REPORT NO. FRA/ORD- 76/300 **PB**

THE CALCULATION OF THE THERMODYNAMIC PROPERTIES OF PROPANE, PROPYLENE, N-BUTANE, AND ETHYLENE

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FINAL REPORT

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16. Abstract

The thermodynamic properties of propane, propylene, n-butane and ethylene were calculated and are presented in tables. The tables list the values of the specific volume, the enthalpy, the entropy, the specific heat at constant pressure, the specific heat at constant volume and the sonic velocity of the four hydrocarbons in a temperature and pressure range which can be encountered when these commodities are shipped by rail tank cars. This includes subcooled states, saturation equilibrium states and superheated states. The computer program with which the tables were generated is discussed in detail and a complete listing of the program is given. The underlying thermodynamic theory and the equation of state used in the development of the presented data was given in Report No. FRA-ORD 76/299 and is not repeated. The present report is user-oriented in that it gives extensive tables and a complete listing of the computer program with which these tables were generated.

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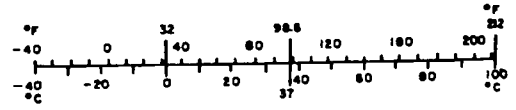
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



PREFACE

The authors would like to express their gratitude to the Computer Science Center of the University of Maryland for matching sponsored computer time on a one-to-one basis and for generously granting additional computer time when the computer time paid for by this contract and the matched time were exceeded. This program is under the technical direction of Mr. David M. Dancer of the Federal Railroad Administration. His cooperation and his administrative as well as technical contributions are gratefully acknowledged.

This report is the follow-up report to FRA-ORD 76/299 entitled "Thermodynamic Properties of Liquified Petroleum Gases (LPG)". While report FRA-ORD 76/299 discusses at length the development of the underlying thermodynamic equations and compares the results of different equations of state, the present report gives extensive tables of the thermodynamic properties of propane, propylene, n-butane and ethylene and also presents and explains the computer program which was used for the evaluation of the properties. In addition, the accuracy in the computations was improved; the presented tabulated data reflect this improvement.

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Nomenclature

a	=	Equation of state coefficient
a_s	=	Sonic velocity
A_o	=	Equation of state coefficient
b	=	Equation of state coefficient
B_o	=	Equation of state coefficient
c	=	Equation of state coefficient
C_o	=	Equation of state coefficient
C_p	=	Constant pressure specific heat
C_p^*	=	Ideal gas constant pressure specific heat
C_v	=	Constant volume specific heat
d	=	Equation of state coefficient
D_o	=	Equation of state coefficient
E_o	=	Equation of state coefficient
f	=	fugacity
$\bar{f}$	=	Fugacity of component in a mixture
H	=	Enthalpy
H^o	=	Ideal gas enthalpy
H_o^o	=	Absolute enthalpy
i	=	Mixture component subscript
P	=	Pressure
R	=	Universal gas constant
S	=	Entropy
S^o	=	Ideal gas entropy at unit pressure
S_o^o	=	Absolute entropy
T	=	Temperature
X	=	Quality

α = Equation of state coefficient

γ = Equation of state coefficient

ρ = Density

I. Description and Use of Tables

The thermodynamic properties of propane, propylene, n-butane and ethylene were calculated using Starling's equation of state. A previous investigation by Sallet and Wu (ref. 1) showed that the thermodynamic data of hydrocarbons which are currently available in the open technical literature are too inconsistent to be used for two-phase flow calculations necessary to properly size safety valves. In addition, Sallet and Wu (ref. 1) compared different equations of state and found that Starling's equation is best suited for the calculation of the thermodynamic data of hydrocarbons in the temperature and pressure regions which include compressed liquid states.

Saturation temperature tables are given for propane, propylene, n-butane, a 65% propane-25% propylene - 10% n-butane (by mole) mixture and ethylene. The mixture is treated as pseudo-fluid, as described by Sallet and Wu (ref. 1). The individual saturation temperature tables have two parts, in the first part the temperature, pressure, specific volume, enthalpy and entropy is listed and in the second part the temperature and pressures are repeated and the specific heat at constant pressure, the specific heat at constant volume and the sonic velocity is given. The saturation temperature tables given the thermodynamic properties at two degree Fahrenheit intervals within the following ranges: for propane, from -50°F to +196°F; for propylene from -50°F to 190°F, for n-butane, from -50°F to 294°F; for the propane mixture from -50°F to 164°F and for ethylene from -50°F to 42°F.

The thermodynamic properties in the superheated vapor region and the compressed liquid region were calculated for propane, propylene, n-butane,

and ethylene. The temperature intervals are 10 degress Fahrenheit and the properties in the superheated vapor and compressed liquid regions are given in the same table, i.e. for a given temperature the properties are tabulated as a function of pressure. The pressure intervals are 10 psi with the lowest pressure selected being 10 psia.

Table II-1 Saturation Temperature Table of Propane

THERMODYNAMC PROPERTIES OF PROPANE USING STARLINGS EQUATION OF STATE

PRESSURE (PSIA)	TEMPERATURE (°F)	SATURATED LIQUID SPECIFIC VOLUME (FT^3/LBM)	SATURATED VAPOR SPECIFIC VOLUME (FT^3/LBM)	SATURATED LIQUID ENTHALPY (BTU/LBM)	SATURATED VAPOR ENTHALPY (BTU/LBM)	SATURATED LIQUID ENTROPY (BTU/LBM/°F)	SATURATED VAPOR ENTROPY (BTU/LBM/°F)
12.58	-50.	.027944	7.641916	-884.1556	-700.1292	.799427	1.248272
13.23	-48.	.028000	7.291954	-883.0893	-699.5757	.802019	1.247440
13.90	-46.	.028056	6.961441	-882.0213	-699.0228	.804602	1.246628
14.61	-44.	.028113	6.649115	-880.9514	-698.4704	.807177	1.245834
15.34	-42.	.028170	6.353810	-879.8797	-697.9187	.809744	1.245058
16.09	-40.	.028227	6.074441	-878.8062	-697.3675	.812303	1.244300
16.88	-38.	.028285	5.810002	-877.7307	-696.8171	.814853	1.243559
17.70	-36.	.028343	5.559561	-876.6534	-696.2673	.817396	1.242835
18.54	-34.	.028401	5.322250	-875.5741	-695.7183	.819931	1.242128
19.42	-32.	.028460	5.097263	-874.4928	-695.1699	.822458	1.241437
20.33	-30.	.028519	4.883850	-873.4096	-694.6224	.824978	1.240762
21.27	-28.	.028579	4.681312	-872.3242	-694.0757	.827490	1.240103
22.25	-26.	.028638	4.488999	-871.2369	-693.5298	.829996	1.239459
23.25	-24.	.028699	4.306305	-870.1474	-692.9847	.832494	1.238830
24.30	-22.	.028759	4.132665	-869.0558	-692.4405	.834985	1.238216
25.38	-20.	.028820	3.967550	-867.9620	-691.8973	.837469	1.237616
26.49	-18.	.028882	3.810470	-866.8660	-691.3549	.839947	1.237030
27.65	-16.	.028944	3.660962	-865.7677	-690.8136	.842418	1.236458
28.84	-14.	.029006	3.518598	-864.6672	-690.2732	.844882	1.235900
30.07	-12.	.029069	3.382975	-863.5643	-689.7339	.847340	1.235355
31.34	-10.	.029132	3.253717	-862.4591	-689.1957	.849792	1.234822
32.65	-8.	.029196	3.130470	-861.3515	-688.6585	.852239	1.234303
34.00	-6.	.029260	3.012906	-860.2414	-688.1225	.854679	1.233795
35.40	-4.	.029325	2.900714	-859.1289	-687.5876	.857113	1.233300
36.83	-2.	.029390	2.793605	-858.0138	-687.0539	.859542	1.232817
38.32	0.	.029456	2.691305	-856.8961	-686.5214	.861965	1.232345
39.84	2.	.029522	2.593559	-855.7759	-685.9902	.864383	1.231884
41.41	4.	.029589	2.500128	-854.6529	-685.4602	.866795	1.231435
43.03	6.	.029657	2.410785	-853.5273	-684.9316	.869203	1.230996
44.70	8.	.029725	2.325319	-852.3989	-684.4043	.871605	1.230568
46.41	10.	.029794	2.243529	-851.2677	-683.8785	.874003	1.230150
48.17	12.	.029863	2.165228	-850.1336	-683.3540	.876396	1.229743
49.99	14.	.029933	2.090240	-848.9966	-682.8310	.878784	1.229345
51.85	16.	.030003	2.018397	-847.8567	-682.3096	.881168	1.228956
53.77	18.	.030075	1.949543	-846.7137	-681.7896	.883548	1.228578
55.74	20.	.030147	1.883530	-845.5677	-681.2713	.885923	1.228208
57.76	22.	.030219	1.820218	-844.4186	-680.7546	.888295	1.227847
59.84	24.	.030293	1.759475	-843.2663	-680.2395	.890662	1.227495
61.97	26.	.030367	1.701177	-842.1107	-679.7262	.893026	1.227151
64.16	28.	.030442	1.645207	-840.9519	-679.2146	.895386	1.226815
66.41	30.	.030517	1.591454	-839.7897	-678.7048	.897743	1.226488
68.71	32.	.030594	1.539813	-838.6242	-678.1969	.900096	1.226168
71.07	34.	.030671	1.490184	-837.4551	-677.6909	.902446	1.225856
73.50	36.	.030749	1.442474	-836.2825	-677.1868	.904793	1.225551
75.99	38.	.030828	1.396594	-835.1063	-676.6847	.907137	1.225253
78.53	40.	.030908	1.352460	-833.9264	-676.1847	.909479	1.224962
81.14	42.	.030989	1.309992	-832.7428	-675.6868	.911817	1.224678
83.82	44.	.031071	1.269114	-831.5554	-675.1910	.914153	1.224400
86.56	46.	.031154	1.229756	-830.3641	-674.6975	.916487	1.224129
89.37	48.	.031237	1.191849	-829.1689	-674.2063	.918819	1.223863
92.24	50.	.031322	1.155329	-827.9697	-673.7174	.921148	1.223604
95.18	52.	.031408	1.120134	-826.7663	-673.2309	.923476	1.223350
98.19	54.	.031495	1.086207	-825.5587	-672.7469	.925802	1.223101
101.27	56.	.031583	1.053493	-824.3469	-672.2655	.928126	1.222858
104.43	58.	.031672	1.021939	-823.1308	-671.7866	.930449	1.222619
107.65	60.	.031763	.991496	-821.9102	-671.3105	.932771	1.222385
110.95	62.	.031854	.962116	-820.6851	-670.8372	.935091	1.222156

Table II-1 (Continued)

114.32	64.	.031947	.933754	-819.4553	-670.3666	.937411	1.221931
117.77	66.	.032041	.906368	-818.2209	-669.8991	.939729	1.221710
121.29	68.	.032137	.879916	-816.9817	-669.4345	.942047	1.221493
124.89	70.	.032234	.854360	-815.7375	-668.9731	.944365	1.221279
128.57	72.	.032332	.829663	-814.4884	-668.5149	.946683	1.221069
132.33	74.	.032432	.805789	-813.2341	-668.0599	.949000	1.220862
136.17	76.	.032534	.782706	-811.9746	-667.6084	.951318	1.220658
140.09	78.	.032637	.760381	-810.7097	-667.1604	.953636	1.220456
144.09	80.	.032741	.738783	-809.4394	-666.7161	.955954	1.220257
148.18	82.	.032848	.717884	-808.1635	-666.2754	.958273	1.220059
152.35	84.	.032956	.697656	-806.8819	-665.8386	.960593	1.219864
156.61	86.	.033066	.678071	-805.5944	-665.4059	.962915	1.219670
160.95	88.	.033178	.659106	-804.3010	-664.9772	.965237	1.219478
165.39	90.	.033292	.640735	-803.0014	-664.5528	.967561	1.219286
169.91	92.	.033408	.622935	-801.6955	-664.1327	.969888	1.219095
174.52	94.	.033526	.605684	-800.3832	-663.7173	.972216	1.218905
179.23	96.	.033646	.588962	-799.0643	-663.3065	.974546	1.218715
184.03	98.	.033769	.572748	-797.7386	-662.9007	.976880	1.218525
188.92	100.	.033894	.557021	-796.4059	-662.4998	.979216	1.218334
193.90	102.	.034021	.541765	-795.0661	-662.1042	.981555	1.218142
198.99	104.	.034151	.526961	-793.7189	-661.7141	.983898	1.217949
204.17	106.	.034284	.512592	-792.3642	-661.3296	.986245	1.217755
209.45	108.	.034420	.498641	-791.0017	-660.9509	.988596	1.217559
214.83	110.	.034558	.485094	-789.6312	-660.5783	.990951	1.217360
220.31	112.	.034700	.471935	-788.2525	-660.2120	.993312	1.217159
225.89	114.	.034845	.459149	-786.8652	-659.8523	.995677	1.216954
231.58	116.	.034994	.446722	-785.4691	-659.4994	.998048	1.216746
237.37	118.	.035146	.434642	-784.0640	-659.1536	1.000426	1.216534
243.27	120.	.035301	.422896	-782.6495	-658.8153	1.002810	1.216317
249.28	122.	.035461	.411471	-781.2252	-658.4847	1.005201	1.216095
255.39	124.	.035625	.400355	-779.7909	-658.1622	1.007600	1.215868
261.62	126.	.035793	.389538	-778.3461	-657.8481	1.010007	1.215635
267.95	128.	.035966	.379007	-776.8905	-657.5429	1.012422	1.215394
274.40	130.	.036144	.368752	-775.4236	-657.2469	1.014847	1.215147
280.97	132.	.036327	.358764	-773.9450	-656.9606	1.017282	1.214891
287.65	134.	.036516	.349032	-772.4541	-656.6845	1.019728	1.214627
294.45	136.	.036710	.339546	-770.9505	-656.4190	1.022186	1.214353
301.36	138.	.036911	.330298	-769.4334	-656.1648	1.024656	1.214068
308.40	140.	.037118	.321279	-767.9024	-655.9224	1.027139	1.213772
315.56	142.	.037332	.312478	-766.3567	-655.6925	1.029637	1.213464
322.84	144.	.037555	.303889	-764.7955	-655.4756	1.032150	1.213143
330.25	146.	.037785	.295503	-763.2181	-655.2727	1.034680	1.212808
337.78	148.	.038024	.287312	-761.6234	-655.0845	1.037228	1.212457
345.44	150.	.038273	.279308	-760.0106	-654.9119	1.039796	1.212089
353.23	152.	.038532	.271482	-758.3785	-654.7559	1.042385	1.211702
361.14	154.	.038802	.263829	-756.7258	-654.6176	1.044996	1.211296
369.20	156.	.039084	.256339	-755.0512	-654.4981	1.047633	1.210869
377.38	158.	.039380	.249006	-753.3531	-654.3987	1.050297	1.210418
385.70	160.	.039690	.241823	-751.6298	-654.3209	1.052991	1.209941
394.16	162.	.040016	.234781	-749.8793	-654.2663	1.055718	1.209436
402.76	164.	.040361	.227873	-748.0994	-654.2367	1.058481	1.208901
411.50	166.	.040725	.221092	-746.2874	-654.2342	1.061283	1.208333
420.38	168.	.041111	.214431	-744.4403	-654.2610	1.064130	1.207728
429.41	170.	.041523	.207880	-742.5546	-654.3197	1.067027	1.207083
438.58	172.	.041962	.201433	-740.6263	-654.4134	1.069979	1.206392
447.89	174.	.042435	.195079	-738.6506	-654.5454	1.072994	1.205652
457.36	176.	.042944	.188811	-736.6215	-654.7199	1.076080	1.204856
466.97	178.	.043497	.182618	-734.5322	-654.9415	1.079248	1.203999
476.74	180.	.044101	.176489	-732.3740	-655.2158	1.082510	1.203070
486.65	182.	.044765	.170412	-730.1365	-655.5495	1.085883	1.202062
496.72	184.	.045503	.164373	-727.8064	-655.9507	1.089384	1.200962
506.94	186.	.046329	.158356	-725.3670	-656.4295	1.093041	1.199755
517.31	188.	.047266	.152342	-722.7965	-656.9984	1.096884	1.198424
527.82	190.	.048343	.146307	-720.0669	-657.6737	1.100955	1.196945
538.48	192.	.049601	.140220	-717.1406	-658.4767	1.105311	1.195286
549.28	194.	.051097	.134042	-713.9679	-659.4366	1.110024	1.193405
560.20	196.	.052914	.127715	-710.4817	-660.5952	1.115195	1.191241

Table II-1 (Continued)

THERMODYNAMIC PROPERTIES OF PROPANE USING STARLINGS EQUATION OF STATE

PRESSURE	TEMPERATURE	SATURATED LIQUID CONSTANT PRESSURE SPECIFIC HEAT	SATURATED VAPOR CONSTANT PRESSURE SPECIFIC HEAT	SATURATED LIQUID CONSTANT VOLUME SPECIFIC HEAT	SATURATED VAPOR CONSTANT VOLUME SPECIFIC HEAT	SATURATED LIQUID SONIC VELOCITY	SATURATED VAPOR SONIC VELOCITY
(PSIA)	(^{o}F)	(BTU/LBM/^{o}F)	(BTU/LBM/^{o}F)	(BTU/LBM/^{o}F)	(BTU/LBM/^{o}F)	(FT/SEC)	(FT/SEC)
12.58	-50.	.526117	.334776	.350211	.286096	4064.422	707.990
13.23	-48.	.527087	.336518	.351611	.287369	4030.075	708.972
13.90	-46.	.528064	.338275	.352991	.288651	3996.110	709.924
14.61	-44.	.529050	.340048	.354352	.289942	3962.514	710.845
15.34	-42.	.530044	.341836	.355694	.291242	3929.274	711.737
16.09	-40.	.531048	.343639	.357018	.292551	3896.378	712.598
16.88	-38.	.532061	.345458	.358325	.293870	3863.814	713.428
17.70	-36.	.533085	.347294	.359615	.295197	3831.570	714.228
18.54	-34.	.534120	.349145	.360890	.296533	3799.636	714.997
19.42	-32.	.535167	.351014	.362150	.297878	3768.001	715.735
20.33	-30.	.536225	.352899	.363396	.299232	3736.654	716.443
21.27	-28.	.537297	.354802	.364628	.300594	3705.587	717.119
22.25	-26.	.538381	.356723	.365848	.301966	3674.789	717.764
23.25	-24.	.539480	.358661	.367055	.303345	3644.251	718.378
24.30	-22.	.540593	.360617	.368250	.304734	3613.965	718.961
25.38	-20.	.541721	.362592	.369435	.306130	3583.922	719.512
26.49	-18.	.542864	.364585	.370608	.307536	3554.113	720.032
27.65	-16.	.544024	.366598	.371772	.308949	3524.532	720.520
28.84	-14.	.545200	.368630	.372926	.310371	3495.169	720.976
30.07	-12.	.546393	.370682	.374072	.311801	3466.019	721.400
31.34	-10.	.547604	.372754	.375208	.313239	3437.072	721.791
32.65	-8.	.548834	.374847	.376337	.314685	3408.324	722.151
34.00	-6.	.550082	.376961	.377458	.316139	3379.765	722.478
35.40	-4.	.551350	.379095	.378572	.317602	3351.391	722.773
36.83	-2.	.552636	.381252	.379679	.319072	3323.194	723.035
38.32	0.	.553947	.383430	.380780	.320549	3295.169	723.264
39.84	2.	.555277	.385632	.381874	.322035	3267.309	723.460
41.41	4.	.556629	.387856	.382963	.323528	3239.608	723.622
43.03	6.	.558003	.390103	.384047	.325029	3212.061	723.756
44.70	8.	.559401	.392375	.385126	.326537	3184.662	723.847
46.41	10.	.560822	.394671	.386201	.328053	3157.406	723.909
48.17	12.	.562269	.396991	.387271	.329576	3130.286	723.937
49.99	14.	.563740	.399338	.388338	.331106	3103.299	723.931
51.85	16.	.565238	.401710	.389400	.332644	3076.439	723.890
53.77	18.	.566762	.404109	.390460	.334189	3049.700	723.815
55.74	20.	.568314	.406535	.391516	.335741	3023.079	723.705
57.76	22.	.569894	.408989	.392570	.337300	2996.570	723.559
59.84	24.	.571504	.411472	.393622	.338865	2970.168	723.378
61.97	26.	.573143	.413984	.394671	.340438	2943.870	723.162
64.16	28.	.574813	.416526	.395718	.342018	2917.670	722.910
66.41	30.	.576515	.419098	.396763	.343604	2891.564	722.621
68.71	32.	.578250	.421702	.397807	.345198	2865.549	722.296
71.07	34.	.580018	.424338	.398850	.346797	2839.618	721.935
73.50	36.	.581821	.427008	.399892	.348404	2813.769	721.536
75.99	38.	.583660	.429712	.400933	.350017	2787.997	721.100
78.53	40.	.585536	.432450	.401973	.351636	2762.299	720.626
81.14	42.	.587450	.435225	.403013	.353262	2736.669	720.114
83.82	44.	.589403	.438037	.404053	.354894	2711.105	719.564
86.56	46.	.591397	.440887	.405092	.356533	2685.601	718.975
89.37	48.	.593432	.443777	.406132	.358178	2660.156	718.346
92.24	50.	.595511	.446707	.407173	.359828	2634.763	717.679
95.18	52.	.597635	.449680	.408213	.361486	2609.420	716.971
98.19	54.	.599805	.452695	.409255	.363149	2584.123	716.223
101.27	56.	.602023	.455756	.410297	.364818	2558.869	715.434
104.43	58.	.604290	.458862	.411341	.366493	2533.652	714.604
107.65	60.	.606609	.462017	.412386	.368175	2508.471	713.732

Table II-1 (Continued)

110.95	62.	.608982	.465221	.413432	.369862	2483.320	712.818
114.32	64.	.611410	.468477	.414480	.371555	2458.197	711.861
117.77	66.	.613895	.471785	.415529	.373254	2433.097	710.861
121.29	68.	.616440	.475150	.416581	.374959	2408.017	709.817
124.89	70.	.619047	.478571	.417634	.376670	2382.954	708.729
128.57	72.	.621719	.482053	.418689	.378386	2357.903	707.596
132.33	74.	.624459	.485596	.419747	.380108	2332.862	706.417
136.17	76.	.627269	.489205	.420808	.381836	2307.825	705.192
140.09	78.	.630152	.492881	.421871	.383570	2282.791	703.921
144.09	80.	.633112	.496627	.422937	.385309	2257.754	702.602
148.18	82.	.636152	.500447	.424006	.387054	2232.711	701.234
152.35	84.	.639276	.504343	.425077	.388805	2207.659	699.818
156.61	86.	.642488	.508320	.426153	.390561	2182.593	698.352
160.95	88.	.645792	.512381	.427231	.392323	2157.511	696.836
165.39	90.	.649192	.516530	.428314	.394091	2132.407	695.268
169.91	92.	.652695	.520772	.429400	.395864	2107.278	693.649
174.52	94.	.656304	.525111	.430490	.397643	2082.121	691.976
179.23	96.	.660026	.529552	.431584	.399428	2056.930	690.249
184.03	98.	.663867	.534101	.432683	.401219	2031.703	688.468
188.92	100.	.667833	.538763	.433786	.403015	2006.434	686.630
193.90	102.	.671932	.543545	.434893	.404817	1981.120	684.736
198.99	104.	.676172	.548453	.436006	.406625	1955.756	682.784
204.17	106.	.680560	.553496	.437124	.408439	1930.338	680.772
209.45	108.	.685107	.558679	.438247	.410259	1904.862	678.701
214.83	110.	.689822	.564013	.439375	.412085	1879.323	676.568
220.31	112.	.694716	.569507	.440510	.413917	1853.716	674.372
225.89	114.	.699801	.575171	.441650	.415755	1828.036	672.112
231.58	116.	.705090	.581015	.442797	.417599	1802.279	669.786
237.37	118.	.710598	.587053	.443950	.419450	1776.440	667.394
243.27	120.	.716340	.593296	.445110	.421307	1750.513	664.933
249.28	122.	.722335	.599761	.446278	.423171	1724.493	662.403
255.39	124.	.728600	.606463	.447453	.425041	1698.374	659.800
261.62	126.	.735158	.613419	.448636	.426919	1672.151	657.125
267.95	128.	.742033	.620650	.449827	.428803	1645.818	654.374
274.40	130.	.749251	.628176	.451027	.430695	1619.368	651.546
280.97	132.	.756841	.636022	.452236	.432594	1592.797	648.639
287.65	134.	.764837	.644215	.453455	.434500	1566.096	645.651
294.45	136.	.773277	.652784	.454684	.436415	1539.260	642.579
301.36	138.	.782203	.661763	.455923	.438337	1512.280	639.422
308.40	140.	.791662	.671190	.457174	.440268	1485.151	636.177
315.56	142.	.801709	.681106	.458437	.442207	1457.865	632.842
322.84	144.	.812407	.691561	.459713	.444155	1430.412	629.413
330.25	146.	.823827	.702608	.461002	.446113	1402.787	625.889
337.78	148.	.836051	.714311	.462305	.448080	1374.979	622.265
345.44	150.	.849174	.726740	.463624	.450057	1346.980	618.540
353.23	152.	.863309	.739978	.464959	.452045	1318.782	614.709
361.14	154.	.878585	.754121	.466312	.454044	1290.374	610.770
369.20	156.	.895156	.769280	.467683	.456054	1261.746	606.719
377.38	158.	.913204	.785585	.469075	.458077	1232.889	602.552
385.70	160.	.932948	.803191	.470489	.460113	1203.792	598.266
394.16	162.	.954649	.822279	.471926	.462162	1174.445	593.855
402.76	164.	.978626	.843069	.473390	.464226	1144.836	589.317
411.50	166.	1.005271	.865825	.474882	.466305	1114.956	584.646
420.38	168.	1.035065	.890867	.476404	.468400	1084.792	579.838
429.41	170.	1.068615	.918593	.477961	.470514	1054.337	574.889
438.58	172.	1.106686	.949495	.479556	.472646	1023.580	569.793
447.89	174.	1.150259	.984194	.481192	.474799	992.514	564.546
457.36	176.	1.200612	1.023482	.482875	.476974	961.133	559.144
466.97	178.	1.259430	1.068390	.484611	.479173	929.437	553.583
476.74	180.	1.328979	1.120279	.486405	.481398	897.429	547.858
486.65	182.	1.412361	1.180982	.488267	.483653	865.122	541.968
496.72	184.	1.513913	1.253035	.490206	.485940	832.541	535.912
506.94	186.	1.639838	1.340033	.492232	.488263	799.727	529.691
517.31	188.	1.799235	1.447250	.494359	.490626	766.750	523.314
527.82	190.	2.005823	1.582726	.496601	.493034	733.716	516.792
538.48	192.	2.280934	1.759340	.498975	.495495	700.785	510.152
549.28	194.	2.658981	1.999016	.501493	.498016	668.191	503.435
560.20	196.	3.198399	2.342198	.504164	.500609	636.249	496.717

Table II-2 Saturation Temperature Table of Propylene

THERMODYNAMIC PROPERTIES OF PROPYLENE AS GIVEN BY STARLINGS EQUATION OF STATE

PRESSURE (PSIA)	TEMPERATURE (^{o}F)	SATURATED LIQUID SPECIFIC VOLUME (FT^3/LBM)	SATURATED VAPOR SPECIFIC VOLUME (FT^3/LBM)	SATURATED LIQUID ENTHALPY (BTU/LBM)	SATURATED VAPOR ENTHALPY (BTU/LBM)	SATURATED LIQUID ENTROPY (BTU/LBM/^{o}F)	SATURATED VAPOR ENTROPY (BTU/LBM/^{o}F)
16.42	-50.	.027302	6.067515	253.6027	440.2414	.833449	1.288665
17.25	-48.	.027370	5.793880	254.6263	440.6554	.836087	1.287613
18.11	-46.	.027438	5.535254	255.6524	441.0693	.838715	1.286582
19.01	-44.	.027506	5.290676	256.6809	441.4830	.841333	1.285569
19.94	-42.	.027575	5.059251	257.7119	441.8965	.843942	1.284575
20.90	-40.	.027644	4.840151	258.7454	442.3098	.846541	1.283599
21.90	-38.	.027713	4.632607	259.7813	442.7227	.849130	1.282641
22.93	-36.	.027782	4.435905	260.8196	443.1353	.851711	1.281701
24.01	-34.	.027852	4.249379	261.8605	443.5475	.854282	1.280777
25.12	-32.	.027922	4.072412	262.9039	443.9593	.856844	1.279870
26.27	-30.	.027993	3.904428	263.9498	444.3705	.859397	1.278980
27.46	-28.	.028064	3.744891	264.9982	444.7812	.861941	1.278105
28.69	-26.	.028135	3.593301	266.0491	445.1913	.864476	1.277246
29.96	-24.	.028206	3.449193	267.1026	445.6007	.867003	1.276402
31.27	-22.	.028278	3.312132	268.1587	446.0095	.869521	1.275573
32.63	-20.	.028351	3.181712	269.2174	446.4175	.872031	1.274758
34.04	-18.	.028423	3.057552	270.2787	446.8246	.874533	1.273958
35.48	-16.	.028496	2.939300	271.3427	447.2310	.877027	1.273172
36.98	-14.	.028570	2.826622	272.4093	447.6364	.879512	1.272398
38.52	-12.	.028644	2.719209	273.4786	448.0409	.881990	1.271639
40.11	-10.	.028718	2.616770	274.5506	448.4445	.884461	1.270891
41.74	-8.	.028793	2.519033	275.6253	448.8469	.886923	1.270157
43.43	-6.	.028869	2.425741	276.7028	449.2483	.889379	1.269435
45.17	-4.	.028945	2.336657	277.7830	449.6485	.891827	1.268725
46.96	-2.	.029021	2.251555	278.8661	450.0475	.894268	1.268026
48.81	0.	.029098	2.170223	279.9520	450.4453	.896701	1.267339
50.70	2.	.029175	2.092465	281.0408	450.8418	.899128	1.266663
52.66	4.	.029253	2.018094	282.1325	451.2369	.901548	1.265998
54.66	6.	.029332	1.946934	283.2271	451.6306	.903962	1.265343
56.73	8.	.029411	1.878820	284.3247	452.0229	.906369	1.264699
58.85	10.	.029490	1.813599	285.4253	452.4136	.908770	1.264064
61.03	12.	.029570	1.751124	286.5289	452.8028	.911164	1.263440
63.27	14.	.029651	1.691257	287.6355	453.1904	.913553	1.262825
65.58	16.	.029733	1.633868	288.7453	453.5763	.915935	1.262219
67.94	18.	.029815	1.578836	289.8582	453.9604	.918312	1.261622
70.37	20.	.029898	1.526044	290.9743	454.3428	.920683	1.261034
72.86	22.	.029981	1.475385	292.0936	454.7233	.923048	1.260454
75.41	24.	.030065	1.426755	293.2162	455.1019	.925408	1.259883
78.03	26.	.030150	1.380057	294.3420	455.4785	.927763	1.259320
80.72	28.	.030236	1.335200	295.4712	455.8531	.930113	1.258764
83.48	30.	.030322	1.292096	296.6038	456.2257	.932458	1.258216
86.30	32.	.030409	1.250664	297.7399	456.5960	.934797	1.257676
89.19	34.	.030497	1.210825	298.8794	456.9642	.937133	1.257142
92.16	36.	.030586	1.172507	300.0224	457.3300	.939463	1.256616
95.20	38.	.030676	1.135640	301.1691	457.6935	.941789	1.256095
98.31	40.	.030766	1.100158	302.3193	458.0546	.944111	1.255582
101.49	42.	.030858	1.065998	303.4733	458.4132	.946429	1.255074
104.75	44.	.030950	1.033102	304.6310	458.7692	.948743	1.254573
108.09	46.	.031043	1.001412	305.7925	459.1226	.951053	1.254077
111.50	48.	.031138	.970875	306.9579	459.4732	.953359	1.253586
114.99	50.	.031233	.941441	308.1272	459.8211	.955662	1.253101
118.56	52.	.031329	.913063	309.3004	460.1661	.957961	1.252621
122.21	54.	.031427	.885693	310.4778	460.5081	.960257	1.252145
125.95	56.	.031525	.859289	311.6592	460.8471	.962550	1.251674
129.76	58.	.031625	.833809	312.8449	461.1829	.964841	1.251207
133.66	60.	.031726	.809214	314.0348	461.5155	.967128	1.250745
137.65	62.	.031828	.785467	315.2290	461.8448	.969413	1.250286
141.72	64.	.031932	.762533	316.4277	462.1707	.971695	1.249831

Table II-2 (Continued)

145.87	66.	.032036	.740376	317.6308	462.4930	.973975	1.249379
150.12	68.	.032142	.718966	318.8385	462.8118	.976254	1.248930
154.45	70.	.032250	.698272	320.0509	463.1268	.978530	1.248484
158.88	72.	.032359	.678263	321.2681	463.4379	.980804	1.248041
163.40	74.	.032469	.658913	322.4901	463.7451	.983077	1.247600
168.01	76.	.032581	.640195	323.7170	464.0482	.985349	1.247161
172.71	78.	.032694	.622083	324.9490	464.3470	.987620	1.246724
177.51	80.	.032809	.604553	326.1862	464.6416	.989889	1.246288
182.40	82.	.032926	.587582	327.4286	464.9316	.992158	1.245854
187.39	84.	.033045	.571147	328.6764	465.2170	.994427	1.245420
192.48	86.	.033165	.555229	329.9297	465.4976	.996695	1.244988
197.67	88.	.033288	.539806	331.1886	465.7733	.998963	1.244555
202.96	90.	.033412	.524859	332.4533	466.0439	1.001231	1.244123
208.35	92.	.033538	.510370	333.7238	466.3092	1.003499	1.243690
213.85	94.	.033667	.496321	335.0004	466.5690	1.005768	1.243257
219.45	96.	.033797	.482695	336.2832	466.8232	1.008038	1.242823
225.15	98.	.033930	.469476	337.5724	467.0715	1.010310	1.242387
230.96	100.	.034066	.456649	338.8680	467.3137	1.012582	1.241950
236.88	102.	.034204	.444198	340.1703	467.5497	1.014857	1.241510
242.91	104.	.034344	.432110	341.4795	467.7791	1.017133	1.241069
249.05	106.	.034488	.420370	342.7958	468.0018	1.019412	1.240624
255.30	108.	.034634	.408965	344.1194	468.2174	1.021693	1.240176
261.66	110.	.034783	.397884	345.4504	468.4256	1.023978	1.239724
268.14	112.	.034935	.387113	346.7892	468.6263	1.026266	1.239268
274.73	114.	.035091	.376641	348.1359	468.8190	1.028557	1.238807
281.44	116.	.035250	.366458	349.4909	469.0035	1.030853	1.238340
288.27	118.	.035412	.356551	350.8544	469.1793	1.033153	1.237868
295.22	120.	.035579	.346911	352.2266	469.3460	1.035459	1.237389
302.29	122.	.035749	.337527	353.6080	469.5034	1.037770	1.236903
309.48	124.	.035924	.328391	354.9989	469.6509	1.040087	1.236409
316.80	126.	.036103	.319492	356.3995	469.7881	1.042411	1.235907
324.24	128.	.036286	.310822	357.8104	469.9144	1.044742	1.235395
331.80	130.	.036475	.302372	359.2319	470.0293	1.047081	1.234873
339.50	132.	.036669	.294132	360.6645	470.1322	1.049428	1.234339
347.33	134.	.036869	.286096	362.1087	470.2225	1.051784	1.233794
355.28	136.	.037074	.278255	363.5650	470.2995	1.054151	1.233236
363.37	138.	.037286	.270602	365.0339	470.3624	1.056529	1.232663
371.60	140.	.037505	.263128	366.5162	470.4104	1.058918	1.232075
379.96	142.	.037731	.255826	368.0125	470.4426	1.061320	1.231470
388.46	144.	.037965	.248688	369.5235	470.4581	1.063736	1.230847
397.10	146.	.038207	.241709	371.0502	470.4557	1.066168	1.230203
405.88	148.	.038458	.234880	372.5934	470.4341	1.068616	1.229538
414.80	150.	.038719	.228194	374.1542	470.3922	1.071083	1.228850
423.88	152.	.038991	.221645	375.7337	470.3285	1.073569	1.228135
433.09	154.	.039274	.215224	377.3333	470.2411	1.076077	1.227392
442.46	156.	.039570	.208926	378.9543	470.1283	1.078609	1.226618
451.98	158.	.039880	.202743	380.5985	469.9880	1.081167	1.225810
461.66	160.	.040206	.196666	382.2678	469.8178	1.083755	1.224964
471.49	162.	.040548	.190690	383.9643	469.6148	1.086375	1.224076
481.48	164.	.040910	.184804	385.6906	469.3761	1.089031	1.223142
491.63	166.	.041293	.179002	387.4496	469.0977	1.091728	1.222156
501.95	168.	.041700	.173272	389.2449	468.7755	1.094470	1.221111
512.43	170.	.042135	.167606	391.0808	468.4043	1.097265	1.220001
523.09	172.	.042602	.161992	392.9622	467.9779	1.100120	1.218816
533.92	174.	.043105	.156416	394.8954	467.4890	1.103043	1.217544
544.93	176.	.043653	.150865	396.8883	466.9281	1.106047	1.216173
556.12	178.	.044253	.145319	398.9510	466.2839	1.109147	1.214685
567.50	180.	.044916	.139758	401.0963	465.5413	1.112362	1.213057
579.06	182.	.045660	.134152	403.3420	464.6807	1.115719	1.211262
590.83	184.	.046504	.128465	405.7125	463.6753	1.119253	1.209258
602.80	186.	.047484	.122644	408.2435	462.4871	1.123020	1.206988
614.98	188.	.048650	.116615	410.9900	461.0586	1.127101	1.204368
627.37	190.	.050094	.110256	414.0445	459.2971	1.131637	1.201257

Table II-2 (Continued)

THERMODYNAMIC PROPERTIES OF PROPYLENE USING STARLINGS EQUATION OF STATE

PRESSURE (PSIA)	TEMPERATURE (^{o}F)	SATURATED LIQUID CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{o}F)	SATURATED VAPOR CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{o}F)	SATURATED LIQUID CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{o}F)	SATURATED VAPOR CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{o}F)	SATURATED LIQUID SONIC VELOCITY (FT/SEC)	SATURATED VAPOR SONIC VELOCITY (FT/SEC)
16.42	-50.	.536923	.322508	.178970	.234880	6274.025	776.185
17.25	-48.	.537505	.324392	.183070	.236853	6154.085	775.717
18.11	-46.	.538093	.326295	.187095	.238827	6039.136	775.245
19.01	-44.	.538689	.328218	.191045	.240801	5928.807	774.769
19.94	-42.	.539293	.330161	.194924	.242776	5822.765	774.287
20.90	-40.	.539907	.332125	.198733	.244751	5720.710	773.800
21.90	-38.	.540530	.334109	.202474	.246727	5622.368	773.307
22.93	-36.	.541164	.336115	.206149	.248703	5527.494	772.808
24.01	-34.	.541810	.338143	.209760	.250679	5435.863	772.303
25.12	-32.	.542467	.340193	.213308	.252655	5347.270	771.790
26.27	-30.	.543138	.342265	.216796	.254631	5261.527	771.270
27.46	-28.	.543821	.344360	.220224	.256607	5178.463	770.742
28.69	-26.	.544519	.346479	.223595	.258583	5097.919	770.206
29.96	-24.	.545231	.348621	.226910	.260559	5019.751	769.661
31.27	-22.	.545959	.350787	.230170	.262534	4943.825	769.107
32.63	-20.	.546703	.352977	.233378	.264509	4870.016	768.544
34.04	-18.	.547465	.355193	.236534	.266484	4798.210	767.971
35.48	-16.	.548240	.357434	.239639	.268458	4728.300	767.387
36.98	-14.	.549035	.359701	.242696	.270432	4660.189	766.793
38.52	-12.	.549849	.361994	.245705	.272405	4593.782	766.188
40.11	-10.	.550681	.364314	.248668	.274378	4528.996	765.571
41.74	-8.	.551533	.366661	.251586	.276350	4465.749	764.942
43.43	-6.	.552406	.369037	.254460	.278321	4403.967	764.300
45.17	-4.	.553299	.371441	.257291	.280291	4343.579	763.646
46.96	-2.	.554213	.373874	.260081	.282261	4284.520	762.978
48.81	0.	.555150	.376337	.262829	.284230	4226.728	762.297
50.70	2.	.556109	.378830	.265539	.286198	4170.145	761.601
52.66	4.	.557092	.381355	.268210	.288165	4114.716	760.890
54.66	6.	.558098	.383911	.270844	.290131	4060.390	760.164
56.73	8.	.559130	.386499	.273441	.292096	4007.117	759.423
58.85	10.	.560186	.389120	.276002	.294060	3954.853	758.665
61.03	12.	.561269	.391776	.278529	.296024	3903.553	757.891
63.27	14.	.562378	.394466	.281023	.297986	3853.176	757.099
65.58	16.	.563515	.397191	.283483	.299947	3803.684	756.290
67.94	18.	.564680	.399953	.285912	.301907	3755.039	755.463
70.37	20.	.565874	.402753	.288310	.303866	3707.207	754.617
72.86	22.	.567098	.405590	.290677	.305824	3660.153	753.752
75.41	24.	.568353	.408467	.293015	.307781	3613.846	752.867
78.03	26.	.569639	.411384	.295324	.309737	3568.256	751.962
80.72	28.	.570957	.414342	.297606	.311692	3523.354	751.037
83.48	30.	.572308	.417343	.299860	.313645	3479.113	750.090
86.30	32.	.573694	.420388	.302088	.315598	3435.505	749.121
89.19	34.	.575115	.423477	.304290	.317549	3392.506	748.130
92.16	36.	.576572	.426613	.306467	.319500	3350.092	747.116
95.20	38.	.578067	.429796	.308620	.321449	3308.239	746.079
98.31	40.	.579600	.433028	.310749	.323398	3266.926	745.017
101.49	42.	.581172	.436311	.312856	.325345	3226.132	743.931
104.75	44.	.582785	.439646	.314940	.327291	3185.835	742.819
108.09	46.	.584441	.443035	.317002	.329237	3146.017	741.682
111.50	48.	.586140	.446480	.319043	.331181	3106.659	740.518
114.99	50.	.587884	.449982	.321064	.333124	3067.742	739.326
118.56	52.	.589674	.453543	.323065	.335067	3029.249	738.108
122.21	54.	.591512	.457166	.325047	.337009	2991.163	736.860
125.95	56.	.593400	.460853	.327011	.338950	2953.469	735.584
129.76	58.	.595339	.464606	.328956	.340890	2916.149	734.277
133.66	60.	.597332	.468427	.330883	.342829	2879.190	732.941

Table II-2 (Continued)

