

Thermodynamic properties of saturated liquid/vapor

This section contains data on the thermodynamic properties on the saturated vapor/liquid boundary for a wide range of liquids/vapors used in a variety of technological contexts. The primary value of this data is to allow quantification of the various thermo-fluid-mechanical processes that involve liquid/vapor interfaces. The tables are dense to allow inclusion of a wide range of thermophysical properties and this requires a very small script. The data is listed using the temperature as the primary tabulating variable and efforts were made to cover the entire range between the triple point temperature (TET) and the critical point temperature (TEC); however, in some instances the author was unable to find values for these important end-point temperatures. Moreover, the reader will observe that there are many vacant boxes in the tables for which the author was not able to find data. The last line in each table contains the reference from which the data was extracted. Within the table an asterisk denotes a value obtained by interpolation using accepted variations with temperature; this is particularly true for the surface tension whose linear dependence with temperature and zero value at the critical point are widely accepted. Also within the table the # denotes a value not necessarily at saturation.

Notation used in the tables:

TET	Triple point temperature, $^{\circ}K$	TEC	Critical point temperature, $^{\circ}K$
TEM	Melting temperature at atmospheric pressure, $^{\circ}K$	MOL	Molecular weight
PRC	Critical point pressure, $kg/m\ s^2$	DEC	Critical point density, kg/m^3
TER	Reduced temperature, TEK/TEC	TEK	Temperature, $^{\circ}K$
PRV	Vapor pressure, $kg/m\ s^2$	DEV	Vapor density, kg/m^3
DEL	Liquid density, kg/m^3	HEV	Saturated vapor enthalpy, m^2/s^2
HEL	Saturated liquid enthalpy, m^2/s^2		
HLT	Latent heat of vaporization, m^2/s^2		
CPL	Specific heat of liquid at constant pressure, $m^2/s^2\ ^{\circ}K$	KNV	Thermal conductivity of vapor, $kg\ m/s^3\ ^{\circ}K$
CPV	Specific heat of vapor at constant pressure, $m^2/s^2\ ^{\circ}K$	DFV	Thermal diffusivity of vapor, m^2/s
KNL	Thermal conductivity of liquid, $kg\ m/s^3\ ^{\circ}K$	VKV	Kinematic viscosity of vapor, m^2/s
DFL	Thermal diffusivity of liquid, m^2/s	VDV	Dynamic viscosity of vapor, $kg/m\ s$
VKL	Kinematic viscosity of liquid, m^2/s		
VDL	Dynamic viscosity of liquid, $kg/m\ s$		
STL	Surface tension, kg/s^2		
HLL	Henry's law constant, the mass fraction of saturated solution of air in liquid, $m\ s^2/kg$		

Some conversion factors:

Density:	$1 \text{ lb}/\text{ft}^3$	=	$16.01846 \text{ kg}/\text{m}^3$
	$1 \text{ gm}/\text{cm}^3$	=	$1000 \text{ kg}/\text{m}^3$
Pressure:	1 psi	=	$6894.757 \text{ kg}/\text{m s}^2$
	1 atm	=	$101325 \text{ kg}/\text{m s}^2$
	$1 \text{ dyne}/\text{cm}^2$	=	$0.1 \text{ kg}/\text{m s}^2$
	$1 \text{ newton}/\text{m}^2$	=	$1 \text{ kg}/\text{m s}^2$
	1 mm.Hg	=	$133.322 \text{ kg}/\text{m s}^2$
Heat:	$1 \text{ cal}/\text{gm}$	=	$4184 \text{ m}^2/\text{s}^2$
	$1 \text{ BTU}/\text{lb}$	=	$2326 \text{ m}^2/\text{s}^2$
	$1 \text{ joule}/\text{gm}$	=	$1000 \text{ m}^2/\text{s}^2$
Specific Heat:	$1 \text{ cal}/\text{gm } ^\circ\text{K}$	=	$4184 \text{ m}^2/\text{s}^2 \text{ } ^\circ\text{K}$
	$1 \text{ BTU}/\text{lb } ^\circ\text{F}$	=	$4184 \text{ m}^2/\text{s}^2 \text{ } ^\circ\text{K}$
Thermal Conductivity:	$1 \text{ cal}/\text{cm s } ^\circ\text{K}$	=	$418.4 \text{ kg m}/\text{s}^3 \text{ } ^\circ\text{K}$
	$1 \text{ BTU}/\text{ft hr } ^\circ\text{F}$	=	$1.729577 \text{ kg m}/\text{s}^3 \text{ } ^\circ\text{K}$
	$1 \text{ W}/\text{m}^\circ\text{K}$	=	$1 \text{ kg m}/\text{s}^3 \text{ } ^\circ\text{K}$
	$1 \text{ mW}/\text{cm}^\circ\text{K}$	=	$0.1 \text{ kg m}/\text{s}^3 \text{ } ^\circ\text{K}$
Diffusivity:	$1 \text{ cm}^2/\text{s}$	=	$0.0001 \text{ m}^2/\text{s}$
(incl. Kinematic Viscosity)	$1 \text{ ft}^2/\text{s}$	=	$0.0929 \text{ m}^2/\text{s}$
Dynamic Viscosity:	1 centistokes	=	$0.000001 \text{ m}^2/\text{s}$
	1 centipoise	=	$0.001 \text{ kg}/\text{m s}$
	$1 \text{ lb}/\text{ft s}$	=	$1.488164 \text{ kg}/\text{m s}$
	$1 \text{ lb}/\text{ft hr}$	=	$0.0004134 \text{ kg}/\text{m s}$
Surface tension:	$1 \text{ dyne}/\text{cm}$	=	$0.001 \text{ kg}/\text{s}^2$
Force:	1 Newton	=	$1 \text{ kg m}/\text{s}^2$
	1 dyne	=	$0.00001 \text{ kg m}/\text{s}^2$
Power:	1 HP	=	$745.7 \text{ kg}/\text{m}^2/\text{s}^3$
	1 W	=	$1 \text{ kg}/\text{m}^2/\text{s}^3$
	1 kW	=	$1000 \text{ kg}/\text{m}^2/\text{s}^3$
Energy:	$1 \text{ erg} = 1 \text{ dyne cm}$	=	$0.0000001 \text{ kg}/\text{m}^2/\text{s}^2$
	1 joule	=	$1 \text{ kg}/\text{m}^2/\text{s}^2$
	1 BTU	=	$1054.35 \text{ kg}/\text{m}^2/\text{s}^2$
	1 cal	=	$4.184 \text{ kg}/\text{m}^2/\text{s}^2$

