


1	 HONEYWELL Calgary, Alberta CANADA	Case Name:	C:\Program Files (x86)\...UniSim ThermoWorkbench R360\NoName.utw
2		Unit Set:	SI
3		Date/Time:	Wednesday Dec 7 2011, 7:02:49
4			
5			

Phase Equilibrium Properties Datasheet

Fluid Package

Selected Fluid Package	Fluid1	Selected Property Package	van Laar-Ideal Gas
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Binary Interaction Information

Minimum Composition	0.0000 *	Maximum Composition	1.0000 *
Number of Points	51 *	X axis Composition Basis	Mole

Constant Pressure Basis

101.0 kPa *

20	Ethanol		Temperature (C)		Enthalpy (kJ/kgmole)		Entropy (kJ/kgmole-C)		Molar Density (kgmole/m3)		Viscosity (cP)		Thermal Cond. (W/m-K)													
	Liquid	Mole	Bubble Point	Dew Point	Bubble Point	Dew Point	Bubble Point	Dew Point	Bubble Point	Dew Point	Bubble Point	Dew Point	Bubble Point	Dew Point												
21	0.0000	*	99.9052	*	-279222.3747	*	-238567.3516	*	23.5540	*	132.4841	*	52.6212	*	0.0326	*	0.2793	*	0.0121	*	0.6827	*	0.0241	*		
22	0.0200	*	95.0333	*	99.3917	*	-279338.2087	*	-238402.6865	*	24.3666	*	134.2438	*	50.8821	*	0.0326	*	0.3025	*	0.0092	*	0.6632	*	0.0239	*
23	0.0400	*	91.7663	*	98.8677	*	-279344.6056	*	-238239.2299	*	25.1978	*	135.7643	*	49.1830	*	0.0327	*	0.3241	*	0.0092	*	0.6448	*	0.0237	*
24	0.0600	*	89.4491	*	98.3358	*	-279285.9378	*	-238077.0912	*	26.0909	*	137.1874	*	47.5479	*	0.0327	*	0.3414	*	0.0092	*	0.6274	*	0.0235	*
25	0.0800	*	87.7392	*	97.7959	*	-279185.3610	*	-237916.2976	*	27.0238	*	138.5433	*	45.9848	*	0.0327	*	0.3556	*	0.0092	*	0.6106	*	0.0233	*
26	0.1000	*	86.4389	*	97.2478	*	-279056.2923	*	-237756.8774	*	27.9803	*	139.8464	*	44.4955	*	0.0328	*	0.3675	*	0.0092	*	0.5944	*	0.0231	*
27	0.1200	*	85.4256	*	96.6912	*	-278907.1106	*	-237598.8597	*	28.9492	*	141.1048	*	43.0786	*	0.0328	*	0.3775	*	0.0092	*	0.5786	*	0.0229	*
28	0.1400	*	84.6189	*	96.1258	*	-278743.3441	*	-237442.2747	*	29.9230	*	142.3241	*	41.7313	*	0.0329	*	0.3861	*	0.0091	*	0.5633	*	0.0228	*
29	0.1600	*	83.9643	*	95.5515	*	-278568.7959	*	-237287.1513	*	30.8963	*	143.5079	*	40.4503	*	0.0329	*	0.3936	*	0.0091	*	0.5483	*	0.0226	*
30	0.1800	*	83.4232	*	95.0333	*	-278386.1677	*	-237133.5227	*	31.8653	*	144.6589	*	39.2321	*	0.0330	*	0.4000	*	0.0091	*	0.5336	*	0.0224	*
31	0.2000	*	82.9681	*	94.3749	*	-278197.4284	*	-236981.4214	*	32.8273	*	145.7792	*	38.0730	*	0.0331	*	0.4057	*	0.0090	*	0.5193	*	0.0222	*
32	0.2200	*	82.5789	*	93.7722	*	-278004.0412	*	-236830.8780	*	33.7803	*	146.8703	*	36.9695	*	0.0331	*	0.4106	*	0.0090	*	0.5053	*	0.0220	*