137.65	62.	.599380	.472320	.332794	.344768	2842.576	731.573
141.72	64.	.601485	.476286	.334689	.346706	2806.293	730.173
145.87	66.	.603650	.480330	.336567	.348643	2770.328	728.740
150.12	68.	.605876	.484453	.338431	.350580	2734.666	727.274
154.45	70.	.608167	.488660	.340279	.352516	2699.296	725.774
158.88	72.	.610525	.492953	.342114	.354452	2664.204	724.238
163.40	74.	.612953	.497338	.343935	.356388	2629.378	722.667
168.01	76.	.615453	.501816	.345743	.358323	2594.806	721.059
172.71	78.	.618030	.506394	.347538	.360258	2560.476	719.413
177.51	80.	.620686	.511075	.349321	.362193	2526.378	717.730
182.40	82.	.623425	.515865	.351092	.364128	2492.499	716.006
187.39	84.	.626251	.520768	.352853	.366063	2458.829	714.243
192.48	86.	.629168	.525791	.354603	.367998	2425.357	712.438
197.67	88.	.632181	.530939	.356343	.369933	2392.073	710.590
202.96	90.	.635294	.536218	.358074	.371868	2358.967	708.700
208.35	92.	.638513	.541637	.359796	.373804	2326.028	706.765
213.85	94.	.641843	.547201	.361509	.375740	2293.246	704.785
219.45	96.	.645291	.552921	.363215	.377677	2260.611	702.758
225.15	98.	.648863	.558803	.364913	.379615	2228.114	700.683
230.96	100.	.652566	.564858	.366605	.381554	2195.746	698.560
236.88	102.	.656408	.571096	.368291	.383493	2163.495	696.386
242.91	104.	.660397	.577528	.369970	.385434	2131.354	694.161
249.05	106.	.664543	.584167	.371645	.387376	2099.313	691.883
255.30	108.	.668855	.591025	.373316	.389319	2067.362	689.551
261.66	110.	.673344	.598117	.374982	.391264	2035.492	687.163
268.14	112.	.678022	.605460	.376646	.393211	2003.694	684.718
274.73	114.	.682902	.613070	.378307	.395160	1971.958	682.214
281.44	116.	.687999	.620966	.379966	.397111	1940.276	679.651
288.27	118.	.693329	.629170	.381623	.399064	1908.636	677.025
295.22	120.	.698909	.637704	.383280	.401020	1877.031	674.335
302.29	122.	.704758	.646595	.384938	.402978	1845.450	671.579
309.48	124.	.710898	.655871	.386596	.404940	1813.884	668.757
316.80	126.	.717354	.665563	.388256	.406904	1782.322	665.864
324.24	128.	.724152	.675708	.389919	.408873	1750.756	662.900
331.80	130.	.731322	.686344	.391585	.410845	1719.173	659.863
339.50	132.	.738900	.697516	.393256	.412821	1687.565	656.749
347.33	134.	.746922	.709275	.394932	.414801	1655.920	653.557
355.28	136.	.755433	.721677	.396614	.416787	1624.226	650.283
363.37	138.	.764482	.734787	.398304	.418777	1592.474	646.926
371.60	140.	.774126	.748677	.400003	.420773	1560.650	643.483
379.96	142.	.784431	.763433	.401712	.422775	1528.743	639.950
388.46	144.	.795472	.779151	.403432	.424783	1496.739	636.325
397.10	146.	.807337	.795944	.405165	.426798	1464.626	632.604
405.88	148.	.820127	.813942	.406913	.428820	1432.389	628.783
414.80	150.	.833964	.833297	.408678	.430850	1400.013	624.860
423.88	152.	.848989	.854190	.410461	.432889	1367.483	620.831
433.09	154.	.865372	.876835	.412264	.434937	1334.782	616.690
442.46	156.	.883317	.901487	.414091	.436995	1301.893	612.435
451.98	158.	.903071	.928454	.415944	.439064	1268.796	608.060
461.66	160.	.924938	.958112	.417826	.441144	1235.472	603.561
471.49	162.	.949291	.990921	.419740	.443236	1201.898	598.932
481.48	164.	.976600	1.027454	.421692	.445342	1168.051	594.169
491.63	166.	1.007460	1.068435	.423685	.447463	1133.905	589.266
501.95	168.	1.042637	1.114787	.425725	.449600	1099.432	584.216
512.43	170.	1.083136	1.167706	.427819	.451754	1064.599	579.015
523.09	172.	1.130298	1.228777	.429974	.453927	1029.374	573.656
533.92	174.	1.185951	1.300139	.432200	.456121	993.716	568.132
544.93	176.	1.252656	1.384754	.434510	.458338	957.582	562.438
556.12	178.	1.334118	1.486839	.436917	.460579	920.923	556.569
567.50	180.	1.435863	1.612611	.439440	.462848	883.679	550.520
579.06	182.	1.566545	1.771641	.442104	.465147	845.784	544.291
590.83	184.	1.740446	1.979436	.444942	.467479	807.156	537.883
602.80	186.	1.982859	2.262892	.448003	.469846	767.696	531.309
614.98	188.	2.342882	2.673031	.451355	.472249	727.275	524.597
627.37	190.	2.929004	3.319653	.455109	.474685	685.716	517.813

Table II-3 Saturation Temperature Table of N-Butane

THERMODYNAMIC PROPERTIES OF N-BUTANE USING STARLINGS EQUATION OF STATE

PRESSURE (PSIA)	TEMPERATURE (°F)	SATURATED LIQUID SPECIFIC VOLUME (FT^3/LBM)	SATURATED VAPOR SPECIFIC VOLUME (FT^3/LBM)	SATURATED LIQUID ENTHALPY (BTU/LBM)	SATURATED VAPOR ENTHALPY (BTU/LBM)	SATURATED LIQUID ENTROPY (BTU/LBM/°F)	SATURATED VAPOR ENTROPY (BTU/LBM/°F)
1.80	-50.	.025165	41.587745	116.3741	299.3126	.710068	1.156259
1.92	-48.	.025205	39.183166	117.4952	299.9476	.712816	1.155662
2.05	-46.	.025244	36.963972	118.6151	300.5839	.715548	1.155086
2.18	-44.	.025284	34.857140	119.7338	301.2215	.718263	1.154532
2.32	-42.	.025324	32.910786	120.8513	301.8604	.720962	1.153998
2.46	-40.	.025364	31.094075	121.9676	302.5005	.723645	1.153485
2.62	-38.	.025404	29.397093	123.0830	303.1417	.726313	1.152992
2.78	-36.	.025444	27.810779	124.1973	303.7842	.728965	1.152519
2.95	-34.	.025484	26.326840	125.3107	304.4279	.731603	1.152066
3.12	-32.	.025524	24.937678	126.4232	305.0726	.734225	1.151631
3.31	-30.	.025564	23.636326	127.5350	305.7185	.736836	1.151214
3.50	-28.	.025605	22.416393	128.6460	306.3655	.739428	1.150816
3.71	-26.	.025646	21.272008	129.7563	307.0136	.742008	1.150435
3.92	-24.	.025686	20.197776	130.8660	307.6627	.744575	1.150072
4.14	-22.	.025727	19.188734	131.9751	308.3129	.747128	1.149726
4.37	-20.	.025768	18.240315	133.0837	308.9640	.749668	1.149396
4.62	-18.	.025809	17.348309	134.1918	309.6162	.752195	1.149083
4.87	-16.	.025850	16.508836	135.2996	310.2693	.754710	1.148786
5.13	-14.	.025891	15.718317	136.4070	310.9233	.757212	1.148504
5.41	-12.	.025933	14.973447	137.5141	311.5783	.759702	1.148238
5.69	-10.	.025975	14.271172	138.6210	312.2341	.762180	1.147987
5.99	-8.	.026016	13.608667	139.7277	312.8908	.764646	1.147751
6.30	-6.	.026058	12.983320	140.8342	313.5484	.767101	1.147529
6.63	-4.	.026100	12.392713	141.9407	314.2068	.769544	1.147321
6.96	-2.	.026142	11.834603	143.0472	314.8660	.771977	1.147127
7.31	0.	.026185	11.306913	144.1537	315.5260	.774398	1.146947
7.68	2.	.026227	10.807714	145.2603	316.1868	.776809	1.146780
8.06	4.	.026270	10.335216	146.3670	316.8483	.779209	1.146626
8.45	6.	.026313	9.887757	147.4739	317.5105	.781599	1.146485
8.86	8.	.026356	9.463790	148.5810	318.1735	.783979	1.146356
9.28	10.	.026399	9.061879	149.6884	318.8371	.786349	1.146240
9.72	12.	.026442	8.680684	150.7962	319.5013	.788709	1.146135
10.17	14.	.026486	8.318960	151.9043	320.1662	.791060	1.146043
10.64	16.	.026530	7.975544	153.0129	320.8317	.793401	1.145962
11.13	18.	.026574	7.649356	154.1220	321.4978	.795734	1.145892
11.63	20.	.026618	7.339382	155.2316	322.1645	.798057	1.145834
12.16	22.	.026663	7.044683	156.3417	322.8317	.800371	1.145786
12.70	24.	.026707	6.764376	157.4525	323.4994	.802677	1.145749
13.26	26.	.026752	6.497638	158.5640	324.1677	.804974	1.145722
13.84	28.	.026797	6.243700	159.6761	324.8364	.807262	1.145706
14.43	30.	.026842	6.001842	160.7891	325.5056	.809543	1.145699
15.05	32.	.026888	5.771389	161.9028	326.1752	.811816	1.145703
15.69	34.	.026934	5.551711	163.0175	326.8453	.814080	1.145716
16.35	36.	.026980	5.342216	164.1330	327.5157	.816337	1.145738
17.03	38.	.027026	5.142350	165.2495	328.1865	.818587	1.145769
17.73	40.	.027073	4.951592	166.3669	328.8577	.820829	1.145810
18.46	42.	.027119	4.769454	167.4855	329.5292	.823063	1.145860
19.20	44.	.027166	4.595478	168.6051	330.2010	.825291	1.145918
19.97	46.	.027214	4.429233	169.7258	330.8731	.827511	1.145984
20.77	48.	.027261	4.270315	170.8477	331.5455	.829725	1.146059
21.58	50.	.027309	4.118344	171.9709	332.2181	.831932	1.146142
22.43	52.	.027357	3.972960	173.0953	332.8909	.834132	1.146233
23.29	54.	.027406	3.833828	174.2210	333.5639	.836326	1.146332
24.19	56.	.027455	3.700630	175.3481	334.2371	.838514	1.146438
25.11	58.	.027504	3.573067	176.4766	334.9105	.840695	1.146552
26.05	60.	.027553	3.450857	177.6065	335.5840	.842871	1.146674
27.02	62.	.027603	3.333736	178.7379	336.2576	.845040	1.146802

Table II-3 (Continued)

28.02	64.	.027653	3.221453	179.8709	336.9312	.847204	1.146937
29.05	66.	.027703	3.113770	181.0054	337.6050	.849362	1.147080
30.11	68.	.027754	3.010466	182.3415	338.2787	.851514	1.147228
31.20	70.	.027805	2.911328	183.2794	338.9525	.853661	1.147384
32.31	72.	.027857	2.816159	184.4189	339.6263	.855803	1.147546
33.46	74.	.027909	2.724769	185.5602	340.3000	.857939	1.147714
34.63	76.	.027961	2.636982	186.7033	340.9737	.860070	1.147888
35.84	78.	.028013	2.552627	187.8482	341.6472	.862197	1.148068
37.08	80.	.028066	2.471547	188.9951	342.3207	.864318	1.148254
38.35	82.	.028120	2.393589	190.1438	342.9940	.866435	1.148446
39.66	84.	.028174	2.318612	191.2946	343.6672	.868547	1.148643
41.00	86.	.028228	2.246479	192.4474	344.3401	.870654	1.148846
42.37	88.	.028283	2.177062	193.6022	345.0129	.872757	1.149054
43.77	90.	.028338	2.110240	194.7592	345.6853	.874856	1.149268
45.22	92.	.028393	2.045897	195.9183	346.3576	.876951	1.149486
46.69	94.	.028449	1.983924	197.0796	347.0295	.879041	1.149709
48.21	96.	.028506	1.924216	198.2432	347.7010	.881128	1.149937
49.76	98.	.028563	1.866674	199.4091	348.3722	.883211	1.150170
51.35	100.	.028620	1.811206	200.5773	349.0430	.885289	1.150407
52.97	102.	.028678	1.757721	201.7479	349.7134	.887365	1.150648
54.64	104.	.028737	1.706136	202.9210	350.3833	.889436	1.150894
56.34	106.	.028796	1.656368	204.0965	351.0528	.891504	1.151144
58.09	108.	.028855	1.608343	205.2746	351.7217	.893569	1.151399
59.87	110.	.028915	1.561986	206.4553	352.3900	.895631	1.151657
61.69	112.	.028976	1.517229	207.6386	353.0578	.897689	1.151918
63.56	114.	.029037	1.474005	208.8246	353.7249	.899744	1.152184
65.47	116.	.029099	1.432251	210.0133	354.3914	.901797	1.152453
67.42	118.	.029161	1.391908	211.2048	355.0571	.903846	1.152726
69.42	120.	.029224	1.352918	212.3992	355.7221	.905893	1.153002
71.46	122.	.029288	1.315226	213.5964	356.3864	.907937	1.153281
73.54	124.	.029352	1.278781	214.7966	357.0498	.909979	1.153563
75.67	126.	.029417	1.243533	215.9998	357.7124	.912018	1.153848
77.85	128.	.029483	1.209435	217.2060	358.3740	.914055	1.154136
80.07	130.	.029549	1.176442	218.4153	359.0347	.916089	1.154427
82.34	132.	.029616	1.144510	219.6278	359.6945	.918121	1.154720
84.65	134.	.029684	1.113598	220.8435	360.3532	.920152	1.155016
87.02	136.	.029753	1.083667	222.0625	361.0108	.922180	1.155315
89.43	138.	.029822	1.054679	223.2848	361.6672	.924207	1.155615
91.90	140.	.029892	1.026599	224.5105	362.3225	.926231	1.155918
94.42	142.	.029963	.999391	225.7397	362.9766	.928255	1.156223
96.98	144.	.030035	.973024	226.9724	363.6293	.930276	1.156529
99.60	146.	.030108	.947465	228.2086	364.2808	.932296	1.156838
102.27	148.	.030181	.922684	229.4485	364.9308	.934315	1.157148
105.00	150.	.030256	.898653	230.6921	365.5793	.936333	1.157460
107.78	152.	.030331	.875345	231.9395	366.2264	.938350	1.157773
110.61	154.	.030407	.852731	233.1907	366.8718	.940365	1.158087
113.50	156.	.030485	.830788	234.4459	367.5156	.942380	1.158402
116.44	158.	.030563	.809491	235.7050	368.1577	.944394	1.158719
119.44	160.	.030642	.788817	236.9683	368.7980	.946407	1.159036
122.50	162.	.030723	.768743	238.2356	369.4364	.948420	1.159354
125.62	164.	.030804	.749248	239.5072	370.0729	.950433	1.159673
128.80	166.	.030887	.730311	240.7831	370.7074	.952445	1.159992
132.03	168.	.030971	.711913	242.0634	371.3398	.954457	1.160311
135.33	170.	.031056	.694035	243.3481	371.9700	.956469	1.160631
138.69	172.	.031143	.676658	244.6374	372.5980	.958481	1.160950
142.11	174.	.031230	.659766	245.9314	373.2236	.960493	1.161270
145.59	176.	.031319	.643341	247.2301	373.8467	.962506	1.161589
149.14	178.	.031410	.627367	248.5336	374.4673	.964519	1.161907
152.75	180.	.031501	.611829	249.8421	375.0852	.966533	1.162225
156.43	182.	.031595	.596712	251.1557	375.7004	.968548	1.162543
160.17	184.	.031689	.582001	252.4744	376.3127	.970563	1.162859
163.98	186.	.031786	.567684	253.7984	376.9220	.972580	1.163174
167.86	188.	.031884	.553745	255.1278	377.5282	.974598	1.163488
171.80	190.	.031983	.540174	256.4627	378.1311	.976618	1.163800
175.82	192.	.032085	.526957	257.8032	378.7307	.978639	1.164111
179.90	194.	.032188	.514083	259.1495	379.3268	.980662	1.164419
184.06	196.	.032293	.501540	260.5018	379.9191	.982687	1.164726
188.29	198.	.032401	.489317	261.8601	380.5077	.984714	1.165030
192.59	200.	.032510	.477404	263.2246	381.0923	.986744	1.165331

Table II-3 (Continued)

196.96	202.	.032621	.465790	264.5955	381.6727	.988776	1.165629
201.41	204.	.032735	.454465	265.9729	382.2488	.990811	1.165925
205.93	206.	.032851	.443421	267.3570	382.8204	.992849	1.166217
210.54	208.	.032969	.432647	268.7481	383.3872	.994890	1.166505
215.21	210.	.033090	.422135	270.1462	383.9491	.996935	1.166790
219.97	212.	.033213	.411876	271.5517	384.5058	.998984	1.167070
224.81	214.	.033340	.401861	272.9647	385.0572	1.001036	1.167346
229.72	216.	.033469	.392084	274.3854	385.6029	1.003094	1.167617
234.75	218.	.033601	.382536	275.8142	386.1427	1.005156	1.167882
239.80	220.	.033736	.373209	277.2512	386.6763	1.007223	1.168142
244.97	222.	.033875	.364096	278.6967	387.2034	1.009295	1.168396
250.22	224.	.034017	.355189	280.1511	387.7237	1.011374	1.168644
255.55	226.	.034163	.346483	281.6147	388.2368	1.013458	1.168884
260.97	228.	.034313	.337970	283.0877	388.7424	1.015550	1.169117
266.48	230.	.034467	.329644	284.5706	389.2401	1.017648	1.169343
272.08	232.	.034626	.321498	286.0638	389.7294	1.019754	1.169560
277.77	234.	.034789	.313526	287.5676	390.2100	1.021868	1.169768
283.55	236.	.034957	.305722	289.0826	390.6813	1.023991	1.169966
289.42	238.	.035130	.298079	290.6093	391.1428	1.026124	1.170155
295.38	240.	.035309	.290593	292.1481	391.5939	1.028266	1.170332
301.44	242.	.035494	.283257	293.6997	392.0341	1.030420	1.170497
307.60	244.	.035685	.276066	295.2648	392.4626	1.032585	1.170650
313.86	246.	.035883	.269014	296.8440	392.8788	1.034763	1.170789
320.21	248.	.036089	.262094	298.4381	393.2817	1.036954	1.170914
326.67	250.	.036302	.255303	300.0480	393.6707	1.039160	1.171023
333.22	252.	.036524	.248634	301.6747	394.0446	1.041382	1.171115
339.86	254.	.036756	.242082	303.3192	394.4024	1.043622	1.171189
346.65	256.	.036998	.235641	304.9828	394.7431	1.045880	1.171244
353.53	258.	.037251	.229305	306.6669	395.0651	1.048159	1.171277
360.51	260.	.037516	.223069	308.3729	395.3671	1.050461	1.171287
367.60	262.	.037795	.216926	310.1028	395.6475	1.052788	1.171271
374.80	264.	.038089	.210871	311.8585	395.9043	1.055143	1.171228
382.12	266.	.038400	.204897	313.6424	396.1354	1.057528	1.171155
389.55	268.	.038730	.198997	315.4574	396.3385	1.059947	1.171048
397.10	270.	.039082	.193164	317.3066	396.5107	1.062406	1.170904
404.77	272.	.039458	.187389	319.1942	396.6487	1.064907	1.170720
412.56	274.	.039862	.181664	321.1247	396.7488	1.067459	1.170489
420.47	276.	.040299	.175980	323.1042	396.8064	1.070068	1.170207
428.51	278.	.040776	.170325	325.1398	396.8161	1.072744	1.169867
436.67	280.	.041298	.164686	327.2409	396.7713	1.075499	1.169459
444.97	282.	.041878	.159049	329.4194	396.6638	1.078349	1.168975
453.39	284.	.042527	.153395	331.6913	396.4836	1.081314	1.168400
461.94	286.	.043267	.147701	334.0787	396.2174	1.084423	1.167719
470.63	288.	.044124	.141939	336.6124	395.8482	1.087717	1.166909
479.44	290.	.045143	.136072	339.3390	395.3527	1.091255	1.165940
488.37	292.	.046394	.130047	342.3304	394.6985	1.095133	1.164772
497.42	294.	.048000	.123793	345.7059	393.8382	1.099507	1.163343

Table II-3 (Continued)

THERMODYNAMIC PROPERTIES OF N-BUTANE USING STARLINGS EQUATION OF STATE

PRESSURE	TEMPERATURE	SATURATED LIQUID CONSTANT PRESSURE SPECIFIC HEAT	SATURATED VAPOR CONSTANT PRESSURE SPECIFIC HEAT	SATURATED LIQUID CONSTANT VOLUME SPECIFIC HEAT	SATURATED VAPOR CONSTANT VOLUME SPECIFIC HEAT	SATURATED LIQUID SONIC VELOCITY	SATURATED VAPOR SONIC VELOCITY
(PSIA)	(^{o}F)	(BTU/LBM/^{o}F)	(BTU/LBM/^{o}F)	(BTU/LBM/^{o}F)	(BTU/LBM/^{o}F)	(FT/SEC)	(FT/SEC)
1.80	-50.	.560146	.332026	.394567	.296746	4836.165	620.688
1.92	-48.	.559659	.333503	.395002	.297951	4801.629	622.025
2.05	-46.	.559179	.334960	.395438	.299157	4767.402	623.326
2.18	-44.	.558708	.336400	.395874	.300365	4733.481	624.593
2.32	-42.	.558248	.337824	.396312	.301576	4699.866	625.827
2.46	-40.	.557799	.339233	.396750	.302788	4666.552	627.030
2.62	-38.	.557363	.340629	.397190	.304002	4633.537	628.202
2.78	-36.	.556941	.342013	.397631	.305219	4600.819	629.345
2.95	-34.	.556533	.343388	.398074	.306438	4568.395	630.460
3.12	-32.	.556140	.344754	.398520	.307658	4536.260	631.547
3.31	-30.	.555764	.346112	.398967	.308881	4504.413	632.609
3.50	-28.	.555405	.347463	.399418	.310107	4472.849	633.646
3.71	-26.	.555064	.348810	.399871	.311334	4441.566	634.659
3.92	-24.	.554741	.350152	.400327	.312564	4410.559	635.648
4.14	-22.	.554438	.351492	.400786	.313796	4379.826	636.614
4.37	-20.	.554155	.352829	.401249	.315030	4349.363	637.558
4.62	-18.	.553892	.354165	.401714	.316267	4319.166	638.481
4.87	-16.	.553650	.355500	.402184	.317506	4289.231	639.383
5.13	-14.	.553429	.356837	.402657	.318747	4259.555	640.265
5.41	-12.	.553231	.358175	.403134	.319991	4230.133	641.128
5.69	-10.	.553055	.359514	.403615	.321237	4200.962	641.971
5.99	-8.	.552902	.360857	.404099	.322486	4172.037	642.795
6.30	-6.	.552771	.362203	.404588	.323737	4143.356	643.600
6.63	-4.	.552665	.363554	.405082	.324990	4114.913	644.388
6.96	-2.	.552582	.364909	.405579	.326246	4086.705	645.158
7.31	0.	.552523	.366270	.406081	.327505	4058.728	645.910
7.68	2.	.552488	.367637	.406588	.328766	4030.978	646.645
8.06	4.	.552477	.369010	.407099	.330030	4003.449	647.363
8.45	6.	.552492	.370390	.407614	.331297	3976.140	648.064
8.86	8.	.552531	.371778	.408135	.332566	3949.045	648.749
9.28	10.	.552595	.373173	.408660	.333837	3922.159	649.416
9.72	12.	.552684	.374577	.409190	.335112	3895.480	650.068
10.17	14.	.552798	.375989	.409724	.336388	3869.003	650.703
10.64	16.	.552938	.377411	.410264	.337668	3842.724	651.321
11.13	18.	.553103	.378841	.410808	.338950	3816.639	651.923
11.63	20.	.553293	.380282	.411358	.340235	3790.743	652.509
12.16	22.	.553509	.381732	.411913	.341523	3765.033	653.078
12.70	24.	.553751	.383193	.412472	.342813	3739.505	653.631
13.26	26.	.554018	.384664	.413037	.344106	3714.154	654.168
13.84	28.	.554310	.386146	.413606	.345402	3688.976	654.688
14.43	30.	.554628	.387639	.414181	.346701	3663.968	655.192
15.05	32.	.554972	.389144	.414761	.348002	3639.126	655.678
15.69	34.	.555341	.390659	.415346	.349306	3614.445	656.148
16.35	36.	.555735	.392187	.415937	.350613	3589.922	656.602
17.03	38.	.556155	.393726	.416532	.351922	3565.553	657.037
17.73	40.	.556601	.395277	.417133	.353235	3541.333	657.456
18.46	42.	.557071	.396841	.417739	.354550	3517.260	657.857
19.20	44.	.557568	.398416	.418350	.355868	3493.330	658.241
19.97	46.	.558089	.400005	.418966	.357188	3469.538	658.607
20.77	48.	.558636	.401605	.419588	.358512	3445.880	658.955
21.58	50.	.559208	.403219	.420214	.359838	3422.354	659.285
22.43	52.	.559805	.404845	.420846	.361167	3398.956	659.596
23.29	54.	.560427	.406485	.421484	.362499	3375.682	659.888
24.19	56.	.561074	.408138	.422126	.363834	3352.528	660.162
25.11	58.	.561746	.409803	.422774	.365172	3329.491	660.417
26.05	60.	.562443	.411483	.423427	.366512	3306.568	660.652

Table II-3 (Continued)

27.02	62.	.563165	.413175	.424085	.367855	3283.754	660.867
28.02	64.	.563912	.414882	.424748	.369201	3261.048	661.063
29.05	66.	.564684	.416602	.425416	.370550	3238.444	661.238
30.11	68.	.565480	.418336	.426090	.371902	3215.941	661.393
31.20	70.	.566302	.420084	.426769	.373257	3193.536	661.528
32.31	72.	.567148	.421846	.427453	.374614	3171.221	661.641
33.46	74.	.568019	.423622	.428142	.375974	3148.998	661.733
34.63	76.	.568914	.425412	.428836	.377337	3126.863	661.803
35.84	78.	.569834	.427217	.429536	.378703	3104.811	661.852
37.08	80.	.570780	.429037	.430240	.380072	3082.840	661.878
38.35	82.	.571749	.430871	.430950	.381443	3060.948	661.881
39.66	84.	.572744	.432721	.431664	.382817	3039.130	661.862
41.00	86.	.573764	.434585	.432384	.384195	3017.385	661.820
42.37	88.	.574808	.436465	.433109	.385574	2995.708	661.754
43.77	90.	.575878	.438360	.433839	.386957	2974.098	661.665
45.22	92.	.576972	.440270	.434574	.388343	2952.551	661.551
46.69	94.	.578092	.442197	.435314	.389731	2931.065	661.413
48.21	96.	.579237	.444139	.436059	.391122	2909.637	661.250
49.76	98.	.580408	.446098	.436809	.392516	2888.264	661.062
51.35	100.	.581604	.448073	.437564	.393913	2866.944	660.848
52.97	102.	.582826	.450065	.438324	.395313	2845.673	660.609
54.64	104.	.584073	.452073	.439089	.396715	2824.450	660.344
56.34	106.	.585347	.454100	.439858	.398120	2803.271	660.052
58.09	108.	.586647	.456143	.440633	.399528	2782.134	659.733
59.87	110.	.587974	.458205	.441413	.400939	2761.037	659.387
61.69	112.	.589328	.460284	.442197	.402352	2739.976	659.014
63.56	114.	.590709	.462382	.442986	.403769	2718.950	658.613
65.47	116.	.592117	.464500	.443781	.405188	2697.956	658.183
67.42	118.	.593553	.466636	.444580	.406609	2676.992	657.725
69.42	120.	.595017	.468792	.445383	.408034	2656.055	657.237
71.46	122.	.596510	.470968	.446192	.409461	2635.142	656.721
73.54	124.	.598032	.473165	.447006	.410892	2614.255	656.174
75.67	126.	.599583	.475383	.447824	.412325	2593.382	655.597
77.85	128.	.601164	.477623	.448647	.413760	2572.530	654.990
80.07	130.	.602776	.479885	.449475	.415199	2551.693	654.351
82.34	132.	.604418	.482169	.450307	.416640	2530.869	653.681
84.65	134.	.606093	.484477	.451144	.418084	2510.055	652.979
87.02	136.	.607799	.486810	.451986	.419531	2489.250	652.245
89.43	138.	.609539	.489166	.452833	.420980	2468.451	651.478
91.90	140.	.611312	.491549	.453684	.422433	2447.656	650.678
94.42	142.	.613120	.493957	.454541	.423888	2426.862	649.844
96.98	144.	.614963	.496393	.455401	.425346	2406.067	648.976
99.60	146.	.616842	.498856	.456267	.426806	2385.270	648.074
102.27	148.	.618758	.501348	.457137	.428270	2364.466	647.137
105.00	150.	.620713	.503871	.458012	.429736	2343.656	646.163
107.78	152.	.622706	.506424	.458891	.431205	2322.835	645.154
110.61	154.	.624740	.509009	.459776	.432677	2302.001	644.109
113.50	156.	.626816	.511627	.460665	.434152	2281.153	643.026
116.44	158.	.628935	.514279	.461558	.435629	2260.288	641.905
119.44	160.	.631097	.516967	.462456	.437110	2239.404	640.746
122.50	162.	.633306	.519692	.463359	.438593	2218.498	639.548
125.62	164.	.635561	.522455	.464267	.440079	2197.567	638.311
128.80	166.	.637866	.525258	.465179	.441568	2176.610	637.034
132.03	168.	.640221	.528103	.466097	.443059	2155.624	635.716
135.33	170.	.642629	.530992	.467018	.444554	2134.606	634.357
138.69	172.	.645092	.533925	.467945	.446052	2113.554	632.955
142.11	174.	.647611	.536906	.468876	.447552	2092.465	631.511
145.59	176.	.650189	.539937	.469812	.449056	2071.336	630.024
149.14	178.	.652829	.543018	.470753	.450562	2050.166	628.492
152.75	180.	.655533	.546154	.471699	.452072	2028.950	626.915
156.43	182.	.658304	.549347	.472650	.453584	2007.687	625.293
160.17	184.	.661145	.552598	.473606	.455100	1986.374	623.624
163.98	186.	.664059	.555912	.474566	.456618	1965.007	621.907
167.86	188.	.667050	.559292	.475532	.458140	1943.584	620.143
171.80	190.	.670121	.562740	.476502	.459665	1922.101	618.328
175.82	192.	.673277	.566260	.477478	.461193	1900.556	616.464
179.90	194.	.676521	.569857	.478459	.462724	1878.944	614.549
184.06	196.	.679859	.573534	.479445	.464259	1857.264	612.581
188.29	198.	.683296	.577296	.480436	.465797	1835.511	610.559

Table II-3 (Continued)

192.59	200.	.686836	.581148	.481433	.467339	1813.682	608.484
196.96	202.	.690487	.585094	.482435	.468883	1791.772	606.352
201.41	204.	.694253	.589141	.483442	.470432	1769.779	604.164
205.93	206.	.698143	.593295	.484456	.471984	1747.699	601.918
210.54	208.	.702164	.597563	.485475	.473539	1725.527	599.612
215.21	210.	.706324	.601951	.486499	.475099	1703.258	597.245
219.97	212.	.710632	.606467	.487530	.476662	1680.889	594.815
224.81	214.	.715097	.611120	.488567	.478229	1658.416	592.322
229.72	216.	.719732	.615920	.489610	.479800	1635.832	589.765
234.72	218.	.724547	.620876	.490659	.481375	1613.133	587.137
239.80	220.	.729556	.626001	.491715	.482954	1590.314	584.442
244.97	222.	.734773	.631305	.492778	.484538	1567.370	581.675
250.22	224.	.740214	.636803	.493847	.486126	1544.293	578.836
255.55	226.	.745897	.642510	.494924	.487719	1521.080	575.922
260.97	228.	.751842	.648442	.496008	.489316	1497.722	572.931
266.48	230.	.758069	.654618	.497100	.490918	1474.213	569.860
272.08	232.	.764606	.661058	.498200	.492526	1450.546	566.707
277.77	234.	.771477	.667786	.499309	.494138	1426.713	563.470
283.55	236.	.778716	.674826	.500425	.495756	1402.707	560.146
289.42	238.	.786357	.682209	.501551	.497380	1378.519	556.731
295.38	240.	.794440	.689966	.502687	.499010	1354.139	553.223
301.44	242.	.803011	.698135	.503832	.500645	1329.558	549.619
307.60	244.	.812122	.706756	.504988	.502287	1304.766	545.914
313.86	246.	.821832	.715880	.506155	.503936	1279.751	542.106
320.21	248.	.832213	.725559	.507333	.505592	1254.501	538.191
326.67	250.	.843344	.735858	.508524	.507256	1229.004	534.163
333.22	252.	.855321	.746849	.509729	.508927	1203.246	530.019
339.89	254.	.868255	.758620	.510947	.510606	1177.211	525.754
346.65	256.	.882279	.771268	.512181	.512294	1150.884	521.363
353.53	258.	.897550	.784915	.513431	.513992	1124.246	516.840
360.51	260.	.914261	.799699	.514699	.515699	1097.278	512.179
367.60	262.	.932643	.815791	.515986	.517417	1069.960	507.374
374.80	264.	.952981	.833393	.517294	.519146	1042.267	502.418
382.12	266.	.975630	.852756	.518626	.520888	1014.173	497.304
389.55	268.	1.001037	.874188	.519983	.522642	985.651	492.023
397.10	270.	1.029770	.898071	.521368	.524410	956.668	486.566
404.77	272.	1.062566	.924892	.522786	.526194	927.189	480.926
412.56	274.	1.100395	.955274	.524240	.527995	897.174	475.090
420.47	276.	1.144564	.990031	.525735	.529814	866.577	469.050
428.51	278.	1.196866	1.030246	.527278	.531653	835.349	462.793
436.67	280.	1.259833	1.077391	.528876	.533516	803.432	456.307
444.97	282.	1.337152	1.133520	.530541	.535403	770.759	449.580
453.39	284.	1.434381	1.201587	.532285	.537319	737.258	442.600
461.94	286.	1.560275	1.285995	.534126	.539267	702.845	435.355
470.63	288.	1.729341	1.393604	.536090	.541253	667.432	427.838
479.44	290.	1.967158	1.535684	.538213	.543283	630.932	420.049
488.37	292.	2.322227	1.732106	.540549	.545365	593.286	412.000
497.42	294.	2.894286	2.021146	.543179	.547508	554.539	403.740

Table II-4 Saturation Temperature Table of a 62-26-10%
By Mole Mixture of Propane, Propylene, and N-Butane

THERMODYNAMIC PROPERTIES OF A 65-25-10 MIXTURE OF PROPANE, PROPYLENE AND N-BUTANE BY MOLE WEIGHT USING STARLINGS EQUATION OF STATE

PRESSURE	TEMPERATURE	SATURATED LIQUID SPECIFIC VOLUME	SATURATED VAPOR SPECIFIC VOLUME	SATURATED LIQUID ENTHALPY	SATURATED VAPOR ENTHALPY	SATURATED LIQUID ENTROPY	SATURATED VAPOR ENTROPY
(PSIA)	(°F)	(FT^3/LBM)	(FT^3/LBM)	(BTU/LBM)	(BTU/LBM)	(BTU/LBM/°F)	(BTU/LBM/°F)
14.93	-50.	.027597	6.242729	-482.0839	-304.9960	.799517	1.231439
15.70	-48.	.027660	5.956919	-480.9839	-304.4897	.802227	1.230611
16.50	-46.	.027724	5.686972	-479.8825	-303.9843	.804927	1.229802
17.32	-44.	.027789	5.431858	-478.7797	-303.4798	.807615	1.229009
18.18	-42.	.027853	5.190622	-477.6755	-302.9762	.810294	1.228235
19.07	-40.	.027919	4.952380	-476.5698	-302.4737	.812962	1.227476
20.00	-38.	.027984	4.746312	-475.4625	-301.9722	.815620	1.226735
20.96	-36.	.028050	4.541656	-474.3537	-301.4717	.818268	1.226009
21.95	-34.	.028117	4.347705	-473.2432	-300.9724	.820907	1.225298
22.98	-32.	.028184	4.163802	-472.1311	-300.4742	.823536	1.224603
24.05	-30.	.028251	3.989334	-471.0173	-299.9772	.826155	1.223923
25.15	-28.	.028319	3.823732	-469.9017	-299.4815	.828766	1.223257
26.29	-26.	.028387	3.666466	-468.7843	-298.9871	.831367	1.222605
27.47	-24.	.028456	3.517043	-467.6650	-298.4940	.833960	1.221967
28.70	-22.	.028525	3.375001	-466.5439	-298.0023	.836544	1.221343
29.96	-20.	.028595	3.239910	-465.4208	-297.5120	.839120	1.220731
31.27	-18.	.028666	3.111370	-464.2957	-297.0232	.841688	1.220132
32.61	-16.	.028737	2.989005	-463.1686	-296.5359	.844247	1.219546
34.01	-14.	.028808	2.872466	-462.0393	-296.0502	.846799	1.218972
35.44	-12.	.028881	2.761423	-460.9079	-295.5661	.849343	1.218410
36.92	-10.	.028953	2.655571	-459.7743	-295.0837	.851880	1.217859
38.45	-8.	.029027	2.554623	-458.6385	-294.6030	.854409	1.217319
40.03	-6.	.029101	2.458309	-457.5003	-294.1240	.856931	1.216791
41.66	-4.	.029176	2.366377	-456.3597	-293.6469	.859446	1.216273
43.33	-2.	.029251	2.278592	-455.2167	-293.1716	.861955	1.215765
45.05	0.	.029327	2.194731	-454.0711	-292.6983	.864457	1.215267
46.83	2.	.029404	2.114585	-452.9231	-292.2269	.866952	1.214779
48.66	4.	.029482	2.037961	-451.7724	-291.7576	.869441	1.214301
50.54	6.	.029560	1.964672	-450.6190	-291.2904	.871924	1.213831
52.48	8.	.029639	1.894547	-449.4628	-290.8253	.874402	1.213371
54.47	10.	.029719	1.827424	-448.3039	-290.3624	.876873	1.212919
56.52	12.	.029800	1.763148	-447.1420	-289.9018	.879339	1.212475
58.62	14.	.029881	1.701577	-445.9772	-289.4436	.881800	1.212040
60.79	16.	.029964	1.642574	-444.8093	-288.9877	.884256	1.211612
63.01	18.	.030047	1.586011	-443.6384	-288.5343	.886707	1.211192
65.30	20.	.030132	1.531769	-442.4643	-288.0835	.889153	1.210779
67.64	22.	.030217	1.479732	-441.2869	-287.6352	.891594	1.210374
70.05	24.	.030304	1.429794	-440.1062	-287.1897	.894031	1.209975
72.52	26.	.030391	1.381853	-438.9220	-286.7469	.896464	1.209582
75.06	28.	.030479	1.335814	-437.7344	-286.3070	.898893	1.209195
77.66	30.	.030569	1.291586	-436.5431	-285.8699	.901319	1.208815
80.33	32.	.030660	1.249083	-435.3482	-285.4359	.903740	1.208440
83.06	34.	.030751	1.208225	-434.1496	-285.0050	.906158	1.208071
85.87	36.	.030844	1.168934	-432.9470	-284.5772	.908573	1.207706
88.74	38.	.030939	1.131139	-431.7405	-284.1527	.910986	1.207347
91.69	40.	.031034	1.094771	-430.5300	-283.7316	.913395	1.206992
94.71	42.	.031131	1.059764	-429.3153	-283.3140	.915802	1.206641
97.80	44.	.031230	1.026057	-428.0963	-282.8999	.918206	1.206294
100.97	46.	.031329	.993592	-426.8730	-282.4895	.920609	1.205951
104.21	48.	.031431	.962313	-425.6451	-282.0830	.923009	1.205612
107.53	50.	.031533	.932167	-424.4126	-281.6803	.925408	1.205275
110.93	52.	.031638	.903105	-423.1754	-281.2816	.927805	1.204942
114.40	54.	.031744	.875078	-421.9334	-280.8872	.930202	1.204611
117.96	56.	.031852	.848043	-420.6863	-280.4970	.932597	1.204282
121.60	58.	.031961	.821955	-419.4341	-280.1113	.934992	1.203955

Table II-4 (Continued)

125.32	60.	.032073	.796775	-418.1766	-279.7301	.937386	1.203630
129.12	62.	.032186	.772463	-416.9137	-279.3537	.939781	1.203306
133.01	64.	.032301	.748983	-415.6452	-278.9822	.942175	1.202983
136.98	66.	.032419	.726299	-414.3709	-278.6158	.944570	1.202660
141.05	68.	.032538	.704378	-413.0907	-278.2546	.946966	1.202338
145.20	70.	.032660	.683189	-411.8043	-277.8988	.949363	1.202015
149.44	72.	.032785	.662699	-410.5117	-277.5487	.951762	1.201692
153.77	74.	.032912	.642882	-409.2125	-277.2044	.954162	1.201368
158.20	76.	.033041	.623709	-407.9066	-276.8661	.956564	1.201043
162.72	78.	.033173	.605153	-406.5938	-276.5342	.958969	1.200716
167.33	80.	.033308	.587190	-405.2737	-276.2087	.961377	1.200386
172.05	82.	.033446	.569795	-403.9462	-275.8900	.963789	1.200055
176.86	84.	.033588	.552945	-402.6110	-275.5784	.966204	1.199719
181.76	86.	.033732	.536619	-401.2677	-275.2742	.968623	1.199381
186.77	88.	.033880	.520795	-399.9162	-274.9776	.971047	1.199038
191.88	90.	.034032	.505453	-398.5560	-274.6889	.973477	1.198690
197.10	92.	.034188	.490574	-397.1867	-274.4086	.975913	1.198337
202.42	94.	.034348	.476139	-395.8081	-274.1370	.978355	1.197978
207.84	96.	.034512	.462130	-394.4197	-273.8745	.980804	1.197612
213.37	98.	.034681	.448531	-393.0210	-273.6216	.983262	1.197239
219.02	100.	.034855	.435325	-391.6116	-273.3786	.985728	1.196858
224.77	102.	.035035	.422496	-390.1910	-273.1461	.988203	1.196468
230.63	104.	.035220	.410030	-388.7585	-272.9245	.990689	1.196069
236.61	106.	.035411	.397910	-387.3136	-272.7146	.993187	1.195658
242.70	108.	.035608	.386124	-385.8556	-272.5169	.995697	1.195237
248.91	110.	.035813	.374658	-384.3836	-272.3320	.998220	1.194802
255.24	112.	.036025	.363498	-382.8970	-272.1607	1.000759	1.194354
261.69	114.	.036245	.352633	-381.3946	-272.0037	1.003314	1.193891
268.26	116.	.036475	.342048	-379.8756	-271.8621	1.005888	1.193411
274.95	118.	.036714	.331732	-378.3387	-271.7366	1.008482	1.192914
281.77	120.	.036963	.321674	-376.7825	-271.6284	1.011097	1.192397
288.71	122.	.037225	.311862	-375.2056	-271.5385	1.013738	1.191860
295.79	124.	.037499	.302285	-373.6062	-271.4684	1.016405	1.191299
302.99	126.	.037788	.292931	-371.9824	-271.4193	1.019103	1.190713
310.32	128.	.038093	.283789	-370.3317	-271.3928	1.021836	1.190099
317.79	130.	.038417	.274849	-368.6515	-271.3908	1.024606	1.189455
325.39	132.	.038760	.266099	-366.9384	-271.4152	1.027421	1.188778
333.13	134.	.039128	.257528	-365.1886	-271.4682	1.030285	1.188064
341.00	136.	.039523	.249126	-363.3972	-271.5525	1.033207	1.187309
349.02	138.	.039950	.240880	-361.5583	-271.6708	1.036196	1.186510
357.17	140.	.040415	.232780	-359.6645	-271.8266	1.039264	1.185661
365.47	142.	.040926	.224812	-357.7062	-272.0238	1.042426	1.184756
373.90	144.	.041494	.216965	-355.6707	-272.2667	1.045702	1.183788
382.47	146.	.042132	.209225	-353.5410	-272.5606	1.049120	1.182751
391.18	148.	.042863	.201579	-351.2933	-272.9115	1.052717	1.181635
400.02	150.	.043716	.194013	-348.8932	-273.3263	1.056549	1.180429
408.99	152.	.044742	.186515	-346.2889	-273.8128	1.060698	1.179123
418.07	154.	.046019	.179075	-343.4003	-274.3792	1.065293	1.177705
427.24	156.	.047680	.171691	-340.1049	-275.0333	1.070529	1.176165
436.47	158.	.049921	.164374	-336.2541	-275.7798	1.076642	1.174497
445.70	160.	.052869	.157151	-331.8458	-276.6197	1.083629	1.172703
454.92	162.	.056298	.150024	-327.2447	-277.5600	1.090895	1.170774
464.13	164.	.059879	.142927	-322.7878	-278.6297	1.097897	1.168663