Tables:

WATER			TET=273.0		TEC=647.0		TEM=273		PRC=2.289E+07		DEC=317.0									
TER	TEK	PRV	DEL	DEV	HLT $\times 10^{-6}$	HEV $\times 10^{-6}$	CPL	KNL	DFL $\times 10^6$	CPV	KNV	DFV	VKL $\times 10^6$	VDL $\times 10^3$	VKV	VDV $\times 10^6$	STL $\times 10^2$	HLL $\times 10^{10}$		
0.422	273.0	6.109E+02	1000.0	4.847E-03	2.500	2.500	4212	0.550	0.131	1857	0.0158	1.755E-03	1.79	1.79	1.830E-03	8.85	7.56	3.67		
0.429	277.8	8.391E+02	1000.0	6.555E-03	2.488	2.507	4200	0.560	0.133	1857	0.0162	1.331E-03	1.55	1.55	1.380E-03	9.02	7.49	3.23		
0.447	288.9	1.769E+03	998.7	1.327E-02	2.463	2.528	4179	0.588	0.141	1866	0.0170	0.686E-03	1.13	1.13	0.707E-03	9.38	7.34	2.57		
0.464	300.0	3.495E+03	996.3	2.527E-02	2.436	2.548	4170	0.610	0.147	1882	0.0179	0.376E-03	0.866	0.863	0.388E-03	9.80	7.17	2.14		
0.481	311.1	6.550E+03	993.2	4.569E-02	2.410	2.568	4170	0.629	0.152	1899	0.0187	0.216E-03	0.687	0.682	0.223E-03	10.2	6.98	1.87		
0.498	322.2	1.167E+04	988.9	7.876E-02	2.384	2.588	4175	0.645	0.156	1916	0.0196	0.130E-03	0.564	0.558	0.135E-03	10.6	6.81	1.67		
0.515	333.3	1.992E+04	983.4	1.300E-01	2.357	2.608	4179	0.659	0.160	1941	0.0205	0.812E-04	0.480	0.472	0.846E-04	11.0	6.62	1.57		
0.532	344.4	3.269E+04	977.4	2.069E-01	2.330	2.627	4187	0.667	0.163	1974	0.0214	0.524E-04	0.411	0.402	0.551E-04	11.4	6.42	1.50		
0.549	355.5	5.177E+04	970.3	3.185E-01	2.302	2.646	4195	0.674	0.166	2012	0.0224	0.350E-04	0.358	0.347	0.371E-04	11.8	6.22	1.48		
0.567	366.6	7.950E+04	963.3	4.762E-01	2.274	2.664	4208	0.679	0.168	2054	0.0234	0.239E-04	0.317	0.305	0.256E-04	12.2	6.02	1.50		
0.610	394.4	2.056E+05	942.3	1.159E+00	2.198	2.707	4246	0.685	0.171	2196	0.0260	0.102E-04	0.242	0.228	0.114E-04	13.2	*5.50			
0.653	422.2	4.620E+05	915.4	2.477E+00	2.116	2.743	4308	0.683	0.173	2384	0.0290	0.491E-05	0.204	0.187	0.573E-05	14.2	*4.96			
0.696	450.0	9.281E+05	890.0	4.791E+00	2.026	2.773	4392	0.676	0.173	2635	0.0324	0.257E-05	0.176	0.157	0.317E-05	15.2	*4.41			
0.738	477.8	1.705E+06	861.3	8.599E+00	1.922	2.794	4518	0.659	0.169	2970	0.0365	0.143E-05	0.157	0.135	0.191E-05	16.4	*3.84			
0.824	533.3	4.694E+06	785.3	2.373E+01	1.660	2.795	4977	0.603	0.154	4183	0.0475	0.479E-06	0.135	0.106	0.784E-06	18.6	*2.62			
0.910	588.9	1.064E+07	678.8	5.978E+01	1.276	2.710	6316	0.505	0.118	7655	0.0666	0.146E-06	0.128	0.0868	0.365E-06	21.8	*1.37			
0.996	644.4	2.133E+07	434.1	2.105E+02	0.388	2.301										*0.06				
REF:	A	A	A	A	A															
CARBON DIOXIDE			TET=216.54		TEC=384.21		TEM=		MOL=44.01		PRC=7.383E+06		DEC=464.0							
TER	TEK	PRV	DEL	DEV	HLT $\times 10^{-6}$	HEV $\times 10^{-6}$	CPL	KNL	DFL $\times 10^6$	CPV	KNV	DFV	VKL $\times 10^6$	VDL $\times 10^3$	VKV	VDV $\times 10^6$	STL $\times 10^2$	HLL $\times 10^{10}$		
0.712	216.5	5.173E+05	1181	1.374E+01	.3519	.3519										0.78E-06	10.7	*1.61		
0.723	220	6.000E+05	1167	1.584E+01	.3461	.3531	1800	.0775	.0369	1008	*.011	*6.7E-07	0.119	0.139	0.68E-06	10.8	*1.53			
0.756	230	8.949E+05	1129	2.333E+01	.3280	.3561	1860	.0972	.0463	1093	.0114	4.47E-07	0.118	0.133	0.48E-06	11.3	*1.30			
0.789	240	1.285E+06	1089	3.337E+01	.3091	.3580	1950	.1090	.0513	1213	.0121	2.99E-07	0.117	0.127	3.60E-07	12.0	*1.08			
0.822	250	1.788E+06	1046	4.673E+01	.2887	.3586	2010	.1148	.0546	1349	.0129	2.05E-07	0.116	0.121	2.70E-07	12.6	0.874			