33	0.2400	*	82.2405	*	93.1595	*	-277807.1107	*	-236681.9257	*	34.7225	*	147.9335	*	35.9183	*	0.0332	*	0.4150	*	0.0090	*	0.4916	*	0.0219	*
34	0.2600	*	81.9416	*	92.5368	*	-277607.4803	*	-236534.5956	*	35.6530	*	148.9696	*	34.9162	*	0.0332	*	0.4188	*	0.0089	*	0.4781	*	0.0217	*
35	0.2800	*	81.6737	*	91.7663	*	-277405.7997	*	-236388.9203	*	36.5709	*	149.9795	*	33.9602	*	0.0333	*	0.4222	*	0.0089	*	0.4649	*	0.0215	*
36	0.3000	*	81.4302	*	91.2604	*	-277202.5718	*	-236244.9295	*	37.4755	*	150.9636	*	33.0474	*	0.0333	*	0.4252	*	0.0088	*	0.4520	*	0.0213	*
37	0.3200	*	81.2061	*	90.6064	*	-276998.1870	*	-236102.6505	*	38.3664	*	151.9225	*	32.1754	*	0.0334	*	0.4279	*	0.0088	*	0.4393	*	0.0212	*
38	0.3400	*	80.9976	*	89.9420	*	-276792.9478	*	-235962.1073	*	39.2432	*	152.8564	*	31.3416	*	0.0335	*	0.4303	*	0.0087	*	0.4269	*	0.0210	*
39	0.3600	*	80.8018	*	89.4491	*	-276587.0874	*	-235823.3183	*	40.1057	*	153.7656	*	30.5437	*	0.0335	*	0.4324	*	0.0087	*	0.4148	*	0.0208	*
40	0.3800	*	80.6163	*	88.5821	*	-276380.7841	*	-235686.2934	*	40.9538	*	154.6504	*	29.7797	*	0.0336	*	0.4343	*	0.0086	*	0.4028	*	0.0206	*
41	0.4000	*	80.4395	*	87.7392	*	-276174.1717	*	-235551.0312	*	41.7873	*	155.5107	*	29.0476	*	0.0336	*	0.4359	*	0.0086	*	0.3911	*	0.0205	*
42	0.4200	*	80.2702	*	87.1839	*	-275967.3481	*	-235417.5127	*	42.6063	*	156.3468	*	28.3455	*	0.0337	*	0.4374	*	0.0085	*	0.3797	*	0.0203	*
43	0.4400	*	80.1073	*	86.4389	*	-275760.3816	*	-235285.6943	*	43.4109	*	157.1588	*	27.6719	*	0.0338	*	0.4386	*	0.0085	*	0.3685	*	0.0201	*
44	0.4600	*	79.9502	*	85.4256	*	-275553.3164	*	-235155.4964	*	44.2009	*	157.9468	*	27.0249	*	0.0338	*	0.4397	*	0.0084	*	0.3575	*	0.0200	*
45	0.4800	*	79.7984	*	85.0351	*	-275346.1763	*	-235026.7868	*	44.9766	*	158.7110	*	26.4033	*	0.0339	*	0.4406	*	0.0083	*	0.3467	*	0.0198	*
46	0.5000	*	79.6517	*	84.6189	*	-275138.9684	*	-234899.3563	*	45.7380	*	159.4519	*	25.8056	*	0.0340	*	0.4414	*	0.0083	*	0.3362	*	0.0196	*
47	0.5200	*	79.5098	*	83.4232	*	-274931.6857	*	-234772.8845	*	46.4853	*	160.1702	*	25.2305	*	0.0341	*	0.4421	*	0.0082	*	0.3259	*	0.0195	*
48	0.5400	*	79.3728	*	82.9681	*	-274724.3088	*	-234646.8958	*	47.2184	*	160.8667	*	24.6769	*	0.0341	*	0.4426	*	0.0082	*	0.3158	*	0.0193	*
49	0.5600	*	79.2405	*	82.2405	*	-274516.8083	*	-234520.7207	*	47.9377	*	161.5431	*	24.1435	*	0.0342	*	0.4429	*	0.0081	*	0.3059	*	0.0192	*