Table II-4 (Continued)

THERMODYNAMIC PROPERTIES OF A 65-25-10 MIXTURE OF PROPANE, PROPYLENE AND N-BUTANE BY MOLE WEIGHT USING STARLINGS EQUATION OF STATE

PRESSURE (PSIA)	TEMPERATURE (°F)	SATURATED LIQUID CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	SATURATED VAROR CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	SATURATED LIQUID CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SATURATED VAPOR CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SATURATED LIQUID SONIC VELOCITY (FT/SEC)	SATURATED VAPOR SONIC VELOCITY (FT/SEC)
14.93	-50.	.550021	.334964	.315244	.277405	4323.866	704.442
15.70	-48.	.550654	.336903	.317031	.278895	4277.107	705.033
16.50	-46.	.551300	.338859	.318792	.280393	4231.024	705.590
17.32	-44.	.551962	.340832	.320526	.281897	4185.593	706.114
18.18	-42.	.552639	.342821	.322236	.283409	4140.790	706.604
19.07	-40.	.553332	.344829	.323922	.284929	4096.592	707.062
20.00	-38.	.554043	.346856	.325585	.286455	4052.978	707.487
20.96	-36.	.554771	.348901	.327226	.287989	4009.927	707.878
21.95	-34.	.555518	.350966	.328845	.289530	3967.419	708.237
22.98	-32.	.556284	.353052	.330445	.291078	3925.435	708.562
24.05	-30.	.557070	.355158	.332024	.292634	3883.957	708.855
25.15	-28.	.557877	.357286	.333585	.294196	3842.967	709.114
26.29	-26.	.558706	.359435	.335128	.295765	3802.449	709.341
27.47	-24.	.559556	.361608	.336654	.297341	3762.386	709.534
28.70	-22.	.560430	.363804	.338163	.298924	3722.762	709.694
29.96	-20.	.561328	.366023	.339656	.300514	3683.562	709.820
31.27	-18.	.562250	.368268	.341134	.302110	3644.771	709.913
32.61	-16.	.563198	.370537	.342598	.303714	3606.376	709.973
34.01	-14.	.564172	.372833	.344047	.305324	3568.362	709.998
35.44	-12.	.565172	.375155	.345484	.306940	3530.716	709.990
36.92	-10.	.566200	.377505	.346907	.308564	3493.426	709.947
38.45	-8.	.567257	.379883	.348319	.310193	3456.480	709.870
40.03	-6.	.568343	.382289	.349718	.311830	3419.864	709.759
41.66	-4.	.569459	.384726	.351107	.313473	3383.567	709.613
43.33	-2.	.570606	.387192	.352485	.315122	3347.579	709.432
45.05	0.	.571785	.389690	.353853	.316778	3311.887	709.215
46.83	2.	.572996	.392221	.355212	.318440	3276.481	708.963
48.66	4.	.574241	.394784	.356561	.320108	3241.351	708.675
50.54	6.	.575521	.397382	.357902	.321783	3206.487	708.351
52.48	8.	.576837	.400014	.359234	.323464	3171.877	707.990
54.47	10.	.578189	.402683	.360559	.325151	3137.514	707.593
56.52	12.	.579579	.405388	.361877	.326845	3103.386	707.158
58.62	14.	.581009	.408132	.363187	.328545	3069.486	706.686
60.79	16.	.582478	.410916	.364491	.330251	3035.803	706.176
63.01	18.	.583989	.413740	.365789	.331963	3002.329	705.627
65.30	20.	.585542	.416606	.367081	.333681	2969.055	705.040
67.64	22.	.587139	.419515	.368368	.335406	2935.972	704.413
70.05	24.	.588782	.422469	.369650	.337136	2903.073	703.747
72.52	26.	.590472	.425469	.370927	.338873	2870.348	703.040
75.06	28.	.592210	.428517	.372200	.340616	2837.790	702.293
77.66	30.	.593999	.431615	.373470	.342365	2805.391	701.505
80.33	32.	.595840	.434763	.374735	.344120	2773.141	700.674
83.06	34.	.597734	.437965	.375997	.345681	2741.035	699.802
85.87	36.	.599685	.441222	.377257	.347648	2709.063	698.886
88.74	38.	.601693	.444536	.378513	.349421	2677.219	697.927
91.69	40.	.603761	.447909	.379768	.351201	2645.494	696.924
94.71	42.	.605892	.451344	.381021	.352986	2613.881	695.875
97.80	44.	.608089	.454843	.382272	.354778	2582.373	694.781
100.97	46.	.610353	.458408	.383521	.356576	2550.961	693.641
104.21	48.	.612687	.462044	.384770	.358380	2519.639	692.454
107.53	50.	.615096	.465752	.386018	.360191	2488.399	691.219
110.93	52.	.617581	.469535	.387266	.362007	2457.233	689.935
114.40	54.	.620148	.473398	.388514	.363830	2426.135	688.602
117.96	56.	.622798	.477344	.389762	.365660	2395.096	687.218

Table II-4 (Continued)

121.60	58.	.625538	.481376	.391011	.367496	2364.109	685.783
125.35	60.	.628370	.485500	.392260	.369358	2333.166	684.796
129.12	62.	.631300	.489719	.393511	.371187	2302.260	683.755
133.01	64.	.634333	.494038	.394764	.373042	2271.384	681.161
136.98	66.	.637475	.498462	.396019	.374905	2240.528	679.511
141.05	68.	.640731	.502998	.397276	.376774	2209.686	677.804
145.20	70.	.644108	.507650	.398536	.378650	2178.849	676.040
149.44	72.	.647614	.512427	.399799	.380533	2148.010	674.216
153.77	74.	.651256	.517334	.401065	.382423	2117.159	672.333
158.20	76.	.655042	.522379	.402335	.384320	2086.289	670.388
162.72	78.	.658983	.527571	.403610	.386225	2055.389	668.380
167.33	80.	.663088	.532919	.404890	.388138	2024.453	666.307
172.05	82.	.667369	.538433	.406174	.390058	1993.470	664.169
176.86	84.	.671839	.544123	.407464	.391986	1962.430	661.963
181.76	86.	.676510	.550001	.408761	.393922	1931.325	659.687
186.77	88.	.681399	.556080	.410064	.395867	1900.143	657.340
191.88	90.	.686522	.562375	.411375	.397820	1868.874	654.921
197.10	92.	.691898	.568901	.412693	.399781	1837.507	652.426
202.42	94.	.697549	.575675	.414021	.401752	1806.030	649.854
207.84	96.	.703499	.582717	.415357	.403732	1774.432	647.203
213.37	98.	.709774	.590047	.416703	.405722	1742.699	644.470
219.02	100.	.716406	.597690	.418060	.407722	1710.819	641.653
224.77	102.	.723427	.605672	.419429	.409732	1678.776	638.750
230.63	104.	.730878	.614023	.420811	.411752	1646.556	635.756
236.61	106.	.738804	.622775	.422206	.413784	1614.143	632.671
242.70	108.	.747257	.631966	.423616	.415828	1581.519	629.489
248.91	110.	.756297	.641639	.425042	.417884	1548.666	626.209
255.24	112.	.765994	.651842	.426486	.419952	1515.565	622.826
261.69	114.	.776429	.662630	.427948	.422034	1482.194	619.337
268.26	116.	.787700	.674067	.429432	.424129	1448.530	615.738
274.95	118.	.799922	.686225	.430938	.426240	1414.548	612.024
281.77	120.	.813230	.699189	.432469	.428365	1380.220	608.190
288.71	122.	.827792	.713058	.434028	.430508	1345.516	604.233
295.79	124.	.843809	.727946	.435617	.432667	1310.403	600.145
302.99	126.	.861531	.743990	.437240	.434845	1274.844	595.923
310.32	128.	.881267	.761353	.438901	.437043	1238.798	591.559
317.79	130.	.903408	.780228	.440605	.439262	1202.217	587.046
325.39	132.	.928455	.800851	.442356	.441503	1165.052	582.378
333.13	134.	.957059	.823509	.444163	.443769	1127.241	577.546
341.00	136.	.990084	.848554	.446032	.446061	1088.719	572.543
349.02	138.	1.028695	.876428	.447975	.448381	1049.408	567.359
357.17	140.	1.074508	.907686	.450004	.450731	1009.221	561.985
365.47	142.	1.129820	.943040	.452135	.453116	968.054	556.410
373.90	144.	1.198003	.983415	.454390	.455536	925.793	550.623
382.47	146.	1.284187	1.030030	.456798	.457997	882.305	544.616
391.18	148.	1.396502	1.084527	.459400	.460502	837.449	538.377
400.02	150.	1.548426	1.149149	.462253	.463055	791.095	531.900
408.99	152.	1.763261	1.227026	.465442	.465659	743.177	525.182
418.07	154.	2.081957	1.322590	.469096	.468319	693.577	518.234
427.24	156.	2.568971	1.442166	.473393	.471034	644.143	511.088
436.47	158.	3.260620	1.594745	.478500	.473800	597.009	503.818
445.70	160.	3.934111	1.793275	.484203	.476605	558.730	496.544
454.92	162.	4.261873	2.058686	.489603	.479442	533.528	489.383
464.13	164.	4.468609	2.430901	.494018	.482325	517.716	482.380

Table II-5 Saturation Temperature Table of Ethylene

THERMODYNAMC PROPERTES OF ETHYLENE USNG STARLINGS EQUATION OF STATE

PRESSURE (PSIA)	TEMPERATURE (°F)	SATURATED LIQUID SPECIFIC VOLUME (FT^3/LBM)	SATURATED VAPOR SPECIFIC VOLUME (FT^3/LBM)	SATURATED LIQUID ENTHALPY (BTU/LBM)	SATURATED VAPOR ENTHALPY (BTU/LBM)	SATURATED LIQUID ENTROPY (BTU/LBM/°F)	SATURATED VAPOR ENTROPY (BTU/LBM/°F)
176.21	-50.	.033369	.710563	-23.7146	135.2498	.995276	1.382994
184.47	-48.	.033513	.685919	-22.4810	135.3254	.998183	1.381209
190.90	-46.	.033660	.662249	-21.2394	135.3926	1.001093	1.379431
197.48	-44.	.033810	.639503	-19.9895	135.4510	1.004006	1.377661
204.23	-42.	.033962	.617636	-18.7309	135.5004	1.006922	1.375897
211.14	-40.	.034118	.596607	-17.4634	135.5404	1.009844	1.374138
218.23	-38.	.034277	.576373	-16.1865	135.5706	1.012770	1.372384
225.48	-36.	.034440	.556898	-14.9000	135.5907	1.015702	1.370633
232.91	-34.	.034606	.538145	-13.6033	135.6001	1.018642	1.368884
240.51	-32.	.034776	.520079	-12.2961	135.5985	1.021589	1.367137
248.30	-30.	.034950	.502668	-10.9779	135.5855	1.024544	1.365389
256.26	-28.	.035128	.485881	-9.6482	135.5605	1.027510	1.363641
264.41	-26.	.035311	.469689	-8.3067	135.5229	1.030485	1.361890
272.75	-24.	.035498	.454065	-6.9526	135.4723	1.033472	1.360135
281.28	-22.	.035691	.438981	-5.5856	135.4080	1.036472	1.358375
290.00	-20.	.035888	.424414	-4.2049	135.3293	1.039485	1.356609
298.92	-18.	.036092	.410338	-2.8099	135.2356	1.042514	1.354834
308.04	-16.	.036301	.396732	-1.3999	135.1262	1.045559	1.353050
317.36	-14.	.036516	.383573	.0257	135.0001	1.048621	1.351255
326.89	-12.	.036739	.370842	1.4679	134.8566	1.051703	1.349446
336.62	-10.	.036968	.358517	2.9275	134.6946	1.054806	1.347622
346.57	-8.	.037205	.346581	4.4054	134.5131	1.057932	1.345781
356.73	-6.	.037451	.335015	5.9028	134.3111	1.061082	1.343920
367.11	-4.	.037705	.323801	7.4206	134.0872	1.064259	1.342037
377.71	-2.	.037969	.312923	8.9602	133.8400	1.067466	1.340129
388.54	0.	.038243	.302364	10.5230	133.5682	1.070704	1.338194
399.60	2.	.038529	.292109	12.1105	133.2700	1.073977	1.336227
410.89	4.	.038826	.282143	13.7243	132.9436	1.077288	1.334226
422.42	6.	.039138	.272450	15.3664	132.5869	1.080641	1.332187
434.19	8.	.039463	.263017	17.0390	132.1976	1.084039	1.330104
446.21	10.	.039805	.253828	18.7445	131.7732	1.087487	1.327974
458.48	12.	.040165	.244869	20.4855	131.3106	1.090991	1.325790
471.00	14.	.040545	.236127	22.2655	130.8065	1.094556	1.323546
483.78	16.	.040946	.227587	24.0879	130.2570	1.098190	1.321235
496.83	18.	.041373	.219235	25.9572	129.6577	1.101901	1.318847
510.15	20.	.041829	.211055	27.8783	129.0034	1.105697	1.316374
523.74	22.	.042316	.203031	29.8574	128.2877	1.109592	1.313804
537.61	24.	.042842	.195148	31.9018	127.5035	1.113598	1.311122
551.77	26.	.043411	.187386	34.0204	126.6417	1.117733	1.308313
566.22	28.	.044032	.179726	36.2243	125.6915	1.122019	1.305353
580.97	30.	.044715	.172144	36.5278	124.6391	1.126481	1.302219
596.02	32.	.045474	.164613	40.9491	123.4673	1.131157	1.298877
611.39	34.	.046327	.157101	43.5127	122.1534	1.136092	1.295284
627.08	36.	.047303	.149563	46.2522	120.6666	1.141352	1.291381
643.10	38.	.048438	.141945	49.2161	118.9642	1.147029	1.287086
659.45	40.	.049797	.134165	52.4774	116.9829	1.153267	1.282278
676.15	42.	.051482	.126099	56.1547	114.6230	1.160294	1.276765

Table II-5 (Continued)

THERMODYNAMIC PROPERTIES OF ETHYLENE USING STARLINGS EQUATION OF STATE

PRESSURE (PSIA)	TEMPERATURE (°F)	SATURATED LIQUID CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	SATURATED VAPOR CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	SATURATED LIQUID CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SATURATED VAPOR CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SATURATED LIQUID SONIC VELOCITY (FT/SEC)	SATURATED VAPOR SONIC VELOCITY (FT/SEC)
178.21	-50.	.630431	.440319	.238779	.256332	3465.224	883.420
184.47	-48.	.634299	.445581	.240155	.258444	3413.775	881.181
190.90	-46.	.638367	.451002	.241534	.260553	3362.686	878.900
197.48	-44.	.642645	.456590	.242916	.262661	3311.938	876.575
204.23	-42.	.647145	.462357	.244303	.264766	3261.510	874.205
211.14	-40.	.651880	.468314	.245695	.266870	3211.380	871.788
218.23	-38.	.656862	.474474	.247093	.268972	3161.530	869.322
225.48	-36.	.662106	.480851	.248496	.271073	3111.938	866.805
232.91	-34.	.667629	.487460	.249906	.273173	3062.585	864.236
240.51	-32.	.673448	.494318	.251324	.275271	3013.450	861.612
248.30	-30.	.679584	.501444	.252749	.277369	2964.515	858.932
256.26	-28.	.686058	.508857	.254183	.279466	2915.760	856.194
264.41	-26.	.692895	.516580	.255626	.281562	2867.164	853.396
272.75	-24.	.700121	.524639	.257080	.283658	2818.708	850.537
281.28	-22.	.707767	.533061	.258544	.285754	2770.371	847.614
290.00	-20.	.715867	.541878	.260020	.287851	2722.134	844.625
298.92	-18.	.724458	.551125	.261509	.289948	2673.976	841.568
308.04	-16.	.733583	.560840	.263011	.292045	2625.876	838.442
317.36	-14.	.743290	.571069	.264528	.294144	2577.813	835.244
326.89	-12.	.753633	.581860	.266061	.296243	2529.765	831.973
336.62	-10.	.764675	.593272	.267611	.298345	2481.709	828.626
346.57	-8.	.776487	.605369	.269179	.300448	2433.623	825.201
356.73	-6.	.789150	.618225	.270768	.302553	2385.483	821.696
367.11	-4.	.802757	.631926	.272377	.304661	2337.263	818.110
377.71	-2.	.817419	.646572	.274010	.306772	2288.939	814.440
388.54	0.	.833261	.662277	.275668	.308886	2240.482	810.684
399.60	2.	.850434	.679176	.277353	.311004	2191.864	806.840
410.89	4.	.869112	.697429	.279067	.313127	2143.054	802.908
422.42	6.	.889507	.717225	.280814	.315253	2094.021	798.884
434.19	8.	.911868	.738789	.282596	.317385	2044.729	794.768
446.21	10.	.936501	.762392	.284416	.319523	1995.142	790.559
458.48	12.	.963776	.788368	.286279	.321667	1945.219	786.256
471.00	14.	.994152	.817120	.288189	.323818	1894.915	781.858
483.78	16.	1.028200	.849156	.290150	.325976	1844.182	777.367
496.83	18.	1.066644	.885111	.292170	.328142	1792.968	772.784
510.15	20.	1.110411	.925796	.294255	.330317	1741.211	768.112
523.74	22.	1.160710	.972263	.296413	.332501	1688.844	763.355
537.61	24.	1.219147	1.025898	.298654	.334695	1635.791	758.520
551.77	26.	1.287900	1.088570	.300991	.336899	1581.963	753.617
566.22	28.	1.369998	1.162856	.303439	.339115	1527.256	748.661
580.97	30.	1.469775	1.252411	.306016	.341342	1471.549	743.673
596.02	32.	1.593648	1.362599	.308747	.343579	1414.693	738.685
611.39	34.	1.751518	1.501605	.311663	.345828	1356.508	733.742
627.08	36.	1.959457	1.682581	.314808	.348084	1296.762	728.913
643.10	38.	2.245284	1.928028	.318241	.350344	1235.155	724.306
659.45	40.	2.661354	2.279842	.322049	.352599	1171.277	720.094
676.15	42.	3.318130	2.825647	.326366	.354830	1104.536	716.577

Table II-6 Superheated Vapor and Compressed Liquid Tables of Propane

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -50. ^{0}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{0}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{0}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{0}F)	SONIC VELOCITY (FT/SEC)
10.00	superheated v.	9.690929	-699.619	1.25951	.331276	.284675	712.0216
12.58	sat. vapor	7.641919	-700.129	1.24827	.334776	.286096	707.9896
12.58	sat. liquid	.027944	-884.156	.79943	.526117	.350211	4064.6221
20.00	compressed	.027942	-884.133	.79939	.526074	.350235	4066.0053
30.00	compressed	.027938	-884.103	.79934	.526016	.350315	4068.1313
40.00	liquid	.027935	-884.072	.79928	.525958	.350372	4070.2565
50.00		.027932	-884.042	.79923	.525900	.350435	4072.3789
60.00		.027929	-884.011	.79918	.525843	.350495	4074.4985
70.00		.027925	-883.981	.79913	.525786	.350555	4076.6152
80.00		.027922	-883.950	.79908	.525730	.350615	4078.7292
90.00		.027919	-883.920	.79903	.525673	.350675	4080.8404
100.00		.027915	-883.889	.79897	.525617	.350734	4082.9488
110.00		.027912	-883.858	.79892	.525561	.350794	4085.0545
120.00		.027909	-883.828	.79887	.525505	.350854	4087.1574
130.00		.027906	-883.797	.79882	.525450	.350913	4089.2576
140.00		.027903	-883.767	.79877	.525395	.350973	4091.3551
150.00		.027899	-883.736	.79872	.525340	.351032	4093.4498
160.00		.027896	-883.705	.79867	.525285	.351092	4095.5418
170.00		.027893	-883.675	.79862	.525231	.351151	4097.6311
180.00		.027890	-883.644	.79857	.525176	.351211	4099.7177
190.00		.027886	-883.613	.79851	.525122	.351270	4101.8016
200.00		.027883	-883.582	.79846	.525069	.351329	4103.8829
210.00		.027880	-883.552	.79841	.525015	.351389	4105.9614
220.00		.027877	-883.521	.79836	.524962	.351448	4108.0373
230.00		.027874	-883.490	.79831	.524909	.351507	4110.1106
240.00		.027870	-883.459	.79826	.524856	.351566	4112.1812
250.00		.027867	-883.428	.79821	.524803	.351625	4114.2491
260.00		.027864	-883.398	.79816	.524751	.351685	4116.3145
270.00		.027861	-883.367	.79811	.524699	.351744	4118.3772
280.00		.027858	-883.336	.79806	.524647	.351803	4120.4372
290.00		.027855	-883.305	.79801	.524595	.351862	4122.4947
300.00		.027851	-883.274	.79796	.524544	.351921	4124.5496
310.00		.027848	-883.243	.79791	.524492	.351980	4126.6019
320.00		.027845	-883.212	.79786	.524441	.352038	4128.6516
330.00		.027842	-883.181	.79781	.524390	.352097	4130.6988
340.00		.027839	-883.150	.79776	.524340	.352156	4132.7434
350.00		.027836	-883.119	.79771	.524289	.352215	4134.7854
360.00		.027833	-883.088	.79766	.524239	.352274	4136.8249
370.00		.027830	-883.057	.79761	.524189	.352332	4138.8618
380.00		.027826	-883.026	.79756	.524140	.352391	4140.8962
390.00		.027823	-882.995	.79751	.524090	.352450	4142.9281
400.00		.027820	-882.964	.79746	.524041	.352508	4144.9574
410.00		.027817	-882.933	.79741	.523992	.352567	4146.9843
420.00		.027814	-882.902	.79736	.523943	.352625	4149.0086
430.00		.027811	-882.871	.79731	.523894	.352684	4151.0305
440.00		.027808	-882.840	.79726	.523846	.352742	4153.0498
450.00		.027805	-882.809	.79721	.523798	.352801	4155.0667
460.00		.027802	-882.778	.79716	.523750	.352859	4157.0811
470.00		.027799	-882.747	.79711	.523702	.352917	4159.0931
480.00		.027796	-882.715	.79706	.523654	.352976	4161.1025
490.00		.027792	-882.684	.79701	.523607	.353034	4163.1096
500.00		.027789	-882.653	.79696	.523559	.353092	4165.1142
510.00		.027786	-882.622	.79691	.523512	.353150	4167.1163
520.00		.027783	-882.590	.79686	.523466	.353209	4169.1161
530.00		.027780	-882.559	.79681	.523419	.353267	4171.1134
540.00		.027777	-882.528	.79676	.523373	.353325	4173.1083

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -40. ^{0}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{0}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{0}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{0}F)	SONIC VELOCITY (FT/SEC)
10.00	superheated v.	9.952337	-696.230	1.26771	.335996	.289476	721.5868
16.09	sat. vapor	6.074440	-697.368	1.24430	.343639	.292551	712.5978
16.09	sat. liquid	.028227	-878.806	.81230	.531048	.357018	3896.3778
20.00	compressed	.028226	-878.795	.81228	.531021	.357040	3897.2591
30.00	liquid	.028222	-878.765	.81223	.530953	.357098	3899.5126
40.00		.028219	-878.735	.81218	.530885	.357155	3901.7630
50.00		.028215	-878.705	.81212	.530817	.357212	3904.0100
60.00		.028212	-878.675	.81207	.530749	.357270	3906.2539
70.00		.028208	-878.645	.81202	.530682	.357327	3908.4947
80.00		.028204	-878.615	.81196	.530616	.357384	3910.7322
90.00		.028201	-878.585	.81191	.530549	.357442	3912.9666
100.00		.028197	-878.555	.81186	.530483	.357499	3915.1978
110.00		.028194	-878.525	.81180	.530417	.357556	3917.4259
120.00		.028190	-878.495	.81175	.530352	.357613	3919.6509
130.00		.028187	-878.465	.81170	.530286	.357670	3921.8727
140.00		.028183	-878.435	.81165	.530221	.357728	3924.0914
150.00		.028180	-878.405	.81159	.530157	.357785	3926.3071
160.00		.028176	-878.375	.81154	.530092	.357842	3928.5196
170.00		.028172	-878.345	.81149	.530028	.357899	3930.7291
180.00		.028169	-878.315	.81144	.529964	.357956	3932.9355
190.00		.028165	-878.285	.81138	.529901	.358012	3935.1389
200.00		.028162	-878.255	.81133	.529837	.358069	3937.3392
210.00		.028158	-878.225	.81128	.529774	.358126	3939.5365
220.00		.028155	-878.194	.81123	.529712	.358183	3941.7308
230.00		.028151	-878.164	.81117	.529649	.358240	3943.9220
240.00		.028148	-878.134	.81112	.529587	.358296	3946.1103
250.00		.028144	-878.104	.81107	.529525	.358353	3948.2955
260.00		.028141	-878.074	.81102	.529463	.358410	3950.4778
270.00		.028137	-878.043	.81097	.529402	.358466	3952.6571
280.00		.028134	-878.013	.81091	.529341	.358523	3954.8334
290.00		.028131	-877.983	.81086	.529280	.358579	3957.0068
300.00		.028127	-877.952	.81081	.529220	.358636	3959.1773
310.00		.028124	-877.922	.81076	.529159	.358692	3961.3448
320.00		.028120	-877.892	.81071	.529099	.358749	3963.5094
330.00		.028117	-877.861	.81066	.529040	.358805	3965.6711
340.00		.028113	-877.831	.81060	.528980	.358862	3967.8299
350.00		.028110	-877.800	.81055	.528921	.358918	3969.9858
360.00		.028106	-877.770	.81050	.528862	.358974	3972.1388
370.00		.028103	-877.739	.81045	.528803	.359030	3974.2889
380.00		.028100	-877.709	.81040	.528745	.359087	3976.4362
390.00		.028096	-877.678	.81035	.528686	.359143	3978.5806
400.00		.028093	-877.648	.81030	.528628	.359199	3980.7222
410.00		.028089	-877.617	.81025	.528571	.359255	3982.8609
420.00		.028086	-877.587	.81019	.528513	.359311	3984.9968
430.00		.028083	-877.556	.81014	.528456	.359367	3987.1299
440.00		.028079	-877.526	.81009	.528399	.359423	3989.2602
450.00		.028076	-877.495	.81004	.528342	.359479	3991.3877
460.00		.028073	-877.464	.80999	.528286	.359535	3993.5124
470.00		.028069	-877.434	.80994	.528230	.359591	3995.6343
480.00		.028066	-877.403	.80989	.528174	.359647	3997.7535
490.00		.028062	-877.372	.80984	.528118	.359703	3999.8698
500.00		.028059	-877.342	.80979	.528062	.359759	4001.9835
510.00		.028056	-877.311	.80974	.528007	.359814	4004.0944
520.00		.028052	-877.280	.80969	.527952	.359870	4006.2025
530.00		.028049	-877.250	.80964	.527897	.359926	4008.3079
540.00		.028046	-877.219	.80959	.527843	.359981	4010.4106

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -30. ^{0}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{0}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{0}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{0}F)	SONIC VELOCITY (FT/SEC)
10.00	superheated	10.212193	-692.797	1.27581	.340870	.294446	730.8487
20.00	vapor	4.968733	-694.563	1.24160	.352492	.299076	718.9154
20.33	sat. vapor	4.883849	-694.622	1.24076	.352899	.299232	716.4428
20.33	sat. liquid	.028519	-873.410	.82498	.536225	.363396	3736.6541
30.00	compressed	.028515	-873.381	.82492	.536148	.363449	3738.9602
40.00	liquid	.028511	-873.352	.82487	.536068	.363504	3741.3410
50.00		.028507	-873.323	.82481	.535988	.363559	3743.7181
60.00		.028503	-873.294	.82476	.535909	.363614	3746.0916
70.00		.028499	-873.265	.82470	.535831	.363669	3748.4615
80.00		.028496	-873.236	.82465	.535752	.363724	3750.8278
90.00		.028492	-873.206	.82460	.535674	.363779	3753.1905
100.00		.028488	-873.177	.82454	.535597	.363833	3755.5495
110.00		.028484	-873.148	.82449	.535519	.363888	3757.9050
120.00		.028480	-873.119	.82443	.535442	.363943	3760.2570
130.00		.028476	-873.089	.82438	.535366	.363998	3762.6054
140.00		.028472	-873.060	.82432	.535289	.364052	3764.9502
150.00		.028468	-873.031	.82427	.535214	.364107	3767.2915
160.00		.028464	-873.001	.82421	.535138	.364161	3769.6294
170.00		.028460	-872.972	.82416	.535063	.364216	3771.9637
180.00		.028456	-872.943	.82411	.534988	.364270	3774.2945
190.00		.028453	-872.913	.82405	.534913	.364325	3776.6219
200.00		.028449	-872.884	.82400	.534839	.364379	3778.9458
210.00		.028445	-872.854	.82394	.534765	.364434	3781.2663
220.00		.028441	-872.825	.82389	.534692	.364488	3783.5834
230.00		.028437	-872.795	.82384	.534619	.364542	3785.8970
240.00		.028433	-872.766	.82378	.534546	.364597	3788.2072
250.00		.028430	-872.736	.82373	.534473	.364651	3790.5140
260.00		.028426	-872.706	.82368	.534401	.364705	3792.8175
270.00		.028422	-872.677	.82362	.534329	.364759	3795.1175
280.00		.028418	-872.647	.82357	.534258	.364814	3797.4143
290.00		.028414	-872.617	.82352	.534187	.364868	3799.7076
300.00		.028410	-872.588	.82346	.534116	.364922	3801.9977
310.00		.028407	-872.558	.82341	.534045	.364976	3804.2844
320.00		.028403	-872.528	.82336	.533975	.365030	3806.5678
330.00		.028399	-872.499	.82330	.533905	.365084	3808.8479
340.00		.028395	-872.469	.82325	.533835	.365138	3811.1248
350.00		.028392	-872.439	.82320	.533766	.365192	3813.3983
360.00		.028388	-872.409	.82314	.533697	.365246	3815.6686
370.00		.028384	-872.379	.82309	.533628	.365300	3817.9357
380.00		.028380	-872.350	.82304	.533560	.365353	3820.1995
390.00		.028377	-872.320	.82299	.533492	.365407	3822.4601
400.00		.028373	-872.290	.82293	.533424	.365461	3824.7174
410.00		.028369	-872.260	.82288	.533357	.365515	3826.9716
420.00		.028365	-872.230	.82283	.533289	.365568	3829.2226
430.00		.028362	-872.200	.82278	.533222	.365622	3831.4704
440.00		.028358	-872.170	.82272	.533156	.365676	3833.7150
450.00		.028354	-872.140	.82267	.533090	.365729	3835.9565
460.00		.028351	-872.110	.82262	.533024	.365783	3838.1948
470.00		.028347	-872.080	.82257	.532958	.365836	3840.4300
480.00		.028343	-872.050	.82251	.532892	.365890	3842.6620
490.00		.028340	-872.020	.82246	.532827	.365943	3844.8910
500.00		.028336	-871.990	.82241	.532762	.365997	3847.1168
510.00		.028332	-871.960	.82236	.532698	.366050	3849.3396
520.00		.028329	-871.930	.82231	.532633	.366103	3851.5592
530.00		.028325	-871.899	.82225	.532569	.366157	3853.7758
540.00		.028321	-871.869	.82220	.532506	.366210	3855.9893

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -20. ^{0}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{0}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{0}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{0}F)	SONIC VELOCITY (FT/SEC)
10.00	superheated	10.470674	-689.320	1.28384	.345887	.299570	739.8367
20.00	vapor	5.106287	-690.975	1.24987	.356405	.303786	726.8213
25.38	sat. vapor	3.967550	-691.897	1.23762	.362592	.306130	719.5121
25.38	sat. liquid	.028820	-867.962	.83747	.541721	.369435	3583.9216
30.00	compressed	.028818	-867.949	.83744	.541678	.369459	3585.0870
40.00	liquid	.028814	-867.921	.83739	.541584	.369512	3587.6054
50.00		.028809	-867.892	.83733	.541491	.369564	3590.1197
60.00		.028805	-867.864	.83727	.541398	.369617	3592.6298
70.00		.028801	-867.836	.83721	.541306	.369669	3595.1358
80.00		.028796	-867.808	.83716	.541214	.369721	3597.6376
90.00		.028792	-867.779	.83710	.541122	.369774	3600.1353
100.00		.028788	-867.751	.83704	.541032	.369826	3602.6289
110.00		.028783	-867.722	.83699	.540941	.369879	3605.1184
120.00		.028779	-867.694	.83693	.540851	.369931	3607.6039
130.00		.028775	-867.665	.83688	.540761	.369983	3610.0853
140.00		.028770	-867.637	.83682	.540672	.370035	3612.5627
150.00		.028766	-867.608	.83676	.540583	.370088	3615.0361
160.00		.028762	-867.580	.83671	.540495	.370140	3617.5055
170.00		.028758	-867.551	.83665	.540407	.370192	3619.9709
180.00		.028753	-867.523	.83660	.540319	.370244	3622.4323
190.00		.028749	-867.494	.83654	.540232	.370296	3624.8898
200.00		.028745	-867.465	.83648	.540145	.370348	3627.3434
210.00		.028741	-867.437	.83643	.540059	.370400	3629.7930
220.00		.028736	-867.408	.83637	.539973	.370452	3632.2387
230.00		.028732	-867.379	.83632	.539888	.370504	3634.6806
240.00		.028728	-867.350	.83626	.539803	.370556	3637.1186
250.00		.028724	-867.322	.83621	.539718	.370608	3639.5527
260.00		.028719	-867.293	.83615	.539634	.370660	3641.9830
270.00		.028715	-867.264	.83610	.539550	.370711	3644.4094
280.00		.028711	-867.235	.83604	.539466	.370763	3646.8321
290.00		.028707	-867.206	.83598	.539383	.370815	3649.2509
300.00		.028703	-867.177	.83593	.539300	.370867	3651.6660
310.00		.028699	-867.148	.83587	.539218	.370918	3654.0773
320.00		.028694	-867.119	.83582	.539136	.370970	3656.4849
330.00		.028690	-867.090	.83577	.539054	.371022	3658.8887
340.00		.028686	-867.061	.83571	.538973	.371073	3661.2888
350.00		.028682	-867.032	.83566	.538892	.371125	3663.6852
360.00		.028678	-867.003	.83560	.538812	.371176	3666.0779
370.00		.028674	-866.974	.83555	.538731	.371228	3668.4669
380.00		.028670	-866.945	.83549	.538652	.371279	3670.8522
390.00		.028666	-866.916	.83544	.538572	.371331	3673.2339
400.00		.028662	-866.887	.83538	.538493	.371382	3675.6120
410.00		.028657	-866.858	.83533	.538415	.371433	3677.9864
420.00		.028653	-866.828	.83528	.538336	.371485	3680.3573
430.00		.028649	-866.799	.83522	.538258	.371536	3682.7245
440.00		.028645	-866.770	.83517	.538181	.371587	3685.0882
450.00		.028641	-866.741	.83511	.538103	.371638	3687.4482
460.00		.028637	-866.711	.83506	.538027	.371690	3689.8048
470.00		.028633	-866.682	.83501	.537950	.371741	3692.1578
480.00		.028629	-866.653	.83495	.537874	.371792	3694.5072
490.00		.028625	-866.623	.83490	.537798	.371843	3696.8532
500.00		.028621	-866.594	.83484	.537722	.371894	3699.1956
510.00		.028617	-866.565	.83479	.537647	.371945	3701.5346
520.00		.028613	-866.535	.83474	.537572	.371996	3703.8701
530.00		.028609	-866.506	.83468	.537498	.372047	3706.2021
540.00		.028605	-866.476	.83463	.537424	.372098	3708.5307

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -10. ^{0}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{0}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{0}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{0}F)	SONIC VELOCITY (FT/SEC)
10.00	superheated	10.727932	-685.795	1.29179	.351033	.304835	748.5776
20.00	vapor	5.242470	-687.350	1.25805	.360568	.308684	736.3947
30.00	vapor	3.410605	-688.973	1.23715	.371232	.312689	723.5647
31.34	sat. vapor	3.253716	-689.196	1.23482	.372754	.313239	721.7914
31.34	sat. liquid	.029132	-862.459	.84979	.547604	.375208	3437.0724
40.00	compressed	.029128	-862.436	.84974	.547509	.375252	3439.3802
50.00	liquid	.029123	-862.408	.84968	.547400	.375302	3442.0405
60.00		.029118	-862.381	.84962	.547291	.375352	3444.6960
70.00		.029113	-862.354	.84956	.547183	.375402	3447.3468
80.00		.029109	-862.326	.84950	.547076	.375452	3449.9928
90.00		.029104	-862.299	.84945	.546969	.375502	3452.6341
100.00		.029099	-862.272	.84939	.546862	.375552	3455.2708
110.00		.029094	-862.244	.84933	.546756	.375602	3457.9027
120.00		.029089	-862.217	.84927	.546651	.375652	3460.5301
130.00		.029085	-862.189	.84921	.546546	.375702	3463.1528
140.00		.029080	-862.162	.84915	.546441	.375751	3465.7708
150.00		.029075	-862.134	.84909	.546337	.375801	3468.3843
160.00		.029070	-862.106	.84904	.546234	.375851	3470.9933
170.00		.029066	-862.079	.84898	.546131	.375901	3473.5976
180.00		.029061	-862.051	.84892	.546029	.375950	3476.1975
190.00		.029056	-862.023	.84886	.545927	.376000	3478.7928
200.00		.029052	-861.996	.84880	.545826	.376050	3481.3837
210.00		.029047	-861.968	.84875	.545725	.376099	3483.9701
220.00		.029042	-861.940	.84869	.545624	.376149	3486.5520
230.00		.029038	-861.912	.84863	.545525	.376198	3489.1295
240.00		.029033	-861.885	.84857	.545425	.376248	3491.7026
250.00		.029028	-861.857	.84852	.545326	.376297	3494.2714
260.00		.029024	-861.829	.84846	.545228	.376347	3496.8357
270.00		.029019	-861.801	.84840	.545130	.376396	3499.3957
280.00		.029014	-861.773	.84834	.545033	.376446	3501.9513
290.00		.029010	-861.745	.84829	.544936	.376495	3504.5027
300.00		.029005	-861.717	.84823	.544839	.376544	3507.0497
310.00		.029001	-861.689	.84817	.544743	.376594	3509.5924
320.00		.028996	-861.661	.84812	.544647	.376643	3512.1309
330.00		.028991	-861.633	.84806	.544552	.376692	3514.6652
340.00		.028987	-861.604	.84800	.544458	.376742	3517.1952
350.00		.028982	-861.576	.84795	.544363	.376791	3519.7210
360.00		.028978	-861.548	.84789	.544270	.376840	3522.2426
370.00		.028973	-861.520	.84783	.544176	.376889	3524.7601
380.00		.028969	-861.492	.84778	.544084	.376938	3527.2734
390.00		.028964	-861.463	.84772	.543991	.376987	3529.7825
400.00		.028960	-861.435	.84766	.543899	.377036	3532.2875
410.00		.028955	-861.407	.84761	.543808	.377085	3534.7883
420.00		.028951	-861.378	.84755	.543716	.377134	3537.2853
430.00		.028946	-861.350	.84750	.543626	.377183	3539.7781
440.00		.028942	-861.322	.84744	.543536	.377232	3542.2668
450.00		.028937	-861.293	.84738	.543446	.377281	3544.7514
460.00		.028933	-861.265	.84733	.543356	.377330	3547.2321
470.00		.028929	-861.236	.84727	.543267	.377379	3549.7087
480.00		.028924	-861.208	.84722	.543179	.377427	3552.1814
490.00		.028920	-861.179	.84716	.543091	.377476	3554.6500
500.00		.028915	-861.151	.84711	.543003	.377525	3557.1148
510.00		.028911	-861.122	.84705	.542915	.377574	3559.5755
520.00		.028906	-861.093	.84700	.542829	.377622	3562.0324
530.00		.028902	-861.065	.84694	.542742	.377671	3564.4853
540.00		.028898	-861.036	.84689	.542656	.377720	3566.9344