0.855	260	2.421E+06	999	6.443E+01	.2660	.3575	2130	.1119	.0526	1420	.0136	1.49E-07	0.114	0.114	2.05E-07	13.2	0.674			
0.886	270	3.204E+06	947	8.826E+01	.2401	.3543	2340	.1067	.0481						0.111	0.105	1.55E-07	13.7	0.486	
0.920	280	4.160E+06	886	1.213E+02	.2092	.3479	2850	.0998	.0395						0.104	0.092	1.17E-07	14.2	0.313	
0.953	290	5.314E+06	807	1.708E+02	.1691	.3361	4310	.0910	.0262						0.094	0.076	0.86E-07	14.7	0.158	
0.986	300	6.706E+06	680	2.667E+02	.1049	.3099									0.083	0.056	0.57E-07	15.2	*.034	
1.000	304.2	7.383E+06	464	4.640E+02	0.0	.2573												0.0		
REF:	A	A	A	A	A	F	F			E	# O	#	F	F O	#	# O	O	H		
AMMONIA			TET=195.4		TEC=406.8		TEM=		MOL=17.03		PRC=1.163E+07		DEC=237.64							
TER	TEK	PRV	DEL	DEV	HLT $\times 10^{-6}$	HEV $\times 10^{-6}$	CPL	KNL	DFL $\times 10^6$	CPV	KNV	DFV	VKL $\times 10^6$	VDL $\times 10^3$	VKV	VDV $\times 10^6$	STL $\times 10^2$	HLL $\times 10^{10}$		
0.492	200	8.644E+03	728.9	8.897E-02	1.477	1.477	4320									0.770E-04	6.85	3.82		
0.541	220	3.380E+04	705.7	3.189E-01	1.425	1.513	4400	0.546	0.176						0.455	0.321	0.235E-05	7.50	3.41	
0.590	240	1.023E+05	681.7	8.969E-01	1.369	1.545	4460	0.547	0.180						0.392	0.267	0.909E-05	8.15	3.00	
0.639	260	2.554E+05	656.2	2.116E+00	1.307	1.572	4530	0.544	0.183						0.379	0.249	0.414E-05	8.75	2.61	
0.688	280	5.510E+05	628.9	4.382E+00	1.237	1.595	4630	0.532	0.183						0.369	0.232	0.215E-05	9.40	2.22	
0.737	300	1.061E+06	600.0	8.244E+00	1.157	1.610	4760	0.511	0.179	3190	.0246	0.935E-06	0.353	0.212	0.123E-05	10.1	1.83			
0.787	320	1.872E+06	568.2	1.450E+01	1.066	1.617	4920	0.481	0.172	3670	.0266	0.500E-06	0.333	0.189	0.745E-06	10.8	1.46			
0.836	340	3.079E+06	532.5	2.439E+01	0.958	1.612	*5170	0.445	0.162	4650					0.310	0.165	0.472E-06	11.5	1.09	
0.885	360	4.791E+06	490.4	4.019E+01	0.825	1.590	*5560										0.306E-06	12.3	0.73	
0.934	380	7.136E+06	436.5	6.720E+01	0.649	1.541	*6370										*0.19E-06	*13.0	0.39	
0.983	400	1.030E+07	347.3	1.304E+02	0.352	1.417	*9840										*0.11E-06	*13.8	0.09	
1.000	406.8	1.163E+07	237.6	2.376E+02	0.0	1.234												0.0		
REF:	A	A	A	A	A	E	F			E	# O	#	F				O	H		
METHANE			TET=90.68		TEC=190.6		TEM=		MOL=16.043		PRC=4.599E+06		DEC=160.43							
TER	TEK	PRV	DEL	DEV	HLT $\times 10^{-6}$	HEV $\times 10^{-6}$	CPL	KNL	DFL $\times 10^6$	CPV	KNV	DFV	VKL $\times 10^6$	VDL $\times 10^3$	VKV	VDV $\times 10^6$	STL $\times 10^2$	HLL $\times 10^{10}$		
0.498	95	1.991E+04	445.8	0.409E+00	0.537	0.551	3330	0.216	0.149	2110	0.0109	1.263E-05	0.384	0.171	0.954E-05	3.9	1.76			
0.525	100	3.451E+04	439.0	0.677E+00	0.530	0.561	3380	0.206	0.139	2130	0.0116	0.804E-05	0.355	0.156	0.606E-05	4.1	1.65			
0.551	105	5.657E+04	432.1	1.064E+00	0.522	0.570	3430	0.197	0.133	2150	0.0124	0.542E-05	0.317	0.137	0.395E-05	4.2	1.54			
0.577	110	8.841E+04	425.0	1.602E+00	0.514	0.579	3480	0.187	0.126	2170	0.0131	0.377E-05	0.280	0.119	0.281E-05	4.5	1.43			
0.603	115	1.326E+05	417.7	2.324E+00	0.504	0.587	3530	0.180	0.122	2200	0.0140	0.274E-05	0.256	0.107	0.202E-05	4.7	1.33			
0.630	120	1.919E+05	410.2	3.267E+00	0.494	0.595	3580	0.169	0.115	2240	0.0147	0.201E-05	0.232	0.095	0.150E-05	4.9	*1.22			
0.682	130	3.681E+05	394.3	5.988E+00	0.472	0.609	3700	0.156	0.107	2360										

