179.35	178.80	177.75	176.68	175.60	174.51	173.41	171.19	168.92	163.07	156.92	150.41	143.50
100	180.52	180.00	178.99	177.96	176.93	175.89	174.84	172.72	170.57	165.03	159.26	153.21	146.88
105	181.68	181.18	180.22	179.23	178.24	177.25	176.25	174.22	172.17	166.93	161.50	155.87	150.03
110	182.84	182.36	181.43	180.49	179.54	178.59	177.63	175.70	173.75	168.78	163.66	158.40	152.99
115	183.98	183.52	182.63	181.73	180.82	179.91	179.00	177.15	175.30	170.58	165.75	160.82	155.78
120	185.12	184.68	183.83	182.96	182.09	181.22	180.34	178.58	176.81	172.33	167.77	163.13	158.44
125	186.25	185.83	185.01	184.18	183.35	182.51	181.67	179.99	178.30	174.03	169.72	165.36	160.97
130	187.38	186.97	186.19	185.39	184.59	183.79	182.99	181.38	179.76	175.70	171.61	167.51	163.40
135	188.50	188.10	187.35	186.58	185.82	185.05	184.28	182.74	181.20	177.33	173.46	169.58	165.72
140	189.61	189.23	188.51	187.77	187.04	186.30	185.56	184.09	182.62	178.93	175.25	171.59	167.96
145	190.71	190.35	189.65	188.95	188.24	187.54	186.83	185.42	184.01	180.50	177.00	173.54	170.12
150	191.81	191.46	190.79	190.11	189.44	188.76	188.08	186.73	185.39	182.03	178.71	175.43	172.21
155	192.90	192.57	191.92	191.27	190.62	189.97	189.32	188.03	186.74	183.54	180.38	177.27	174.23
160	193.98	193.66	193.04	192.42	191.80	191.17	190.55	189.31	188.08	185.02	182.02	179.07	176.19
165	195.06	194.75	194.16	193.56	192.96	192.36	191.77	190.58	189.40	186.48	183.62	180.82	178.10
170	196.14	195.84	195.27	194.69	194.11	193.54	192.97	191.83	190.70	187.91	185.19	182.53	179.96
175	197.20	196.92	196.37	195.81	195.26	194.71	194.16	193.07	191.99	189.32	186.73	184.20	181.77
180	198.26	197.99	197.46	196.93	196.40	195.87	195.34	194.30	193.26	190.71	188.24	185.84	183.53
185	199.32	199.05	198.54	198.03	197.52	197.02	196.51	195.51	194.52	192.08	189.72	187.44	185.26
190	200.37	200.11	199.62	199.13	198.64	198.16	197.67	196.71	195.76	193.44	191.18	189.02	186.94
195	201.41	201.16	200.70	200.22	199.75	199.29	198.82	197.90	196.99	194.77	192.62	190.56	188.59
200	202.45	202.21	201.76	201.31	200.86	200.41	199.96	199.08	198.21	196.08	194.04	192.08	190.21
205	203.48	203.25	202.82	202.39	201.95	201.52	201.10	200.25	199.41	197.38	195.43	193.57	191.80
210	204.51	204.29	203.87	203.46	203.04	202.63	202.22	201.41	200.61	198.66	196.80	195.03	193.35
215	205.53	205.32	204.92	204.52	204.12	203.72	203.33	202.56	201.79	199.93	198.16	196.47	194.88
220	206.55	206.34	205.96	205.58	205.19	204.81	204.44	203.69	202.96	201.19	199.49	197.89	196.38
225	207.56	207.36	207.00	206.63	206.26	205.90	205.54	204.82	204.12	202.43	200.81	199.29	197.86
230	208.56	208.38	208.03	207.67	207.32	206.97	206.62	205.94	205.27	203.65	202.11	200.66	199.31
235	209.57	209.39	209.05	208.71	208.37	208.04	207.71	207.05	206.41	204.86	203.40	202.02	200.74
240	210.56	210.39	210.07	209.74	209.42	209.10	208.78	208.16	207.54	206.06	204.67	203.36	202.15
245	211.56	211.39	211.08	210.77	210.46	210.15	209.85	209.25	208.66	207.25	205.93	204.68	203.53
250	212.54	212.39	212.09	211.79	211.49	211.20	210.91	210.34	209.78	208.43	207.17	205.99	204.90
255	213.53	213.38	213.09	212.81	212.52	212.24	211.96	211.41	210.88	209.60	208.40	207.28	206.25
260	214.51	214.36	214.09	213.81	213.54	213.27	213.01	212.49	211.97	210.75	209.61	208.55	207.58
265	215.48	215.34	215.08	214.82	214.56	214.30	214.05	213.55	213.06	211.90	210.81	209.81	208.89
270	216.45	216.32	216.07	215.82	215.57	215.32	215.08	214.60	214.14	213.03	212.00	211.05	210.19
275	217.42	217.29	217.05	216.81	216.57	216.34	216.11	215.65	215.21	214.16	213.18	212.28	211.47
280	218.38	218.26	218.03	217.80	217.57	217.35	217.13	216.70	216.27	215.27	214.35	213.50	212.74



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