50	0.5800	*	79.1133	*	81.6737	*	-274309.1458	*	-234393.5115	*	48.6431	*	162.2014	*	23.6295	*	0.0342	*	0.4432	*	0.0081	*	0.2963	*	0.0190	*
51	0.6000	*	78.9911	*	81.2061	*	-274101.2749	*	-234264.3839	*	49.3348	*	162.8434	*	23.1336	*	0.0343	*	0.4434	*	0.0080	*	0.2868	*	0.0189	*
52	0.6200	*	78.8743	*	80.6163	*	-273893.1428	*	-234132.6728	*	50.0128	*	163.4706	*	22.6552	*	0.0343	*	0.4434	*	0.0079	*	0.2776	*	0.0187	*
53	0.6400	*	78.7630	*	80.1073	*	-273684.6902	*	-233998.0963	*	50.6773	*	164.0831	*	22.1932	*	0.0344	*	0.4433	*	0.0079	*	0.2685	*	0.0186	*
54	0.6600	*	78.6575	*	79.7984	*	-273475.8523	*	-233860.7045	*	51.3281	*	164.6801	*	21.7469	*	0.0344	*	0.4432	*	0.0078	*	0.2597	*	0.0185	*
55	0.6800	*	78.5580	*	79.3728	*	-273266.5594	*	-233720.7169	*	51.9654	*	165.2600	*	21.3156	*	0.0345	*	0.4429	*	0.0078	*	0.2510	*	0.0183	*
56	0.7000	*	78.4650	*	79.1133	*	-273056.7370	*	-233578.4109	*	52.5891	*	165.8211	*	20.8984	*	0.0345	*	0.4425	*	0.0077	*	0.2426	*	0.0182	*
57	0.7200	*	78.3787	*	78.8743	*	-272846.3059	*	-233434.0574	*	53.1989	*	166.3613	*	20.4948	*	0.0345	*	0.4421	*	0.0077	*	0.2343	*	0.0181	*
58	0.7400	*	78.2995	*	78.6575	*	-272635.1827	*	-233287.9003	*	53.7947	*	166.8785	*	20.1041	*	0.0345	*	0.4415	*	0.0077	*	0.2263	*	0.0180	*
59	0.7600	*	78.2277	*	78.4650	*	-272423.2798	*	-233140.1508	*	54.3762	*	167.3704	*	19.7256	*	0.0346	*	0.4409	*	0.0076	*	0.2184	*	0.0179	*
60	0.7800	*	78.1636	*	78.2995	*	-272210.5053	*	-232990.9893	*	54.9430	*	167.8345	*	19.3590	*	0.0346	*	0.4402	*	0.0076	*	0.2107	*	0.0178	*
61	0.8000	*	78.1078	*	78.2277	*	-271996.7629	*	-232840.5684	*	55.4943	*	168.2679	*	19.0035	*	0.0346	*	0.4394	*	0.0075	*	0.2032	*	0.0177	*
62	0.8200	*	78.0604	*	78.1078	*	-271781.9519	*	-232689.0166	*	56.0293	*	168.6672	*	18.6588	*	0.0346	*	0.4384	*	0.0075	*	0.1959	*	0.0176	*
63	0.8400	*	78.0221	*	78.0604	*	-271565.9672	*	-232536.4441	*	56.5468	*	169.0287	*	18.3243	*	0.0346	*	0.4374	*	0.0074	*	0.1887	*	0.0175	*
64	0.8600	*	77.9931	*	78.0221	*	-271348.6985	*	-232382.9405	*	57.0452	*	169.3473	*	17.9996	*	0.0346	*	0.4364	*	0.0074	*	0.1817	*	0.0174	*
65	0.8800	*	77.9739	*	77.9739	*	-271130.0308	*	-232228.5812	*	57.5223	*	169.6169	*	17.6843	*	0.0346	*	0.4352	*	0.0074	*	0.1749	*	0.0174	*
66	0.9000	*	77.9650	*	77.9650	*	-270909.8434	*	-232073.4264	*	57.9747	*	169.8293	*	17.3780	*	0.0346	*	0.4339	*	0.0073	*	0.1683	*	0.0173	*
67	0.9200	*	77.9667	*	77.9667	*	-270688.0097	*	-231917.5241	*	58.3975	*	169.9732	*	17.0802	*	0.0346	*	0.4326	*	0.0073	*	0.1618	*	0.0172	*