ETHANE			TET=89.8		TEC=305.8		TEM=		MOL=30.07		PRC=5.010E+06		DEC=217.59					
TER	TEK	PRV	DEL	DEV	HLT × 10 ⁻⁶	HEV × 10 ⁻⁶	CPL	KNL	DFL × 10 ⁶	CPV	KNV	DFV	VKL × 10 ⁶	VDL × 10 ³	VKV	VDV × 10 ⁶	STL × 10 ²	HLL × 10 ¹⁰
0.327	100	0.710E+01	642.6				2271								0.846			
0.392	120	3.506E+02	617.9				2286								0.465			
0.458	140	3.835E+03	593.1	0.749E-01	.5414		2320											
0.523	160	2.148E+04	576.4	4.924E-01	.5240	.5512	2363								0.303	0.220		
0.589	180	7.968E+04	548.5	1.652E+00	.4947	.5743	2416								0.312	0.171		
0.654	200	2.200E+05	521.4	4.246E+00	.4641	.5956	2479								0.269	0.140	0.153E-05	
0.719	220	4.968E+05	494.3	9.166E+00	.4301	.6143	2583								0.241	0.119	0.769E-06	
0.785	240	9.730E+05	465.8	1.768E+01	.3911	.6293	2746								0.223	0.104	0.429E-06	
0.850	260	1.720E+06	433.3	3.195E+01	.3427	.6389	3006								0.215	0.093	0.255E-06	
0.916	280	2.822E+06	391.4	5.685E+01	.2764	.6388	3458								0.215	0.084	0.153E-06	
0.981	300	4.409E+06	318.3	1.163E+02	.1570	.6075									0.214		0.795E-07	
1.000	305.8	5.010E+06	217.6	2.176E+02	0.0	.5320											9.25	
REF:		A E	A E	A	A	E			E	# O	#	H L	H L	#		# O		

PROPANE			TET=85.45		TEC=369.82		TEM=		MOL=44.09		PRC=4.236E+06		DEC=197.38					
TER	TEK	PRV	DEL	DEV	HLT × 10 ⁻⁶	HEV × 10 ⁻⁶	CPL	KNL	DFL × 10 ⁶	CPV	KNV	DFV	VKL × 10 ⁶	VDL × 10 ³	VKV	VDV × 10 ⁶	STL × 10 ²	HLL × 10 ¹⁰
0.541	200	1.997E+04	602.0	5.362E-01	.4562	.4562												
0.568	210	3.566E+04	592.1	9.183E-01	.4465	.4681												
0.595	220	5.998E+04	581.7	1.488E+00	.4362	.4799												
0.622	230	9.586E+04	571.1	2.301E+00	.4256	.4917	2250								1370			
0.649	240	1.467E+05	560.5	3.422E+00	.4144	.5033	2260								1440			
0.676	250	2.161E+05	549.8	4.924E+00	.4028	.5148	2270								1540			
0.703	260	3.081E+05	538.5	6.887E+00	.3906	.5261	2290								1670			
0.730	270	4.272E+05	527.1	9.416E+00	.3777	.5371	2330								1870			
0.757	280	5.779E+05	515.2	1.262E+01	.3637	.5477	2420								2040			
0.784	290	7.650E+05	502.5	1.665E+01	.3485	.5579	2530								2250			
0.811	300	9.935E+05	489.2	2.168E+01	.3318	.5676	2670								2610			
0.838	310	1.269E+06	474.6	2.796E+01	.3134	.5766	2820								2990			
0.865	320	1.596E+06	458.1	3.584E+01	.2929	.5846	3030								3510			
0.892	330	1.983E+06	439.2	4.587E+01	.2694	.5912	3270								4200			
0.919	340	2.435E+06	416.1	5.900E+01	.2413	.5958	3690								5310			
0.946	350	2.961E+06	385.4	7.710E+01	.2051	.5968	4310								7100			
0.973	360	3.566E+06	338.3	1.051E+02	.1524	.5907												
1.000	369.8	4.236E+06	197.4	1.974E+02	0.0	.5398												
REF:		A	A	A	A	E			E									

BUTANE			TET=		TEC=423.95		TEM=		MOL=58.12		PRC=3.718E+06		DEC=204.00					
TER	TEK	PRV	DEL	DEV	HLT × 10 ⁻⁶	HEV × 10 ⁻⁶	CPL	KNL	DFL × 10 ⁶	CPV	KNV	DFV	VKL × 10 ⁶	VDL × 10 ³	VKV	VDV × 10 ⁶	STL × 10 ²	HLL × 10 ¹⁰
0.472	200	1.886E+03	661.8	6.605E-02	.4560	.4560										2.37		
0.519	220	7.791E+03	643.9	2.492E-01	.4332	.4824										2.13		
0.566	240	2.420E+04	625.8	7.158E-01	.4131	.5097										1.89		
0.613	260	6.116E+04	607.9	1.695E+00	.3941	.5378										1.64		
0.660	280	1.326E+05	589.6	3.490E+00	.3755	.5662										1.40		
0.708	300	2.559E+05	570.5	6.489E+00	.3565	.5949									0.160	0.273	0.156	
0.755	320	4.518E+05	550.1	1.119E+01	.3357	.6233									0.0180	0.240	0.132	
0.802	340	7.437E+05	528.0	1.832E+01	.3121	.6511									0.0200	0.210	0.111	
0.849	360	1.158E+06	502.8	2.894E+01	.2844	.6777									0.0220	0.183	0.092	
0.896	380	1.726E+06	471.3	4.513E+01	.2503	.7015									*.024	0.159	0.075	
0.944	400	2.488E+06	426.6	7.194E+01	.2022	.7193									0.138	0.059	0.164E-06	
1.000	423.9	3.718E+06	204.0	2.040E+02	0.0	.6796									0.147	0.030	0.147E-06	
REF:		A	A	A	A	E			# O			H			H	H	H	