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 0. ^{0}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{0}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{0}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{0}F)	SONIC VELOCITY (FT/SEC)
10.00	superheated	10.984097	-682.222	1.29967	.356300	.310229	757.0959
20.00	vapor	5.377444	-683.685	1.26613	.365009	.313750	745.6705
30.00		3.505673	-685.207	1.24546	.374616	.317402	733.6958
38.32	sat. vapor	2.691305	-686.521	1.23234	.383430	.320549	723.2637
38.32	sat. liquid	.029456	-856.896	.86197	.553947	.380780	3295.1690
40.00	compressed	.029455	-856.892	.86195	.553925	.380788	3295.6442
50.00	liquid	.029450	-856.866	.86189	.553797	.380835	3298.4618
60.00		.029444	-856.840	.86183	.553669	.380883	3301.2735
70.00		.029439	-856.813	.86177	.553542	.380930	3304.0799
80.00		.029434	-856.787	.86171	.553416	.380978	3306.8809
90.00		.029428	-856.761	.86165	.553290	.381026	3309.6764
100.00		.029423	-856.735	.86159	.553165	.381073	3312.4666
110.00		.029418	-856.708	.86152	.553041	.381120	3315.2514
120.00		.029412	-856.682	.86146	.552917	.381168	3318.0309
130.00		.029407	-856.656	.86140	.552794	.381215	3320.8050
140.00		.029402	-856.629	.86134	.552672	.381263	3323.5739
150.00		.029397	-856.603	.86128	.552550	.381310	3326.3375
160.00		.029391	-856.576	.86122	.552429	.381357	3329.0958
170.00		.029386	-856.550	.86116	.552309	.381405	3331.8490
180.00		.029381	-856.523	.86110	.552189	.381452	3334.5969
190.00		.029376	-856.497	.86104	.552070	.381499	3337.3397
200.00		.029370	-856.470	.86098	.551952	.381547	3340.0774
210.00		.029365	-856.444	.86092	.551834	.381594	3342.8099
220.00		.029360	-856.417	.86086	.551716	.381641	3345.5374
230.00		.029355	-856.390	.86080	.551600	.381688	3348.2598
240.00		.029350	-856.363	.86074	.551484	.381735	3350.9771
250.00		.029345	-856.337	.86068	.551368	.381782	3353.6895
260.00		.029340	-856.310	.86062	.551253	.381829	3356.3968
270.00		.029334	-856.283	.86056	.551139	.381876	3359.0991
280.00		.029329	-856.256	.86050	.551025	.381923	3361.7966
290.00		.029324	-856.229	.86044	.550912	.381970	3364.4890
300.00		.029319	-856.202	.86038	.550799	.382017	3367.1766
310.00		.029314	-856.175	.86032	.550687	.382064	3369.8593
320.00		.029309	-856.148	.86026	.550576	.382111	3372.5372
330.00		.029304	-856.121	.86020	.550465	.382158	3375.2102
340.00		.029299	-856.094	.86014	.550355	.382205	3377.8783
350.00		.029294	-856.067	.86008	.550245	.382252	3380.5417
360.00		.029289	-856.039	.86003	.550136	.382298	3383.2004
370.00		.029284	-856.012	.85997	.550027	.382345	3385.8542
380.00		.029279	-855.985	.85991	.549919	.382392	3388.5034
390.00		.029274	-855.958	.85985	.549812	.382439	3391.1478
400.00		.029269	-855.930	.85979	.549705	.382485	3393.7876
410.00		.029264	-855.903	.85973	.549598	.382532	3396.4227
420.00		.029259	-855.876	.85968	.549492	.382579	3399.0531
430.00		.029254	-855.848	.85962	.549387	.382625	3401.6789
440.00		.029249	-855.821	.85956	.549282	.382672	3404.3001
450.00		.029244	-855.793	.85950	.549177	.382718	3406.9168
460.00		.029240	-855.766	.85944	.549073	.382765	3409.5289
470.00		.029235	-855.738	.85939	.548970	.382811	3412.1364
480.00		.029230	-855.711	.85933	.548867	.382858	3414.7394
490.00		.029225	-855.683	.85927	.548765	.382904	3417.3379
500.00		.029220	-855.655	.85921	.548663	.382951	3419.9319
510.00		.029215	-855.628	.85915	.548561	.382997	3422.5215
520.00		.029210	-855.600	.85910	.548460	.383044	3425.1066
530.00		.029206	-855.572	.85904	.548360	.383090	3427.6873
540.00		.029201	-855.545	.85898	.548260	.383136	3430.2635

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 10. ^{o}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{o}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{o}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{o}F)	SONIC VELOCITY (FT/SEC)
10.00		11.239285	-678.597	1.30749	.361678	.315738	765.4141
20.00	superheated	5.511544	-679.978	1.27414	.369641	.318968	754.6800
30.00		3.599552	-681.408	1.25366	.378349	.322306	743.4771
40.00	vapor	2.641572	-682.893	1.23839	.387953	.325765	731.7442
46.41	sat. vapor	2.243529	-683.878	1.23015	.394671	.328053	723.9093
46.41	sat. liquid	.029794	-851.268	.87400	.560822	.386201	3157.4056
50.00	compressed	.029791	-851.259	.87398	.560768	.386217	3158.4773
60.00	liquid	.029785	-851.234	.87392	.560618	.386262	3161.4590
70.00		.029779	-851.209	.87385	.560468	.386307	3164.4344
80.00		.029774	-851.185	.87379	.560320	.386352	3167.4035
90.00		.029768	-851.160	.87372	.560172	.386397	3170.3663
100.00		.029762	-851.135	.87366	.560025	.386442	3173.3229
110.00		.029756	-851.110	.87359	.559879	.386487	3176.2733
120.00		.029750	-851.085	.87353	.559734	.386532	3179.2175
130.00		.029744	-851.060	.87347	.559589	.386577	3182.1556
140.00		.029738	-851.035	.87340	.559446	.386622	3185.0876
150.00		.029732	-851.010	.87334	.559303	.386667	3188.0135
160.00		.029726	-850.984	.87327	.559161	.386712	3190.9334
170.00		.029721	-850.959	.87321	.559019	.386756	3193.8473
180.00		.029715	-850.934	.87315	.558879	.386801	3196.7552
190.00		.029709	-850.909	.87308	.558739	.386846	3199.6572
200.00		.029703	-850.883	.87302	.558600	.386891	3202.5533
210.00		.029698	-850.858	.87296	.558462	.386936	3205.4435
220.00		.029692	-850.832	.87290	.558325	.386980	3208.3278
230.00		.029686	-850.807	.87283	.558188	.387025	3211.2063
240.00		.029680	-850.782	.87277	.558052	.387070	3214.0791
250.00		.029675	-850.756	.87271	.557917	.387114	3216.9460
260.00		.029669	-850.730	.87265	.557783	.387159	3219.8073
270.00		.029663	-850.705	.87258	.557649	.387204	3222.6628
280.00		.029658	-850.679	.87252	.557516	.387248	3225.5126
290.00		.029652	-850.653	.87246	.557384	.387293	3228.3569
300.00		.029646	-850.628	.87240	.557252	.387337	3231.1955
310.00		.029641	-850.602	.87234	.557121	.387382	3234.0285
320.00		.029635	-850.576	.87227	.556991	.387426	3236.8559
330.00		.029630	-850.550	.87221	.556862	.387471	3239.6778
340.00		.029624	-850.524	.87215	.556733	.387515	3242.4942
350.00		.029619	-850.498	.87209	.556605	.387560	3245.3052
360.00		.029613	-850.472	.87203	.556478	.387604	3248.1106
370.00		.029607	-850.446	.87197	.556351	.387648	3250.9107
380.00		.029602	-850.420	.87191	.556225	.387693	3253.7053
390.00		.029596	-850.394	.87184	.556100	.387737	3256.4946
400.00		.029591	-850.368	.87178	.555975	.387781	3259.2785
410.00		.029586	-850.342	.87172	.555851	.387826	3262.0572
420.00		.029580	-850.315	.87166	.555727	.387870	3264.8305
430.00		.029575	-850.289	.87160	.555605	.387914	3267.5985
440.00		.029569	-850.263	.87154	.555483	.387958	3270.3613
450.00		.029564	-850.236	.87148	.555361	.388002	3273.1189
460.00		.029558	-850.210	.87142	.555240	.388047	3275.8713
470.00		.029553	-850.184	.87136	.555120	.388091	3278.6185
480.00		.029548	-850.157	.87130	.555000	.388135	3281.3606
490.00		.029542	-850.131	.87124	.554881	.388179	3284.0976
500.00		.029537	-850.104	.87118	.554763	.388223	3286.8294
510.00		.029531	-850.078	.87112	.554645	.388267	3289.5562
520.00		.029526	-850.051	.87106	.554528	.388311	3292.2780
530.00		.029521	-850.024	.87100	.554412	.388355	3294.9947
540.00		.029516	-849.998	.87094	.554296	.388399	3297.7064

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 20. ^{0}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{0}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{0}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{0}F)	SONIC VELOCITY (FT/SEC)
10.00		11.493595	-674.921	1.31526	.367160	.321353	773.5524
20.00		5.644287	-676.225	1.28207	.374461	.324322	763.4509
30.00		3.692379	-677.572	1.26176	.382386	.327381	752.9474
40.00	superheated	2.714645	-678.966	1.24669	.391047	.330540	741.9943
50.00	vapor	2.126412	-680.414	1.23442	.400590	.333809	730.5341
55.74	sat. vapor	1.883530	-681.271	1.22821	.406535	.335741	723.7045
55.74	sat. liquid	.030147	-845.568	.88592	.568314	.391516	3023.0788
60.00	compressed	.030144	-845.558	.88589	.568238	.391535	3024.4286
70.00	liquid	.030137	-845.535	.88583	.568061	.391577	3027.5893
80.00		.030130	-845.512	.88576	.567886	.391619	3030.7426
90.00		.030124	-845.488	.88569	.567711	.391662	3033.8886
100.00		.030117	-845.465	.88562	.567537	.391704	3037.0274
110.00		.030111	-845.442	.88556	.567365	.391746	3040.1590
120.00		.030104	-845.418	.88549	.567193	.391789	3043.2834
130.00		.030097	-845.395	.88542	.567023	.391831	3046.4007
140.00		.030091	-845.371	.88535	.566853	.391873	3049.5109
150.00		.030084	-845.348	.88529	.566685	.391916	3052.6141
160.00		.030078	-845.324	.88522	.566518	.391958	3055.7103
170.00		.030071	-845.300	.88515	.566351	.392000	3058.7996
180.00		.030065	-845.277	.88509	.566186	.392042	3061.8819
190.00		.030059	-845.253	.88502	.566021	.392085	3064.9574
200.00		.030052	-845.229	.88495	.565858	.392127	3068.0260
210.00		.030046	-845.205	.88489	.565695	.392169	3071.0878
220.00		.030039	-845.181	.88482	.565534	.392211	3074.1428
230.00		.030033	-845.157	.88476	.565373	.392253	3077.1912
240.00		.030027	-845.133	.88469	.565214	.392295	3080.2328
250.00		.030020	-845.109	.88463	.565055	.392338	3083.2678
260.00		.030014	-845.085	.88456	.564897	.392380	3086.2962
270.00		.030008	-845.061	.88449	.564740	.392422	3089.3180
280.00		.030001	-845.037	.88443	.564584	.392464	3092.3333
290.00		.029995	-845.012	.88436	.564429	.392506	3095.3420
300.00		.029989	-844.988	.88430	.564275	.392548	3098.3443
310.00		.029983	-844.964	.88423	.564122	.392590	3101.3402
320.00		.029976	-844.939	.88417	.563969	.392632	3104.3297
330.00		.029970	-844.915	.88411	.563818	.392674	3107.3128
340.00		.029964	-844.890	.88404	.563667	.392716	3110.2896
350.00		.029958	-844.866	.88398	.563517	.392758	3113.2601
360.00		.029952	-844.841	.88391	.563368	.392800	3116.2243
370.00		.029945	-844.816	.88385	.563220	.392842	3119.1823
380.00		.029939	-844.792	.88378	.563073	.392884	3122.1341
390.00		.029933	-844.767	.88372	.562927	.392925	3125.0798
400.00		.029927	-844.742	.88366	.562781	.392967	3128.0193
410.00		.029921	-844.717	.88359	.562636	.393009	3130.9527
420.00		.029915	-844.692	.88353	.562492	.393051	3133.8801
430.00		.029909	-844.667	.88347	.562349	.393093	3136.8014
440.00		.029903	-844.642	.88340	.562206	.393135	3139.7168
450.00		.029897	-844.617	.88334	.562065	.393176	3142.6261
460.00		.029891	-844.592	.88328	.561924	.393218	3145.5296
470.00		.029885	-844.567	.88321	.561784	.393260	3148.4271
480.00		.029879	-844.542	.88315	.561645	.393302	3151.3188
490.00		.029873	-844.517	.88309	.561506	.393343	3154.2046
500.00		.029867	-844.491	.88303	.561368	.393385	3157.0846
510.00		.029861	-844.466	.88296	.561231	.393427	3159.9588
520.00		.029855	-844.441	.88290	.561095	.393468	3162.8272
530.00		.029849	-844.415	.88284	.560959	.393510	3165.6899
540.00		.029844	-844.390	.88278	.560824	.393552	3168.5470

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 30. ^{0}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{0}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{0}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{0}F)	SONIC VELOCITY (FT/SEC)
10.00		11.747113	-671.191	1.32298	.372738	.327062	781.5294
20.00		5.776374	-672.424	1.28993	.379451	.329797	772.0082
30.00		3.784274	-673.696	1.26979	.386687	.332607	762.1407
40.00	superheated	2.786696	-675.008	1.25488	.394534	.335499	751.8897
50.00		2.186794	-676.365	1.24280	.403101	.338483	741.2109
60.00	vapor	1.785601	-677.773	1.23247	.412527	.341569	730.0511
66.41	sat. vapor	1.591454	-678.705	1.22649	.419098	.343604	722.6212
66.41	sat. liquid	.030517	-839.790	.89774	.576515	.396763	2891.5644
70.00	compressed	.030515	-839.782	.89772	.576440	.396777	2892.7735
80.00	liquid	.030507	-839.761	.89765	.576230	.396817	2896.1308
90.00		.030500	-839.739	.89757	.576023	.396857	2899.4797
100.00		.030492	-839.718	.89750	.575816	.396896	2902.8200
110.00		.030485	-839.697	.89743	.575611	.396936	2906.1519
120.00		.030478	-839.675	.89736	.575407	.396975	2909.4755
130.00		.030470	-839.653	.89729	.575205	.397015	2912.7907
140.00		.030463	-839.632	.89722	.575004	.397054	2916.0976
150.00		.030455	-839.610	.89715	.574804	.397094	2919.3963
160.00		.030448	-839.588	.89708	.574606	.397134	2922.6869
170.00		.030441	-839.566	.89701	.574409	.397173	2925.9693
180.00		.030434	-839.544	.89694	.574213	.397213	2929.2436
190.00		.030426	-839.522	.89687	.574018	.397252	2932.5100
200.00		.030419	-839.500	.89680	.573825	.397292	2935.7684
210.00		.030412	-839.478	.89673	.573633	.397331	2939.0188
220.00		.030405	-839.456	.89666	.573442	.397371	2942.2614
230.00		.030398	-839.434	.89659	.573252	.397410	2945.4962
240.00		.030391	-839.412	.89652	.573064	.397450	2948.7232
250.00		.030384	-839.389	.89645	.572877	.397489	2951.9425
260.00		.030377	-839.367	.89638	.572691	.397529	2955.1541
270.00		.030369	-839.344	.89631	.572506	.397568	2958.3581
280.00		.030362	-839.322	.89624	.572322	.397607	2961.5545
290.00		.030355	-839.299	.89617	.572139	.397647	2964.7434
300.00		.030348	-839.276	.89611	.571958	.397686	2967.9248
310.00		.030341	-839.254	.89604	.571777	.397726	2971.0987
320.00		.030335	-839.231	.89597	.571598	.397765	2974.2652
330.00		.030328	-839.208	.89590	.571420	.397804	2977.4244
340.00		.030321	-839.185	.89583	.571243	.397844	2980.5763
350.00		.030314	-839.162	.89577	.571067	.397883	2983.7209
360.00		.030307	-839.139	.89570	.570892	.397923	2986.8582
370.00		.030300	-839.116	.89563	.570718	.397962	2989.9884
380.00		.030293	-839.093	.89556	.570545	.398001	2993.1114
390.00		.030287	-839.070	.89550	.570373	.398041	2996.2274
400.00		.030280	-839.047	.89543	.570203	.398080	2999.3362
410.00		.030273	-839.023	.89536	.570033	.398119	3002.4381
420.00		.030266	-839.000	.89530	.569864	.398159	3005.5330
430.00		.030260	-838.977	.89523	.569697	.398198	3008.6209
440.00		.030253	-838.953	.89516	.569530	.398237	3011.7019
450.00		.030246	-838.930	.89510	.569364	.398276	3014.7761
460.00		.030239	-838.906	.89503	.569199	.398316	3017.8435
470.00		.030233	-838.883	.89496	.569036	.398355	3020.9040
480.00		.030226	-838.859	.89490	.568873	.398394	3023.9579
490.00		.030220	-838.835	.89483	.568711	.398433	3027.0050
500.00		.030213	-838.812	.89477	.568550	.398472	3030.0454
510.00		.030206	-838.788	.89470	.568390	.398512	3033.0793
520.00		.030200	-838.764	.89464	.568231	.398551	3036.1065
530.00		.030193	-838.740	.89457	.568073	.398590	3039.1271
540.00		.030187	-838.716	.89451	.567916	.398629	3042.1413

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 40. ^{0}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{0}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{0}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{0}F)	SONIC VELOCITY (FT/SEC)
10.00		11.999916	-667.406	1.33066	.378406	.332856	789.3617
20.00		5.907692	-668.575	1.29774	.384593	.335379	780.3739
30.00		3.875338	-669.777	1.27773	.391222	.337966	771.0869
40.00		2.857842	-671.014	1.26297	.398361	.340621	761.4710
50.00	superheated	2.246186	-672.290	1.25106	.406092	.343352	751.4918
60.00	vapor	1.837348	-673.609	1.24091	.414519	.346167	741.1088
70.00		1.544305	-674.976	1.23194	.423773	.349074	730.2734
78.53	sat. vapor	1.352460	-676.185	1.22496	.432450	.351636	720.6259
78.53	sat. liquid	.030908	-833.926	.90948	.585536	.401973	2762.2987
80.00	compressed	.030907	-833.924	.90947	.585499	.401978	2762.8241
90.00	liquid	.030899	-833.905	.90939	.585250	.402015	2766.3999
100.00		.030890	-833.885	.90932	.585003	.402051	2769.9658
110.00		.030882	-833.866	.90924	.584757	.402088	2773.5216
120.00		.030873	-833.847	.90916	.584513	.402125	2777.0676
130.00		.030865	-833.827	.90909	.584271	.402161	2780.6037
140.00		.030857	-833.808	.90901	.584031	.402198	2784.1301
150.00		.030849	-833.788	.90894	.583792	.402234	2787.6468
160.00		.030840	-833.769	.90886	.583555	.402271	2791.1538
170.00		.030832	-833.749	.90879	.583320	.402308	2794.6513
180.00		.030824	-833.729	.90871	.583087	.402344	2798.1394
190.00		.030816	-833.709	.90864	.582855	.402381	2801.6180
200.00		.030808	-833.690	.90856	.582624	.402417	2805.0872
210.00		.030800	-833.670	.90849	.582396	.402454	2808.5472
220.00		.030792	-833.649	.90842	.582169	.402491	2811.9979
230.00		.030784	-833.629	.90834	.581943	.402527	2815.4395
240.00		.030776	-833.609	.90827	.581719	.402564	2818.8720
250.00		.030768	-833.589	.90820	.581497	.402600	2822.2954
260.00		.030760	-833.568	.90812	.581276	.402637	2825.7099
270.00		.030752	-833.548	.90805	.581056	.402674	2829.1154
280.00		.030744	-833.527	.90798	.580838	.402710	2832.5121
290.00		.030736	-833.507	.90791	.580622	.402747	2835.9000
300.00		.030728	-833.486	.90783	.580407	.402784	2639.2791
310.00		.030720	-833.465	.90776	.580193	.402820	2842.6496
320.00		.030713	-833.444	.90769	.579981	.402857	2646.0114
330.00		.030705	-833.424	.90762	.579771	.402894	2849.3647
340.00		.030697	-833.403	.90755	.579561	.402930	2852.7094
350.00		.030689	-833.382	.90747	.579353	.402967	2856.0457
360.00		.030682	-833.360	.90740	.579147	.403003	2859.3736
370.00		.030674	-833.339	.90733	.578942	.403040	2862.6931
380.00		.030666	-833.318	.90726	.578738	.403077	2866.0044
390.00		.030659	-833.297	.90719	.578535	.403113	2869.3074
400.00		.030651	-833.275	.90712	.578334	.403150	2872.6022
410.00		.030644	-833.254	.90705	.578134	.403187	2875.8889
420.00		.030636	-833.232	.90698	.577935	.403223	2879.1675
430.00		.030629	-833.211	.90691	.577738	.403260	2882.4380
440.00		.030621	-833.189	.90684	.577542	.403296	2885.7006
450.00		.030614	-833.167	.90677	.577347	.403333	2888.9552
460.00		.030606	-833.146	.90670	.577154	.403370	2892.2020
470.00		.030599	-833.124	.90663	.576961	.403406	2895.4409
480.00		.030591	-833.102	.90656	.576770	.403443	2898.6720
490.00		.030584	-833.080	.90649	.576580	.403479	2901.8954
500.00		.030577	-833.058	.90642	.576391	.403516	2905.1111
510.00		.030569	-833.036	.90635	.576204	.403553	2908.3191
520.00		.030562	-833.014	.90628	.576017	.403589	2911.5196
530.00		.030555	-832.992	.90621	.575832	.403626	2914.7125
540.00		.030547	-832.969	.90614	.575648	.403662	2917.8979

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 50. ^{0}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{0}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{0}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{0}F)	SONIC VELOCITY (FT/SEC)
10.00		12.252073	-663.565	1.33830	.384157	.338724	797.0641
20.00		6.038318	-664.675	1.30549	.389872	.341056	788.5680
30.00		3.965659	-665.813	1.28561	.395963	.343442	779.8122
40.00		2.928185	-666.982	1.27099	.402482	.345886	770.7732
50.00		2.304704	-668.184	1.25922	.409493	.348393	761.4240
60.00		1.888142	-669.424	1.24923	.417073	.350968	751.7333
70.00		1.589739	-670.703	1.24044	.425318	.353619	741.6642
80.00	superheated	1.365105	-672.027	1.23249	.434349	.356353	731.1730
90.00	vapor	1.189564	-673.402	1.22518	.444324	.359181	720.2073
92.24	sat. vapor	1.155329	-673.717	1.22360	.446707	.359828	717.6787
92.24	sat. liquid	.031322	-827.970	.92115	.595511	.407173	2634.7631
100.00		.031315	-827.957	.92109	.595279	.407198	2637.7270
110.00	compressed	.031305	-827.940	.92100	.594982	.407232	2641.5363
120.00	liquid	.031296	-827.924	.92092	.594687	.407265	2645.3337
130.00		.031286	-827.907	.92084	.594395	.407298	2649.1195
140.00		.031277	-827.890	.92076	.594104	.407332	2652.8936
150.00		.031267	-827.873	.92068	.593817	.407365	2656.6561
160.00		.031258	-827.856	.92060	.593531	.407398	2660.4073
170.00		.031249	-827.839	.92052	.593248	.407432	2664.1470
180.00		.031239	-827.822	.92044	.592967	.407465	2667.8755
190.00		.031230	-827.805	.92036	.592688	.407498	2671.5928
200.00		.031221	-827.787	.92028	.592411	.407532	2675.2990
210.00		.031212	-827.770	.92020	.592136	.407565	2678.9942
220.00		.031203	-827.752	.92013	.591863	.407599	2682.6785
230.00		.031194	-827.734	.92005	.591593	.407632	2686.3519
240.00		.031185	-827.717	.91997	.591325	.407666	2690.0146
250.00		.031176	-827.699	.91989	.591058	.407699	2693.6666
260.00		.031167	-827.681	.91981	.590794	.407733	2697.3080
270.00		.031158	-827.663	.91974	.590531	.407766	2700.9389
280.00		.031149	-827.644	.91966	.590271	.407800	2704.5593
290.00		.031140	-827.626	.91958	.590012	.407834	2708.1694
300.00		.031131	-827.608	.91950	.589755	.407867	2711.7691
310.00		.031122	-827.589	.91943	.589501	.407901	2715.3587
320.00		.031113	-827.571	.91935	.589248	.407934	2718.9381
330.00		.031105	-827.552	.91927	.588997	.407968	2722.5075
340.00		.031096	-827.534	.91920	.588747	.408002	2726.0669
350.00		.031087	-827.515	.91912	.588500	.408035	2729.6163
360.00		.031079	-827.496	.91905	.588254	.408069	2733.1559
370.00		.031070	-827.477	.91897	.588010	.408103	2736.6857
380.00		.031061	-827.458	.91889	.587768	.408136	2740.2058
390.00		.031053	-827.439	.91882	.587528	.408170	2743.7163
400.00		.031044	-827.420	.91874	.587289	.408204	2747.2172
410.00		.031036	-827.401	.91867	.587052	.408238	2750.7086
420.00		.031027	-827.381	.91859	.586817	.408271	2754.1905
430.00		.031019	-827.362	.91852	.586583	.408305	2757.6631
440.00		.031010	-827.342	.91845	.586351	.408339	2761.1264
450.00		.031002	-827.323	.91837	.586120	.408373	2764.5806
460.00		.030994	-827.303	.91830	.585891	.408406	2768.0252
470.00		.030985	-827.283	.91822	.585664	.408440	2771.4609
480.00		.030977	-827.264	.91815	.585438	.408474	2774.8876
490.00		.030969	-827.244	.91808	.585214	.408508	2778.3053
500.00		.030961	-827.224	.91800	.584991	.408542	2781.7140
510.00		.030952	-827.204	.91793	.584770	.408576	2785.1138
520.00		.030944	-827.183	.91786	.584551	.408609	2788.5049
530.00		.030936	-827.163	.91778	.584332	.408643	2791.8872
540.00		.030928	-827.143	.91771	.584116	.408677	2795.2608

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 60. ^{o}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{o}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{o}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{o}F)	SONIC VELOCITY (FT/SEC)
10.00		12.503641	-659.667	1.34589	.389985	.344657	804.6501
20.00		6.168319	-660.722	1.31320	.395275	.346817	796.6080
30.00		4.055312	-661.802	1.29343	.400887	.349022	788.3398
40.00		2.997812	-662.908	1.27893	.406860	.351276	779.8267
50.00		2.362451	-664.044	1.26729	.413245	.353589	771.0475
60.00		1.938097	-665.211	1.25744	.420099	.355945	761.9776
70.00		1.634258	-666.413	1.24880	.427494	.358370	752.5889
80.00	superheated	1.405678	-667.652	1.24102	.435519	.360863	742.8482
90.00		1.227208	-668.933	1.23388	.444285	.363432	732.7167
100.00	vapor	1.083744	-670.260	1.22723	.453931	.366083	722.1480
107.65	sat. vapor	.991496	-671.311	1.22239	.462017	.368175	713.7321
107.65	sat. liquid	.031763	-821.910	.93277	.606609	.412386	2508.4706
110.00		.031760	-821.907	.93275	.606524	.412393	2509.4324
120.00	compressed	.031749	-821.894	.93266	.606163	.412422	2513.5181
130.00	liquid	.031738	-821.880	.93258	.605805	.412452	2517.5897
140.00		.031727	-821.867	.93249	.605451	.412481	2521.6472
150.00		.031717	-821.853	.93240	.605099	.412511	2525.6908
160.00		.031706	-821.839	.93232	.604751	.412541	2529.7207
170.00		.031695	-821.825	.93223	.604405	.412571	2533.7368
180.00		.031685	-821.811	.93214	.604063	.412600	2537.7394
190.00		.031674	-821.797	.93206	.603723	.412630	2541.7285
200.00		.031664	-821.782	.93197	.603387	.412660	2545.7044
210.00		.031653	-821.768	.93189	.603053	.412690	2549.6670
220.00		.031643	-821.753	.93180	.602722	.412720	2553.6165
230.00		.031632	-821.738	.93172	.602394	.412750	2557.5531
240.00		.031622	-821.724	.93164	.602069	.412780	2561.4768
250.00		.031612	-821.709	.93155	.601747	.412810	2565.3877
260.00		.031602	-821.694	.93147	.601427	.412840	2569.2860
270.00		.031591	-821.678	.93139	.601110	.412870	2573.1717
280.00		.031581	-821.663	.93130	.600795	.412900	2577.0450
290.00		.031571	-821.648	.93122	.600483	.412931	2580.9059
300.00		.031561	-821.632	.93114	.600174	.412961	2584.7546
310.00		.031551	-821.617	.93106	.599867	.412991	2588.5912
320.00		.031541	-821.601	.93097	.599562	.413021	2592.4157
330.00		.031531	-821.585	.93089	.599260	.413052	2596.2285
340.00		.031521	-821.569	.93081	.598961	.413082	2600.0296
350.00		.031511	-821.553	.93073	.598663	.413112	2603.8180
360.00		.031502	-821.537	.93065	.598369	.413143	2607.5953
370.00		.031492	-821.521	.93057	.598076	.413173	2611.3611
380.00		.031482	-821.504	.93049	.597786	.413204	2615.1153
390.00		.031472	-821.488	.93041	.597498	.413234	2618.8582
400.00		.031463	-821.471	.93033	.597212	.413265	2622.5899
410.00		.031453	-821.455	.93025	.596929	.413295	2626.3103
420.00		.031443	-821.438	.93017	.596648	.413326	2630.0195
430.00		.031434	-821.421	.93009	.596368	.413357	2633.7178
440.00		.031424	-821.404	.93001	.596091	.413387	2637.4051
450.00		.031415	-821.387	.92993	.595817	.413418	2641.0815
460.00		.031405	-821.370	.92985	.595544	.413449	2644.7472
470.00		.031396	-821.352	.92977	.595273	.413479	2648.4021
480.00		.031387	-821.335	.92969	.595004	.413510	2652.0465
490.00		.031377	-821.318	.92961	.594738	.413541	2655.6803
500.00		.031368	-821.300	.92954	.594473	.413572	2659.3036
510.00		.031359	-821.282	.92946	.594210	.413602	2662.9165
520.00		.031350	-821.265	.92938	.593950	.413633	2666.5192
530.00		.031340	-821.247	.92930	.593691	.413664	2670.1116
540.00		.031331	-821.229	.92923	.593434	.413695	2673.6938

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 70. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00		12.754675	-655.712	1.35346	.395883	.350646	812.1315
20.00		6.297754	-656.716	1.32086	.400791	.352649	804.5095
30.00		4.144363	-657.742	1.30120	.405974	.354691	796.6901
40.00		3.066797	-658.791	1.28680	.411464	.356774	788.6581
50.00		2.419509	-659.869	1.27528	.417300	.358900	780.3967
60.00		1.987312	-660.967	1.26555	.423527	.361075	771.8867
70.00		1.677976	-662.099	1.25705	.430199	.363300	763.1061
80.00		1.445380	-663.262	1.24942	.437381	.365582	754.0298
90.00		1.263895	-664.460	1.24244	.445154	.367924	744.6284
100.00		1.118136	-665.697	1.23595	.453616	.370333	734.8677
110.00	superheated	.998304	-666.977	1.22985	.462893	.372816	724.7073
120.00	vapor	.897858	-668.305	1.22404	.473143	.375382	714.0985
124.89	sat. vapor	.854360	-668.973	1.22128	.478571	.376670	708.7291
124.89	sat. liquid	.032234	-815.738	.94437	.619047	.417634	2382.9540
130.00	compressed	.032228	-815.733	.94432	.618821	.417647	2385.2018
140.00	liquid	.032215	-815.723	.94422	.618380	.417672	2389.5886
150.00		.032203	-815.713	.94413	.617944	.417697	2393.9584
160.00		.032190	-815.703	.94404	.617513	.417723	2398.3113
170.00		.032178	-815.693	.94394	.617085	.417748	2402.6474
180.00		.032166	-815.683	.94385	.616662	.417774	2406.9671
190.00		.032153	-815.672	.94376	.616243	.417800	2411.2703
200.00		.032141	-815.662	.94366	.615828	.417825	2415.5573
210.00		.032129	-815.651	.94357	.615417	.417851	2419.8283
220.00		.032117	-815.640	.94348	.615010	.417877	2424.0833
230.00		.032105	-815.629	.94339	.614606	.417903	2428.3226
240.00		.032093	-815.618	.94330	.614207	.417929	2432.5463
250.00		.032082	-815.606	.94321	.613811	.417955	2436.7545
260.00		.032070	-815.595	.94312	.613419	.417981	2440.9474
270.00		.032058	-815.583	.94303	.613031	.418008	2445.1251
280.00		.032046	-815.571	.94294	.612646	.418034	2449.2878
290.00		.032035	-815.559	.94285	.612265	.418060	2453.4357
300.00		.032023	-815.547	.94276	.611887	.418087	2457.5688
310.00		.032012	-815.535	.94267	.611513	.418113	2461.6873
320.00		.032000	-815.523	.94258	.611142	.418140	2465.7913
330.00		.031989	-815.510	.94249	.610775	.418166	2469.8810
340.00		.031978	-815.497	.94241	.610410	.418193	2473.9564
350.00		.031966	-815.485	.94232	.610049	.418220	2478.0178
360.00		.031955	-815.472	.94223	.609691	.418246	2482.0652
370.00		.031944	-815.459	.94214	.609337	.418273	2486.0988
380.00		.031933	-815.446	.94206	.608985	.418300	2490.1187
390.00		.031922	-815.432	.94197	.608637	.418327	2494.1249
400.00		.031911	-815.419	.94189	.608291	.418354	2498.1177
410.00		.031900	-815.405	.94180	.607948	.418381	2502.0972
420.00		.031889	-815.392	.94171	.607609	.418408	2506.0634
430.00		.031878	-815.378	.94163	.607272	.418435	2510.0165
440.00		.031867	-815.364	.94154	.606938	.418462	2513.9566
450.00		.031856	-815.350	.94146	.606607	.418489	2517.8838
460.00		.031846	-815.336	.94137	.606279	.418516	2521.7982
470.00		.031835	-815.321	.94129	.605953	.418544	2525.6999
480.00		.031824	-815.307	.94121	.605631	.418571	2529.5890
490.00		.031814	-815.292	.94112	.605310	.418598	2533.4656
500.00		.031803	-815.278	.94104	.604993	.418626	2537.3299
510.00		.031793	-815.263	.94096	.604678	.418653	2541.1819
520.00		.031782	-815.248	.94087	.604366	.418681	2545.0218
530.00		.031772	-815.233	.94079	.604056	.418708	2548.8496
540.00		.031761	-815.218	.94071	.603749	.418736	2552.6654

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 80. ^{0}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{0}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{0}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{0}F)	SONIC VELOCITY (FT/SEC)
10.00		13.005221	-651.698	1.36099	.401846	.356682	819.5189
20.00		6.426674	-652.655	1.32648	.406407	.358543	812.2863
30.00		4.232870	-653.631	1.30891	.411205	.360437	804.8809
40.00		3.135205	-654.628	1.29462	.416266	.362365	797.2904
50.00		2.475953	-655.646	1.28320	.421619	.364331	789.5014
60.00		2.035870	-656.689	1.27358	.427301	.366336	781.4986
70.00		1.720987	-657.756	1.26520	.433351	.368384	773.2650
80.00		1.484318	-658.851	1.25769	.439819	.370478	764.7810
90.00		1.299754	-659.976	1.25085	.446764	.372622	756.0244
100.00		1.151624	-661.134	1.24451	.454257	.374820	746.9696
110.00		1.029950	-662.327	1.23857	.462388	.377078	737.5866
120.00	superheated	.928074	-663.559	1.23294	.471263	.379400	727.8407
130.00	vapor	.841379	-664.835	1.22755	.481023	.381795	717.6901
140.00		.766559	-666.159	1.22234	.491843	.384271	707.0852
144.09	sat. vapor	.738783	-666.716	1.22026	.496627	.385309	702.6017
144.09	sat. liquid	.032741	-809.439	.95595	.633112	.422937	2257.7538
150.00	compressed	.032733	-809.436	.95589	.632787	.422949	2260.5609
160.00	liquid	.032718	-809.431	.95579	.632241	.422969	2265.2950
170.00		.032704	-809.426	.95569	.631702	.422989	2270.0083
180.00		.032690	-809.420	.95559	.631169	.423010	2274.7010
190.00		.032675	-809.415	.95549	.630642	.423031	2279.3733
200.00		.032661	-809.409	.95538	.630121	.423052	2284.0255
210.00		.032647	-809.403	.95528	.629605	.423073	2288.6579
220.00		.032633	-809.396	.95518	.629095	.423094	2293.2705
230.00		.032619	-809.390	.95508	.628591	.423115	2297.8637
240.00		.032605	-809.383	.95498	.628092	.423136	2302.4377
250.00		.032592	-809.376	.95488	.627598	.423158	2306.9926
260.00		.032578	-809.369	.95479	.627110	.423179	2311.5287
270.00		.032564	-809.361	.95469	.626627	.423201	2316.0461
280.00		.032551	-809.354	.95459	.626149	.423222	2320.5452
290.00		.032537	-809.346	.95449	.625676	.423244	2325.0260
300.00		.032524	-809.338	.95440	.625207	.423266	2329.4887
310.00		.032511	-809.330	.95430	.624744	.423288	2333.9336
320.00		.032497	-809.322	.95420	.624285	.423310	2338.3609
330.00		.032484	-809.314	.95411	.623831	.423332	2342.7707
340.00		.032471	-809.305	.95401	.623382	.423355	2347.1632
350.00		.032458	-809.296	.95392	.622937	.423377	2351.5385
360.00		.032445	-809.287	.95382	.622496	.423400	2355.8969
370.00		.032432	-809.278	.95373	.622060	.423422	2360.2385
380.00		.032419	-809.269	.95364	.621628	.423445	2364.5635
390.00		.032407	-809.259	.95354	.621200	.423468	2368.8721
400.00		.032394	-809.250	.95345	.620777	.423490	2373.1644
410.00		.032381	-809.240	.95336	.620358	.423513	2377.4406
420.00		.032369	-809.230	.95326	.619942	.423536	2381.7007
430.00		.032356	-809.220	.95317	.619531	.423559	2385.9451
440.00		.032344	-809.210	.95308	.619123	.423582	2390.1739
450.00		.032331	-809.199	.95299	.618720	.423606	2394.3871
460.00		.032319	-809.189	.95290	.618320	.423629	2398.5849
470.00		.032307	-809.178	.95281	.617924	.423652	2402.7676
480.00		.032295	-809.167	.95271	.617531	.423676	2406.9352
490.00		.032282	-809.156	.95262	.617142	.423699	2411.0878
500.00		.032270	-809.145	.95253	.616757	.423723	2415.2256
510.00		.032258	-809.134	.95244	.616375	.423746	2419.3488
520.00		.032246	-809.123	.95236	.615997	.423770	2423.4575
530.00		.032235	-809.111	.95227	.615622	.423794	2427.5518
540.00		.032223	-809.099	.95218	.615251	.423818	2431.6319

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 90. ^{o}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{o}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{o}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{o}F)	SONIC VELOCITY (FT/SEC)
10.00		13.255321	-647.626	1.36850	.407868	.362759	826.8214
20.00		6.555126	-648.539	1.33607	.412115	.364490	819.9506
30.00		4.320884	-649.468	1.31658	.416566	.366249	812.9280
40.00		3.203091	-650.416	1.30238	.421243	.368038	805.7438
50.00		2.531845	-651.384	1.29106	.426169	.369858	798.3871
60.00		2.083840	-652.372	1.28154	.431372	.371711	790.8459
70.00		1.763373	-653.381	1.27326	.436882	.373601	783.1068
80.00		1.522586	-654.415	1.26587	.442739	.375528	775.1544
90.00		1.334891	-655.474	1.25914	.448986	.377497	766.9717
100.00		1.184330	-656.561	1.25294	.455674	.379510	758.5393
110.00		1.060744	-657.677	1.24714	.462869	.381571	749.8349
120.00		.957357	-658.826	1.24166	.470646	.383684	740.8327
130.00		.869472	-660.011	1.23643	.479099	.385854	731.5028
140.00	superheated	.793730	-661.236	1.23141	.488348	.388088	721.8102
150.00	vapor	.727658	-662.504	1.22655	.498541	.390391	711.7131
160.00		.669398	-663.821	1.22180	.509871	.392772	701.1616
165.39	sat. vapor	.640735	-664.553	1.21929	.516530	.394091	695.2683
165.39	sat. liquid	.033292	-803.001	.96756	.649192	.428314	2132.4070
170.00	compressed	.033284	-803.002	.96751	.648872	.428320	2134.7874
180.00	liquid	.033267	-803.002	.96740	.648184	.428335	2139.9285
190.00		.033250	-803.002	.96728	.647505	.428349	2145.0436
200.00		.033233	-803.002	.96717	.646835	.428364	2150.1332
210.00		.033217	-803.002	.96706	.646173	.428379	2155.1976
220.00		.033200	-803.001	.96695	.645520	.428394	2160.2371
230.00		.033184	-803.001	.96684	.644875	.428410	2165.2521
240.00		.033167	-802.999	.96673	.644238	.428425	2170.2428
250.00		.033151	-802.998	.96662	.643609	.428441	2175.2096
260.00		.033135	-802.996	.96651	.642987	.428457	2180.1528
270.00		.033119	-802.995	.96640	.642374	.428473	2185.0726
280.00		.033103	-802.992	.96630	.641767	.428489	2189.9694
290.00		.033087	-802.990	.96619	.641168	.428505	2194.8434
300.00		.033071	-802.987	.96608	.640576	.428522	2199.6949
310.00		.033056	-802.985	.96598	.639991	.428538	2204.5242
320.00		.033040	-802.981	.96587	.639413	.428555	2209.3316
330.00		.033025	-802.978	.96577	.638841	.428572	2214.1172
340.00		.033010	-802.975	.96566	.638277	.428589	2218.8815
350.00		.032994	-802.971	.96556	.637718	.428606	2223.6245
360.00		.032979	-802.967	.96545	.637166	.428624	2228.3466
370.00		.032964	-802.963	.96535	.636620	.428641	2233.0480
380.00		.032949	-802.958	.96525	.636081	.428659	2237.7289
390.00		.032934	-802.954	.96515	.635547	.428677	2242.3896
400.00		.032919	-802.949	.96504	.635019	.428695	2247.0303
410.00		.032905	-802.944	.96494	.634498	.428713	2251.6513
420.00		.032890	-802.938	.96484	.633981	.428731	2256.2526
430.00		.032876	-802.933	.96474	.633471	.428749	2260.8347
440.00		.032861	-802.927	.96464	.632965	.428767	2265.3976
450.00		.032847	-802.921	.96454	.632466	.428786	2269.9416
460.00		.032833	-802.915	.96444	.631971	.428805	2274.4668
470.00		.032818	-802.909	.96434	.631482	.428823	2278.9736
480.00		.032804	-802.902	.96424	.630998	.428842	2283.4620
490.00		.032790	-802.896	.96415	.630519	.428861	2287.9323
500.00		.032776	-802.889	.96405	.630045	.428880	2292.3847
510.00		.032762	-802.882	.96395	.629576	.428899	2296.8194
520.00		.032749	-802.875	.96385	.629111	.428919	2301.2365
530.00		.032735	-802.867	.96376	.628652	.428938	2305.6362
540.00		.032721	-802.860	.96366	.628196	.428958	2310.0187