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2		Unit Set:	SI
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4			
5			

Phase Equilibrium Properties Datasheet

Binary Interaction Information

Constant Pressure Basis

101.0 kPa *

Liquid Mole	Ethanol		Temperature (C)		Enthalpy (kJ/kgmole)		Entropy (kJ/kgmole-C)		Molar Density (kgmole/m3)		Viscosity (cP)		Thermal Cond. (W/m-K)	
	Bubble Point	Dew Point	Bubble Point	Dew Point	Bubble Point	Dew Point	Bubble Point	Dew Point	Bubble Point	Dew Point	Bubble Point	Dew Point	Bubble Point	Dew Point
0.9400 *	77.9797 *	77.9797 *	-270464.3970 *	-231760.9012 *	58.7831 *	170.0314 *	16.7907 *	0.0346 *	0.4312 *	0.0073 *	0.1555 *	0.0171 *		
0.9600 *	78.0043 *	78.0043 *	-270238.8654 *	-231603.5675 *	59.1178 *	169.9746 *	16.5091 *	0.0346 *	0.4296 *	0.0072 *	0.1494 *	0.0170 *		
0.9800 *	78.0412 *	78.0412 *	-270011.2676 *	-231445.4877 *	59.3719 *	169.7419 *	16.2351 *	0.0346 *	0.4280 *	0.0072 *	0.1434 *	0.0170 *		
1.0000 *	78.0908 *	78.0908 *	-269781.5637 *	-231286.5191 *	59.4035 *	169.0548 *	15.9686 *	0.0346 *	0.4263 *	0.0071 *	0.1375 *	0.0169 *		