TOLUENE			TET=		TEC=594.1		TEM=178		MOL=92.13		PRC=		DEC=					
TER	TEK	PRV	DEL	DEV	HLT × 10 ⁻⁶	HEV × 10 ⁻⁶	CPL	KNL	DFL × 10 ⁶	CPV	KNV	DFV	VKL × 10 ⁶	VDL × 10 ³	VKV	VDV × 10 ⁶	STL × 10 ²	HLL × 10 ¹⁰
0.477	283.3	1.720E+03	870.8	0.674E-01	.4137	.0104	1476	0.154	.0120						0.792	0.690		*2.90
0.524	311.1	7.193E+03	845.4	0.257E+00	.4018	.0143	1610	0.147	.0108	1208					0.587	0.496		*2.60
0.570	338.9	2.306E+04	819.1	0.762E+00	.3889	.0750	1748	0.140	.0098	1296					0.449	0.368	1.068E-05	8.14
0.617	366.7	6.040E+04	791.6	1.864E+00	.3744	.1111	1891	0.134	.0090	1403					0.355	0.281	0.473E-05	8.81
0.664	394.4	1.353E+05	762.7	3.951E+00	.3579	.1492	2029	0.127	.0082	1511	0.0245	0.410E-05			0.290	0.221	0.239E-05	9.43
0.711	422.2	2.682E+05	732.2	7.511E+00	.3393	.1889	2158	0.120	.0076	1618					0.240	0.176	0.133E-05	10.0
0.757	450.0	4.827E+05	699.5	1.315E+01	.3184	.2290	2271	0.111	.0070	1739					0.197	0.138		*1.15
0.804	477.8	8.046E+05	663.9	2.168E+01	.2951	.2710	2380	0.102	.0065	1865					0.167	0.111		*0.89
0.851	505.6	1.262E+06	624.1	3.430E+01	.2686	.3121	2506											*0.64
0.898	533.3	1.889E+06	577.5</td															

FREON 11			TET=		TEC=471.2		TEM=162.0		MOL=137.4		PRC=4.409E+06		DEC=553.71					
TER	TEK	PRV	DEL	DEV	HLT x 10^-6	HEV x 10^-6	CPL	KNL	DFL x 10^6	CPV	KNV	DFV	VKL x 10^6	VDL x 10^3	VKV	VDV x 10^6	STL x 10^2	HLL x 10^10
0.424	200.0	4.374E+02	1692.0	3.615E-02	0.215	0.215	1096				157							
0.467	220.0	2.142E+03	1650.2	0.161E+00	0.207	0.224	852				481							
0.509	240.0	7.721E+03	1607.7	0.535E+00	0.200	0.234	781				588	0.0052	1.651E-05					
0.552	260.0	2.215E+04	1564.9	1.426E+00	0.193	0.244	803				573	0.0059	7.274E-06					
0.594	280	5.341E+04	1517.4	2.562E+00	0.186	0.254	862				509	0.0067	5.127E-06					
0.637	300.0	1.126E+05	1470.6	6.472E+00	0.179	0.264	915	0.087	0.065		449							
0.679	320	2.138E+05	1422.5	1.180E+01	0.171	0.274	941				422							
0.722	340.0	3.735E+05	1369.9	2.002E+01	0.163	0.284	933				435							
0.764	360.0	6.102E+05	1315.8	3.216E+01	0.154	0.293	906				474							
0.806	380.0	9.446E+05	1254.7	4.965E+01	0.144	0.301	890				503							
0.849	400.0	1.399E+06	1187.6	7.463E+01	0.131	0.308	936				464							
0.891	420.0	1.999E+06	1108.6	1.110E+02	0.116	0.315	1109				276							
0.934	440.0	2.774E+06	1012.1	1.670E+02	0.096	0.318	1497											
0.976	460.0	3.756E+06	864.3	2.723E+02	0.064	0.315	2202											
1.000	471.1	4.409E+06	553.7	5.537E+02	0.000	0.289	2778											
REF:		A	A	A	A	A	A	O		A	O							

FREON 12			TET=		TEC=385.17		TEM=115		MOL=120.9		PRC=4.116E+06		DEC=588.08					
TER	TEK	PRV	DEL	DEV	HLT x 10^-6	HEV x 10^-6	CPL	KNL	DFL x 10^6	CPV	KNV	DFV	VKL x 10^6	VDL x 10^3	VKV	VDV x 10^6	STL x 10^2	HLL x 10^10
0.312	120																	
0.363	140																	
0.415	160																	
0.467	180																	
0.519	200	9.957E+03	1605	0.730E+00	.1830	.1830				490			0.372	0.597		*.219		
0.571	220	3.311E+04	1553	2.234E+00	.1750	.1923	871	0.067	0.050	530			0.307	0.477		*.191		
0.623	240	8.754E+04	1497	5.522E+00	.1667	.2016	891	0.069	0.052	570	.00715	2.27E-06	0.264	0.396		*.163		
0.675	260	1.954E+05	1439	1.171E+01	.1578	.2106	916	0.071	0.054	610	.00792	1.11E-06	0.234	0.337	0.922E-06	10.8	*.137	
0.727	280	3.840E+05	1374	2.225E+01	.1480	.2193	943	0.071	0.055	660	.00870	5.92E-07	0.214	0.294		*.111		
0.779	300	6.847E+05	1304	3.911E+01	.1369	.2273	978	0.070	0.055	730	.00947	3.32E-07	0.200	0.261	0.332E-06	13.0	0.862	
0.831	320	1.132E+06	1224	6.527E+01	.1238	.2343	1015	0.068	0.055	820			0.193	0.236		*.063		
0.883	340	1.766E+06	1131	1.061E+02	.1074	.2397				980			0.190	0.215		*.040		
0.935	360	2.628E+06	1011	1.747E+02	.0846	.2419				1290						*.020		
0.987	380	3.769E+06	806	3.350E+02	.0430	.2333										*.003		
1.000	385.2	4.116E+06	588	5.882E+02	0.0	.2095										0.0		
REF:		A	A	A	A	A	F O	F O ?	?	A	# O G	#	H	H	#	# G O	H	