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 100. ^{o}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{o}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{o}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{o}F)	SONIC VELOCITY (FT/SEC)
10.00		13.505013	-643.494	1.37598	.413944	.368867	834.0472
20.00		6.683151	-644.366	1.34362	.417904	.370480	827.5130
30.00		4.408449	-645.253	1.32421	.422042	.372116	820.8452
40.00		3.270506	-646.156	1.31009	.426374	.373778	814.0359
50.00		2.587239	-647.076	1.29885	.430920	.375467	807.0762
60.00		2.131285	-648.014	1.28942	.435701	.377184	799.9567
70.00		1.805199	-648.971	1.28124	.440741	.378931	792.6666
80.00		1.560259	-649.949	1.27395	.446069	.380709	785.1940
90.00		1.369392	-650.948	1.26733	.451719	.382522	777.5257
100.00		1.216354	-651.971	1.26124	.457730	.384371	769.6466
110.00		1.090803	-653.020	1.25556	.464149	.386260	761.5400
120.00		.985843	-654.096	1.25021	.471029	.388191	753.1866
130.00		.896695	-655.202	1.24513	.478439	.390168	744.5646
140.00		.818945	-656.340	1.24027	.486459	.392194	735.6486
150.00		.753081	-657.514	1.23557	.495189	.394276	726.4091
160.00	superheated	.694217	-658.727	1.23102	.504753	.396417	716.8118
170.00	vapor	.641904	-659.983	1.22657	.515309	.398626	706.8154
180.00		.595009	-661.289	1.22219	.527061	.400909	696.3707
188.92	sat. vapor	.557021	-662.500	1.21833	.538763	.403015	686.6302
188.92	sat. liquid	.033894	-796.406	.97922	.667833	.433786	2006.4339
190.00	compressed	.033892	-796.407	.97920	.667736	.433786	2007.0451
200.00	liquid	.033871	-796.414	.97908	.666848	.433793	2012.6719
210.00		.033851	-796.422	.97895	.665973	.433801	2018.2659
220.00		.033831	-796.429	.97883	.665111	.433808	2023.8275
230.00		.033811	-796.435	.97870	.664262	.433816	2029.3572
240.00		.033792	-796.441	.97858	.663425	.433824	2034.8556
250.00		.033772	-796.447	.97846	.662601	.433833	2040.3231
260.00		.033753	-796.453	.97834	.661788	.433842	2045.7601
270.00		.033734	-796.458	.97822	.660987	.433851	2051.1671
280.00		.033715	-796.463	.97810	.660197	.433860	2056.5446
290.00		.033696	-796.467	.97798	.659419	.433869	2061.8929
300.00		.033677	-796.471	.97786	.658651	.433879	2067.2125
310.00		.033659	-796.475	.97774	.657894	.433889	2072.5038
320.00		.033640	-796.478	.97762	.657148	.433899	2077.7671
330.00		.033622	-796.482	.97751	.656411	.433909	2083.0029
340.00		.033604	-796.484	.97739	.655685	.433920	2088.2116
350.00		.033585	-796.487	.97727	.654968	.433931	2093.3934
360.00		.033567	-796.489	.97716	.654260	.433942	2098.5488
370.00		.033550	-796.491	.97705	.653562	.433953	2103.6782
380.00		.033532	-796.493	.97693	.652873	.433965	2108.7818
390.00		.033514	-796.494	.97682	.652192	.433976	2113.8601
400.00		.033497	-796.495	.97671	.651521	.433988	2118.9132
410.00		.033480	-796.496	.97659	.650858	.434000	2123.9417
420.00		.033462	-796.497	.97648	.650203	.434013	2128.9457
430.00		.033445	-796.497	.97637	.649557	.434025	2133.9256
440.00		.033428	-796.497	.97626	.648918	.434038	2138.8818
450.00		.033411	-796.497	.97615	.648287	.434051	2143.8144
460.00		.033395	-796.496	.97604	.647664	.434064	2148.7238
470.00		.033378	-796.495	.97593	.647049	.434077	2153.6102
480.00		.033361	-796.494	.97582	.646441	.434090	2158.4741
490.00		.033345	-796.493	.97572	.645840	.434104	2163.3155
500.00		.033329	-796.491	.97561	.645246	.434117	2168.1349
510.00		.033312	-796.490	.97550	.644659	.434131	2172.9324
520.00		.033296	-796.488	.97540	.644079	.434145	2177.7084
530.00		.033280	-796.485	.97529	.643506	.434159	2182.4630
540.00		.033264	-796.483	.97518	.642939	.434174	2187.1965

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 110. ^{o}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{o}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{o}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{o}F)	SONIC VELOCITY (FT/SEC)
10.00		13.754331	-639.303	1.38343	.420066	.375000	841.2034
20.00		6.810785	-640.136	1.35114	.423765	.376505	834.9828
30.00		4.495606	-640.983	1.33181	.427619	.378030	828.6445
40.00		3.337493	-641.844	1.31776	.431642	.379576	822.1819
50.00		2.642183	-642.720	1.30660	.435848	.381145	815.5880
60.00		2.178255	-643.612	1.29725	.440254	.382739	808.8551
70.00		1.846-26	-644.521	1.28915	.444880	.384357	801.9745
80.00		1.597402	-645.448	1.28195	.449749	.386002	794.9371
90.00		1.403331	-646.394	1.27543	.454885	.387676	787.7323
100.00		1.247778	-647.360	1.26944	.460319	.389380	780.3486
110.00		1.120219	-648.348	1.26387	.466085	.391116	772.7732
120.00		1.015638	-649.359	1.25863	.472223	.392887	764.9915
130.00		.923173	-650.395	1.25368	.478782	.394695	756.9871
140.00		.843351	-651.458	1.24894	.485818	.396543	748.7417
150.00		.771620	-652.550	1.24439	.493401	.398435	740.2338
160.00		.718064	-653.675	1.23999	.501613	.400374	731.4390
170.00		.665215	-654.834	1.23572	.510558	.402364	722.3290
180.00		.617927	-656.033	1.23153	.520363	.404412	712.8704
190.00	superheated	.575288	-657.274	1.22742	.531192	.406522	703.0238
200.00	vapor	.536564	-658.564	1.22335	.543252	.408702	692.7417
210.00		.501155	-659.908	1.21931	.556819	.410962	681.9665
214.83	sat. vapor	.485094	-660.578	1.21736	.564013	.412085	676.5675
214.83	sat. liquid	.034558	-789.631	.99095	.689822	.439375	1879.3229
220.00	compressed	.034546	-789.640	.99088	.689212	.439374	1882.5349
230.00	liquid	.034521	-789.656	.99074	.688050	.439372	1888.7124
240.00		.034497	-789.672	.99060	.686909	.439370	1894.8479
250.00		.034473	-789.688	.99046	.685787	.439369	1900.9420
260.00		.034450	-789.703	.99032	.684686	.439369	1906.9955
270.00		.034426	-789.717	.99018	.683603	.439368	1913.0092
280.00		.034403	-789.731	.99005	.682538	.439368	1918.9837
290.00		.034380	-789.745	.98991	.681492	.439369	1924.9196
300.00		.034357	-789.758	.98978	.680463	.439370	1930.8177
310.00		.034334	-789.770	.98964	.679451	.439371	1936.6786
320.00		.034312	-789.782	.98951	.678455	.439372	1942.5029
330.00		.034290	-789.794	.98938	.677476	.439374	1948.2913
340.00		.034268	-789.805	.98925	.676512	.439377	1954.0442
350.00		.034246	-789.816	.98912	.675563	.439379	1959.7622
360.00		.034224	-789.826	.98899	.674630	.439382	1965.4460
370.00		.034203	-789.836	.98886	.673710	.439386	1971.0961
380.00		.034181	-789.846	.98873	.672805	.439389	1976.7129
390.00		.034160	-789.855	.98860	.671914	.439393	1982.2970
400.00		.034139	-789.864	.98848	.671036	.439398	1987.8490
410.00		.034118	-789.872	.98835	.670171	.439402	1993.3692
420.00		.034098	-789.880	.98823	.669319	.439407	1998.8582
430.00		.034077	-789.888	.98810	.668479	.439412	2004.3165
440.00		.034057	-789.895	.98798	.667652	.439418	2009.7444
450.00		.034037	-789.902	.98786	.666836	.439423	2015.1425
460.00		.034017	-789.909	.98774	.666032	.439429	2020.5111
470.00		.033997	-789.915	.98761	.665239	.439436	2025.8507
480.00		.033977	-789.921	.98749	.664457	.439442	2031.1617
490.00		.033958	-789.926	.98737	.663687	.439449	2036.4445
500.00		.033938	-789.931	.98725	.662926	.439456	2041.6995
510.00		.033919	-789.936	.98714	.662176	.439463	2046.9271
520.00		.033900	-789.941	.98702	.661437	.439471	2052.1277
530.00		.033881	-789.945	.98690	.660707	.439478	2057.3015
540.00		.033862	-789.949	.98678	.659986	.439486	2062.4491

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 120. ^{o}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{o}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{o}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{o}F)	SONIC VELOCITY (FT/SEC)
10.00		14.003306	-635.051	1.39086	.426230	.381152	848.2960
20.00		6.938061	-635.848	1.35864	.429691	.382557	842.3682
30.00		4.582389	-636.658	1.33936	.433287	.383980	836.3364
40.00		3.404089	-637.481	1.32538	.437030	.385421	830.1953
50.00		2.696719	-638.316	1.31429	.440930	.386882	823.9392
60.00		2.224798	-639.166	1.30502	.445003	.388363	817.5618
70.00		1.887402	-640.031	1.29699	.449263	.389865	811.0563
80.00		1.634071	-640.911	1.28988	.453729	.391390	804.4152
90.00		1.436768	-641.808	1.28344	.458419	.392939	797.6304
100.00		1.278671	-642.722	1.27754	.463356	.394513	790.6930
110.00		1.149072	-643.655	1.27207	.468567	.396114	783.5929
120.00		1.040832	-644.607	1.26693	.474082	.397744	776.3190
130.00		.949007	-645.582	1.26208	.479935	.399404	768.8591
140.00		.870063	-646.578	1.25747	.486169	.401096	761.1994
150.00		.801409	-647.600	1.25304	.492831	.402823	753.3242
160.00		.741097	-648.648	1.24877	.499979	.404588	745.2158
170.00		.687637	-649.724	1.24464	.507683	.406393	736.8542
180.00		.639865	-650.832	1.24061	.516026	.408243	728.2162
190.00		.596861	-651.974	1.23667	.525114	.410141	719.2750
200.00		.557886	-653.155	1.23280	.535073	.412092	709.9990
210.00		.522336	-654.376	1.22897	.546067	.414102	700.3513
220.00	superheated	.489712	-655.645	1.22516	.558304	.416177	690.2875
230.00		.459595	-656.967	1.22137	.572058	.418325	679.7536
240.00	vapor	.431629	-658.349	1.21757	.587695	.420557	668.6835
243.27	sat. vapor	.422896	-658.815	1.21632	.593296	.421307	664.9333
243.27	sat. liquid	.035301	-782.649	1.00281	.716340	.445110	1750.5128
250.00	compressed	.035281	-782.669	1.00270	.715263	.445101	1755.3564
260.00		.035251	-782.697	1.00254	.713692	.445087	1762.0094
270.00	liquid	.035221	-782.724	1.00238	.712154	.445074	1768.8069
280.00		.035192	-782.751	1.00222	.710649	.445061	1775.5502
290.00		.035163	-782.777	1.00207	.709175	.445049	1782.2403
300.00		.035135	-782.802	1.00191	.707731	.445038	1788.8784
310.00		.035106	-782.827	1.00175	.706317	.445027	1795.4655
320.00		.035078	-782.850	1.00160	.704931	.445017	1802.0027
330.00		.035051	-782.874	1.00145	.703572	.445008	1808.4910
340.00		.035023	-782.896	1.00130	.702240	.444999	1814.9314
350.00		.034996	-782.918	1.00115	.700934	.444990	1821.3248
360.00		.034969	-782.939	1.00100	.699652	.444983	1827.6720
370.00		.034943	-782.960	1.00085	.698395	.444975	1833.9741
380.00		.034917	-782.980	1.00071	.697161	.444968	1840.2318
390.00		.034891	-783.000	1.00056	.695949	.444962	1846.4459
400.00		.034865	-783.019	1.00042	.694760	.444956	1852.6173
410.00		.034839	-783.037	1.00028	.693591	.444951	1858.7468
420.00		.034814	-783.055	1.00013	.692444	.444946	1864.8350
430.00		.034789	-783.073	.99999	.691317	.444942	1870.8828
440.00		.034764	-783.089	.99985	.690209	.444938	1876.8908
450.00		.034740	-783.106	.99971	.689120	.444934	1882.8597
460.00		.034715	-783.122	.99958	.688049	.444931	1888.7902
470.00		.034691	-783.137	.99944	.686997	.444928	1894.6830
480.00		.034667	-783.152	.99930	.685961	.444926	1900.5387
490.00		.034644	-783.166	.99917	.684943	.444924	1906.3579
500.00		.034620	-783.180	.99903	.683942	.444923	1912.1411
510.00		.034597	-783.193	.99890	.682956	.444922	1917.8891
520.00		.034574	-783.206	.99877	.681986	.444921	1923.6023
530.00		.034551	-783.219	.99863	.681031	.444920	1929.2814
540.00		.034528	-783.231	.99850	.680091	.444920	1934.9268

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 130. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00		14.251903	-630.739	1.39827	.432430	.387315	655.3301
20.00		7.065005	-631.503	1.36610	.435673	.388629	849.6761
30.00		4.668831	-632.278	1.34689	.439034	.389958	843.9301
40.00		3.470329	-633.064	1.33297	.442522	.391303	838.0877
50.00		2.750884	-633.862	1.32194	.446148	.392665	832.1443
60.00		2.270952	-634.673	1.31274	.449923	.394044	826.0948
70.00		1.927872	-635.496	1.30478	.453858	.395442	819.9338
80.00		1.670314	-636.334	1.29774	.457967	.396858	813.6554
90.00		1.469757	-637.186	1.29138	.462267	.398295	807.2530
100.00		1.309091	-638.053	1.28556	.466774	.399752	800.7196
110.00		1.177424	-638.936	1.28017	.471508	.401232	794.0475
120.00		1.067495	-639.836	1.27513	.476493	.402736	787.2281
130.00		.974276	-640.755	1.27037	.481754	.404265	780.2521
140.00		.894175	-641.693	1.26586	.487321	.405820	773.1091
150.00		.824555	-642.651	1.26154	.493230	.407404	765.7874
160.00		.763438	-643.632	1.25739	.499522	.409017	758.2740
170.00		.709308	-644.637	1.25337	.506245	.410664	750.5545
180.00		.660990	-645.667	1.24946	.513455	.412345	742.6123
190.00		.617546	-646.726	1.24568	.521223	.414064	734.4286
200.00		.578230	-647.814	1.24196	.529631	.415823	725.9821
210.00		.542432	-648.936	1.23830	.538780	.417628	717.2478
220.00		.509695	-650.094	1.23469	.548796	.419481	708.1969
230.00		.479472	-651.293	1.23111	.559839	.421388	698.7953
240.00		.451540	-652.536	1.22754	.572109	.423355	689.0026
250.00	superheated	.425555	-653.830	1.22397	.585870	.425389	678.7701
260.00	vapor	.401256	-655.182	1.22039	.601470	.427499	668.0379
270.00		.378419	-656.599	1.21676	.619366	.429696	656.7318
274.40	sat. vapor	.368752	-657.247	1.21515	.628176	.430695	651.5458
274.40	sat. liquid	.030144	-775.424	1.01485	.749251	.451027	1619.3685
280.00	compressed	.030123	-775.469	1.01476	.747981	.451010	1623.7141
290.00	liquid	.030085	-775.493	1.01455	.745761	.450980	1631.4204
300.00		.030048	-775.516	1.01437	.743598	.450951	1639.0508
310.00		.030011	-775.577	1.01418	.741493	.450923	1646.6073
320.00		.035975	-775.618	1.01400	.739440	.450896	1654.0918
330.00		.035939	-775.658	1.01382	.737440	.450870	1661.5061
340.00		.035904	-775.697	1.01364	.735489	.450845	1668.8519
350.00		.035869	-775.734	1.01347	.733585	.450821	1676.1310
360.00		.035834	-775.771	1.01329	.731728	.450797	1683.3449
370.00		.035801	-775.807	1.01312	.729913	.450775	1690.4953
380.00		.035767	-775.842	1.01295	.728142	.450754	1697.5835
390.00		.035734	-775.876	1.01278	.726410	.450733	1704.6111
400.00		.035701	-775.909	1.01261	.724718	.450713	1711.5794
410.00		.035669	-775.941	1.01244	.723063	.450694	1718.4897
420.00		.035637	-775.973	1.01228	.721445	.450676	1725.3433
430.00		.035606	-776.004	1.01211	.719861	.450658	1732.1415
440.00		.035575	-776.034	1.01195	.718311	.450641	1738.8855
450.00		.035544	-776.063	1.01179	.716794	.450625	1745.5763
460.00		.035514	-776.091	1.01163	.715308	.450609	1752.2151
470.00		.035484	-776.119	1.01147	.713852	.450595	1758.8031
480.00		.035454	-776.146	1.01132	.712426	.450580	1765.3411
490.00		.035424	-776.172	1.01116	.711029	.450567	1771.8302
500.00		.035395	-776.198	1.01100	.709658	.450554	1778.2715
510.00		.035367	-776.223	1.01085	.708315	.450541	1784.6657
520.00		.035338	-776.247	1.01070	.706997	.450530	1791.0139
530.00		.035310	-776.271	1.01055	.705704	.450518	1797.3169
540.00		.035283	-776.294	1.01040	.704435	.450508	1803.5755

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 140. ^{o}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{o}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{o}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{o}F)	SONIC VELOCITY (FT/SEC)
10.00		14.500329	-626.366	1.40566	.438660	.393484	862.3102
20.00		7.191654	-627.099	1.37354	.441703	.394714	856.9125
30.00		4.754959	-627.841	1.35439	.444849	.395958	851.4333
40.00		3.536244	-628.594	1.34052	.448107	.397215	845.8690
50.00		2.804709	-629.357	1.32955	.451485	.398486	840.2159
60.00		2.316753	-630.131	1.32041	.454991	.399773	834.4698
70.00		1.967974	-630.917	1.31252	.458635	.401074	828.6263
80.00		1.706171	-631.715	1.30554	.462429	.402392	822.6807
90.00		1.502342	-632.525	1.29925	.466385	.403727	816.6278
100.00		1.339087	-633.349	1.29351	.470515	.405080	810.4622
110.00		1.205331	-634.187	1.28819	.474837	.406452	804.1776
120.00		1.093689	-635.040	1.28323	.479366	.407845	797.7675
130.00		.999050	-635.909	1.27856	.484124	.409255	791.2247
140.00		.917760	-636.794	1.27413	.489131	.410688	784.5413
150.00		.847141	-637.697	1.26990	.494415	.412145	777.7085
160.00		.785181	-638.618	1.26585	.500005	.413627	770.7167
170.00		.730343	-639.560	1.26195	.505935	.415135	763.5551
180.00		.681627	-640.523	1.25817	.512245	.416670	756.2119
190.00		.637489	-641.508	1.25449	.518983	.418236	748.6736
200.00		.597767	-642.519	1.25090	.526204	.419834	740.9251
210.00		.561648	-643.557	1.24738	.533974	.421466	732.9495
220.00		.528624	-644.623	1.24393	.542373	.423135	724.7271
230.00		.498277	-645.721	1.24051	.551500	.424846	716.2356
240.00		.470254	-646.854	1.23713	.561473	.426600	707.4490
250.00		.444255	-648.025	1.23377	.572443	.428404	698.3370
260.00		.420025	-649.239	1.23041	.584599	.430262	688.8636
270.00		.397341	-650.501	1.22705	.598186	.432180	678.9859
280.00	superheated	.376007	-651.816	1.22366	.613526	.434165	668.6518
290.00		.355846	-653.194	1.22024	.631051	.436228	657.7971
300.00	vapor	.336696	-654.642	1.21676	.651361	.438380	646.3410
308.40	sat. vapor	.321278	-655.922	1.21377	.671190	.440268	636.1773
308.40	sat. liquid	.037118	-767.902	1.02714	.791662	.457174	1485.1513
310.00		.037110	-767.913	1.02710	.791117	.457165	1486.5738
320.00	compressed	.037060	-767.980	1.02688	.787779	.457112	1495.4016
330.00	liquid	.037012	-768.045	1.02665	.784554	.457060	1504.1200
340.00		.036964	-768.109	1.02643	.781435	.457010	1512.7327
350.00		.036917	-768.170	1.02622	.778418	.456962	1521.2432
360.00		.036871	-768.230	1.02600	.775497	.456915	1529.6546
370.00		.036826	-768.289	1.02579	.772666	.456870	1537.9700
380.00		.036781	-768.346	1.02558	.769922	.456826	1546.1924
390.00		.036737	-768.401	1.02538	.767260	.456784	1554.3246
400.00		.036694	-768.455	1.02517	.764675	.456743	1562.3691
410.00		.036652	-768.508	1.02497	.762166	.456704	1570.3286
420.00		.036610	-768.560	1.02477	.759727	.456666	1578.2053
430.00		.036569	-768.610	1.02458	.757355	.456629	1586.0017
440.00		.036528	-768.659	1.02438	.755048	.456593	1593.7199
450.00		.036488	-768.706	1.02419	.752803	.456558	1601.3619
460.00		.036449	-768.753	1.02400	.750617	.456525	1608.9299
470.00		.036410	-768.798	1.02381	.748488	.456493	1616.4256
480.00		.036371	-768.842	1.02363	.746412	.456462	1623.8510
490.00		.036334	-768.885	1.02344	.744388	.456432	1631.2078
500.00		.036296	-768.927	1.02326	.742415	.456402	1638.4976
510.00		.036260	-768.969	1.02308	.740489	.456374	1645.7222
520.00		.036223	-769.009	1.02290	.738609	.456347	1652.8830
530.00		.036187	-769.048	1.02273	.736773	.456321	1659.9816
540.00		.036152	-769.086	1.02255	.734979	.456295	1667.0194

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 150. ^{o}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{o}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{o}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{o}F)	SONIC VELOCITY (FT/SEC)
10.00		14.748425	-621.933	1.41303	.444915	.399653	869.2399
20.00		7.318020	-622.636	1.38096	.447774	.400806	864.0826
30.00		4.840798	-623.348	1.36185	.450724	.401971	858.8529
40.00		3.601860	-624.069	1.34804	.453772	.403148	853.5481
50.00		2.858224	-624.799	1.33713	.456924	.404336	848.1649
60.00		2.362231	-625.540	1.32804	.460188	.405538	842.7001
70.00		2.007740	-626.290	1.32021	.463572	.406752	837.1501
80.00		1.741679	-627.052	1.31329	.467085	.407981	831.5111
90.00		1.534564	-627.824	1.30706	.470735	.409224	825.7789
100.00		1.368703	-628.609	1.30138	.474535	.410482	819.9492
110.00		1.232839	-629.405	1.29613	.478496	.411755	814.0173
120.00		1.119465	-630.215	1.29124	.482631	.413045	807.9778
130.00		1.023384	-631.038	1.28665	.486956	.414355	801.8253
140.00		.940882	-631.876	1.28230	.491487	.415678	795.5537
150.00		.869237	-632.728	1.27816	.496245	.417023	789.1563
160.00		.806406	-633.597	1.27419	.501250	.418388	782.6260
170.00		.750825	-634.482	1.27038	.506529	.419774	775.9546
180.00		.701277	-635.386	1.26670	.512109	.421183	769.1334
190.00		.656802	-636.309	1.26312	.518023	.422616	762.1528
200.00		.616629	-637.252	1.25965	.524310	.424074	755.0018
210.00		.580134	-638.217	1.25625	.531016	.425559	747.6686
220.00		.546806	-639.206	1.25292	.538193	.427074	740.1395
230.00		.516220	-640.221	1.24964	.545903	.428620	732.3993
240.00		.488021	-641.265	1.24641	.554222	.430200	724.4308
250.00		.461910	-642.336	1.24322	.563242	.431816	716.2142
260.00		.437630	-643.439	1.24004	.573073	.433472	707.7268
270.00		.414962	-644.580	1.23688	.583854	.435173	698.9420
280.00		.393715	-645.760	1.23372	.595756	.436921	689.8291
290.00		.373719	-646.985	1.23054	.609001	.438722	680.3513
300.00		.354825	-648.260	1.22735	.623876	.440583	670.4646
310.00		.336897	-649.591	1.22412	.640758	.442512	660.1153
320.00	superheated	.319809	-650.987	1.22083	.660164	.444517	649.2371
330.00	vapor	.303439	-652.456	1.21747	.682815	.446612	637.7458
340.00		.287671	-654.020	1.21402	.709758	.448811	625.5324
345.44	sat. vapor	.279307	-654.912	1.21209	.726740	.450057	618.5398
345.44	sat. liquid	.036273	-760.011	1.03980	.849174	.463624	1349.9804
350.00	compressed	.038241	-760.057	1.03967	.846698	.463583	1351.6988
360.00	liquid	.038174	-760.156	1.03939	.841451	.463496	1361.8157
370.00		.038109	-760.252	1.03911	.836436	.463412	1371.9705
380.00		.038045	-760.346	1.03885	.831638	.463331	1381.8701
390.00		.037983	-760.436	1.03858	.827041	.463253	1391.6209
400.00		.037922	-760.524	1.03832	.822632	.463178	1401.2288
410.00		.037862	-760.609	1.03807	.818397	.463105	1410.6998
420.00		.037804	-760.692	1.03782	.814327	.463035	1420.0384
430.00		.037747	-760.773	1.03757	.810411	.462968	1429.2503
440.00		.037691	-760.851	1.03733	.806639	.462902	1438.3398
450.00		.037636	-760.927	1.03709	.803003	.462839	1447.3112
460.00		.037582	-761.002	1.03685	.799495	.462778	1456.1687
470.00		.037529	-761.074	1.03662	.796107	.462719	1464.9162
480.00		.037477	-761.144	1.03639	.792834	.462661	1473.5574
490.00		.037426	-761.213	1.03617	.789669	.462606	1482.0956
500.00		.037376	-761.279	1.03594	.786605	.462552	1490.5341
510.00		.037327	-761.344	1.03572	.783638	.462500	1498.8762
520.00		.037279	-761.407	1.03551	.780763	.462450	1507.1246
530.00		.037231	-761.469	1.03529	.777975	.462401	1515.2823
540.00		.037184	-761.529	1.03508	.775271	.462354	1523.3519

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 160. ^{o}F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/^{o}F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/^{o}F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/^{o}F)	SONIC VELOCITY (FT/SEC)
10.00		14.996271	-617.439	1.42038	.451190	.405818	876.1221
20.00		7.444128	-618.114	1.38836	.453879	.406900	871.1605
30.00		4.926371	-618.797	1.36929	.456649	.407992	866.1947
40.00		3.667201	-619.489	1.35553	.459505	.409094	861.1323
50.00		2.911456	-620.189	1.34466	.462453	.410207	856.0008
60.00		2.407416	-620.898	1.33563	.465498	.411331	850.7975
70.00		2.047201	-621.616	1.32785	.468647	.412466	845.5194
80.00		1.776869	-622.343	1.32098	.471907	.413613	840.1636
90.00		1.566455	-623.081	1.31482	.475286	.414772	834.7267
100.00		1.397975	-623.829	1.30919	.478793	.415944	829.2053
110.00		1.259989	-624.587	1.30401	.482436	.417129	823.5955
120.00		1.144866	-625.357	1.29918	.486228	.418328	817.8933
130.00		1.047325	-626.139	1.29465	.490178	.419541	812.0945
140.00		.963592	-626.933	1.29037	.494300	.420770	806.1942
150.00		.890901	-627.741	1.28631	.498610	.422015	800.1874
160.00		.827174	-628.562	1.28242	.503122	.423276	794.0686
170.00		.770825	-629.397	1.27869	.507857	.424554	787.8317
180.00		.720617	-630.248	1.27509	.512834	.425851	781.4704
190.00		.675574	-631.116	1.27161	.518077	.427168	774.9773
200.00		.634914	-632.000	1.26823	.523614	.428505	768.3447
210.00		.598005	-632.902	1.26493	.529477	.429864	761.5639
220.00		.564327	-633.825	1.26171	.535700	.431245	754.6254
230.00		.533451	-634.767	1.25855	.542327	.432652	747.5186
240.00		.505018	-635.733	1.25545	.549406	.434084	740.2316
250.00		.478726	-636.722	1.25238	.556997	.435545	732.7511
260.00		.454318	-637.737	1.24935	.565167	.437036	725.0622
270.00		.431574	-638.780	1.24635	.574001	.438560	717.1478
280.00		.410303	-639.854	1.24336	.583598	.440119	708.9886
290.00		.390339	-640.961	1.24038	.594083	.441716	700.5623
300.00		.371536	-642.105	1.23740	.605607	.443356	691.8429
310.00		.353766	-643.290	1.23441	.618365	.445043	682.7999
320.00		.336910	-644.520	1.23139	.632603	.446780	673.3974
330.00		.320864	-645.801	1.22834	.648641	.448576	663.5920
340.00		.305527	-647.141	1.22525	.666907	.450439	653.3311
350.00		.290806	-648.547	1.22209	.687985	.452373	642.5492
360.00	superheated	.276608	-650.031	1.21885	.712698	.454395	631.1634
370.00	vapor	.262837	-651.608	1.21550	.742246	.456519	619.0661
380.00		.249392	-653.297	1.21201	.778466	.458765	606.1129
385.70	sat. vapor	.241823	-654.321	1.20994	.803191	.460113	598.2656
385.70	sat. liquid	.039690	-751.630	1.05299	.932948	.470489	1203.7922
390.00	compressed	.039647	-751.697	1.05283	.928813	.470426	1209.1065
400.00	liquid	.039551	-751.848	1.05247	.919627	.470285	1221.2832
410.00		.039457	-751.994	1.05212	.911005	.470149	1233.1991
420.00		.039367	-752.134	1.05177	.902894	.470020	1244.8691
430.00		.039279	-752.270	1.05144	.895245	.469895	1256.3069
440.00		.039194	-752.400	1.05111	.888017	.469776	1267.5251
450.00		.039111	-752.526	1.05079	.881172	.469662	1278.5349
460.00		.039031	-752.648	1.05048	.874678	.469552	1289.3467
470.00		.038953	-752.766	1.05017	.868507	.469446	1299.9702
480.00		.038877	-752.880	1.04987	.862633	.469344	1310.4141
490.00		.038803	-752.991	1.04957	.857034	.469246	1320.6867
500.00		.038731	-753.098	1.04929	.851667	.469152	1330.7954
510.00		.038660	-753.202	1.04900	.846577	.469060	1340.7474
520.00		.038591	-753.303	1.04872	.841685	.468972	1350.5491
530.00		.038524	-753.401	1.04845	.836997	.468888	1360.2066
540.00		.038459	-753.496	1.04818	.832499	.468806	1369.7256

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 170. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00		15.243887	-612.884	1.42771	.457479	.411973	882.9593
20.00		7.570000	-613.533	1.39573	.460011	.412989	878.2400
30.00		5.011700	-614.190	1.37671	.462616	.414014	873.4636
40.00		3.732288	-614.854	1.36299	.465296	.415048	868.6282
50.00		2.964425	-615.525	1.35217	.468057	.416091	863.7317
60.00		2.452330	-616.204	1.34318	.470903	.417144	858.7719
70.00		2.086382	-616.892	1.33545	.473840	.418206	853.7465
80.00		1.811771	-617.588	1.32864	.476874	.419278	848.6531
90.00		1.598045	-618.293	1.32252	.480010	.420361	843.4889
100.00		1.426935	-619.007	1.31695	.483256	.421454	838.2512
110.00		1.286814	-619.731	1.31182	.486619	.422559	832.9370
120.00		1.169929	-620.464	1.30705	.490108	.423676	827.5431
130.00		1.070914	-621.208	1.30259	.493731	.424805	822.0662
140.00		.985934	-621.963	1.29837	.497499	.425946	816.5025
150.00		.912180	-622.729	1.29437	.501422	.427101	810.8482
160.00		.847540	-623.508	1.29055	.505515	.428269	805.0991
170.00		.790402	-624.298	1.28689	.509789	.429452	799.2505
180.00		.739511	-625.102	1.28337	.514261	.430650	793.2977
190.00		.693875	-625.920	1.27997	.518949	.431864	787.2352
200.00		.652702	-626.752	1.27667	.523871	.433095	781.0574
210.00		.615348	-627.599	1.27346	.529051	.434343	774.7579
220.00		.581287	-628.463	1.27033	.534514	.435610	768.3298
230.00		.550083	-629.344	1.26727	.540289	.436896	761.7657
240.00		.521375	-630.243	1.26427	.546409	.438203	755.0572
250.00		.494854	-631.162	1.26132	.552913	.439531	748.1952
260.00		.470263	-632.102	1.25841	.559846	.440884	741.1695
270.00		.447379	-633.064	1.25554	.567261	.442261	733.9689
280.00		.426012	-634.051	1.25269	.575220	.443665	726.5807
290.00		.405994	-635.063	1.24986	.583796	.445097	718.9906
300.00		.387183	-636.104	1.24704	.593080	.446561	711.1826
310.00		.369449	-637.175	1.24423	.603178	.448058	703.1382
320.00		.352681	-638.280	1.24142	.614222	.449591	694.8364
330.00		.336777	-639.422	1.23859	.626377	.451165	686.2526
340.00		.321645	-640.605	1.23575	.639848	.452783	677.3584
350.00		.307201	-641.833	1.23287	.654898	.454449	668.1198
360.00		.293366	-643.113	1.22996	.671873	.456170	658.4966
370.00		.280067	-644.452	1.22699	.691227	.457952	648.4395
380.00		.267230	-645.857	1.22396	.713584	.459805	637.8879
390.00		.254784	-647.341	1.22084	.739820	.461739	626.7653
400.00	superheated	.242650	-648.916	1.21760	.771213	.463769	614.9729
410.00		.230744	-650.606	1.21423	.809713	.465913	602.3786
420.00	vapor	.218964	-652.435	1.21066	.858476	.468199	588.7992
429.41	sat. vapor	.207880	-654.320	1.20708	.918594	.470514	574.8887
429.41	sat. liquid	.041523	-742.555	1.06703	1.068615	.477961	1054.3370
430.00	compressed	.041513	-742.570	1.06700	1.067210	.477946	1055.2554
440.00	liquid	.041357	-742.818	1.06648	1.048177	.477704	1070.4552
450.00		.041209	-743.053	1.06599	1.030741	.477476	1085.1771
460.00		.041068	-743.277	1.06551	1.014842	.477260	1099.4617
470.00		.040934	-743.490	1.06505	1.000271	.477056	1113.3441
480.00		.040805	-743.693	1.06461	.986855	.476863	1126.8548
490.00		.040682	-743.886	1.06418	.974451	.476679	1140.0207
500.00		.040563	-744.072	1.06377	.962940	.476504	1152.8655
510.00		.040450	-744.250	1.06337	.952221	.476337	1165.4103
520.00		.040340	-744.421	1.06298	.942208	.476178	1177.6741
530.00		.040234	-744.585	1.06260	.932829	.476026	1189.6739
540.00		.040132	-744.743	1.06223	.924020	.475880	1201.4250

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 180. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00		15.491288	-608.266	1.43502	.463777	.418113	889.7533
20.00		7.695650	-608.893	1.40308	.466165	.419069	885.2338
30.00		5.096801	-609.524	1.38410	.468617	.420033	880.6636
40.00		3.797143	-610.162	1.37042	.471136	.421004	876.0410
50.00		3.017155	-610.807	1.35964	.473726	.421982	871.3644
60.00		2.496996	-611.459	1.35070	.476391	.422969	866.6320
70.00		2.125307	-612.118	1.34301	.479136	.423965	861.8419
80.00		1.846407	-612.785	1.33624	.481965	.424969	856.9921
90.00		1.629362	-613.459	1.33017	.484883	.425982	852.0805
100.00		1.455612	-614.142	1.32466	.487895	.427004	847.1049
110.00		1.313345	-614.834	1.31958	.491009	.428036	842.0629
120.00		1.194687	-615.534	1.31486	.494230	.429077	836.9519
130.00		1.094186	-616.243	1.31045	.497565	.430129	831.7693
140.00		1.007947	-616.962	1.30628	.501023	.431192	826.5124
150.00		.933114	-617.690	1.30235	.504613	.432266	821.1780
160.00		.867546	-618.429	1.29859	.508343	.433351	815.7629
170.00		.809603	-619.179	1.29499	.512224	.434448	810.2636
180.00		.758011	-619.941	1.29154	.516269	.435558	804.6765
190.00		.711764	-620.714	1.28821	.520489	.436681	798.9976
200.00		.670055	-621.499	1.28498	.524900	.437817	793.2225
210.00		.632233	-622.298	1.28185	.529519	.438968	787.3464
220.00		.597764	-623.110	1.27881	.534362	.440134	781.3651
230.00		.566205	-623.937	1.27583	.539451	.441315	775.2723
240.00		.537188	-624.779	1.27292	.544810	.442513	769.0625
250.00		.510405	-625.637	1.27006	.550464	.443729	762.7291
260.00		.485591	-626.513	1.26726	.556444	.444962	756.2653
270.00		.462523	-627.407	1.26449	.562785	.446215	749.6632
280.00		.441009	-628.320	1.26176	.569528	.447489	742.9145
290.00		.420881	-629.254	1.25905	.576718	.448785	736.0096
300.00		.401994	-630.210	1.25637	.584411	.450104	728.9382
310.00		.384222	-631.190	1.25370	.592671	.451448	721.6888
320.00		.367451	-632.196	1.25104	.601575	.452818	714.2482
330.00		.351583	-633.229	1.24839	.611215	.454218	706.6017
340.00		.336528	-634.294	1.24573	.621701	.455649	698.7327
350.00		.322207	-635.391	1.24306	.633170	.457113	690.6221
360.00		.308545	-636.525	1.24038	.645788	.458615	682.2481
370.00		.295477	-637.699	1.23767	.659767	.460157	673.5849
380.00		.282940	-638.918	1.23493	.675375	.461744	664.6028
390.00		.270874	-640.188	1.23215	.692958	.463381	655.2661
400.00		.259223	-641.514	1.22931	.712976	.465075	645.5320
410.00		.247930	-642.906	1.22640	.736051	.466832	635.3480
420.00		.236938	-644.375	1.22340	.763048	.468663	624.6488
430.00		.226185	-645.932	1.22030	.795218	.470580	613.3511
440.00		.215602	-647.596	1.21706	.834437	.472599	601.3455
450.00	superheated	.205106	-649.397	1.21364	.883685	.474742	588.4829
460.00	vapor	.194591	-651.365	1.20999	.948038	.477043	574.5510
470.00		.183904	-653.561	1.20601	1.037014	.479551	559.2258
476.74	sat. vapor	.176489	-655.216	1.20307	1.120279	.481399	547.8579
476.74	sat. liquid	.044101	-732.374	1.08251	1.328979	.486405	897.4293
480.00	compressed	.044003	-732.525	1.08223	1.311435	.486255	904.0450
490.00	liquid	.043720	-732.962	1.08142	1.263595	.485822	923.6084
500.00		.043461	-733.364	1.08067	1.222994	.485425	942.2159
510.00		.043222	-733.736	1.07996	1.188004	.485061	959.9930
520.00		.043000	-734.081	1.07930	1.157462	.484723	977.0395
530.00		.042792	-734.405	1.07867	1.130518	.484409	993.4365
540.00		.042597	-734.708	1.07807	1.106529	.484116	1009.2507

Table II-6 (Continued)

THERMODYNAMIC DATA FOR PROPANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 190. °F

PRESSURE (PSIA)	SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	15.738490	-603.592	1.44231	.470079	.424236	896.5056
20.00	7.821096	-604.194	1.41041	.472333	.425136	892.1745
30.00	5.181693	-604.801	1.39146	.474644	.426042	887.7982
40.00	3.861782	-605.415	1.37782	.477015	.426955	883.3755
50.00	3.069662	-606.034	1.36709	.479449	.427875	878.9051
60.00	2.541434	-606.660	1.35818	.481948	.428801	874.3853
70.00	2.163997	-607.293	1.35053	.484518	.429735	869.8148
80.00	1.880801	-607.932	1.34381	.487161	.430676	865.1918
90.00	1.660429	-608.579	1.33779	.489883	.431625	860.5148
100.00	1.484030	-609.233	1.33231	.492686	.432582	855.7819
110.00	1.339609	-609.894	1.32728	.495577	.433547	850.9912
120.00	1.219168	-610.563	1.32261	.498559	.434521	846.1408
130.00	1.117170	-611.240	1.31825	.501641	.435503	841.2285
140.00	1.029661	-611.926	1.31414	.504826	.436494	836.2522
150.00	.953740	-612.620	1.31025	.508123	.437495	831.2095
160.00	.887231	-613.324	1.30655	.511538	.438505	826.0979
170.00	.828470	-614.036	1.30301	.515080	.439525	820.9147
180.00	.776163	-614.759	1.29962	.518758	.440556	815.6572
190.00	.729288	-615.492	1.29635	.522582	.441597	810.3223
200.00	.687028	-616.236	1.29319	.526562	.442650	804.9068
210.00	.648719	-616.990	1.29013	.530711	.443714	799.4074
220.00	.613821	-617.757	1.28715	.535041	.444791	793.8202
230.00	.581885	-618.536	1.28425	.539569	.445880	788.1414
240.00	.552537	-619.328	1.28142	.544310	.446983	782.3668
250.00	.525463	-620.133	1.27864	.549284	.448100	776.4918
260.00	.500398	-620.952	1.27592	.554511	.449231	770.5113
270.00	.477114	-621.787	1.27325	.560015	.450377	764.4202
280.00	.455416	-622.638	1.27061	.565823	.451540	758.2125
290.00	.435137	-623.505	1.26801	.571967	.452720	751.8820
300.00	.416130	-624.390	1.26544	.578481	.453917	745.4217
310.00	.398266	-625.295	1.26288	.585406	.455134	738.8241
320.00	.381434	-626.220	1.26035	.592790	.456371	732.0807
330.00	.365535	-627.166	1.25785	.600687	.457629	725.1824
340.00	.350479	-628.136	1.25532	.609162	.458910	718.1191
350.00	.336188	-629.131	1.25281	.618292	.460216	710.8792
360.00	.322592	-630.154	1.25030	.628168	.461548	703.4500
370.00	.309625	-631.206	1.24778	.638900	.462908	695.8171
380.00	.297230	-632.290	1.24525	.650620	.464299	687.9644
390.00	.285351	-633.409	1.24270	.663494	.465724	679.8730
400.00	.273940	-634.567	1.24012	.677726	.467185	671.5217
410.00	.262948	-635.769	1.23751	.693574	.468686	662.8856
420.00	.252332	-637.018	1.23485	.711367	.470232	653.9354
430.00	.242046	-638.322	1.23214	.731540	.471827	644.6367
440.00	.232046	-639.688	1.22937	.754669	.473478	634.9477
450.00	.222269	-641.125	1.22651	.781545	.475193	624.8174
460.00	.212725	-642.645	1.22355	.813284	.476982	614.1824
470.00	.203301	-644.264	1.22047	.851521	.478857	602.9614
480.00	.193954	-646.004	1.21723	.898760	.480835	591.0478
490.00	.184605	-647.894	1.21378	.959075	.482941	578.2957
500.00 superheated	.175145	-649.976	1.21006	1.039623	.485209	564.4951
510.00 vapor	.165409	-652.330	1.20596	1.154439	.487694	549.3219
520.00	.155114	-655.078	1.20127	1.336026	.490496	532.2174
527.82 sat. vapor	.146307	-657.674	1.19694	1.582728	.493034	516.7921
527.82 sat. liquid	.048343	-720.067	1.10096	2.005822	.496601	733.7157
530.00 compressed	.048170	-720.307	1.10056	1.953254	.496374	740.1304
540.00 liquid	.047473	-721.285	1.09892	1.763070	.495441	767.6669