Liquid Mole	Ethanol		Liquid Surface Tension dyne/cm	Relative Volatility	Gibbs Excess kJ/kgmole	K Factor		Activity Coefficient		Fugacity Coefficient	
	Vapour Mole	Mole				Ethanol	H2O	Ethanol	H2O	Ethanol	H2O
0.0000 *	0.0001 *	58.6229 *	---	0.0516 *	---	0.9999 *	1.6647 *	0.0000 *	2.4685 *	-0.0001 *	
0.0200 *	0.1778 *	58.6680 *	10.5943 *	98.3704 *	8.8887 *	0.8390 *	1.5507 *	0.0011 *	2.1848 *	-0.1755 *	
0.0400 *	0.2843 *	58.3935 *	9.5336 *	188.1586 *	7.1075 *	0.7455 *	1.4439 *	0.0044 *	1.9612 *	-0.2937 *	
0.0600 *	0.3546 *	57.9324 *	8.6090 *	270.5566 *	5.9106 *	0.6866 *	1.3438 *	0.0097 *	1.7767 *	-0.3761 *	
0.0800 *	0.4042 *	57.3529 *	7.8029 *	346.2988 *	5.0529 *	0.6476 *	1.2501 *	0.0167 *	1.6200 *	-0.4345 *	
0.1000 *	0.4409 *	56.6941 *	7.0985 *	415.8978 *	4.4094 *	0.6212 *	1.1624 *	0.0254 *	1.4837 *	-0.4761 *	
0.1200 *	0.4692 *	55.9802 *	6.4813 *	479.7445 *	3.9097 *	0.6032 *	1.0801 *	0.0356 *	1.3635 *	-0.5055 *	
0.1400 *	0.4916 *	55.2267 *	5.9388 *	538.1564 *	3.5111 *	0.5912 *	1.0031 *	0.0471 *	1.2559 *	-0.5256 *	
0.1600 *	0.5098 *	54.4442 *	5.4602 *	591.4037 *	3.1863 *	0.5836 *	0.9309 *	0.0598 *	1.1589 *	-0.5386 *	
0.1800 *	0.5251 *	53.6401 *	5.0366 *	639.7239 *	2.9171 *	0.5792 *	0.8632 *	0.0737 *	1.0706 *	-0.5461 *	
0.2000 *	0.5381 *	52.8197 *	4.6604 *	683.3311 *	2.6906 *	0.5773 *	0.7998 *	0.0885 *	0.9898 *	-0.5493 *	
0.2200 *	0.5495 *	51.9867 *	4.3252 *	722.4215 *	2.4979 *	0.5775 *	0.7404 *	0.1043 *	0.9154 *	-0.5490 *	
0.2400 *	0.5597 *	51.1441 *	4.0256 *	757.1770 *	2.3321 *	0.5793 *	0.6848 *	0.1209 *	0.8468 *	-0.5459 *	
0.2600 *	0.5690 *	50.2938 *	3.7568 *	787.7680 *	2.1883 *	0.5825 *	0.6326 *	0.1383 *	0.7831 *	-0.5404 *	
0.2800 *	0.5775 *	49.4376 *	3.5151 *	814.3549 *	2.0626 *	0.5868 *	0.5838 *	0.1564 *	0.7240 *	-0.5331 *	
0.3000 *	0.5856 *	48.5765 *	3.2970 *	837.0895 *	1.9519 *	0.5920 *	0.5381 *	0.1750 *	0.6688 *	-0.5242 *	
0.3200 *	0.5933 *	47.7115 *	3.0998 *	856.1160 *	1.8540 *	0.5981 *	0.4953 *	0.1942 *	0.6174 *	-0.5140 *	
0.3400 *	0.6007 *	46.8433 *	2.9208 *	871.5715 *	1.7669 *	0.6049 *	0.4553 *	0.2140 *	0.5692 *	-0.5026 *	
0.3600 *	0.6081 *	45.9725 *	2.7581 *	883.5870 *	1.6891 *	0.6124 *	0.4178 *	0.2341 *	0.5242 *	-0.4904 *	
0.3800 *	0.6153 *	45.0993 *	2.6097 *	892.2872 *	1.6192 *	0.6205 *	0.3828 *	0.2547 *	0.4820 *	-0.4773 *	
0.4000 *	0.6226 *	44.2243 *	2.4741 *	897.7914 *	1.5564 *	0.6291 *	0.3501 *	0.2756 *	0.4424 *	-0.4635 *	
0.4200 *	0.6299 *	43.3475 *	2.3499 *	900.2138 *	1.4997 *	0.6382 *	0.3196 *	0.2968 *	0.4052 *	-0.4491 *	
0.4400 *	0.6373 *	42.4691 *	2.2359 *	899.6633 *	1.4483 *	0.6477 *	0.2911 *	0.3183 *	0.3704 *	-0.4343 *	