HYDROGEN (PARA)			TET=13.8		TEC=32.938		TEM=115		MOL=2.016		PRC=1.284E+06		DEC=31.36					
TER	TEK	PRV	DEL	DEV	HLT x 10^-6	HEV x 10^-6	CPL	KNL	DFL x 10^6	CPV	KNV	DFV	VKL x 10^6	VDL x 10^3	VKV	VDV x 10^6	STL x 10^2	HLL x 10^10
0.419	13.8	7.042E+03	77.02	1.257E-01	.4472	.4472				1.034						*.305		
0.425	14.0	7.896E+03	76.86	1.392E-01	.4479	.4491				1.038						*.301		
0.486	16.0	2.153E+04	75.11	3.378E-01	.4522	.4666	7600	1.085	1.901	10750						0.266		
0.546	18.0	4.807E+04	73.21	6.878E-01	.4520	.4821	8400	1.132	1.841	11210			0.221	0.0162		0.232		
0.607	20.0	9.326E+04	71.10	1.243E+00	.4468	.4951	9500	1.178	1.744	11800			0.188	0.0134		0.197		
0.668	22.0	1.632E+05	68.73	2.067E+00	.4357	.5049	10600	1.225	1.681	12550						*.164		
0.729	24.0	2.642E+05	66.02	3.246E+00	.4174	.5107	11800	1.271	1.632	14100						*.131		
0.789	26.0	4.029E+05	62.85	6.615E+00	.3902	.5114	13200	1.318	1.589	16310						*.099		
0.850	28.0	5.861E+05	58.99	7.278E+00	.3507	.5051	15700	1.365	1.474	20080						*.068		
0.911	30.0	8.214E+05	53.96	1.086E+01	.2916	.4874	20200			26770						*.038		
0.941	31.0	9.615E+05	50.61	1.354E+01	.2486	.4708	25000			34720						*.024		
1.000	32.94	1.284E+06	31.36	3.135E+01	0.0	.3465										0.0		
REF:		A	A	A	A	A	I	I ?	I	A I ?	I		A I	I		I		

HELIUM-4			TET=Y2.177		TEC=5.201		TEM=		MOL=4.003		PRC=		DEC=					
TER	TEK	PRV	DEL	DEV	HLT x 10^-6	HEV x 10^-6	CPL	KNL	DFL x 10^6	CPV	KNV	DFV	VKL x 10^6	VDL x 10^3	VKV	VDV x 10^6	STL x 10^2	HLL x 10^10
0.419	2.177	5.039E+03	146.2	0.118E+01	.0254		3160	0.014	0.321	5630	.00453	0.652E-05	0.0247	.00361	0.443E-06	0.545	.0306	
0.423	2.20	5.330E+03	146.1	0.123E+01	.0222	.0255	2130	0.016	0.535	5850	.00535	0.427E-05	0.0258	.00373	0.298E-06	0.638	.0276	
0.481	2.50	1.022E+04	144.8	0.214E+01	.0226	.0267												
0.529	2.75	1.613E+04	143.1	0.316E+01	.0229	.0275	2180	0.017	0.553	6070	.00603	0.314E-05	0.0261	.00373	0.226E-06	0.717	.0250	
0.577	3.00	2.404E+04	141.1	0.446E+01	.0231	.0283	2420	0.017	0.521	6360	.00671	0.236E-05	0.0261	.00368	0.178E-06	0.796	.0225	
0.625	3.25	3.423E+04	138.8	0.608E+01	.0231	.0290	2730	0.018	0.483	6720	.00741	0.181E-05	0.0259	.00360	0.145E-06	0.879	.0199	
0.673	3.50	4.702E+04	136.0	0.808E+01	.0228	.0295	3100	0.018										