Table II-7 Superheated Vapor and Compressed Liquid Tables of Propylene

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -50. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
	SUPERHEATED						
10.00	VAPOR	10.164669	441.616	1.31456	.312460	.230708	787.062
16.42	SAT. VAPOR	6.067514	440.241	1.28866	.322508	.254880	776.1846
16.42	SAT. LIQUID	.027302	253.603	.83345	.536923	.178970	6274.0254
20.0	COMPRESSED	.027301	253.612	.83343	.536904	.178996	6274.7278
30.00	LIQUID	.027299	253.636	.83336	.536851	.179070	6276.6878
40.00		.027296	253.661	.83330	.536798	.179144	6278.6450
50.00		.027293	253.686	.83324	.536745	.179218	6280.5997
60.00		.027291	253.711	.83318	.536693	.179292	6282.5516
70.00		.027288	253.736	.83311	.536641	.179366	6284.5009
80.00		.027285	253.761	.83305	.536589	.179439	6286.4475
90.00		.027283	253.786	.83299	.536537	.179513	6288.3915
100.00		.027280	253.811	.83293	.536486	.179587	6290.3329
110.00		.027278	253.836	.83286	.536435	.179660	6292.2716
120.00		.027275	253.860	.83280	.536384	.179734	6294.2077
130.00		.027272	253.885	.83274	.536333	.179807	6296.1412
140.00		.027270	253.910	.83268	.536283	.179881	6298.0721
150.00		.027267	253.935	.83261	.536233	.179954	6300.0005
160.00		.027265	253.961	.83255	.536183	.180028	6301.9262
170.00		.027262	253.986	.83249	.536133	.180101	6303.8493
180.00		.027259	254.011	.83243	.536084	.180175	6305.7699
190.00		.027257	254.036	.83237	.536035	.180248	6307.6880
200.00		.027254	254.061	.83231	.535986	.180321	6309.6034
210.00		.027252	254.086	.83224	.535937	.180394	6311.5164
220.00		.027249	254.111	.83218	.535889	.180468	6313.4268
230.00		.027247	254.136	.83212	.535841	.180541	6315.3346
240.00		.027244	254.161	.83206	.535793	.180614	6317.2400
250.00		.027241	254.187	.83200	.535745	.180687	6319.1428
260.00		.027239	254.212	.83194	.535697	.180760	6321.0431
270.00		.027236	254.237	.83187	.535650	.180833	6322.9410
280.00		.027234	254.262	.83181	.535603	.180906	6324.8363
290.00		.027231	254.287	.83175	.535557	.180979	6326.7291
300.00		.027229	254.313	.83169	.535510	.181052	6328.6195
310.00		.027226	254.338	.83163	.535464	.181125	6330.5074
320.00		.027224	254.363	.83157	.535418	.181198	6332.3929
330.00		.027221	254.389	.83151	.535372	.181271	6334.2759
340.00		.027219	254.414	.83145	.535326	.181344	6336.1564
350.00		.027216	254.439	.83138	.535281	.181417	6338.0345
360.00		.027214	254.465	.83132	.535236	.181489	6339.9102
370.00		.027211	254.490	.83126	.535191	.181562	6341.7834
380.00		.027209	254.515	.83120	.535146	.181635	6343.6543
390.00		.027206	254.541	.83114	.535101	.181708	6345.5227
400.00		.027204	254.566	.83108	.535057	.181780	6347.3887
410.00		.027201	254.592	.83102	.535013	.181853	6349.2523
420.00		.027199	254.617	.83096	.534969	.181925	6351.1136
430.00		.027196	254.643	.83090	.534926	.181998	6352.9724
440.00		.027194	254.668	.83084	.534882	.182070	6354.8289
450.00		.027191	254.694	.83078	.534839	.182143	6356.6830
460.00		.027189	254.719	.83072	.534796	.182215	6358.5348
470.00		.027186	254.745	.83066	.534754	.182288	6360.3842
480.00		.027184	254.770	.83059	.534711	.182360	6362.2312
490.00		.027181	254.796	.83053	.534669	.182432	6364.0759
500.00		.027179	254.821	.83047	.534627	.182505	6365.9183
510.00		.027176	254.847	.83041	.534585	.182577	6367.7583
520.00		.027174	254.872	.83035	.534543	.182649	6369.5961
530.00		.027171	254.898	.83029	.534502	.182721	6371.4315
540.00		.027169	254.924	.83023	.534460	.182794	6373.2646
550.00		.027166	254.949	.83017	.534419	.182866	6375.0954
560.00		.027164	254.975	.83011	.534378	.182938	6376.9239
570.00		.027161	255.001	.83005	.534338	.183010	6378.7502

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -40. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	10.439345	444.507	1.32229	.316313	.238242	790.8026
20.00		5.071656	442.496	1.28601	.330730	.244200	775.2441
20.90	SAT. VAPOR	4.80150	442.310	1.28360	.332125	.244751	773.8002
20.90	SAT. LIQUID	.027644	258.745	.84654	.539907	.198733	5720.7096
30.0	COMPRESSED LIQUID	.027641	258.767	.84648	.539849	.198797	5722.7582
40.00		.027638	258.792	.84642	.539785	.198867	5725.0064
50.00		.027635	258.816	.84635	.539722	.198937	5727.2513
60.00		.027632	258.840	.84629	.539660	.199007	5729.4929
70.00		.027629	258.865	.84623	.539597	.199077	5731.7313
80.00		.027626	258.889	.84616	.539535	.199147	5733.9665
90.00		.027623	258.913	.84610	.539474	.199217	5736.1985
100.00		.027620	258.938	.84604	.539412	.199287	5738.4273
110.00		.027618	258.962	.84597	.539351	.199357	5740.6528
120.00		.027615	258.986	.84591	.539290	.199427	5742.8752
130.00		.027612	259.011	.84584	.539230	.199497	5745.0944
140.00		.027609	259.035	.84578	.539170	.199566	5747.3105
150.00		.027606	259.060	.84572	.539110	.199636	5749.5234
160.00		.027603	259.084	.84565	.539050	.199706	5751.7332
170.00		.027600	259.109	.84559	.538991	.199775	5753.9398
180.00		.027597	259.133	.84553	.538932	.199845	5756.1433
190.00		.027594	259.158	.84546	.538873	.199915	5758.3437
200.00		.027592	259.182	.84540	.538815	.199984	5760.5410
210.00		.027589	259.207	.84534	.538756	.200054	5762.7352
220.00		.027586	259.232	.84528	.538699	.200123	5764.9264
230.00		.027583	259.256	.84521	.538641	.200193	5767.1144
240.00		.027580	259.281	.84515	.538584	.200262	5769.2994
250.00		.027577	259.306	.84509	.538527	.200332	5771.4813
260.00		.027574	259.330	.84502	.538470	.200401	5773.6602
270.00		.027572	259.355	.84496	.538414	.200471	5775.8361
280.00		.027569	259.380	.84490	.538357	.200540	5778.0090
290.00		.027566	259.404	.84484	.538301	.200609	5780.1788
300.00		.027563	259.429	.84477	.538246	.200678	5782.3456
310.00		.027560	259.454	.84471	.538191	.200748	5784.5095
320.00		.027557	259.479	.84465	.538135	.200817	5786.6703
330.00		.027555	259.503	.84459	.538081	.200886	5788.8282
340.00		.027552	259.528	.84452	.538026	.200955	5790.9831
350.00		.027549	259.553	.84446	.537972	.201024	5793.1350
360.00		.027546	259.578	.84440	.537918	.201093	5795.2841
370.00		.027543	259.603	.84434	.537864	.201163	5797.4301
380.00		.027541	259.628	.84428	.537811	.201232	5799.5733
390.00		.027538	259.653	.84421	.537758	.201301	5801.7135
400.00		.027535	259.678	.84415	.537705	.201369	5803.8508
410.00		.027532	259.703	.84409	.537652	.201438	5805.9852
420.00		.027529	259.728	.84403	.537599	.201507	5808.1167
430.00		.027527	259.752	.84397	.537547	.201576	5810.2454
440.00		.027524	259.778	.84390	.537495	.201645	5812.3711
450.00		.027521	259.803	.84384	.537444	.201714	5814.4940
460.00		.027518	259.828	.84378	.537392	.201783	5816.6140
470.00		.027516	259.853	.84372	.537341	.201851	5818.7312
480.00		.027513	259.878	.84366	.537290	.201920	5820.8456
490.00		.027510	259.903	.84360	.537240	.201989	5822.9571
500.00		.027507	259.928	.84353	.537189	.202057	5825.0658
510.00		.027505	259.953	.84347	.537139	.202126	5827.1717
520.00		.027502	259.978	.84341	.537090	.202195	5829.2747
530.00		.027499	260.003	.84335	.537040	.202263	5831.3750
540.00		.027496	260.029	.84329	.536991	.202332	5833.4725
550.00		.027494	260.054	.84323	.536941	.202400	5835.5672
560.00		.027491	260.079	.84317	.536893	.202469	5837.6592
570.00		.027488	260.104	.84311	.536844	.202537	5839.7484

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -30. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	10.712281	447.466	1.32993	.320292	.245680	794.7465
20.00		5.218020	445.592	1.29397	.333275	.251102	780.5533
26.27	SAT. VAPOR	3.904428	444.371	1.27898	.342265	.254631	771.2697
26.27	SAT. LIQUID	.027993	263.950	.85940	.543138	.216796	5261.5270
30.0	COMPRESSED LIQUID	.027991	263.959	.85937	.543109	.216820	5262.4575
40.00		.027988	263.982	.85931	.543034	.216887	5264.9483
50.00		.027985	264.006	.85924	.542959	.216953	5267.4353
60.00		.027982	264.029	.85918	.542885	.217019	5269.9185
70.00		.027978	264.053	.85911	.542810	.217085	5272.3978
80.00		.027975	264.077	.85904	.542737	.217151	5274.8734
90.00		.027972	264.100	.85898	.542663	.217217	5277.3451
100.00		.027969	264.124	.85891	.542590	.217284	5279.8131
110.00		.027965	264.148	.85885	.542517	.217350	5282.2774
120.00		.027962	264.171	.85878	.542445	.217416	5284.7379
130.00		.027959	264.195	.85872	.542373	.217482	5287.1947
140.00		.027956	264.219	.85865	.542301	.217548	5289.6477
150.00		.027952	264.243	.85859	.542230	.217614	5292.0971
160.00		.027949	264.267	.85852	.542159	.217679	5294.5427
170.00		.027946	264.291	.85846	.542089	.217745	5296.9847
180.00		.027943	264.314	.85839	.542018	.217811	5299.4230
190.00		.027940	264.338	.85833	.541949	.217877	5301.8577
200.00		.027936	264.362	.85826	.541879	.217943	5304.2887
210.00		.027933	264.386	.85820	.541810	.218009	5306.7161
220.00		.027930	264.410	.85814	.541741	.218074	5309.1399
230.00		.027927	264.434	.85807	.541673	.218140	5311.5601
240.00		.027924	264.458	.85801	.541605	.218206	5313.9767
250.00		.027920	264.482	.85794	.541537	.218271	5316.3897
260.00		.027917	264.506	.85788	.541469	.218337	5318.7991
270.00		.027914	264.530	.85781	.541402	.218403	5321.2050
280.00		.027911	264.554	.85775	.541335	.218468	5323.6074
290.00		.027908	264.579	.85769	.541269	.218534	5326.0062
300.00		.027905	264.603	.85762	.541203	.218599	5328.4015
310.00		.027901	264.627	.85756	.541137	.218665	5330.7933
320.00		.027898	264.651	.85749	.541072	.218730	5333.1816
330.00		.027895	264.675	.85743	.541007	.218795	5335.5664
340.00		.027892	264.699	.85737	.540942	.218861	5337.9478
350.00		.027889	264.724	.85730	.540877	.218926	5340.3256
360.00		.027886	264.748	.85724	.540813	.218992	5342.7001
370.00		.027883	264.772	.85718	.540749	.219057	5345.0711
380.00		.027880	264.797	.85711	.540686	.219122	5347.4387
390.00		.027876	264.821	.85705	.540623	.219187	5349.8028
400.00		.027873	264.845	.85699	.540560	.219253	5352.1636
410.00		.027870	264.870	.85692	.540497	.219318	5354.5210
420.00		.027867	264.894	.85686	.540435	.219383	5356.8750
430.00		.027864	264.918	.85680	.540373	.219448	5359.2256
440.00		.027861	264.943	.85673	.540311	.219513	5361.5729
450.00		.027858	264.967	.85667	.540250	.219578	5363.9168
460.00		.027855	264.992	.85661	.540189	.219643	5366.2574
470.00		.027852	265.016	.85654	.540128	.219708	5368.5947
480.00		.027849	265.041	.85648	.540068	.219773	5370.9286
490.00		.027846	265.065	.85642	.540008	.219838	5373.2593
500.00		.027843	265.090	.85636	.539948	.219903	5375.5866
510.00		.027840	265.115	.85629	.539888	.219968	5377.9107
520.00		.027836	265.139	.85623	.539829	.220033	5380.2315
530.00		.027833	265.164	.85617	.539770	.220098	5382.5491
540.00		.027830	265.188	.85611	.539711	.220163	5384.8633
550.00		.027827	265.213	.85604	.539653	.220228	5387.1744
560.00		.027824	265.238	.85598	.539595	.220292	5389.4822
570.00		.027821	265.262	.85592	.539537	.220357	5391.7869

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -20. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	10.983675	450.494	1.33749	.324379	.253004	798.9042
20.00		5.362650	448.743	1.30181	.336119	.257953	785.9016
30.00		3.485276	446.914	1.27957	.349248	.263112	772.2563
32.63	SAT. VAPOR	3.181712	446.417	1.27476	.352977	.264509	768.5437
32.63	SAT. LIQUID	.028351	269.217	.87203	.546703	.233378	4870.0158
40.0	COMPRESSED LIQUID	.028348	269.234	.87198	.546637	.233424	4872.0115
50.00		.028344	269.257	.87191	.546548	.233486	4874.7167
60.00		.028340	269.280	.87185	.546459	.233548	4877.4173
70.00		.028337	269.303	.87178	.546371	.233610	4880.1136
80.00		.028333	269.325	.87171	.546284	.233673	4882.8054
90.00		.028330	269.348	.87164	.546196	.233735	4885.4928
100.00		.028326	269.371	.87158	.546110	.233797	4888.1759
110.00		.028322	269.394	.87151	.546023	.233859	4890.8546
120.00		.028319	269.417	.87144	.545937	.233921	4893.5289
130.00		.028315	269.440	.87138	.545852	.233983	4896.1989
140.00		.028311	269.463	.87131	.545767	.234045	4898.8646
150.00		.028308	269.486	.87124	.545683	.234107	4901.5260
160.00		.028304	269.509	.87118	.545598	.234169	4904.1832
170.00		.028301	269.532	.87111	.545515	.234231	4906.8360
180.00		.028297	269.555	.87104	.545432	.234293	4909.4846
190.00		.028293	269.579	.87098	.545349	.234355	4912.1290
200.00		.028290	269.602	.87091	.545266	.234417	4914.7691
210.00		.028286	269.625	.87084	.545184	.234479	4917.4051
220.00		.028283	269.648	.87078	.545103	.234541	4920.0368
230.00		.028279	269.671	.87071	.545022	.234602	4922.6644
240.00		.028276	269.695	.87065	.544941	.234664	4925.2879
250.00		.028272	269.718	.87058	.544861	.234726	4927.9072
260.00		.028269	269.741	.87051	.544781	.234788	4930.5223
270.00		.028265	269.765	.87045	.544701	.234849	4933.1334
280.00		.028261	269.788	.87038	.544622	.234911	4935.7403
290.00		.028258	269.811	.87032	.544544	.234973	4938.3432
300.00		.028254	269.835	.87025	.544465	.235034	4940.9420
310.00		.028251	269.858	.87019	.544387	.235096	4943.5368
320.00		.028247	269.882	.87012	.544310	.235158	4946.1275
330.00		.028244	269.905	.87005	.544233	.235219	4948.7142
340.00		.028240	269.929	.86999	.544156	.235281	4951.2969
350.00		.028237	269.952	.86992	.544080	.235342	4953.8756
360.00		.028233	269.976	.86986	.544004	.235404	4956.4504
370.00		.028230	269.999	.86979	.543928	.235465	4959.0211
380.00		.028226	270.023	.86973	.543853	.235527	4961.5879
390.00		.028223	270.047	.86966	.543778	.235588	4964.1508
400.00		.028220	270.070	.86960	.543704	.235649	4966.7098
410.00		.028216	270.094	.86953	.543630	.235711	4969.2648
420.00		.028213	270.118	.86947	.543556	.235772	4971.8160
430.00		.028209	270.142	.86940	.543483	.235835	4974.3633
440.00		.028206	270.165	.86934	.543410	.235895	4976.9067
450.00		.028202	270.189	.86928	.543338	.235956	4979.4462
460.00		.028199	270.213	.86921	.543265	.236017	4981.9820
470.00		.028196	270.237	.86915	.543194	.236078	4984.5139
480.00		.028192	270.261	.86908	.543122	.236140	4987.0420
490.00		.028189	270.284	.86902	.543051	.236201	4989.5662
500.00		.028185	270.308	.86895	.542980	.236262	4992.0867
510.00		.028182	270.332	.86889	.542910	.236323	4994.6035
520.00		.028179	270.356	.86883	.542840	.236384	4997.1165
530.00		.028175	270.380	.86876	.542770	.236445	4999.6257
540.00		.028172	270.404	.86870	.542701	.236506	5002.1312
550.00		.028168	270.428	.86863	.542632	.236567	5004.6330
560.00		.028165	270.452	.86857	.542563	.236628	5007.1310
570.00		.028162	270.476	.86851	.542495	.236689	5009.6254

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -10. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	11.253700	453.588	1.34497	.328560	.260201	803.2800
20.00		5.505757	451.950	1.30955	.339215	.264729	791.3214
30.00		3.586666	450.245	1.28759	.350997	.269429	778.8267
40.00		2.624466	446.464	1.27105	.364165	.274324	765.7142
40.11	SAT. VAPOR	2.616770	448.444	1.27089	.364314	.274378	765.5706
40.11	SAT. LIQUID	.028718	274.551	.88446	.550681	.248668	4528.9960
50.0	COMPRESSED LIQUID	.028714	274.572	.88439	.550577	.248726	4531.8786
60.00		.028710	274.594	.88432	.550472	.248784	4534.7872
70.00		.028706	274.616	.88425	.550367	.248842	4537.6907
80.00		.028702	274.638	.88418	.550263	.248900	4540.5890
90.00		.028698	274.660	.88411	.550160	.248958	4543.4822
100.00		.028694	274.682	.88404	.550057	.249016	4546.3704
110.00		.028690	274.704	.88398	.549954	.249074	4549.2535
120.00		.028686	274.726	.88391	.549853	.249132	4552.1315
130.00		.028682	274.748	.88384	.549751	.249190	4555.0046
140.00		.028678	274.770	.88377	.549651	.249248	4557.8727
150.00		.028674	274.792	.88370	.549550	.249306	4560.7358
160.00		.028670	274.814	.88363	.549451	.249364	4563.5939
170.00		.028665	274.836	.88356	.549352	.249422	4566.4471
180.00		.028661	274.858	.88349	.549253	.249480	4569.2954
190.00		.028657	274.881	.88343	.549155	.249537	4572.1388
200.00		.028653	274.903	.88336	.549058	.249595	4574.9774
210.00		.028649	274.925	.88329	.548961	.249653	4577.8111
220.00		.028645	274.948	.88322	.548864	.249711	4580.6399
230.00		.028641	274.970	.88315	.548768	.249769	4583.4640
240.00		.028637	274.992	.88308	.548673	.249826	4586.2832
250.00		.028634	275.015	.88302	.548578	.249884	4589.0977
260.00		.028630	275.037	.88295	.548483	.249942	4591.9074
270.00		.028626	275.060	.88288	.548389	.250000	4594.7124
280.00		.028622	275.082	.88281	.548296	.250057	4597.5127
290.00		.028618	275.105	.88275	.548203	.250115	4600.3083
300.00		.028614	275.127	.88268	.548110	.250173	4603.0992
310.00		.028610	275.150	.88261	.548018	.250230	4605.8854
320.00		.028606	275.173	.88254	.547927	.250288	4608.6670
330.00		.028602	275.195	.88248	.547835	.250345	4611.4440
340.00		.028598	275.218	.88241	.547745	.250403	4614.2164
350.00		.028594	275.241	.88234	.547655	.250461	4616.9842
360.00		.028590	275.263	.88227	.547565	.250518	4619.7474
370.00		.028587	275.286	.88221	.547476	.250576	4622.5060
380.00		.028583	275.309	.88214	.547387	.250633	4625.2602
390.00		.028579	275.332	.88207	.547299	.250690	4628.0098
400.00		.028575	275.355	.88201	.547211	.250748	4630.7549
410.00		.028571	275.377	.88194	.547124	.250805	4633.4955
420.00		.028567	275.400	.88187	.547037	.250863	4636.2317
430.00		.028563	275.423	.88181	.546950	.250920	4638.9634
440.00		.028560	275.446	.88174	.546864	.250978	4641.6907
450.00		.028556	275.469	.88167	.546779	.251035	4644.4136
460.00		.028552	275.492	.88161	.546694	.251092	4647.1321
470.00		.028548	275.515	.88154	.546609	.251150	4649.8462
480.00		.028544	275.539	.88148	.546525	.251207	4652.5559
490.00		.028541	275.562	.88141	.546441	.251264	4655.2613
500.00		.028537	275.585	.88134	.546358	.251321	4657.9624
510.00		.028533	275.608	.88128	.546275	.251379	4660.6591
520.00		.028529	275.631	.88121	.546192	.251436	4663.3516
530.00		.028525	275.654	.88115	.546110	.251493	4666.0397
540.00		.028522	275.678	.88108	.546029	.251550	4668.7236
550.00		.028518	275.701	.88102	.545947	.251607	4671.4033
560.00		.028514	275.724	.88095	.545866	.251664	4674.0787
570.00		.028510	275.747	.88088	.545786	.251722	4676.7499

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 0. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
	SUPERHEATED						
10.00	VAPOR	11.522503	456.750	1.35239	.332823	.267262	807.8736
20.00		5.647519	455.212	1.31719	.342526	.271414	796.8352
30.00		3.686560	453.619	1.29548	.353150	.275708	785.3467
40.00		2.703863	451.963	1.27921	.364865	.280160	773.3469
48.81	SAT. VAPOR	2.170223	450.445	1.26734	.376337	.284230	762.2966
48.81	SAT. LIQUID	.029098	279.952	.89670	.555150	.262829	4226.7284
50.0	COMPRESSED	.029097	279.954	.89669	.555135	.262836	4227.1008
60.00	LIQUID	.029093	279.975	.89662	.555010	.262890	4230.2173
70.00		.029088	279.996	.89655	.554886	.262943	4233.3279
80.00		.029083	280.017	.89648	.554762	.262997	4236.4326
90.00		.029079	280.037	.89640	.554639	.263051	4239.5313
100.00		.029074	280.058	.89633	.554517	.263105	4242.6241
110.00		.029070	280.079	.89626	.554396	.263158	4245.7111
120.00		.029065	280.100	.89619	.554275	.263212	4248.7922
130.00		.029060	280.121	.89612	.554155	.263266	4251.8676
140.00		.029056	280.142	.89605	.554035	.263319	4254.9371
150.00		.029051	280.163	.89598	.553917	.263373	4258.0009
160.00		.029047	280.184	.89591	.553799	.263427	4261.0589
170.00		.029042	280.205	.89583	.553681	.263480	4264.1113
180.00		.029038	280.226	.89576	.553564	.263534	4267.1580
190.00		.029033	280.248	.89569	.553448	.263588	4270.1990
200.00		.029029	280.269	.89562	.553333	.263641	4273.2344
210.00		.029024	280.290	.89555	.553218	.263695	4276.2641
220.00		.029020	280.311	.89548	.553104	.263748	4279.2883
230.00		.029015	280.333	.89541	.552990	.263802	4282.3070
240.00		.029011	280.354	.89534	.552877	.263855	4285.3201
250.00		.029006	280.375	.89527	.552765	.263909	4288.3277
260.00		.029002	280.397	.89520	.552653	.263962	4291.3298
270.00		.028998	280.418	.89513	.552542	.264016	4294.3265
280.00		.028993	280.440	.89506	.552431	.264069	4297.3178
290.00		.028989	280.461	.89499	.552321	.264123	4300.3036
300.00		.028984	280.483	.89492	.552212	.264176	4303.2840
310.00		.028980	280.504	.89485	.552103	.264230	4306.2591
320.00		.028976	280.526	.89478	.551995	.264283	4309.2288
330.00		.028971	280.548	.89471	.551888	.264337	4312.1933
340.00		.028967	280.569	.89464	.551781	.264390	4315.1524
350.00		.028962	280.591	.89457	.551674	.264444	4318.1062
360.00		.028958	280.613	.89450	.551569	.264497	4321.0548
370.00		.028954	280.635	.89443	.551463	.264550	4323.9982
380.00		.028949	280.657	.89437	.551359	.264604	4326.9364
390.00		.028945	280.678	.89430	.551255	.264657	4329.8694
400.00		.028941	280.700	.89423	.551151	.264711	4332.7972
410.00		.028936	280.722	.89416	.551048	.264764	4335.7199
420.00		.028932	280.744	.89409	.550946	.264817	4338.6375
430.00		.028928	280.766	.89402	.550844	.264870	4341.5499
440.00		.028924	280.788	.89395	.550743	.264924	4344.4573
450.00		.028919	280.810	.89388	.550642	.264977	4347.3597
460.00		.028915	280.832	.89382	.550542	.265030	4350.2570
470.00		.028911	280.855	.89375	.550442	.265084	4353.1493
480.00		.028907	280.877	.89368	.550343	.265137	4356.0366
490.00		.028902	280.899	.89361	.550244	.265190	4358.9189
500.00		.028898	280.921	.89354	.550146	.265243	4361.7963
510.00		.028894	280.943	.89348	.550049	.265297	4364.6688
520.00		.028890	280.966	.89341	.549951	.265350	4367.5363
530.00		.028886	280.988	.89334	.549855	.265403	4370.3990
540.00		.028881	281.010	.89327	.549759	.265456	4373.2568
550.00		.028877	281.033	.89321	.549663	.265509	4376.1097
560.00		.028873	281.055	.89314	.549568	.265562	4378.9578
570.00		.028869	281.078	.89307	.549474	.265615	4381.8011

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 10. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
	SUPERHEATED						
10.00	VAPOR	11.790212	459.976	1.35975	.337159	.274179	812.6813
20.00		5.788089	458.532	1.32475	.346021	.277995	802.4579
30.00		3.785143	457.040	1.30325	.355643	.281928	791.8544
40.00		2.781805	455.495	1.28722	.366164	.285991	780.8245
50.00		2.176131	453.890	1.27413	.377764	.290199	769.3124
58.85	SAT. VAPOR	1.813599	452.414	1.26406	.389120	.294060	758.6652
58.85	SAT. LIQUID	.029490	285.425	.90877	.560186	.276002	3954.8528
60.0	COMPRESSED	.029490	285.427	.90876	.560169	.276008	3955.2349
70.00	LIQUID	.029484	285.447	.90869	.560021	.276057	3958.5600
80.00		.029479	285.466	.90861	.559874	.276106	3961.8781
90.00		.029474	285.486	.90854	.559728	.276155	3965.1893
100.00		.029469	285.505	.90846	.559582	.276205	3968.4937
110.00		.029464	285.525	.90839	.559438	.276254	3971.7912
120.00		.029458	285.544	.90831	.559294	.276303	3975.0819
130.00		.029453	285.564	.90824	.559151	.276352	3978.3659
140.00		.029448	285.584	.90817	.559009	.276401	3981.6432
150.00		.029443	285.603	.90809	.558868	.276450	3984.9137
160.00		.029438	285.623	.90802	.558728	.276499	3988.1776
170.00		.029433	285.643	.90794	.558589	.276548	3991.4349
180.00		.029428	285.663	.90787	.558450	.276598	3994.6855
190.00		.029423	285.683	.90780	.558312	.276647	3997.9296
200.00		.029418	285.703	.90772	.558175	.276696	4001.1672
210.00		.029413	285.723	.90765	.558039	.276745	4004.3983
220.00		.029408	285.743	.90758	.557903	.276794	4007.6229
230.00		.029402	285.763	.90750	.557769	.276843	4010.8411
240.00		.029397	285.783	.90743	.557635	.276892	4014.0528
250.00		.029392	285.803	.90736	.557502	.276941	4017.2582
260.00		.029387	285.823	.90728	.557370	.276991	4020.4573
270.00		.029382	285.844	.90721	.557238	.277040	4023.6500
280.00		.029378	285.864	.90714	.557107	.277089	4026.8365
290.00		.029373	285.884	.90707	.556977	.277138	4030.0167
300.00		.029368	285.905	.90699	.556848	.277187	4033.1907
310.00		.029363	285.925	.90692	.556719	.277236	4036.3585
320.00		.029358	285.945	.90685	.556592	.277285	4039.5201
330.00		.029353	285.966	.90678	.556465	.277334	4042.6756
340.00		.029348	285.986	.90671	.556338	.277383	4045.8250
350.00		.029343	286.007	.90664	.556213	.277432	4048.9683
360.00		.029338	286.028	.90656	.556088	.277481	4052.1055
370.00		.029333	286.048	.90649	.555963	.277531	4055.2368
380.00		.029328	286.069	.90642	.555840	.277580	4058.3620
390.00		.029324	286.090	.90635	.555717	.277629	4061.4813
400.00		.029319	286.111	.90628	.555595	.277678	4064.5947
410.00		.029314	286.131	.90621	.555474	.277727	4067.7021
420.00		.029309	286.152	.90614	.555353	.277776	4070.8037
430.00		.029304	286.173	.90606	.555233	.277825	4073.8994
440.00		.029300	286.194	.90599	.555113	.277874	4076.9892
450.00		.029295	286.215	.90592	.554995	.277923	4080.0733
460.00		.029290	286.236	.90585	.554877	.277972	4083.1516
470.00		.029285	286.257	.90578	.554759	.278021	4086.2242
480.00		.029281	286.278	.90571	.554643	.278070	4089.2910
490.00		.029276	286.299	.90564	.554526	.278119	4092.3521
500.00		.029271	286.321	.90557	.554411	.278168	4095.4076
510.00		.029266	286.342	.90550	.554296	.278217	4098.4574
520.00		.029262	286.363	.90543	.554182	.278266	4101.5016
530.00		.029257	286.384	.90536	.554068	.278315	4104.5402
540.00		.029252	286.406	.90529	.553956	.278364	4107.5732
550.00		.029248	286.427	.90522	.553843	.278413	4110.6007
560.00		.029243	286.448	.90515	.553732	.278462	4113.6227
570.00		.029238	286.470	.90508	.553621	.278511	4116.6392

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 20. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	12.056941	463.268	1.36704	.341560	.280948	817.6966
20.00		5.927595	461.908	1.33222	.349677	.284463	808.1984
30.00		3.882570	460.508	1.31092	.358424	.288074	798.3776
40.00		2.858476	459.063	1.29510	.367905	.291793	788.1987
50.00		2.242621	457.568	1.28224	.378251	.295629	777.6198
60.00		1.830751	456.017	1.27120	.389631	.299596	766.5908
70.00		1.535303	454.403	1.26138	.402263	.303712	755.0507
70.37	SAT. VAPOR	1.526044	454.343	1.26103	.402753	.303866	754.6171
70.37	SAT. LIQUID	.029898	290.974	.92068	.565874	.288310	3707.2068
80.0	COMPRESSED	.029892	290.991	.92061	.565705	.288352	3710.6220
90.00	LIQUID	.029886	291.009	.92053	.565530	.288397	3714.1592
100.00		.029880	291.027	.92045	.565356	.288441	3717.6883
110.00		.029874	291.045	.92037	.565183	.288485	3721.2094
120.00		.029868	291.063	.92030	.565012	.288529	3724.7226
130.00		.029863	291.081	.92022	.564841	.288573	3728.2279
140.00		.029857	291.099	.92014	.564672	.288618	3731.7252
150.00		.029851	291.118	.92006	.564504	.288662	3735.2148
160.00		.029845	291.136	.91999	.564336	.288706	3738.6965
170.00		.029839	291.154	.91991	.564170	.288751	3742.1705
180.00		.029834	291.172	.91983	.564005	.288795	3745.6368
190.00		.029828	291.191	.91976	.563841	.288839	3749.0954
200.00		.029822	291.209	.91968	.563678	.288884	3752.5464
210.00		.029816	291.228	.91960	.563515	.288928	3755.9898
220.00		.029811	291.246	.91953	.563354	.288972	3759.4257
230.00		.029805	291.265	.91945	.563194	.289017	3762.8541
240.00		.029799	291.284	.91938	.563035	.289061	3766.2750
250.00		.029794	291.302	.91930	.562877	.289105	3769.6885
260.00		.029788	291.321	.91922	.562720	.289150	3773.0947
270.00		.029783	291.340	.91915	.562564	.289194	3776.4934
280.00		.029777	291.359	.91907	.562408	.289239	3779.8849
290.00		.029771	291.378	.91900	.562254	.289283	3783.2692
300.00		.029766	291.397	.91892	.562101	.289328	3786.6462
310.00		.029760	291.416	.91885	.561948	.289372	3790.0160
320.00		.029755	291.435	.91877	.561797	.289416	3793.3787
330.00		.029749	291.454	.91870	.561646	.289461	3796.7342
340.00		.029744	291.473	.91862	.561497	.289505	3800.0827
350.00		.029738	291.492	.91855	.561348	.289550	3803.4241
360.00		.029733	291.512	.91847	.561200	.289594	3806.7586
370.00		.029727	291.531	.91840	.561053	.289639	3810.0861
380.00		.029722	291.550	.91832	.560907	.289683	3813.4066
390.00		.029716	291.570	.91825	.560762	.289728	3816.7203
400.00		.029711	291.589	.91818	.560618	.289772	3820.0271
410.00		.029705	291.609	.91810	.560474	.289817	3823.3271
420.00		.029700	291.628	.91803	.560332	.289862	3826.6203
430.00		.029695	291.648	.91795	.560190	.289906	3829.9067
440.00		.029689	291.667	.91788	.560049	.289951	3833.1864
450.00		.029684	291.687	.91781	.559909	.289995	3836.4594
460.00		.029679	291.707	.91773	.559770	.290040	3839.7258
470.00		.029673	291.727	.91766	.559631	.290084	3842.9855
480.00		.029668	291.746	.91759	.559494	.290129	3846.2387
490.00		.029663	291.766	.91751	.559357	.290174	3849.4853
500.00		.029657	291.786	.91744	.559221	.290218	3852.7254
510.00		.029652	291.806	.91737	.559086	.290263	3855.9590
520.00		.029647	291.826	.91730	.558951	.290307	3859.1861
530.00		.029641	291.846	.91722	.558817	.290352	3862.4068
540.00		.029636	291.866	.91715	.558685	.290397	3865.6212
550.00		.029631	291.886	.91708	.558552	.290441	3868.8291
560.00		.029626	291.907	.91701	.558421	.290486	3872.0307
570.00		.029620	291.927	.91693	.558291	.290530	3875.2260

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 30. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
	SUPERHEATED						
10.00	VAPOR	12.322788	466.623	1.37428	.346017	.287567	822.9113
20.00		6.066158	465.341	1.33962	.353471	.290810	814.0612
30.00		3.978971	464.024	1.31849	.361451	.294134	804.9360
40.00		2.934033	462.669	1.30285	.370034	.297546	795.5082
50.00		2.305890	461.272	1.29019	.379319	.301054	785.7460
60.00		1.886044	459.829	1.27938	.389426	.304669	775.6120
70.00		1.585121	458.333	1.26980	.400508	.308402	765.0618
80.00		1.358416	456.780	1.26109	.412764	.312268	754.0415
83.48	SAT. VAPOR	1.292096	456.226	1.25822	.417343	.313645	750.0899
83.48	SAT. LIQUID	.030322	296.604	.93246	.572308	.299860	3479.1127
90.0	COMPRESSED	.030318	296.614	.93240	.572171	.299885	3481.5799
100.00	LIQUID	.030311	296.630	.93232	.571962	.299924	3485.3535
110.00		.030304	296.646	.93224	.571755	.299963	3489.1176
120.00		.030298	296.662	.93216	.571548	.300002	3492.8723
130.00		.030291	296.679	.93208	.571344	.300041	3496.6176
140.00		.030284	296.695	.93200	.571140	.300080	3500.3536
150.00		.030278	296.711	.93192	.570938	.300119	3504.0804
160.00		.030271	296.728	.93183	.570738	.300158	3507.7980
170.00		.030265	296.744	.93175	.570538	.300197	3511.5065
180.00		.030258	296.761	.93167	.570341	.300236	3515.2059
190.00		.030252	296.777	.93159	.570144	.300275	3518.8963
200.00		.030245	296.794	.93151	.569949	.300314	3522.5777
210.00		.030239	296.811	.93143	.569755	.300354	3526.2503
220.00		.030232	296.827	.93135	.569562	.300393	3529.9139
230.00		.030226	296.844	.93127	.569371	.300432	3533.5688
240.00		.030219	296.861	.93119	.569181	.300471	3537.2149
250.00		.030213	296.878	.93111	.568992	.300511	3540.8523
260.00		.030207	296.895	.93103	.568805	.300550	3544.4811
270.00		.030200	296.912	.93096	.568618	.300589	3548.1013
280.00		.030194	296.930	.93088	.568433	.300629	3551.7129
290.00		.030188	296.947	.93080	.568250	.300668	3555.3161
300.00		.030181	296.964	.93072	.568067	.300708	3558.9108
310.00		.030175	296.981	.93064	.567885	.300747	3562.4971
320.00		.030169	296.999	.93056	.567705	.300786	3566.0750
330.00		.030162	297.016	.93048	.567526	.300826	3569.6447
340.00		.030156	297.034	.93041	.567348	.300866	3573.2061
350.00		.030150	297.051	.93033	.567171	.300905	3576.7593
360.00		.030144	297.069	.93025	.566996	.300945	3580.3044
370.00		.030138	297.087	.93017	.566821	.300984	3583.8413
380.00		.030131	297.105	.93009	.566648	.301024	3587.3702
390.00		.030125	297.122	.93002	.566476	.301064	3590.8911
400.00		.030119	297.140	.92994	.566305	.301103	3594.4040
410.00		.030113	297.158	.92986	.566134	.301143	3597.9089
420.00		.030107	297.176	.92979	.565965	.301183	3601.4060
430.00		.030101	297.194	.92971	.565798	.301222	3604.8953
440.00		.030095	297.212	.92963	.565631	.301262	3608.3767
450.00		.030089	297.230	.92955	.565465	.301302	3611.8505
460.00		.030083	297.249	.92948	.565300	.301342	3615.3164
470.00		.030077	297.267	.92940	.565136	.301381	3618.7748
480.00		.030071	297.285	.92933	.564974	.301421	3622.2255
490.00		.030065	297.304	.92925	.564812	.301461	3625.6686
500.00		.030059	297.322	.92917	.564651	.301501	3629.1042
510.00		.030053	297.341	.92910	.564492	.301541	3632.5323
520.00		.030047	297.359	.92902	.564333	.301581	3635.9529
530.00		.030041	297.378	.92895	.564175	.301621	3639.3661
540.00		.030035	297.396	.92887	.564018	.301661	3642.7719
550.00		.030029	297.415	.92880	.563863	.301701	3646.1704
560.00		.030023	297.434	.92872	.563708	.301741	3649.5616
570.00		.030017	297.453	.92865	.563554	.301781	3652.9456