0.4600 *	0.6448 *	41.5894 *	2.1310 *	896.2443 *	1.4017 *	0.6578 *	0.2646 *	0.3400 *	0.3377 *	-0.4189 *	
0.4800 *	0.6525 *	40.7083 *	2.0343 *	890.0566 *	1.3594 *	0.6682 *	0.2398 *	0.3619 *	0.3071 *	-0.4031 *	
0.5000 *	0.6604 *	39.8260 *	1.9450 *	881.1958 *	1.3209 *	0.6791 *	0.2168 *	0.3840 *	0.2783 *	-0.3870 *	
0.5200 *	0.6686 *	38.9425 *	1.8624 *	869.7533 *	1.2858 *	0.6904 *	0.1955 *	0.4062 *	0.2514 *	-0.3705 *	
0.5400 *	0.6770 *	38.0578 *	1.7858 *	855.8165 *	1.2538 *	0.7021 *	0.1756 *	0.4286 *	0.2262 *	-0.3537 *	
0.5600 *	0.6858 *	37.1720 *	1.7146 *	839.4691 *	1.2246 *	0.7142 *	0.1572 *	0.4511 *	0.2026 *	-0.3366 *	
0.5800 *	0.6948 *	36.2851 *	1.6484 *	820.7911 *	1.1979 *	0.7267 *	0.1402 *	0.4736 *	0.1806 *	-0.3192 *	
0.6000 *	0.7042 *	35.3970 *	1.5868 *	799.8590 *	1.1736 *	0.7396 *	0.1245 *	0.4962 *	0.1601 *	-0.3016 *	
0.6200 *	0.7139 *	34.5078 *	1.5292 *	776.7461 *	1.1514 *	0.7529 *	0.1101 *	0.5188 *	0.1410 *	-0.2838 *	
0.6400 *	0.7240 *	33.6175 *	1.4754 *	751.5225 *	1.1312 *	0.7667 *	0.0967 *	0.5415 *	0.1233 *	-0.2656 *	
0.6600 *	0.7345 *	32.7261 *	1.4251 *	724.2549 *	1.1129 *	0.7809 *	0.0845 *	0.5641 *	0.1069 *	-0.2473 *	
0.6800 *	0.7454 *	31.8336 *	1.3779 *	695.0073 *	1.0962 *	0.7956 *	0.0734 *	0.5868 *	0.0919 *	-0.2287 *	
0.7000 *	0.7568 *	30.9399 *	1.3336 *	663.8409 *	1.0811 *	0.8107 *	0.0632 *	0.6094 *	0.0780 *	-0.2099 *	
0.7200 *	0.7686 *	30.0451 *	1.2920 *	630.8139 *	1.0675 *	0.8263 *	0.0540 *	0.6320 *	0.0654 *	-0.1908 *	
0.7400 *	0.7810 *	29.1492 *	1.2528 *	595.9822 *	1.0554 *	0.8424 *	0.0456 *	0.6546 *	0.0539 *	-0.1715 *	
0.7600 *	0.7938 *	28.2521 *	1.2159 *	559.3987 *	1.0445 *	0.8591 *	0.0381 *	0.6771 *	0.0435 *	-0.1519 *	
0.7800 *	0.8072 *	27.3539 *	1.1811 *	521.1143 *	1.0349 *	0.8763 *	0.0314 *	0.6995 *	0.0343 *	-0.1321 *	
0.8000 *	0.8212 *	26.4545 *	1.1482 *	481.1774 *	1.0265 *	0.8940 *	0.0255 *	0.7219 *	0.0261 *	-0.1120 *	
0.8200 *	0.8358 *	25.5540 *	1.1171 *	439.6338 *	1.0192 *	0.9124 *	0.0202 *	0.7442 *	0.0190 *	-0.0917 *	
0.8400 *	0.8510 *	24.6523 *	1.0877 *	396.5275 *	1.0131 *	0.9314 *	0.0157 *	0.7664 *	0.0130 *	-0.0711 *	
0.8600 *	0.8668 *	23.7495 *	1.0598 *	351.9002 *	1.0080 *	0.9511 *	0.0118 *	0.7885 *	0.0079 *	-0.0501 *	
0.8800 *	0.8834 *	22.8456 *	1.0333 *	305.7914 *	1.0039 *	0.9715 *	0.0085 *	0.8105 *	0.0039 *	-0.0289 *	
0.9000 *	0.9007 *	21.9405 *	1.0082 *	258.2389 *	1.0008 *	0.9926 *	0.0058 *	0.8324 *	0.0008 *	-0.0074 *	
0.9200 *	0.9188 *	21.0343 *	0.9844 *	209.2781 *	0.9987 *	1.0146 *	0.0036 *	0.8542 *	-0.0013 *	0.0145 *	