NITROGEN			TET=63.15			TEC=126.2			TEM=			MOL=28.016			PRC=			DEC=		
TER	TEK	PRV	DEL	DEV	HLT × 10 ⁻⁶	HEV × 10 ⁻⁶	CPL	KNL	DFL × 10 ⁶	CPV	KNV	DFV	VKL × 10 ⁶	VDL × 10 ³	VKV	VDV × 10 ⁶	STL × 10 ²	HLL × 10 ¹⁰		
0.500	63.15	1.254E+04	867.3	0.675E+00	.2148	.2148	1950	0.152	.0878	1060	0.0057	0.797E-05	0.326	0.283	0.620E-05	4.2	*1.21			
0.515	65	1.742E+04	860.6	0.914E+00	.2133	.2166	2010	0.149	.0861	1070	0.0060	0.614E-05	0.294	0.253	0.470E-05	4.3	*1.16			
0.555	70	3.858E+04	840.3	1.878E+00	.2081	.2211	2050	0.143	.0830	1080	0.0066	0.325E-05	0.243	0.204	0.250E-05	4.7	1.05			
0.594	75	7.612E+04	819.0	3.544E+00	.2021	.2254	2070	0.135	.0796	1110	0.0073	0.186E-05	0.200	0.164	0.144E-05	5.1	0.937			
0.634	80	1.370E+05	796.2	6.094E+00	.1956	.2291	2080	0.129	.0779	1140	0.0080	0.115E-05	0.168	0.134	0.890E-06	5.4	0.826			
0.673	85	2.291E+05	772.2	9.833E+00	.1886	.2324	2100	0.121	.0746	1200	0.0086	0.729E-06	0.149	0.115	0.610E-06	6.0	0.718			
0.713	90	3.608E+05	746.3	1.509E+01	.1806	.2351	2140	0.112	.0701	1250	0.0095	0.504E-06	0.130	0.097	0.420E-06	6.3	0.613			
0.753	95	5.411E+05	718.4	2.227E+01	.1716	.2370	2200	0.105	.0664	1340	0.0105	0.352E-06	0.115	0.083	0.310E-06	6.8	*.511			
0.792	100	7.790E+05	688.7	3.194E+01	.1612	.2380	2330	0.098	.0611	1480	0.0117	0.248E-06	0.103	0.071	0.220E-06	7.1	*.413			
0.832	105	1.084E+06	656.2	4.488E+01	.1492	.2379	2500	0.090	.0549	1670	0.0130	0.173E-06	0.093	0.061	0.172E-06	7.7	*.319			
0.872	110	1.467E+06	620.0	6.242E+01	.1349	.2363	2760	0.080	.0468	2010	0.0147	0.117E-06	0.084	0.052	0.135E-06	8.4	*.229			
0.911	115	1.940E+06	578.4	8.703E+01	.1170	.2325	3350	0.073	.0377	2680	0.0176	0.075E-06	0.076	0.044	0.106E-06	9.2	*.146			
0.951	120	2.513E+06	525.2	1.245E+02	.0926	.2251	4890	0.064	.0249	4810	0.0233	0.039E-06	0.068	0.036	0.085E-06	10.6	*.071			
1.000	126.2	3.400E+06	314.1	3.141E+02	0.0	.1808							0.054	0.017	0.054E-06	17.1	0.0			
REF:	A	A	A	A	A	C	C	C	C				C	C	C	I				
OXYGEN			TET=54.3			TEC=154.6			TEM=			MOL=32.00			PRC=5.043E+06			DEC=436.15		
TER	TEK	PRV	DEL	DEV	HLT × 10 ⁻⁶	HEV × 10 ⁻⁶	CPL	KNL	DFL × 10 ⁶	CPV	KNV	DFV	VKL × 10 ⁶	VDL × 10 ³	VKV	VDV × 10 ⁶	STL × 10 ²	HLL × 10 ¹⁰		
0.388	60	0.725E+03	1282	0.466E-01	.2383	.2475	1664	0.183	.0858				0.452	0.580		*2.06				
0.453	70	0.625E+04	1238	0.345E+00	.2305	.2564	1670	0.172	.0832				0.287	0.355		1.83				
0.517	80	0.301E+05	1190	1.468E+00	.2223	.2649	1683	0.160	.0799				0.223	0.265	0.402E-05	5.9	1.57			
0.582	90	0.993E+05	1142	4.388E+00	.2132	.2726	1697	0.152	.0784				0.173	0.197	0.155E-05	6.8	1.32			
0.647	100	0.254E+06	1091	1.043E+01	.2026	.2792	1711	0.138	.0739				0.137	0.150	0.757E-06	7.9	*1.07			
0.711	110	0.543E+06	1035	2.127E+01	.1897	.2842	1740	0.124	.0688				0.115	0.119	0.433E-06	9.2	*0.81			
0.776	120	0.102E+07	974	3.928E+01	.1737	.2871	1810	0.110	.0624				0.136	0.100	0.275E-06	10.8	*0.57			
0.841	130	0.175E+07	903	6.835E+01	.1533	.2870	1930	0.096	.0551				0.163	0.092	0.189E-06	12.9	*0.35			
0.906	140	0.279E+07	813	1.168E+02	.1251	.2820	2150	0.081	.0463				0.201	0.086	0.135E-06	15.8	*0.17			
0.970	150	0.422E+07	676	2.141E+02	.0795	.2664							0.063	0.0272	0.054	0.986E-07	21.1	*0.05		
0.996	154	0.493E+07											0.052	0.0352		0.042		26.9		
REF:	A	A	A	A	A	A	N						N	N	N	N				
MERCURY			TET=			TEC=1763			TEM=234			MOL=200.6			PRC=1.530E+08			DEC=5500.6		
TER	TEK	PRV	DEL	DEV	HLT × 10 ⁻⁶	HEV × 10 ⁻⁶	CPL	KNL	DFL × 10 ⁶	CPV	KNV	DFV	VKL × 10 ⁶	VDL × 10 ³	VKV	VDV × 10 ⁶	STL × 10 ²	HLL × 10 ¹⁰		
0.133	234	0.160E-03					141.4											58.8		
0.155	273	0.247E-01	13630				140.1	8.20	4.29	103.6			0.124	1.69				*57.0		
0.183	323	1.689E+00	13510				138.5	9.39	5.02	103.6			0.104	1.40				*54.7		
0.227	400	1.397E+02	13300	8.425E-03	.3019	.3019	136.8	11.07	6.08	103.6			0.083	1.10				*51.2		
0.284	500	5.241E+03	13050	2.530E-01	.2989	.3123	135.5	12.74	7.20	103.7			0.071	0.93				*46.7		
0.340	600	5.757E+04	12820	2.319E-02	.2963	.3225	135.1	14.11	8.15	103.9			0.065	0.83				*42.3		
0.397	700	3.154E+05	12560	1.094E+01	.2931	.3325	136.0			104.3			*0.061	*0.76				*38.0		
0.454	800	1.122E+06	12320	3.440E+01	.2884	.3419	137.2			107			*0.058	*0.72				*33.8		
0.510	900	2.999E+06	12050	8.299E+01	.2816	.3505				110			*0.056	*0.68				*29.6		
0.567	1000	6.565E+06	11790	1.672E+02	.2725	.3581				115								*25.5		
0.624	1100	1.244E+07	11520	2.959E+02	.2611	.3645				*126								*21.6		
0.737	1300																			
0.851	1500																			
REF:	A O	A	A	A	A	F O	F	F	A O				F	F			H			
SODIUM			TET=371.0			TEC=2509			TEM=			MOL=22.99			PRC=3.41E+07			DEC=206.2		
TER	TEK	PRV	DEL	DEV	HLT × 10 ⁻⁶	HEV × 10 ⁻⁶	CPL	KNL	DFL × 10 ⁶	CPV	KNV	DFV	VKL × 10 ⁶	VDL × 10 ³	VKV	VDV × 10 ⁶	STL × 10 ²	HLL × 10 ¹⁰		
0.159	400	1.358E-04	920.7	0.960E-11	4.493	4.740	1373	86.8	68.7	1023			0.667	0.614				19.0		
0.199	500	7.635E-02	897.3	4.340E-07	4.438	4.820	1330	81.8	68.6	1316			0.464	0.416				18.0		
0.239	600	5.047E+00	873.6	2.409E-05	4.374	4.887	1299	76.4	67.3	1745			0.366	0.320				17.0		
0.279	700	9.869E+01	849.8	4.083E-04	4.296	4.938	1277	71.5	65.9	2160			0.312	0.265				16.0		
0.319	800	9.043E+02	825.8	3.321E-03	4.209	4.978	1264	66.8	64.0	2452			0.277	0.229				15.0		
0.359	900	5.010E+03	801.7	1.662E-02	4.116	5.011	1258	62.5	62.0	2597			0.254	0.204				14.0		
0.399	1000	1.955E+04	777.5	5.938E-02	4.021	5.042	1259	58.3	59.6	2624			0.238	0.185				13.0		
0.478	1200	1.482E+05	729.1	3.889E-01	3.835	5.109	1281	50.3	53.9	2515			0.219	0.160				11.0		
0.558	1400	6.203E+05	680.7	1.454E+00	3.640	5.175	1330	42.2	47.3	2391			0.209	0.142				9.0		
0.638	1600	1.798E+06	632.7	3.881E+00	3.416	5.225	1406	35.8	40.2	2301			0.206	0.130				7.0		
0.717	1800	4.087E+06	585.1	8.365E+00	3.153	5.255	1516	28.9	32.6	2261			0.205	0.120				5.0		
0.797	2000	7.851E+06	536.4	1.575E+01	2.834	5.256	1702	22.2	24.4	2481			0.209	0.112				*3.1		
0.877	2200	1.335E+07	481.7	2.765E+01	2.413	5.207	2101	15.6	15.8	3306			0.218	0.105				*1.5		
0.957	2400	2.076E+07	403.2	5.089E+01	1.7															