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 40. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	12.587838	470.040	1.38146	.350526	.294036	828.3154
20.00		6.203867	468.830	1.34694	.357387	.297032	820.0471
30.00		4.074459	467.590	1.32596	.364689	.300097	811.5430
40.00		3.008604	466.316	1.31050	.372492	.303236	802.7818
50.00		2.368090	465.007	1.29801	.380868	.306454	793.7391
60.00		1.940169	463.659	1.28739	.389906	.309759	784.3868
70.00		1.633652	462.268	1.27802	.399715	.313160	774.6917
80.00		1.402933	460.830	1.26955	.410434	.316665	764.6148
90.00		1.222661	459.339	1.26172	.422237	.320288	754.1095
98.31	SAT. VAPOR	1.100158	458.055	1.25558	.433028	.323398	745.0169
98.31	SAT. LIQUID	.030766	302.319	.94411	.579600	.310749	3266.9264
100.0	COMPRESSED	.030765	302.322	.94410	.579557	.310755	3267.6105
110.00	LIQUID	.030757	302.335	.94401	.579305	.310788	3271.6440
120.00		.030750	302.349	.94392	.579055	.310821	3275.6664
130.00		.030742	302.363	.94384	.578807	.310854	3279.6775
140.00		.030734	302.377	.94375	.578561	.310887	3283.6776
150.00		.030727	302.391	.94367	.578317	.310920	3287.6666
160.00		.030719	302.406	.94358	.578075	.310954	3291.6447
170.00		.030712	302.420	.94350	.577834	.310987	3295.6120
180.00		.030704	302.434	.94341	.577595	.311020	3299.5685
190.00		.030697	302.449	.94333	.577358	.311054	3303.5142
200.00		.030690	302.463	.94324	.577123	.311087	3307.4493
210.00		.030682	302.478	.94316	.576889	.311121	3311.3739
220.00		.030675	302.492	.94307	.576658	.311154	3315.2879
230.00		.030667	302.507	.94299	.576427	.311188	3319.1916
240.00		.030660	302.522	.94291	.576199	.311221	3323.0848
250.00		.030653	302.537	.94282	.575972	.311255	3326.9678
260.00		.030646	302.552	.94274	.575747	.311289	3330.8406
270.00		.030638	302.567	.94266	.575523	.311323	3334.7032
280.00		.030631	302.582	.94257	.575301	.311356	3338.5557
290.00		.030624	302.597	.94249	.575081	.311390	3342.3982
300.00		.030617	302.613	.94241	.574862	.311424	3346.2308
310.00		.030610	302.628	.94232	.574645	.311458	3350.0535
320.00		.030602	302.644	.94224	.574429	.311492	3353.8663
330.00		.030595	302.659	.94216	.574215	.311526	3357.6694
340.00		.030588	302.675	.94208	.574002	.311561	3361.4628
350.00		.030581	302.690	.94200	.573791	.311595	3365.2466
360.00		.030574	302.706	.94191	.573581	.311629	3369.0208
370.00		.030567	302.722	.94183	.573373	.311663	3372.7855
380.00		.030560	302.738	.94175	.573166	.311698	3376.5407
390.00		.030553	302.754	.94167	.572960	.311732	3380.2866
400.00		.030546	302.770	.94159	.572756	.311766	3384.0231
410.00		.030539	302.786	.94151	.572554	.311801	3387.7503
420.00		.030532	302.802	.94143	.572352	.311835	3391.4683
430.00		.030526	302.818	.94135	.572152	.311870	3395.1772
440.00		.030519	302.834	.94127	.571954	.311904	3398.8769
450.00		.030512	302.851	.94119	.571757	.311939	3402.5676
460.00		.030505	302.867	.94111	.571561	.311974	3406.2493
470.00		.030498	302.884	.94103	.571366	.312008	3409.9221
480.00		.030491	302.900	.94095	.571173	.312043	3413.5860
490.00		.030485	302.917	.94087	.570981	.312078	3417.2410
500.00		.030478	302.933	.94079	.570791	.312113	3420.8873
510.00		.030471	302.950	.94071	.570601	.312148	3424.5249
520.00		.030464	302.967	.94063	.570413	.312182	3428.1538
530.00		.030458	302.984	.94055	.570226	.312217	3431.7741
540.00		.030451	303.001	.94047	.570041	.312252	3435.3858
550.00		.030444	303.018	.94039	.569856	.312287	3438.9890
560.00		.030438	303.035	.94031	.569673	.312322	3442.5837
570.00		.030431	303.052	.94023	.569491	.312357	3446.1700

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 50. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	12.852168	473.519	1.38858	.355081	.300351	833.8980
20.00		6.340811	472.375	1.35420	.361410	.303127	826.1539
30.00		4.169132	471.204	1.33336	.368111	.305960	818.2070
40.00		3.082302	470.005	1.31804	.375230	.308854	810.0405
50.00		2.429350	468.776	1.30572	.382822	.311814	801.6356
60.00		1.993276	467.514	1.29526	.390952	.314845	792.9707
70.00		1.681075	466.216	1.28608	.399700	.317953	784.0211
80.00		1.446234	464.878	1.27780	.409163	.321146	774.7578
90.00		1.262904	463.497	1.27019	.419464	.324433	765.1470
100.00		1.115568	462.067	1.26308	.430755	.327822	755.1488
110.00		.994335	460.584	1.25635	.443233	.331327	744.7151
114.99	SAT. VAPOR	.941441	459.821	1.25310	.449982	.333124	739.3264
114.99	SAT. LIQUID	.031233	308.127	.95566	.587884	.321064	3067.7420
120.0	COMPRESSED LIQUID	.031229	308.133	.95562	.587731	.321078	3069.9063
130.00		.031220	308.144	.95552	.587427	.321104	3074.2174
140.00		.031211	308.155	.95543	.587127	.321130	3078.5151
150.00		.031202	308.167	.95534	.586828	.321157	3082.7995
160.00		.031194	308.178	.95525	.586532	.321184	3087.0707
170.00		.031185	308.190	.95516	.586239	.321211	3091.3289
180.00		.031177	308.202	.95507	.585948	.321237	3095.5741
190.00		.031168	308.213	.95498	.585658	.321264	3099.8064
200.00		.031159	308.225	.95489	.585373	.321291	3104.0259
210.00		.031151	308.237	.95480	.585089	.321319	3108.2328
220.00		.031143	308.249	.95471	.584807	.321346	3112.4271
230.00		.031134	308.262	.95462	.584528	.321373	3116.6089
240.00		.031126	308.274	.95454	.584251	.321400	3120.7783
250.00		.031117	308.286	.95445	.583976	.321428	3124.9354
260.00		.031109	308.299	.95436	.583703	.321456	3129.0803
270.00		.031101	308.312	.95427	.583432	.321483	3133.2130
280.00		.031092	308.324	.95418	.583164	.321511	3137.3338
290.00		.031084	308.337	.95409	.582897	.321539	3141.4426
300.00		.031076	308.350	.95401	.582633	.321567	3145.5396
310.00		.031068	308.363	.95392	.582370	.321594	3149.6248
320.00		.031060	308.376	.95383	.582110	.321623	3153.6983
330.00		.031051	308.389	.95375	.581852	.321651	3157.7602
340.00		.031043	308.402	.95366	.581595	.321679	3161.8107
350.00		.031035	308.416	.95357	.581341	.321707	3165.8497
360.00		.031027	308.429	.95349	.581089	.321735	3169.8774
370.00		.031019	308.443	.95340	.580838	.321764	3173.8938
380.00		.031011	308.456	.95331	.580590	.321792	3177.8990
390.00		.031003	308.470	.95323	.580343	.321821	3181.8931
400.00		.030995	308.484	.95314	.580098	.321849	3185.8762
410.00		.030987	308.498	.95306	.579855	.321878	3189.8483
420.00		.030980	308.511	.95297	.579614	.321907	3193.8096
430.00		.030972	308.525	.95289	.579374	.321936	3197.7600
440.00		.030964	308.540	.95280	.579136	.321965	3201.6998
450.00		.030956	308.554	.95272	.578900	.321993	3205.6289
460.00		.030949	308.568	.95263	.578666	.322023	3209.5474
470.00		.030941	308.582	.95255	.578434	.322052	3213.4554
480.00		.030933	308.597	.95247	.578203	.322081	3217.3530
490.00		.030925	308.611	.95238	.577974	.322110	3221.2402
500.00		.030918	308.626	.95230	.577746	.322139	3225.1172
510.00		.030910	308.641	.95221	.577520	.322169	3228.9839
520.00		.030902	308.655	.95213	.577296	.322198	3232.8404
530.00		.030895	308.670	.95205	.577074	.322227	3236.6869
540.00		.030887	308.685	.95197	.576853	.322257	3240.5233
550.00		.030880	308.700	.95188	.576633	.322286	3244.3498
560.00		.030872	308.715	.95180	.576415	.322316	3248.1664
570.00		.030865	308.730	.95172	.576199	.322346	3251.9732

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 60. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT³/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	13.115845	477.057	1.39566	.359676	.306521	839.6475
20.00		6.477066	475.974	1.36139	.365527	.309096	832.3776
30.00		4.263072	474.868	1.34068	.371693	.311718	824.9324
40.00		3.155221	473.737	1.32549	.378209	.314392	817.2990
50.00		2.489776	472.580	1.31331	.385118	.317121	809.4624
60.00		2.045489	471.395	1.30301	.392469	.319908	801.4063
70.00		1.727532	470.180	1.29398	.400321	.322759	793.1115
80.00		1.488487	468.931	1.28588	.408744	.325678	784.5567
90.00		1.302004	467.647	1.27845	.417823	.328673	775.7187
100.00		1.152265	466.323	1.27155	.427666	.331749	766.5628
110.00		1.029199	464.955	1.26504	.438402	.334916	757.0608
120.00		.926081	463.539	1.25885	.450199	.338183	747.1704
130.00		.838247	462.069	1.25288	.463269	.341561	736.8431
133.66	SAT. VAPOR	.809214	461.516	1.25074	.468427	.342829	732.9406
133.66	SAT. LIQUID	.031726	314.035	.96713	.597332	.330883	2879.1899
140.0	COMPRESSED LIQUID	.031720	314.040	.96707	.597096	.330895	2882.1286
150.00		.031710	314.048	.96697	.596727	.330914	2886.7520
160.00		.031699	314.056	.96687	.596361	.330934	2891.3593
170.00		.031689	314.065	.96678	.595998	.330953	2895.9507
180.00		.031679	314.073	.96668	.595639	.330972	2900.5261
190.00		.031670	314.082	.96658	.595283	.330992	2905.0859
200.00		.031660	314.090	.96649	.594931	.331012	2909.6302
210.00		.031650	314.099	.96639	.594581	.331032	2914.1590
220.00		.031640	314.108	.96630	.594235	.331052	2918.6725
230.00		.031630	314.117	.96620	.593891	.331072	2923.1709
240.00		.031621	314.127	.96611	.593551	.331092	2927.6542
250.00		.031611	314.136	.96601	.593214	.331112	2932.1226
260.00		.031601	314.145	.96592	.592880	.331133	2936.5763
270.00		.031592	314.155	.96582	.592548	.331153	2941.0153
280.00		.031582	314.165	.96573	.592220	.331174	2945.4398
290.00		.031573	314.175	.96564	.591894	.331195	2949.8499
300.00		.031563	314.185	.96554	.591571	.331216	2954.2457
310.00		.031554	314.195	.96545	.591251	.331237	2958.6274
320.00		.031544	314.205	.96536	.590934	.331258	2962.9950
330.00		.031535	314.215	.96526	.590619	.331280	2967.3486
340.00		.031526	314.226	.96517	.590308	.331301	2971.6885
350.00		.031516	314.236	.96508	.589998	.331323	2976.0146
360.00		.031507	314.247	.96499	.589692	.331344	2980.3272
370.00		.031498	314.257	.96490	.589387	.331366	2984.6263
380.00		.031489	314.268	.96481	.589086	.331388	2988.9119
390.00		.031480	314.279	.96471	.588789	.331410	2993.1844
400.00		.031470	314.290	.96462	.588490	.331432	2997.4436
410.00		.031461	314.302	.96453	.588196	.331454	3001.6898
420.00		.031452	314.313	.96444	.587904	.331477	3005.9230
430.00		.031443	314.324	.96435	.587615	.331499	3010.1434
440.00		.031434	314.336	.96426	.587328	.331522	3014.3510
450.00		.031426	314.347	.96417	.587043	.331544	3018.5460
460.00		.031417	314.359	.96408	.586761	.331567	3022.7284
470.00		.031408	314.371	.96400	.586481	.331590	3026.8983
480.00		.031399	314.383	.96391	.586203	.331613	3031.0558
490.00		.031390	314.395	.96382	.585927	.331636	3035.2011
500.00		.031381	314.407	.96373	.585653	.331659	3039.3342
510.00		.031373	314.419	.96364	.585382	.331682	3043.4552
520.00		.031364	314.431	.96355	.585113	.331706	3047.5642
530.00		.031355	314.444	.96347	.584846	.331729	3051.6612
540.00		.031347	314.456	.96338	.584581	.331752	3055.7465
550.00		.031338	314.469	.96329	.584318	.331776	3059.8200
560.00		.031330	314.482	.96320	.584057	.331800	3063.8818
570.00		.031321	314.494	.96312	.583798	.331823	3067.9321

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 70. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
	SUPERHEATED						
10.00	VAPOR	13.378929	480.655	1.40269	.364307	.312546	845.5515
20.00		6.612695	479.627	1.36853	.369727	.314938	838.7120
30.00		4.356354	478.580	1.34793	.375414	.317371	831.7207
40.00		3.227442	477.512	1.33286	.381397	.319846	824.5671
50.00		2.549462	476.422	1.32080	.387708	.322367	817.2397
60.00		2.096912	475.307	1.31063	.394385	.324937	809.7256
70.00		1.773144	474.166	1.30175	.401471	.327559	802.0104
80.00		1.529831	472.997	1.29380	.409019	.330237	794.0774
90.00		1.340119	471.798	1.28654	.417089	.332976	785.9083
100.00		1.187892	470.567	1.27981	.425758	.335781	777.4817
110.00		1.062891	469.299	1.27350	.435114	.338657	768.7729
120.00		.958267	467.992	1.26751	.445270	.341612	759.7534
130.00		.869277	466.642	1.26177	.456363	.344655	750.3896
140.00		.792522	465.244	1.25624	.468571	.347790	740.6418
150.00		.725502	463.793	1.25085	.482119	.351034	730.4619
154.45	SAT. VAPOR	.698272	463.127	1.24848	.488660	.352516	725.7735
154.45	SAT. LIQUID	.032250	320.051	.97853	.608167	.340279	2699.2959
160.0	COMPRESSED	.032243	320.053	.97847	.607912	.340285	2702.0665
170.00	LIQUID	.032231	320.058	.97837	.607457	.340296	2707.0471
180.00		.032220	320.062	.97826	.607006	.340306	2712.0080
190.00		.032208	320.067	.97816	.606560	.340317	2716.9494
200.00		.032197	320.071	.97806	.606118	.340328	2721.8715
210.00		.032185	320.076	.97795	.605681	.340340	2726.7745
220.00		.032174	320.082	.97785	.605249	.340351	2731.6586
230.00		.032162	320.087	.97775	.604821	.340363	2736.5240
240.00		.032151	320.092	.97765	.604397	.340375	2741.3709
250.00		.032139	320.098	.97754	.603977	.340387	2746.1995
260.00		.032128	320.104	.97744	.603561	.340399	2751.0099
270.00		.032117	320.110	.97734	.603150	.340412	2755.8023
280.00		.032106	320.116	.97724	.602743	.340424	2760.5769
290.00		.032095	320.122	.97714	.602339	.340437	2765.3338
300.00		.032084	320.128	.97704	.601940	.340450	2770.0733
310.00		.032073	320.135	.97694	.601544	.340464	2774.7955
320.00		.032062	320.141	.97684	.601152	.340477	2779.5005
330.00		.032051	320.148	.97674	.600764	.340491	2784.1885
340.00		.032040	320.155	.97664	.600380	.340504	2788.8597
350.00		.032029	320.162	.97655	.599999	.340518	2793.5143
360.00		.032019	320.169	.97645	.599622	.340532	2798.1523
370.00		.032008	320.177	.97635	.599248	.340546	2802.7739
380.00		.031997	320.184	.97625	.598878	.340561	2807.3794
390.00		.031987	320.192	.97615	.598511	.340575	2811.9687
400.00		.031976	320.200	.97606	.598148	.340590	2816.5422
410.00		.031966	320.208	.97596	.597788	.340605	2821.0998
420.00		.031955	320.216	.97586	.597431	.340620	2825.6418
430.00		.031945	320.224	.97577	.597077	.340635	2830.1684
440.00		.031935	320.232	.97567	.596727	.340650	2834.6795
450.00		.031924	320.241	.97558	.596380	.340666	2839.1754
460.00		.031914	320.249	.97548	.596035	.340681	2843.6562
470.00		.031904	320.258	.97539	.595694	.340697	2848.1220
480.00		.031894	320.267	.97529	.595356	.340713	2852.5730
490.00		.031884	320.276	.97520	.595021	.340729	2857.0093
500.00		.031874	320.285	.97510	.594689	.340745	2861.4309
510.00		.031864	320.294	.97501	.594360	.340762	2865.8381
520.00		.031854	320.303	.97492	.594033	.340778	2870.2310
530.00		.031844	320.313	.97482	.593710	.340795	2874.6096
540.00		.031834	320.322	.97473	.593389	.340811	2878.9742
550.00		.031824	320.332	.97464	.593071	.340828	2883.3247
560.00		.031814	320.342	.97454	.592756	.340845	2887.6614
570.00		.031804	320.352	.97445	.592443	.340862	2891.9843

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 80. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	13.641473	484.309	1.40967	.368971	.318433	851.5976
20.00		6.747759	483.334	1.37561	.374000	.320658	845.1502
30.00		4.449040	482.342	1.35511	.379257	.322918	838.5707
40.00		3.299036	481.331	1.34015	.384766	.325213	831.8510
50.00		2.608485	480.301	1.32821	.390550	.327547	824.9818
60.00		2.147633	479.250	1.31816	.396639	.329922	817.9531
70.00		1.818010	478.177	1.30940	.403066	.332340	810.7536
80.00		1.570378	477.079	1.30158	.409869	.334805	803.3707
90.00		1.377381	475.957	1.29446	.417094	.337318	795.7905
100.00		1.222601	474.807	1.28789	.424794	.339886	787.9968
110.00		1.095587	473.627	1.28174	.433033	.342510	779.9718
120.00		.989369	472.415	1.27592	.441888	.345197	771.6946
130.00		.899117	471.168	1.27038	.451451	.347951	763.1415
140.00		.821376	469.883	1.26506	.461838	.350780	754.2849
150.00		.753608	468.555	1.25990	.473191	.353690	745.0921
160.00		.693902	467.180	1.25488	.485691	.356690	735.5249
170.00		.640790	465.752	1.24995	.499570	.359791	725.5368
177.51	SAT. VAPOR	.604553	464.642	1.24629	.511075	.362193	717.7295
177.51	SAT. LIQUID	.032809	326.186	.98989	.620686	.349321	2526.3777
180.0	COMPRESSED LIQUID	.032806	326.186	.98986	.620542	.349321	2527.7272
190.00		.032792	326.186	.98975	.619971	.349321	2533.1232
200.00		.032778	326.185	.98964	.619406	.349322	2538.4948
210.00		.032765	326.185	.98952	.618849	.349323	2543.8422
220.00		.032751	326.186	.98941	.618297	.349324	2549.1658
230.00		.032738	326.186	.98930	.617753	.349326	2554.4658
240.00		.032724	326.187	.98919	.617214	.349328	2559.7425
250.00		.032711	326.188	.98908	.616682	.349330	2564.9962
260.00		.032698	326.189	.98897	.616155	.349333	2570.2270
270.00		.032684	326.190	.98886	.615635	.349336	2575.4354
280.00		.032671	326.192	.98875	.615120	.349339	2580.6215
290.00		.032658	326.193	.98864	.614611	.349342	2585.7855
300.00		.032645	326.195	.98853	.614108	.349346	2590.9278
310.00		.032632	326.197	.98842	.613611	.349349	2596.0485
320.00		.032619	326.199	.98832	.613118	.349353	2601.1480
330.00		.032607	326.202	.98821	.612632	.349358	2606.2263
340.00		.032594	326.205	.98810	.612150	.349362	2611.2838
350.00		.032581	326.207	.98800	.611673	.349367	2616.3207
360.00		.032569	326.210	.98789	.611202	.349372	2621.3372
370.00		.032556	326.214	.98778	.610736	.349378	2626.3334
380.00		.032544	326.217	.98768	.610274	.349383	2631.3097
390.00		.032532	326.221	.98757	.609818	.349389	2636.2662
400.00		.032519	326.224	.98747	.609366	.349395	2641.2032
410.00		.032507	326.228	.98736	.608918	.349401	2646.1207
420.00		.032495	326.232	.98726	.608476	.349408	2651.0191
430.00		.032483	326.236	.98716	.608038	.349414	2655.8985
440.00		.032471	326.241	.98705	.607604	.349421	2660.7592
450.00		.032459	326.246	.98695	.607175	.349428	2665.6012
460.00		.032447	326.250	.98685	.606750	.349436	2670.4248
470.00		.032435	326.255	.98675	.606329	.349443	2675.2301
480.00		.032423	326.260	.98665	.605912	.349451	2680.0174
490.00		.032411	326.266	.98654	.605500	.349459	2684.7869
500.00		.032400	326.271	.98644	.605092	.349467	2689.5386
510.00		.032388	326.276	.98634	.604687	.349476	2694.2728
520.00		.032377	326.282	.98624	.604287	.349484	2698.9896
530.00		.032365	326.288	.98614	.603890	.349493	2703.6892
540.00		.032354	326.294	.98604	.603497	.349502	2708.3717
550.00		.032342	326.300	.98594	.603108	.349511	2713.0374
560.00		.032331	326.307	.98584	.602723	.349520	2717.6863
570.00		.032320	326.313	.98574	.602341	.349530	2722.3187

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 90. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	13.903524	488.020	1.41661	.373663	.324185	857.7728
20.00		6.882308	487.094	1.38264	.378338	.326258	851.6837
30.00		4.541188	486.152	1.36223	.383208	.328361	845.4795
40.00		3.370065	485.194	1.34737	.388293	.330494	839.1535
50.00		2.666914	484.220	1.33552	.393611	.332659	832.6985
60.00		2.197728	483.227	1.32558	.399184	.334858	826.1065
70.00		1.862214	482.215	1.31694	.405037	.337093	819.3688
80.00		1.610224	481.182	1.30924	.411201	.339367	812.4755
90.00		1.413896	480.128	1.30225	.417708	.341681	805.4161
100.00		1.256511	479.051	1.29580	.424598	.344039	798.1783
110.00		1.127427	477.949	1.28980	.431917	.346443	790.7488
120.00		1.019548	476.820	1.28414	.439718	.348897	783.1123
130.00		.927957	475.663	1.27876	.448066	.351405	775.2515
140.00		.849141	474.474	1.27361	.457039	.353971	767.1469
150.00		.780517	473.251	1.26865	.466729	.356600	758.7756
160.00		.720149	471.990	1.26383	.477252	.359298	750.1116
170.00		.666547	470.689	1.25913	.488751	.362073	741.1239
180.00		.618550	469.341	1.25452	.501406	.364931	731.7763
190.00		.575234	467.943	1.24997	.515448	.367883	722.0253
200.00		.535853	466.487	1.24546	.531181	.370941	711.8178
202.96	SAT. VAPOR	.524859	466.044	1.24412	.536218	.371868	708.7000
202.96	SAT. LIQUID	.033412	332.453	1.00123	.635294	.358074	2358.9668
210.0	COMPRESSED LIQUID	.033400	332.449	1.00114	.634780	.358066	2363.1095
220.00		.033384	332.443	1.00102	.634058	.358054	2368.9675
230.00		.033368	332.437	1.00090	.633347	.358044	2374.7950
240.00		.033352	332.431	1.00077	.632645	.358033	2380.5924
250.00		.033336	332.426	1.00065	.631952	.358023	2386.3601
260.00		.033320	332.421	1.00053	.631269	.358014	2392.0984
270.00		.033304	332.417	1.00041	.630594	.358004	2397.8079
280.00		.033288	332.412	1.00029	.629929	.357996	2403.4888
290.00		.033273	332.408	1.00017	.629272	.357987	2409.1416
300.00		.033257	332.404	1.00005	.628623	.357979	2414.7666
310.00		.033242	332.401	.99993	.627983	.357972	2420.3641
320.00		.033226	332.398	.99982	.627351	.357964	2425.9346
330.00		.033211	332.394	.99970	.626727	.357958	2431.4783
340.00		.033196	332.392	.99958	.626110	.357951	2436.9956
350.00		.033181	332.389	.99947	.625502	.357945	2442.4868
360.00		.033166	332.387	.99935	.624900	.357939	2447.9521
370.00		.033151	332.385	.99924	.624306	.357934	2453.3924
380.00		.033137	332.383	.99912	.623720	.357929	2458.8073
390.00		.033122	332.381	.99901	.623140	.357924	2464.1974
400.00		.033107	332.380	.99889	.622567	.357920	2469.5629
410.00		.033093	332.379	.99878	.622001	.357916	2474.9042
420.00		.033079	332.378	.99867	.621442	.357912	2480.2216
430.00		.033064	332.377	.99855	.620889	.357908	2485.5153
440.00		.033050	332.377	.99844	.620343	.357905	2490.7856
450.00		.033036	332.377	.99833	.619803	.357903	2496.0328
460.00		.033022	332.377	.99822	.619269	.357900	2501.2571
470.00		.033008	332.377	.99811	.618741	.357898	2506.4588
480.00		.032994	332.377	.99800	.618219	.357896	2511.6382
490.00		.032980	332.378	.99789	.617703	.357894	2516.7954
500.00		.032967	332.379	.99778	.617193	.357893	2521.9308
510.00		.032953	332.380	.99767	.616688	.357892	2527.0447
520.00		.032940	332.381	.99756	.616189	.357891	2532.1371
530.00		.032926	332.382	.99745	.615696	.357891	2537.2084
540.00		.032913	332.384	.99734	.615207	.357891	2542.2588
550.00		.032899	332.386	.99724	.614724	.357891	2547.2885
560.00		.032886	332.388	.99713	.614247	.357891	2552.2977
570.00		.032873	332.390	.99702	.613774	.357892	2557.2867

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 100. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	14.165125	491.787	1.42350	.378380	.329810	864.0645
20.00		7.016387	490.905	1.38961	.382733	.331744	858.3038
30.00		4.632847	490.011	1.36929	.387254	.333703	852.4425
40.00		3.440583	489.102	1.35452	.391958	.335688	846.4752
50.00		2.724808	488.178	1.34277	.396860	.337700	840.3961
60.00		2.247261	487.238	1.33292	.401978	.339740	834.1988
70.00		1.905827	486.282	1.32438	.407330	.341811	827.8766
80.00		1.649446	485.309	1.31678	.412940	.343914	821.4217
90.00		1.449752	484.317	1.30990	.418832	.346050	814.8260
100.00		1.289723	483.305	1.30358	.425036	.348222	808.0801
110.00		1.156525	482.272	1.29769	.431585	.350432	801.1740
120.00		1.048933	481.217	1.29217	.438519	.352682	794.0962
130.00		.955946	480.138	1.28693	.445881	.354975	786.8341
140.00		.875987	479.033	1.28193	.453727	.357315	779.3733
150.00		.806432	477.900	1.27713	.462119	.359705	771.6977
160.00		.745311	476.737	1.27249	.471134	.362148	763.7888
170.00		.691114	475.541	1.26798	.480863	.364650	755.6257
180.00		.642663	474.309	1.26358	.491419	.367215	747.1837
190.00		.599026	473.038	1.25926	.502941	.369851	738.4346
200.00		.559452	471.723	1.25500	.515603	.372563	729.3448
210.00		.523328	470.359	1.25078	.529630	.375361	719.8739
220.00		.490146	468.940	1.24657	.545310	.378256	709.9743
230.00		.459477	467.460	1.24236	.563030	.381259	699.5864
230.96	SAT. VAPOR	.456649	467.314	1.24195	.564858	.381554	698.5599
230.96	SAT. LIQUID	.034066	338.868	1.01258	.652566	.366605	2195.7455
240.0	COMPRESSED LIQUID	.034048	338.856	1.01246	.651711	.366581	2201.5719
250.00		.034028	338.842	1.01232	.650778	.366555	2207.9799
260.00		.034009	338.830	1.01219	.649861	.366530	2214.3490
270.00		.033990	338.817	1.01205	.648958	.366506	2220.6798
280.00		.033970	338.805	1.01192	.648069	.366482	2226.9728
290.00		.033951	338.793	1.01179	.647194	.366459	2233.2287
300.00		.033933	338.782	1.01165	.646332	.366436	2239.4480
310.00		.033914	338.771	1.01152	.645484	.366414	2245.6314
320.00		.033895	338.761	1.01139	.644648	.366393	2251.7792
330.00		.033877	338.750	1.01126	.643824	.366372	2257.8922
340.00		.033859	338.740	1.01113	.643013	.366351	2263.9708
350.00		.033841	338.731	1.01100	.642214	.366331	2270.0155
360.00		.033823	338.722	1.01087	.641426	.366312	2276.0268
370.00		.033805	338.713	1.01075	.640649	.366293	2282.0052
380.00		.033787	338.704	1.01062	.639883	.366275	2287.9511
390.00		.033769	338.696	1.01049	.639129	.366257	2293.8652
400.00		.033752	338.688	1.01037	.638384	.366240	2299.7476
410.00		.033734	338.681	1.01024	.637651	.366223	2305.5991
420.00		.033717	338.673	1.01012	.636927	.366207	2311.4198
430.00		.033700	338.666	1.00999	.636213	.366191	2317.2104
440.00		.033683	338.660	1.00987	.635508	.366176	2322.9711
450.00		.033666	338.653	1.00975	.634813	.366161	2328.7025
460.00		.033650	338.647	1.00963	.634128	.366147	2334.4048
470.00		.033633	338.642	1.00950	.633451	.366132	2340.0785
480.00		.033616	338.636	1.00938	.632783	.366119	2345.7240
490.00		.033600	338.631	1.00926	.632124	.366105	2351.3415
500.00		.033584	338.626	1.00914	.631473	.366093	2356.9316
510.00		.033568	338.621	1.00902	.630831	.366080	2362.4945
520.00		.033551	338.617	1.00890	.630196	.366068	2368.0306
530.00		.033536	338.613	1.00879	.629570	.366057	2373.5402
540.00		.033520	338.609	1.00867	.628952	.366046	2379.0236
550.00		.033504	338.605	1.00855	.628341	.366035	2384.4812
560.00		.033488	338.602	1.00844	.627737	.366024	2389.9134
570.00		.033473	338.599	1.00832	.627141	.366014	2395.3203

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 110. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	14.426313	495.607	1.43036	.383120	.335314	870.4598
20.00		7.150039	494.768	1.39654	.387179	.337121	865.0011
30.00		4.724060	493.916	1.37630	.391383	.338948	859.4542
40.00		3.510637	493.053	1.36160	.395744	.340798	853.8147
50.00		2.782219	492.176	1.34993	.400275	.342671	848.0780
60.00		2.296289	491.286	1.34017	.404988	.344568	842.2391
70.00		1.948911	490.381	1.33172	.409899	.346490	836.2924
80.00		1.688113	489.461	1.32422	.415025	.348439	830.2322
90.00		1.485024	488.525	1.31744	.420386	.350416	824.0518
100.00		1.322319	487.573	1.31122	.426003	.352422	817.7442
110.00		1.188971	486.602	1.30545	.431901	.354459	811.3017
120.00		1.077628	485.612	1.30004	.438108	.356530	804.7155
130.00		.983200	484.603	1.29492	.444658	.358635	797.9763
140.00		.902050	483.571	1.29006	.451588	.360777	791.0736
150.00		.831507	482.517	1.28540	.458943	.362960	783.9954
160.00		.769568	481.438	1.28090	.466774	.365185	776.7287
170.00		.714700	480.332	1.27656	.475142	.367455	769.2585
180.00		.665709	479.198	1.27233	.484121	.369775	761.5680
190.00		.621648	478.032	1.26819	.493799	.372148	753.6378
200.00		.581759	476.832	1.26413	.504286	.374579	745.4457
210.00		.545424	475.595	1.26013	.515708	.377073	736.9660
220.00		.512135	474.316	1.25618	.528225	.379637	728.1685
230.00		.481468	472.992	1.25224	.542057	.382279	719.0173
240.00		.453063	471.616	1.24831	.557468	.385006	709.4697
250.00		.426614	470.182	1.24437	.574811	.387830	699.4734
260.00		.401851	468.682	1.24039	.594561	.390765	688.9640
261.66	SAT. VAPOR	.397884	468.426	1.23972	.598117	.391264	687.1631
261.66	SAT. LIQUID	.034783	345.450	1.02398	.673344	.374982	2035.4926
270.0	COMPRESSED	.034763	345.431	1.02385	.672291	.374945	2041.4348
280.00	LIQUID	.034739	345.409	1.02370	.671050	.374901	2048.5133
290.00		.034715	345.387	1.02355	.669833	.374858	2055.5407
300.00		.034692	345.365	1.02340	.668639	.374816	2062.5179
310.00		.034668	345.344	1.02325	.667467	.374774	2069.4460
320.00		.034645	345.324	1.02310	.666316	.374734	2076.3258
330.00		.034622	345.304	1.02295	.665186	.374695	2083.1582
340.00		.034600	345.285	1.02280	.664077	.374656	2089.9441
350.00		.034577	345.266	1.02266	.662987	.374618	2096.6844
360.00		.034555	345.247	1.02251	.661916	.374581	2103.3798
370.00		.034533	345.229	1.02237	.660863	.374545	2110.0312
380.00		.034511	345.212	1.02223	.659829	.374510	2116.6392
390.00		.034490	345.195	1.02209	.658812	.374475	2123.2047
400.00		.034468	345.178	1.02195	.657812	.374441	2129.7284
410.00		.034447	345.162	1.02181	.656829	.374408	2136.2109
420.00		.034426	345.147	1.02167	.655862	.374376	2142.6531
430.00		.034405	345.132	1.02153	.654911	.374344	2149.0554
440.00		.034384	345.117	1.02139	.653974	.374313	2155.4186
450.00		.034364	345.102	1.02125	.653053	.374282	2161.7434
460.00		.034343	345.088	1.02112	.652146	.374253	2168.0302
470.00		.034323	345.075	1.02098	.651254	.374224	2174.2798
480.00		.034303	345.062	1.02085	.650375	.374195	2180.4927
490.00		.034283	345.049	1.02071	.649509	.374168	2186.6694
500.00		.034264	345.037	1.02058	.648657	.374141	2192.8106
510.00		.034244	345.025	1.02045	.647817	.374114	2198.9168
520.00		.034225	345.013	1.02032	.646990	.374088	2204.9884
530.00		.034205	345.002	1.02019	.646175	.374063	2211.0261
540.00		.034186	344.991	1.02006	.645372	.374038	2217.0303
550.00		.034167	344.980	1.01993	.644581	.374014	2223.0014
560.00		.034149	344.970	1.01980	.643801	.373990	2228.9401
570.00		.034130	344.960	1.01967	.643032	.373967	2234.8467

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 120. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	14.687122	499.480	1.43717	.387879	.340704	876.9461
20.00		7.283298	498.680	1.40342	.391669	.342393	871.7658
30.00		4.814868	497.870	1.38325	.395585	.344101	866.5079
40.00		3.580270	497.048	1.36863	.399637	.345827	861.1691
50.00		2.839191	496.215	1.35703	.403834	.347573	855.7455
60.00		2.344861	495.370	1.34735	.408186	.349340	850.2330
70.00		1.991519	494.512	1.33898	.412707	.351128	844.6274
80.00		1.726283	493.641	1.33157	.417408	.352937	838.9241
90.00		1.519776	492.757	1.32488	.422305	.354771	833.1178
100.00		1.354369	491.858	1.31875	.427415	.356629	827.2031
110.00		1.218843	490.943	1.31308	.432755	.358512	821.1739
120.00		1.105718	490.012	1.30777	.438349	.360423	815.0238
130.00		1.009815	489.065	1.30276	.444218	.362362	808.7456
140.00		.927434	488.099	1.29801	.450391	.364331	802.3314
150.00		.855860	487.114	1.29347	.456900	.366333	795.7724
160.00		.793056	486.108	1.28910	.463780	.368368	789.0591
170.00		.737463	485.080	1.28489	.471074	.370439	782.1806
180.00		.687868	484.029	1.28081	.478831	.372550	775.1252
190.00		.643312	482.953	1.27683	.487108	.374701	767.8792
200.00		.603024	481.850	1.27294	.495974	.376897	760.4275
210.00		.566381	480.717	1.26912	.505512	.379141	752.7528
220.00		.532870	479.552	1.26536	.515820	.381437	744.8353
230.00		.502065	478.352	1.26164	.527021	.383790	736.6523
240.00		.473608	477.113	1.25795	.539265	.386205	728.1770
250.00		.447195	475.832	1.25427	.552739	.388688	719.3784
260.00		.422565	474.503	1.25059	.567685	.391248	710.2193
270.00		.399491	473.121	1.24690	.584415	.393892	700.6551
280.00		.377772	471.679	1.24317	.603344	.396633	690.6311
290.00		.357225	470.167	1.23939	.625034	.399483	680.0795
295.22	SAT. VAPOR	.346911	469.346	1.23739	.637704	.401020	674.3348
295.22	SAT. LIQUID	.035579	352.227	1.03546	.698909	.383280	1877.0310
300.0	COMPRESSED LIQUID	.035564	352.210	1.03538	.698073	.383247	1880.8423
310.00		.035534	352.174	1.03520	.696355	.383179	1888.7625
320.00		.035505	352.140	1.03503	.694678	.383112	1896.6131
330.00		.035475	352.107	1.03486	.693039	.383047	1904.3960
340.00		.035446	352.074	1.03469	.691437	.382983	1912.1126
350.00		.035418	352.042	1.03452	.689870	.382921	1919.7644
360.00		.035389	352.011	1.03435	.688338	.382859	1927.3530
370.00		.035362	351.980	1.03419	.686839	.382799	1934.8796
380.00		.035334	351.951	1.03402	.685371	.382741	1942.3456
390.00		.035307	351.922	1.03386	.683935	.382683	1949.7524
400.00		.035280	351.893	1.03370	.682528	.382627	1957.1011
410.00		.035253	351.865	1.03354	.681151	.382572	1964.3930
420.00		.035226	351.838	1.03338	.679800	.382518	1971.6293
430.00		.035200	351.812	1.03322	.678477	.382465	1978.8110
440.00		.035174	351.786	1.03307	.677180	.382413	1985.9393
450.00		.035149	351.761	1.03291	.675908	.382362	1993.0153
460.00		.035123	351.736	1.03276	.674661	.382313	2000.0398
470.00		.035098	351.712	1.03260	.673437	.382264	2007.0140
480.00		.035073	351.689	1.03245	.672236	.382216	2013.9388
490.00		.035049	351.666	1.03230	.671057	.382169	2020.8152
500.00		.035024	351.644	1.03215	.669900	.382123	2027.6439
510.00		.035000	351.622	1.03200	.668764	.382079	2034.4260
520.00		.034976	351.601	1.03185	.667648	.382034	2041.1621
530.00		.034953	351.580	1.03170	.666551	.381991	2047.8533
540.00		.034929	351.560	1.03156	.665474	.381949	2054.5002
550.00		.034906	351.540	1.03141	.664416	.381908	2061.1039
560.00		.034883	351.521	1.03127	.663375	.381867	2067.6644
570.00		.034860	351.502	1.03112	.662352	.381827	2074.1832

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 130. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	14.947584	503.406	1.44395	.392654	.345987	883.5110
20.00		7.416199	502.642	1.41026	.396198	.347569	878.5880
30.00		4.905304	501.870	1.39015	.399852	.349166	873.5968
40.00		3.649518	501.087	1.37559	.403623	.350780	868.5344
50.00		2.895765	500.294	1.36407	.407520	.352410	863.3979
60.00		2.393019	499.491	1.35446	.411549	.354058	858.1841
70.00		2.033697	498.677	1.34617	.415721	.355723	852.8894
80.00		1.764006	497.851	1.33883	.420047	.357407	847.5102
90.00		1.554061	497.014	1.33222	.424537	.359111	842.0425
100.00		1.385431	496.163	1.32617	.429205	.360835	836.4818
110.00		1.248205	495.300	1.32059	.434065	.362581	830.8237
120.00		1.133273	494.422	1.31537	.439132	.364349	825.0630
130.00		1.035868	493.530	1.31046	.444425	.366140	819.1943
140.00		.952227	492.623	1.30581	.449964	.367956	813.2115
150.00		.879589	491.699	1.30137	.455772	.369798	807.1082
160.00		.815882	490.758	1.29712	.461874	.371667	800.8772
170.00		.759524	489.799	1.29302	.468300	.373566	794.5107
180.00		.709279	488.820	1.28906	.475085	.375495	788.0001
190.00		.664175	487.821	1.28521	.482267	.377457	781.3356
200.00		.623430	486.800	1.28146	.489892	.379453	774.5067
210.00		.586411	485.755	1.27780	.498014	.381487	767.5015
220.00		.552600	484.685	1.27420	.506696	.383560	760.3064
230.00		.521565	483.587	1.27065	.516012	.385676	752.9064
240.00		.492948	482.459	1.26715	.526053	.387838	745.2841
250.00		.466444	481.299	1.26368	.536928	.390051	737.4200
260.00		.441793	480.103	1.26023	.548771	.392318	729.2909
270.00		.418771	478.868	1.25679	.561747	.394644	720.8706
280.00		.397184	477.590	1.25334	.576066	.397037	712.1275
290.00		.376861	476.264	1.24988	.591994	.399503	703.0246
300.00		.357648	474.883	1.24638	.609881	.402052	693.5169
310.00		.339405	473.440	1.24285	.630191	.404693	683.5404
320.00		.322002	471.925	1.23924	.653565	.407441	673.0534
330.00		.305316	470.328	1.23555	.680898	.410312	661.9415
331.80	SAT. VAPOR	.302372	470.029	1.23487	.686344	.410845	659.8626
331.80	SAT. LIQUID	.036475	359.232	1.04708	.731322	.391585	1719.1732
340.0	COMPRESSED LIQUID	.036443	359.189	1.04691	.729269	.391502	1726.5578
350.00		.036405	359.137	1.04671	.726831	.391405	1735.4782
360.00		.036368	359.087	1.04651	.724463	.391305	1744.3024
370.00		.036331	359.038	1.04632	.722163	.391211	1753.0333
380.00		.036294	358.990	1.04612	.719926	.391118	1761.6734
390.00		.036258	358.943	1.04593	.717750	.391027	1770.2252
400.00		.036223	358.898	1.04574	.715633	.390939	1778.6913
410.00		.036188	358.853	1.04555	.713572	.390852	1787.0738
420.00		.036153	358.810	1.04536	.711564	.390767	1795.3750
430.00		.036119	358.767	1.04517	.709607	.390684	1803.5970
440.00		.036086	358.726	1.04499	.707700	.390603	1811.7418
450.00		.036053	358.685	1.04481	.705839	.390523	1819.8113
460.00		.036020	358.645	1.04463	.704024	.390446	1827.8075
470.00		.035988	358.607	1.04445	.702252	.390370	1835.7320
480.00		.035956	358.569	1.04427	.700522	.390295	1843.5866
490.00		.035924	358.532	1.04410	.698831	.390222	1851.3730
500.00		.035893	358.496	1.04392	.697180	.390150	1859.0926
510.00		.035862	358.460	1.04375	.695566	.390080	1866.7471
520.00		.035832	358.426	1.04358	.693987	.390012	1874.3380
530.00		.035802	358.392	1.04341	.692443	.389944	1881.8665
540.00		.035773	358.359	1.04324	.690932	.389878	1889.3341
550.00		.035743	358.327	1.04308	.689453	.389814	1896.7421
560.00		.035714	358.295	1.04291	.688006	.389750	1904.0918
570.00		.035686	358.265	1.04275	.686588	.389688	1911.3843