Phase Equilibrium Properties Datasheet

Binary Interaction Information

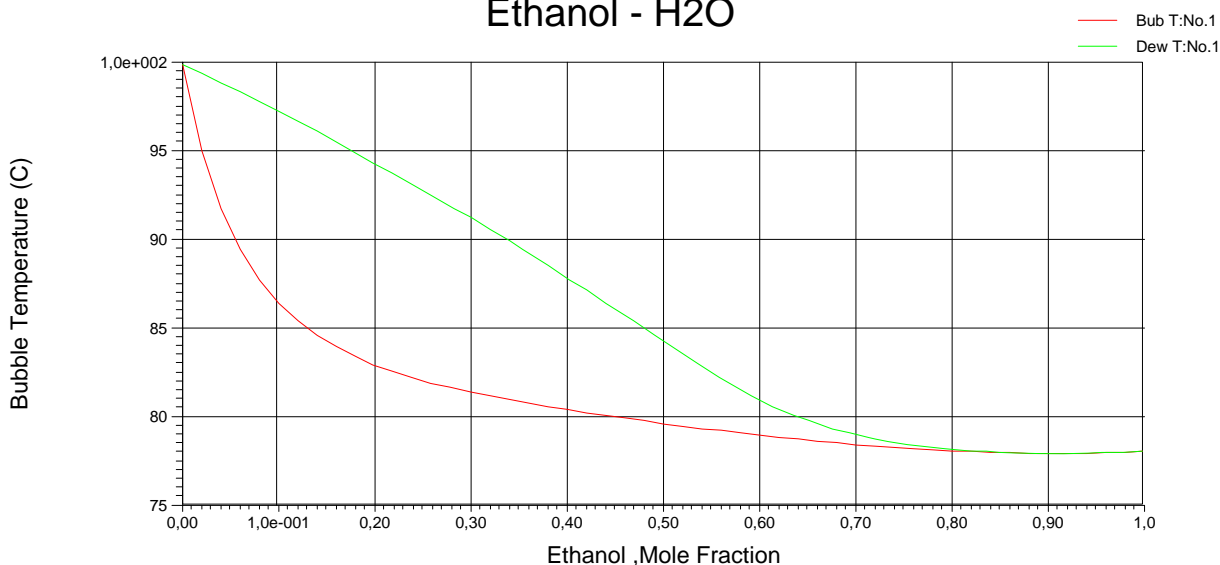
Constant Pressure Basis

101.0 kPa *

	Ethanol		Ethanol		Liquid Surface Tension dyne/cm	Relative Volatility	Gibbs Excess kJ/kgmole	K Factor		Activity Coefficient		Fugacity Coefficient	
	Liquid Mole		Vapour Mole					Ethanol	H2O	Ethanol	H2O	Ethanol	H2O
15	0.9400	*	0.9378	*	20.1270	0.9617	158.9430	0.9976	1.0373	0.0020	0.8758	-0.0024	0.0367
16	0.9600	*	0.9576	*	19.2186	0.9401	107.2652	0.9975	1.0610	0.0009	0.8974	-0.0025	0.0592
17	0.9800	*	0.9783	*	18.3092	0.9195	54.2748	0.9983	1.0856	0.0002	0.9188	-0.0017	0.0822
18	1.0000	*	1.0000	*	17.3990	---	0.0275	1.0000	---	0.0000	0.9401	-0.0000	0.1055

Plots

Ethanol - H2O



Notes and Comments