URANIUM DIOXIDE			TET=		TEC=7560			TEM=		MOL=22.99			PRC=			DEC=		
TER	TEK	PRV	DEL	DEV	HLT × 10 ⁻⁶	HEV × 10 ⁻⁶	CPL	KNL	DFL ×10 ⁶	CPV	KNV	DFV	VKL ×10 ⁶	VDL ×10 ³	VKV	VDV ×10 ⁶	STL ×10 ²	HLL × 10 ¹⁰
0.413	3120	0.559E+03	8739		1.935	3.334	485						0.492	4.30			49.4	
0.423	3200	0.923E+03	8667		1.921	3.358	485						0.483	4.19			*48.2	
0.437	3300	0.166E+04	8577		1.903	3.389	485						0.468	4.01			*46.9	
0.450	3400	0.288E+04	8487		1.886	3.420	485						*.452	*3.84			*45.6	
0.463	3500	0.480E+04	*8397		1.869	3.452	485						*.441	*3.70			*44.3	
0.489	3700	0.122E+05	*8218		1.834	3.514	485						*.419	*3.44			*41.7	
0.529	4000	0.400E+06	*7948		1.782	3.607							*.395	*3.14			*37.8	
0.595	4500	0.192E+07	*7596		1.695	3.763							*.363	*2.76			*31.5	
0.661	5000	0.634E+07	*7047		1.607	3.917							*.353	*2.49			*25.5	
0.728	5500	*1.6E+07	*6600		*1.52	*4.07											*19.6	
0.794	6000	*3.3E+07	*6151		*1.43	*4.23											*14.1	
REF:		M		M	M	M							M	M			M	

NITROGEN TETROXIDE			TET=		TEC=431.35			TEM=261.95		MOL=92.016			PRC=9.937E+06			DEC=550.4		
TER	TEK	PRV	DEL	DEV	HLT × 10 ⁻⁶	HEV × 10 ⁻⁶	CPL	KNL	DFL ×10 ⁶	CPV	KNV	DFV	VKL ×10 ⁶	VDL ×10 ³	VKV	VDV ×10 ⁶	STL ×10 ²	HLL × 10 ¹⁰
0.607	261.9	1.894E+04	1514.6	0.640E+00														
0.626	270.0	2.963E+04	1496.5	0.102E+01														
0.649	280.0	4.998E+04	1474.0	0.177E+01														
0.673	290.0	8.182E+04	1451.5	0.294E+01														
0.682	294.3	1.003E+05	1441.8	0.346E+01	0.414												*2.58	
0.691	298.1	1.195E+05	1433.2	0.406E+01													2.51	
0.719	310.0	2.023E+05	1406.1	0.649E+01													*2.29	
0.742	320.0	3.069E+05	1383.3	0.894E+01													*2.10	
0.788	340.0		1312.0	0.166E+02													*1.72	
0.835	360.0		1236.0	0.312E+02													*1.34	
0.881	380.0		1119.0	0.563E+02													*0.97	
0.927	400.0		992.0	0.105E+03													*0.59	
0.974	420.0		821.0	0.230E+03													*0.21	
REF:	N	N	NP	P	N			N	N	N			N	N			N	

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