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 140. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	15.207726	507.382	1.45068	.397442	.351171	890.1425
20.00		7.548770	506.653	1.41705	.400761	.352654	885.4579
30.00		4.995400	505.916	1.39700	.404176	.354150	880.7131
40.00		3.718415	505.170	1.38251	.407692	.355660	875.9058
50.00		2.951976	504.415	1.37105	.411316	.357184	871.0335
60.00		2.440801	503.650	1.36151	.415055	.358723	866.0937
70.00		2.075485	502.876	1.35328	.418916	.360277	861.0835
80.00		1.801324	502.092	1.34601	.422908	.361847	856.0000
90.00		1.587927	501.297	1.33947	.427039	.363433	850.8400
100.00		1.417058	500.492	1.33350	.431320	.365037	845.6001
110.00		1.277112	499.675	1.32799	.435761	.366658	840.2766
120.00		1.160353	498.845	1.32286	.440374	.368298	834.8658
130.00		1.061425	498.004	1.31803	.445173	.369957	829.3632
140.00		.976500	497.149	1.31347	.450174	.371637	823.7645
150.00		.902772	496.280	1.30912	.455392	.373337	818.0645
160.00		.838135	495.397	1.30497	.460847	.375060	812.2581
170.00		.780878	494.499	1.30097	.466561	.376807	806.3393
180.00		.730050	493.584	1.29712	.472556	.378578	800.3018
190.00		.684359	492.652	1.29339	.478861	.380375	794.1387
200.00		.643113	491.702	1.28976	.485508	.382200	787.8422
210.00		.605670	490.732	1.28622	.492531	.384053	781.4039
220.00		.571503	489.742	1.28275	.499973	.385938	774.8146
230.00		.540176	488.730	1.27935	.507882	.387855	768.0638
240.00		.511327	487.694	1.27600	.516315	.389808	761.1398
250.00		.484648	486.633	1.27270	.525339	.391798	754.0297
260.00		.459878	485.545	1.26943	.535034	.393829	746.7187
270.00		.436794	484.426	1.26618	.545494	.395903	739.1901
280.00		.415202	483.275	1.26295	.556837	.398025	731.4248
290.00		.394934	482.089	1.25972	.569204	.400198	723.4005
300.00		.375843	480.864	1.25649	.582772	.402428	715.0916
310.00		.357795	479.595	1.25324	.597763	.404720	706.4678
320.00		.340673	478.278	1.24997	.614462	.407082	697.4931
330.00		.324367	476.906	1.24666	.633243	.409521	688.1243
340.00		.308777	475.472	1.24329	.654601	.412047	678.3082
350.00		.293806	473.967	1.23986	.679216	.414674	667.9787
360.00		.279359	472.379	1.23633	.708051	.417417	657.0518
370.00		.265337	470.691	1.23267	.742516	.420298	645.4174
371.60	SAT. VAPOR	.263128	470.410	1.23207	.748677	.420773	643.4828
371.60	SAT. LIQUID	.037505	366.516	1.05892	.774126	.400003	1560.6501
380.0	COMPRESSED LIQUID	.037402	366.452	1.05871	.770918	.399879	1569.3666
390.00		.037411	366.377	1.05847	.767233	.399735	1579.6075
400.00		.037362	366.303	1.05824	.763686	.399595	1589.7080
410.00		.037313	366.232	1.05800	.760267	.399459	1599.6733
420.00		.037266	366.163	1.05777	.756970	.399326	1609.5083
430.00		.037219	366.096	1.05754	.753788	.399197	1619.2174
440.00		.037173	366.030	1.05732	.750713	.399071	1628.8051
450.00		.037128	365.966	1.05710	.747740	.398947	1638.2754
460.00		.037084	365.903	1.05688	.744864	.398827	1647.6321
470.00		.037040	365.842	1.05666	.742080	.398710	1656.8789
480.00		.036998	365.783	1.05645	.739382	.398595	1666.0193
490.00		.036956	365.725	1.05624	.736766	.398483	1675.0566
500.00		.036914	365.668	1.05603	.734229	.398374	1683.9938
510.00		.036873	365.613	1.05583	.731767	.398267	1692.8339
520.00		.036833	365.559	1.05562	.729375	.398163	1701.5798
530.00		.036794	365.506	1.05542	.727051	.398061	1710.2342
540.00		.036755	365.455	1.05522	.724791	.397961	1718.7995
550.00		.036717	365.405	1.05502	.722593	.397863	1727.2783
560.00		.036679	365.356	1.05483	.720454	.397767	1735.6729
570.00		.036642	365.308	1.05464	.718371	.397674	1743.9856

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 150. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
	SUPERHEATED						
10.00	VAPOR	15.467574	511.409	1.45738	.402242	.356263	896.8287
20.00		7.681038	510.712	1.42381	.405353	.357655	892.3655
30.00		5.085183	510.008	1.40381	.408549	.359058	887.8492
40.00		3.786990	509.296	1.38937	.411833	.360473	883.2778
50.00		3.007855	508.575	1.37797	.415211	.361900	878.6493
60.00		2.488241	507.847	1.36849	.418687	.363339	873.9617
70.00		2.116921	507.110	1.36032	.422269	.364791	869.2126
80.00		1.838277	506.365	1.35312	.425963	.366257	864.3998
90.00		1.621414	505.610	1.34664	.429775	.367737	859.5207
100.00		1.447791	504.845	1.34074	.433713	.369231	854.5726
110.00		1.305611	504.070	1.33530	.437787	.370740	849.5527
120.00		1.187010	503.285	1.33024	.442005	.372264	844.4578
130.00		1.086540	502.490	1.32549	.446378	.373804	839.2848
140.00		1.000312	501.682	1.32100	.450916	.375362	834.0301
150.00		.925473	500.863	1.31674	.455634	.376936	828.6899
160.00		.859863	500.032	1.31267	.460544	.378529	823.2602
170.00		.801905	499.187	1.30877	.465662	.380141	817.7366
180.00		.750266	498.329	1.30501	.471006	.381773	812.1143
190.00		.703959	497.457	1.30137	.476596	.383426	806.3883
200.00		.662179	496.569	1.29785	.482452	.385101	800.5530
210.00		.624275	495.665	1.29441	.488602	.386799	794.6023
220.00		.589713	494.745	1.29106	.495072	.388521	788.5294
230.00		.558050	493.806	1.28778	.501895	.390269	782.3273
240.00		.528918	492.848	1.28456	.509109	.392045	775.9877
250.00		.502006	491.870	1.28140	.516756	.393849	769.5018
260.00		.477052	490.870	1.27827	.524887	.395683	762.8598
270.00		.453830	489.847	1.27518	.533560	.397551	756.0508
280.00		.432146	488.799	1.27212	.542844	.399454	749.0622
290.00		.411832	487.723	1.26908	.552821	.401394	741.8803
300.00		.392742	486.619	1.26605	.563589	.403375	734.4893
310.00		.374745	485.482	1.26302	.575268	.405400	726.8713
320.00		.357728	484.310	1.25999	.588003	.407472	719.0056
330.00		.341587	483.100	1.25694	.601975	.409597	710.8680
340.00		.326229	481.848	1.25388	.617410	.411779	702.4307
350.00		.311568	480.548	1.25078	.634599	.414025	693.6602
360.00		.297526	479.195	1.24764	.653919	.416343	684.5166
370.00		.284026	477.781	1.24444	.675871	.418740	674.9512
380.00		.270996	476.298	1.24116	.701138	.421229	664.9038
390.00		.258360	474.733	1.23780	.730680	.423824	654.2983
400.00		.246041	473.073	1.23431	.765895	.426542	643.0356
410.00		.233951	471.295	1.23067	.808914	.429410	630.9833
414.80	SAT. VAPOR	.228194	470.392	1.22885	.833297	.430850	624.8603
414.80	SAT. LIQUID	.038719	374.154	1.07108	.833964	.406678	1400.0127
420.0	COMPRESSED	.038682	374.095	1.07092	.830655	.408565	1406.3855
430.00	LIQUID	.038611	373.983	1.07062	.824539	.408353	1418.4760
440.00		.038543	373.875	1.07033	.818734	.408148	1430.3450
450.00		.038476	373.771	1.07004	.813214	.407949	1442.0035
460.00		.038411	373.669	1.06976	.807956	.407757	1453.4615
470.00		.038348	373.571	1.06948	.802941	.407570	1464.7282
480.00		.038286	373.476	1.06921	.798151	.407389	1475.8123
490.00		.038226	373.383	1.06894	.793568	.407213	1486.7217
500.00		.038167	373.293	1.06868	.789180	.407042	1497.4639
510.00		.038109	373.206	1.06842	.784972	.406876	1508.0456
520.00		.038052	373.121	1.06816	.780933	.406715	1518.4734
530.00		.037997	373.038	1.06791	.777051	.406558	1528.7533
540.00		.037943	372.957	1.06767	.773317	.406404	1538.8909
550.00		.037890	372.879	1.06742	.769722	.406255	1548.8915
560.00		.037838	372.803	1.06718	.766257	.406110	1558.7601
570.00		.037787	372.728	1.06694	.762914	.405969	1568.5013

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 160. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	15.727148	515.485	1.46405	.407050	.361271	903.5583
20.00		7.613026	514.818	1.43052	.409971	.362578	899.3012
30.00		5.174680	514.145	1.41058	.412965	.363896	894.9971
40.00		3.855271	513.465	1.39619	.416037	.365223	890.6445
50.00		3.063430	512.777	1.38484	.419191	.366561	886.2416
60.00		2.535369	512.082	1.37541	.422430	.367909	881.7868
70.00		2.158033	511.380	1.36730	.425760	.369268	877.2783
80.00		1.874897	510.670	1.36015	.429186	.370639	872.7142
90.00		1.654557	509.952	1.35374	.432713	.372021	868.0924
100.00		1.478169	509.225	1.34790	.436348	.373415	863.4109
110.00		1.333743	508.489	1.34252	.440098	.374822	858.6674
120.00		1.213285	507.745	1.33753	.443969	.376242	853.8594
130.00		1.111260	506.991	1.33284	.447970	.377676	848.9844
140.00		1.023714	506.227	1.32843	.452109	.379123	844.0398
150.00		.947748	505.453	1.32424	.456396	.380585	839.0225
160.00		.881187	504.668	1.32025	.460841	.382061	833.9296
170.00		.822368	503.872	1.31642	.465457	.383554	828.7576
180.00		.769997	503.065	1.31274	.470255	.385062	823.5030
190.00		.723051	502.245	1.30919	.475251	.386588	818.1620
200.00		.680713	501.413	1.30576	.480459	.388131	812.7306
210.00		.642321	500.567	1.30242	.485899	.389693	807.2041
220.00		.607333	499.707	1.29917	.491588	.391274	801.5778
230.00		.575300	498.832	1.29599	.497551	.392876	795.8466
240.00		.545848	497.941	1.29288	.503813	.394498	790.0047
250.00		.518664	497.036	1.28983	.510401	.396144	784.0459
260.00		.493479	496.109	1.28683	.517349	.397813	777.9634
270.00		.470068	495.166	1.28387	.524695	.399507	771.7499
280.00		.448233	494.202	1.28095	.532481	.401228	765.3970
290.00		.427807	493.218	1.27805	.540758	.402977	758.8957
300.00		.408642	492.211	1.27518	.549585	.404756	752.2360
310.00		.390608	491.179	1.27232	.559031	.406567	745.4065
320.00		.373591	490.121	1.26947	.569176	.408413	738.3945
330.00		.357492	489.035	1.26663	.580119	.410295	731.1858
340.00		.342220	487.917	1.26378	.591977	.412217	723.7642
350.00		.327692	486.766	1.26093	.604895	.414183	716.1109
360.00		.313836	485.578	1.25805	.619048	.416196	708.2046
370.00		.300583	484.349	1.25515	.634658	.418261	700.0202
380.00		.287871	483.075	1.25222	.652005	.420382	691.5283
390.00		.275639	481.749	1.24924	.671452	.422567	682.6940
400.00		.263831	480.366	1.24621	.693476	.424824	673.4750
410.00		.252389	478.917	1.24310	.718720	.427160	663.8196
420.00		.241255	477.391	1.23990	.748074	.429589	653.6630
430.00		.230369	475.776	1.23659	.782817	.432126	642.9226
440.00		.219682	474.052	1.23314	.824854	.434790	631.4896
450.00		.209052	472.197	1.22951	.877188	.437609	619.2156
460.00		.198434	470.173	1.22563	.944874	.440622	605.8885
461.66	SAT. VAPOR	.196666	469.818	1.22496	.958112	.441144	603.5605
461.66	SAT. LIQUID	.040206	382.268	1.08375	.924938	.417826	1235.4717
470.0	COMPRESSED	.040116	382.122	1.08342	.915109	.417551	1247.9057
480.00	LIQUID	.040013	381.954	1.08303	.904142	.417235	1262.4445
490.00		.039914	381.794	1.08265	.893962	.416933	1276.6154
500.00		.039819	381.639	1.08228	.884480	.416643	1290.4434
510.00		.039727	381.491	1.08192	.875620	.416364	1303.9509
520.00		.039638	381.346	1.08158	.867318	.416096	1317.1579
530.00		.039552	381.210	1.08124	.859517	.415838	1330.0823
540.00		.039468	381.077	1.08090	.852169	.415589	1342.7404
550.00		.039387	380.949	1.08058	.845233	.415349	1355.1471
560.00		.039309	380.825	1.08026	.838672	.415116	1367.3157
570.00		.039232	380.705	1.07995	.832453	.414892	1379.2587

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 170. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	15.986472	519.610	1.47068	.411864	.366202	910.3203
20.00		7.944757	518.972	1.43719	.414609	.367432	906.2555
30.00		5.263912	518.327	1.41730	.417419	.368670	902.1491
40.00		3.923280	517.677	1.40296	.420297	.369916	897.9997
50.00		3.118727	517.020	1.39166	.423246	.371172	893.8061
60.00		2.582209	516.356	1.38228	.426269	.372436	889.5669
70.00		2.198851	515.686	1.37422	.429371	.373710	885.2806
80.00		1.911314	515.009	1.36713	.432558	.374993	880.9456
90.00		1.687388	514.325	1.36077	.435828	.376287	876.5605
100.00		1.508225	513.633	1.35498	.439192	.377590	872.1234
110.00		1.361543	512.933	1.34966	.442654	.378905	867.6326
120.00		1.239217	512.226	1.34473	.446219	.380230	863.0862
130.00		1.135625	511.510	1.34011	.449894	.381566	858.4825
140.00		1.046748	510.786	1.33575	.453684	.382914	853.8185
150.00		.969642	510.053	1.33163	.457598	.384274	849.0928
160.00		.902096	509.311	1.32770	.461644	.385646	844.3028
170.00		.842420	508.559	1.32395	.465830	.387031	839.4459
180.00		.789300	507.797	1.32035	.470165	.388430	834.5193
190.00		.741698	507.025	1.31687	.474661	.389842	829.5204
200.00		.698782	506.241	1.31351	.479329	.391269	824.4458
210.00		.659882	505.447	1.31026	.484182	.392710	819.2925
220.00		.624445	504.640	1.30709	.489234	.394168	814.0568
230.00		.592017	503.821	1.30401	.494501	.395641	808.7349
240.00		.562218	502.990	1.30099	.500000	.397132	803.3229
250.00		.534730	502.144	1.29804	.505752	.398640	797.8161
260.00		.509282	501.284	1.29514	.511779	.400167	792.2101
270.00		.485644	500.409	1.29229	.518105	.401713	786.4994
280.00		.463619	499.517	1.28948	.524759	.403280	780.6785
290.00		.443034	498.609	1.28671	.531773	.404869	774.7414
300.00		.423741	497.682	1.28396	.539184	.406480	768.6813
310.00		.405612	496.737	1.28124	.547035	.408115	762.4907
320.00		.388531	495.771	1.27854	.555374	.409776	756.1618
330.00		.372398	494.783	1.27586	.564259	.411464	749.6853
340.00		.357123	493.772	1.27318	.573756	.413180	743.0515
350.00		.342626	492.735	1.27051	.583943	.414928	736.2491
360.00		.328836	491.671	1.26783	.594914	.416708	729.2657
370.00		.315687	490.578	1.26515	.606780	.418526	722.0871
380.00		.303119	489.453	1.26246	.619679	.420378	714.6974
390.00		.291079	488.293	1.25974	.633774	.422273	707.0781
400.00		.279516	487.094	1.25700	.649272	.424214	699.2081
410.00		.268381	485.852	1.25423	.666432	.426205	691.0628
420.00		.257631	484.563	1.25141	.685581	.428250	682.6150
430.00		.247219	483.220	1.24853	.707148	.430357	673.8244
440.00		.237104	481.817	1.24560	.731701	.432532	664.6551
450.00		.227240	480.344	1.24257	.760009	.434784	655.0540
460.00		.217580	478.789	1.23945	.793152	.437126	644.9568
470.00		.208071	477.139	1.23621	.832691	.439572	634.2814
480.00		.198653	475.372	1.23281	.880995	.442142	622.9191
490.00		.189250	473.462	1.22921	.941852	.444863	610.7208
500.00		.179760	471.367	1.22534	1.021793	.447774	597.4914
510.00		.170032	469.023	1.22110	1.133291	.450937	582.8383
512.43	SAT. VAPOR	.167606	468.404	1.22000	1.167706	.451754	579.0150
512.43	SAT. LIQUID	.042135	391.081	1.09727	1.083136	.427819	1064.5995
520.00	COMPRESSED LIQUID	.041999	390.861	1.09682	1.062807	.427410	1079.0852
530.00		.041830	390.597	1.09627	1.038796	.426901	1097.5309
540.00		.041671	390.330	1.09573	1.017478	.426423	1115.2671
550.00		.041521	390.087	1.09523	.998390	.425972	1132.3670
560.00		.041378	389.857	1.09474	.981172	.425547	1148.8916
570.00		.041243	389.638	1.09427	.965540	.425143	1164.8930

Table II-7 (Continued)

THERMODYNAMIC DATA FOR PROPYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 180. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	16.245562	523.783	1.47727	.416682	.371064	917.1043
20.00		8.076249	523.171	1.44383	.419265	.372221	913.2192
30.00		5.352900	522.554	1.42398	.421905	.373386	909.2972
40.00		3.991039	521.932	1.40968	.424604	.374558	905.3375
50.00		3.173767	521.303	1.39843	.427366	.375738	901.3383
60.00		2.628788	520.669	1.38909	.430193	.376925	897.2991
70.00		2.239400	520.029	1.38108	.433088	.378120	893.2186
80.00		1.947254	519.382	1.37404	.436055	.379324	889.0955
90.00		1.719934	518.729	1.36773	.439098	.380536	884.9286
100.00		1.537988	518.070	1.36200	.442219	.381756	880.7165
110.00		1.389041	517.404	1.35673	.445425	.382986	876.4577
120.00		1.264839	516.731	1.35185	.448718	.384224	872.1508
130.00		1.159669	516.050	1.34728	.452104	.385472	867.7942
140.00		1.069452	515.363	1.34299	.455588	.386730	863.3862
150.00		.991194	514.667	1.33892	.459177	.387998	858.9251
160.00		.922651	513.963	1.33506	.462875	.389276	854.4091
170.00		.862107	513.251	1.33137	.466690	.390565	849.8362
180.00		.808225	512.531	1.32783	.470628	.391864	845.2044
190.00		.759951	511.801	1.32442	.474699	.393176	840.5114
200.00		.716443	511.062	1.32113	.478910	.394498	835.7550
210.00		.677016	510.314	1.31795	.483272	.395833	830.9326
220.00		.641113	509.555	1.31486	.487793	.397181	826.0418
230.00		.608271	508.786	1.31185	.492487	.398542	821.0797
240.00		.578104	508.006	1.30891	.497365	.399916	816.0432
250.00		.550290	507.214	1.30605	.502441	.401305	810.9294
260.00		.524554	506.411	1.30324	.507732	.402708	805.7347
270.00		.500663	505.594	1.30048	.513253	.404127	800.4555
280.00		.478416	504.765	1.29777	.519025	.405561	795.0879
290.00		.457640	503.922	1.29510	.525069	.407013	789.6277
300.00		.438185	503.064	1.29246	.531409	.408482	784.0702
310.00		.419919	502.191	1.28986	.538072	.409969	778.4106
320.00		.402728	501.301	1.28728	.545089	.411476	772.6435
330.00		.386511	500.394	1.28472	.552496	.413002	766.7631
340.00		.371177	499.469	1.28218	.560332	.414551	760.7629
350.00		.356647	498.525	1.27965	.568644	.416121	754.6360
360.00		.342849	497.559	1.27713	.577486	.417716	748.3748
370.00		.329719	496.572	1.27462	.586920	.419336	741.9707
380.00		.317199	495.561	1.27210	.597018	.420983	735.4143
390.00		.305236	494.524	1.26958	.607868	.422659	728.6952
400.00		.293782	493.460	1.26705	.619570	.424365	721.8017
410.00		.282793	492.365	1.26451	.632249	.426105	714.7206
420.00		.272227	491.238	1.26195	.646053	.427880	707.4370
430.00		.262046	490.076	1.25936	.661165	.429694	699.9339
440.00		.252215	488.874	1.25673	.677809	.431550	692.1917
450.00		.242697	487.628	1.25407	.696270	.433452	684.1878
460.00		.233459	486.335	1.25136	.716911	.435404	675.8957
470.00		.224468	484.986	1.24859	.740201	.437413	667.2839
480.00		.215690	483.576	1.24575	.766764	.439484	658.3148
490.00		.207088	482.095	1.24283	.797447	.441627	648.9423
500.00		.198623	480.531	1.23980	.833435	.443851	639.1094
510.00		.190253	478.869	1.23664	.876439	.446169	628.7436
520.00		.181925	477.089	1.23332	.929048	.448598	617.7498
530.00		.173571	475.163	1.22980	.995389	.451163	605.9997
540.00		.165104	473.050	1.22601	1.082532	.453896	593.3103
550.00		.156389	470.685	1.22184	1.203845	.456849	579.4043
560.00		.147203	467.955	1.21714	1.388588	.460108	563.8176
567.50	SAT. VAPOR	.139758	465.541	1.21306	1.612613	.462848	550.5204
567.50	SAT. LIQUID	.044916	401.096	1.11238	1.435863	.439440	883.6792
570.0	COMPRESSED LIQUID	.044820	400.949	1.11210	1.412074	.439173	890.5585

Table II-8 Superheated Vapor and Compressed Liquid Tables of N-Butane

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 20. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	8.585949	322.466	1.15146	.378512	.339515	655.3775
11.63	SAT. VAPOR	7.339385	322.164	1.14583	.380282	.340235	652.5090
11.63	SAT. LIQUID	.026618	155.232	.79806	.553293	.411358	3790.7432
20.00	COMPRESSED LIQUID	.026616	155.256	.79802	.553252	.411402	3792.4323
30.00		.026612	155.286	.79798	.553204	.411454	3794.4492
40.00		.026609	155.315	.79794	.553155	.411506	3796.4636
50.00		.026606	155.345	.79790	.553107	.411558	3798.4754
60.00		.026603	155.374	.79786	.553059	.411609	3800.4848
70.00		.026600	155.404	.79782	.553011	.411661	3802.4916
80.00		.026597	155.434	.79778	.552964	.411713	3804.4959
90.00		.026594	155.463	.79774	.552916	.411765	3806.4977
100.00		.026591	155.493	.79769	.552869	.411817	3808.4971
110.00		.026588	155.523	.79765	.552822	.411868	3810.4940
120.00		.026585	155.552	.79761	.552775	.411920	3812.4884
130.00		.026582	155.582	.79757	.552728	.411972	3814.4804
140.00		.026579	155.612	.79753	.552682	.412023	3816.4699
150.00		.026576	155.641	.79749	.552636	.412075	3818.4570
160.00		.026573	155.671	.79745	.552590	.412126	3820.4416
170.00		.026570	155.701	.79741	.552544	.412178	3822.4239
180.00		.026567	155.731	.79737	.552498	.412229	3824.4037
190.00		.026564	155.761	.79733	.552453	.412281	3826.3811
200.00		.026561	155.790	.79729	.552407	.412332	3828.3560
210.00		.026558	155.820	.79725	.552362	.412383	3830.3286
220.00		.026555	155.850	.79721	.552317	.412435	3832.2988
230.00		.026552	155.880	.79717	.552273	.412486	3834.2667
240.00		.026549	155.910	.79713	.552228	.412537	3836.2321
250.00		.026546	155.940	.79709	.552184	.412588	3838.1952
260.00		.026543	155.969	.79705	.552139	.412639	3840.1559
270.00		.026540	155.999	.79701	.552095	.412691	3842.1143
280.00		.026537	156.029	.79697	.552052	.412742	3844.0703
290.00		.026534	156.059	.79693	.552008	.412793	3846.0240
300.00		.026531	156.089	.79689	.551965	.412844	3847.9753
310.00		.026528	156.119	.79685	.551921	.412895	3849.9244
320.00		.026525	156.149	.79681	.551878	.412945	3851.8711
330.00		.026522	156.179	.79677	.551835	.412996	3853.8155
340.00		.026520	156.209	.79673	.551793	.413047	3855.7576
350.00		.026517	156.239	.79669	.551750	.413098	3857.6974
360.00		.026514	156.269	.79665	.551708	.413149	3859.6349
370.00		.026511	156.299	.79661	.551665	.413199	3861.5701
380.00		.026508	156.329	.79657	.551623	.413250	3863.5031
390.00		.026505	156.359	.79653	.551581	.413301	3865.4338
400.00		.026502	156.390	.79649	.551540	.413351	3867.3622
410.00		.026499	156.420	.79645	.551498	.413402	3869.2883
420.00		.026496	156.450	.79641	.551457	.413453	3871.2122
430.00		.026493	156.480	.79637	.551416	.413503	3873.1339
440.00		.026490	156.510	.79633	.551375	.413553	3875.0534
450.00		.026488	156.540	.79629	.551334	.413604	3876.9706
460.00		.026485	156.570	.79626	.551293	.413654	3878.8855
470.00		.026482	156.601	.79622	.551252	.413705	3880.7983
480.00		.026479	156.631	.79618	.551212	.413755	3882.7089
490.00		.026476	156.661	.79614	.551171	.413805	3884.6172
500.00		.026473	156.691	.79610	.551132	.413856	3886.5234

Table II-8 (Continued)

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 40. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	8.982823	330.153	1.16725	.387955	.350309	669.6640
17.73	SAT. VAPOR	4.951593	328.858	1.14581	.395277	.353235	657.4562
17.73	SAT. LIQUID	.027073	166.367	.82083	.556401	.417133	3541.3335
20.00	COMPRESSED LIQUID	.027072	166.373	.82082	.556586	.417144	3541.8358
30.00		.027068	166.402	.82078	.556522	.417193	3544.0492
40.00		.027064	166.430	.82073	.556458	.417242	3546.2593
50.00		.027061	166.459	.82069	.556394	.417291	3548.4663
60.00		.027057	166.487	.82065	.556331	.417339	3550.6702
70.00		.027054	166.516	.82060	.556268	.417388	3552.8709
80.00		.027050	166.544	.82056	.556205	.417437	3555.0684
90.00		.027047	166.573	.82052	.556142	.417486	3557.2629
100.00		.027043	166.601	.82047	.556080	.417534	3559.4543
110.00		.027039	166.630	.82043	.556018	.417583	3561.6425
120.00		.027036	166.658	.82039	.555956	.417631	3563.8277
130.00		.027032	166.687	.82034	.555895	.417680	3566.0098
140.00		.027029	166.716	.82030	.555834	.417728	3568.1889
150.00		.027025	166.744	.82026	.555773	.417777	3570.3649
160.00		.027022	166.773	.82022	.555712	.417825	3572.5378
170.00		.027018	166.802	.82017	.555652	.417874	3574.7078
180.00		.027015	166.830	.82013	.555592	.417922	3576.8747
190.00		.027011	166.859	.82009	.555532	.417970	3579.0386
200.00		.027008	166.888	.82005	.555472	.418018	3581.1995
210.00		.027004	166.917	.82000	.555413	.418067	3583.3574
220.00		.027001	166.946	.81996	.555354	.418115	3585.5124
230.00		.026997	166.974	.81992	.555295	.418163	3587.6644
240.00		.026994	167.003	.81988	.555236	.418211	3589.8134
250.00		.026990	167.032	.81983	.555178	.418259	3591.9595
260.00		.026987	167.061	.81979	.555120	.418307	3594.1026
270.00		.026983	167.090	.81975	.555062	.418355	3596.2429
280.00		.026980	167.119	.81971	.555004	.418403	3598.3802
290.00		.026976	167.148	.81967	.554947	.418451	3600.5146
300.00		.026973	167.177	.81962	.554890	.418499	3602.6461
310.00		.026969	167.206	.81958	.554833	.418546	3604.7747
320.00		.026966	167.235	.81954	.554776	.418594	3606.9005
330.00		.026963	167.264	.81950	.554720	.418642	3609.0234
340.00		.026959	167.293	.81946	.554664	.418690	3611.1434
350.00		.026956	167.322	.81942	.554608	.418737	3613.2606
360.00		.026952	167.351	.81937	.554552	.418785	3615.3750
370.00		.026949	167.380	.81933	.554497	.418833	3617.4866
380.00		.026945	167.409	.81929	.554441	.418880	3619.5953
390.00		.026942	167.438	.81925	.554387	.418928	3621.7012
400.00		.026939	167.467	.81921	.554332	.418975	3623.8043
410.00		.026935	167.496	.81917	.554277	.419023	3625.9046
420.00		.026932	167.526	.81912	.554223	.419070	3628.0022
430.00		.026929	167.555	.81908	.554169	.419117	3630.0970
440.00		.026925	167.584	.81904	.554115	.419165	3632.1890
450.00		.026922	167.613	.81900	.554062	.419212	3634.2783
460.00		.026918	167.642	.81896	.554008	.419259	3636.3648
470.00		.026915	167.672	.81892	.553955	.419307	3638.4486
480.00		.026912	167.701	.81888	.553902	.419354	3640.5297
490.00		.026908	167.730	.81884	.553849	.419401	3642.6081
500.00		.026905	167.760	.81880	.553797	.419448	3644.6838

Table II-8 (Continued)

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 60. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
	SUPERHEATED						
10.00	VAPOR	9.375791	338.042	1.18281	.397998	.361256	683.6594
20.00		4.569399	336.533	1.15703	.406092	.364486	669.5851
26.05	SAT. VAPOR	3.450857	335.584	1.14667	.411483	.366512	660.6519
26.05	SAT. LIQUID	.027553	177.606	.84287	.562443	.423427	3306.5678
30.00	COMPRESSED	.027552	177.617	.84285	.562410	.423445	3307.5282
40.00	LIQUID	.027547	177.644	.84281	.562326	.423491	3309.9581
50.00		.027543	177.671	.84276	.562242	.423536	3312.3860
60.00		.027539	177.698	.84271	.562159	.423582	3314.8058
70.00		.027534	177.725	.84267	.562076	.423628	3317.2238
80.00		.027530	177.752	.84262	.561994	.423674	3319.6377
90.00		.027526	177.779	.84258	.561912	.423719	3322.0477
100.00		.027522	177.806	.84253	.561830	.423765	3324.4538
110.00		.027518	177.834	.84248	.561749	.423811	3326.8560
120.00		.027513	177.861	.84244	.561668	.423856	3329.2543
130.00		.027509	177.888	.84239	.561588	.423902	3331.6488
140.00		.027505	177.915	.84235	.561508	.423947	3334.0394
150.00		.027501	177.942	.84230	.561428	.423993	3336.4261
160.00		.027497	177.970	.84226	.561349	.424038	3338.8090
170.00		.027493	177.997	.84221	.561270	.424083	3341.1882
180.00		.027488	178.024	.84217	.561191	.424129	3343.5635
190.00		.027484	178.052	.84212	.561113	.424174	3345.9350
200.00		.027480	178.079	.84208	.561035	.424219	3348.3028
210.00		.027476	178.107	.84203	.560958	.424264	3350.6669
220.00		.027472	178.134	.84199	.560880	.424309	3353.0272
230.00		.027468	178.162	.84194	.560804	.424355	3355.3838
240.00		.027464	178.189	.84190	.560727	.424400	3357.7366
250.00		.027460	178.217	.84185	.560651	.424445	3360.0859
260.00		.027455	178.244	.84181	.560575	.424490	3362.4314
270.00		.027451	178.272	.84176	.560500	.424535	3364.7733
280.00		.027447	178.299	.84172	.560425	.424580	3367.1115
290.00		.027443	178.327	.84167	.560350	.424625	3369.4461
300.00		.027439	178.355	.84163	.560276	.424670	3371.7771
310.00		.027435	178.382	.84158	.560202	.424714	3374.1045
320.00		.027431	178.410	.84154	.560128	.424759	3376.4283
330.00		.027427	178.438	.84149	.560055	.424806	3378.7485
340.00		.027423	178.465	.84145	.559981	.424849	3381.0652
350.00		.027419	178.493	.84141	.559909	.424893	3383.3783
360.00		.027415	178.521	.84136	.559836	.424938	3385.6879
370.00		.027411	178.549	.84132	.559764	.424983	3387.9940
380.00		.027407	178.577	.84127	.559693	.425027	3390.2966
390.00		.027403	178.604	.84123	.559621	.425072	3392.5957
400.00		.027399	178.632	.84119	.559550	.425116	3394.8913
410.00		.027395	178.660	.84114	.559479	.425161	3397.1834
420.00		.027391	178.688	.84110	.559409	.425205	3399.4721
430.00		.027387	178.716	.84106	.559339	.425249	3401.7574
440.00		.027383	178.744	.84101	.559269	.425294	3404.0392
450.00		.027379	178.772	.84097	.559199	.425338	3406.3177
460.00		.027375	178.800	.84092	.559130	.425382	3408.5927
470.00		.027371	178.828	.84088	.559061	.425427	3410.8644
480.00		.027367	178.856	.84084	.558992	.425471	3413.1327
490.00		.027364	178.884	.84079	.558924	.425515	3415.3976
500.00		.027360	178.912	.84075	.558856	.425559	3417.6592

Table II-8 (Continued)

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 80. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
	SUPERHEATED VAPOR						
10.00		9.765568	346.139	1.19815	.408571	.372335	697.4190
20.00		4.775577	344.779	1.17265	.415454	.375098	684.8766
30.00		3.109414	343.362	1.15690	.423086	.377968	671.6764
37.08	SAT. VAPOR	2.471547	342.321	1.14825	.429037	.380072	661.8777
37.08	SAT. LIQUID	.028066	188.995	.86432	.570780	.430240	3082.8404
40.00	COMPRESSED LIQUID	.028065	189.002	.86430	.570747	.430253	3083.6230
50.00		.028060	189.027	.86425	.570637	.430295	3086.3002
60.00		.028055	189.053	.86420	.570528	.430338	3088.9723
70.00		.028050	189.078	.86415	.570419	.430381	3091.6394
80.00		.028045	189.103	.86410	.570311	.430424	3094.3013
90.00		.028040	189.128	.86406	.570203	.430467	3096.9582
100.00		.028035	189.153	.86401	.570096	.430509	3099.6102
110.00		.028030	189.179	.86396	.569989	.430552	3102.2571
120.00		.028025	189.204	.86391	.569883	.430594	3104.8991
130.00		.028020	189.229	.86386	.569777	.430637	3107.5361
140.00		.026015	189.255	.86381	.569672	.430680	3110.1682
150.00		.028010	189.280	.86376	.569568	.430722	3112.7954
160.00		.028005	189.306	.86371	.569464	.430764	3115.4178
170.00		.028000	189.331	.86366	.569360	.430807	3118.0353
180.00		.027995	189.357	.86361	.569257	.430849	3120.6480
190.00		.027990	189.382	.86357	.569155	.430892	3123.2559
200.00		.027985	189.408	.86352	.569053	.430934	3125.8590
210.00		.027980	189.433	.86347	.568952	.430976	3128.4574
220.00		.027975	189.459	.86342	.568851	.431018	3131.0510
230.00		.027970	189.485	.86337	.568751	.431061	3133.6399
240.00		.027965	189.511	.86332	.568651	.431103	3136.2242
250.00		.027961	189.536	.86328	.568552	.431145	3138.8037
260.00		.027956	189.562	.86323	.568453	.431187	3141.3787
270.00		.027951	189.588	.86318	.568355	.431229	3143.9489
280.00		.027946	189.614	.86313	.568257	.431271	3146.5146
290.00		.027941	189.640	.86308	.568159	.431313	3149.0758
300.00		.027936	189.666	.86304	.568063	.431355	3151.6323
310.00		.027932	189.692	.86299	.567966	.431397	3154.1843
320.00		.027927	189.718	.86294	.567870	.431439	3156.7318
330.00		.027922	189.744	.86289	.567775	.431481	3159.2748
340.00		.027917	189.770	.86285	.567680	.431522	3161.8133
350.00		.027913	189.796	.86280	.567585	.431564	3164.3474
360.00		.027908	189.822	.86275	.567491	.431606	3166.8770
370.00		.027903	189.848	.86270	.567398	.431648	3169.4022
380.00		.027898	189.874	.86266	.567305	.431689	3171.9230
390.00		.027894	189.901	.86261	.567212	.431731	3174.4395
400.00		.027889	189.927	.86256	.567120	.431772	3176.9515
410.00		.027884	189.953	.86252	.567028	.431814	3179.4592
420.00		.027880	189.980	.86247	.566937	.431856	3181.9627
430.00		.027875	190.006	.86242	.566846	.431897	3184.4618
440.00		.027870	190.032	.86238	.566756	.431938	3186.9566
450.00		.027866	190.059	.86233	.566665	.431980	3189.4471
460.00		.027861	190.085	.86228	.566576	.432021	3191.9334
470.00		.027856	190.112	.86224	.566487	.432063	3194.4155
480.00		.027852	190.138	.86219	.566398	.432104	3196.8934
490.00		.027847	190.165	.86214	.566310	.432145	3199.3671
500.00		.027843	190.191	.86210	.566222	.432186	3201.8366

Table II-8 (Continued)

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 100. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	10.152710	354.448	1.21331	.419557	.383530	710.9331
20.00		4.978848	353.216	1.18804	.425465	.385909	699.6842
30.00		3.252036	351.940	1.17254	.431920	.388366	687.9333
40.00		2.386791	350.614	1.16100	.439029	.390909	675.6151
50.00		1.865980	349.234	1.15157	.446937	.393549	662.6492
51.35	SAT. VAPOR	1.811206	349.043	1.15041	.448073	.393913	660.8485
51.35	SAT. LIQUID	.028620	200.577	.88529	.581604	.437564	2866.9439
60.00	COMPRESSED LIQUID	.028615	200.597	.88524	.581478	.437598	2869.5105
70.00		.028609	200.619	.88519	.581333	.437638	2872.4703
80.00		.028603	200.642	.88513	.581189	.437678	2875.4235
90.00		.028597	200.665	.88508	.581045	.437717	2878.3702
100.00		.028591	200.688	.88503	.580903	.437757	2881.3103
110.00		.028584	200.710	.88497	.580762	.437797	2884.2440
120.00		.028578	200.733	.88492	.580621	.437836	2887.1712
130.00		.028572	200.756	.88487	.580481	.437876	2890.0920
140.00		.028566	200.779	.88481	.580342	.437915	2893.0065
150.00		.028560	200.802	.88476	.580204	.437955	2895.9146
160.00		.028554	200.825	.88471	.580066	.437994	2898.8164
170.00		.028549	200.848	.88465	.579930	.438034	2901.7119
180.00		.028543	200.872	.88460	.579794	.438073	2904.6012
190.00		.028537	200.895	.88455	.579659	.438112	2907.4843
200.00		.028531	200.918	.88449	.579524	.438152	2910.3613
210.00		.028525	200.941	.88444	.579391	.438191	2913.2321
220.00		.028519	200.965	.88439	.579258	.438230	2916.0968
230.00		.028513	200.988	.88434	.579126	.438269	2918.9555
240.00		.028507	201.012	.88428	.578995	.438309	2921.8081
250.00		.028501	201.035	.88423	.578864	.438348	2924.6547
260.00		.028496	201.059	.88418	.578734	.438387	2927.4954
270.00		.028490	201.082	.88413	.578605	.438426	2930.3301
280.00		.028484	201.106	.88408	.578477	.438465	2933.1589
290.00		.028478	201.130	.88402	.578349	.438504	2935.9819
300.00		.028473	201.153	.88397	.578222	.438543	2938.7990
310.00		.028467	201.177	.88392	.578096	.438582	2941.6103
320.00		.028461	201.201	.88387	.577970	.438621	2944.4159
330.00		.028455	201.225	.88382	.577846	.438660	2947.2157
340.00		.028450	201.249	.88377	.577721	.438699	2950.0097
350.00		.028444	201.273	.88371	.577598	.438737	2952.7981
360.00		.028438	201.297	.88366	.577475	.438776	2955.5809
370.00		.028433	201.321	.88361	.577353	.438815	2958.3580
380.00		.028427	201.345	.88356	.577232	.438854	2961.1295
390.00		.028422	201.369	.88351	.577111	.438892	2963.8954
400.00		.028416	201.393	.88346	.576991	.438931	2966.6558
410.00		.028410	201.417	.88341	.576871	.438970	2969.4107
420.00		.028405	201.441	.88336	.576752	.439008	2972.1601
430.00		.028399	201.466	.88331	.576634	.439047	2974.9041
440.00		.028394	201.490	.88326	.576516	.439085	2977.6426
450.00		.028388	201.514	.88321	.576399	.439124	2980.3757
460.00		.028383	201.539	.88316	.576283	.439162	2983.1035
470.00		.028377	201.563	.88311	.576167	.439201	2985.8259
480.00		.028372	201.588	.88306	.576052	.439239	2988.5430
490.00		.028366	201.612	.88301	.575938	.439278	2991.2548
500.00		.028361	201.637	.88296	.575824	.439316	2993.9613

Table II-8 (Continued)

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 120. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	10.537660	362.974	1.22830	.430828	.394825	724.1665
20.00		5.179731	361.851	1.20323	.435941	.396886	714.0233
30.00		3.392037	360.695	1.18794	.441460	.399005	703.4917
40.00		2.496772	359.500	1.17662	.447454	.401186	692.5288
50.00		1.958354	358.263	1.16744	.454010	.403436	681.0834
60.00		1.598236	356.980	1.15959	.461239	.405763	669.0937
69.42	SAT. VAPOR	1.352917	355.722	1.15300	.468792	.408034	657.2373
69.42	SAT. LIQUID	.029224	212.399	.90589	.595017	.445383	2656.0548
70.00	COMPRESSED LIQUID	.029224	212.400	.90589	.595006	.445386	2656.2476
80.00		.029216	212.420	.90583	.594810	.445422	2659.5525
90.00		.029209	212.439	.90577	.594616	.445458	2662.8486
100.00		.029202	212.458	.90571	.594424	.445495	2666.1360
110.00		.029194	212.478	.90565	.594232	.445531	2669.4148
120.00		.029187	212.498	.90559	.594042	.445568	2672.6850
130.00		.029179	212.517	.90553	.593854	.445604	2675.9467
140.00		.029172	212.537	.90547	.593666	.445640	2679.1999
150.00		.029165	212.557	.90541	.593480	.445676	2682.4448
160.00		.029157	212.577	.90536	.593295	.445713	2685.6812
170.00		.029150	212.597	.90530	.593111	.445749	2688.9094
180.00		.029143	212.617	.90524	.592929	.445785	2692.1294
190.00		.029136	212.637	.90518	.592747	.445821	2695.3411
200.00		.029129	212.657	.90512	.592567	.445857	2698.5448
210.00		.029121	212.677	.90506	.592389	.445893	2701.7404
220.00		.029114	212.697	.90501	.592211	.445929	2704.9279
230.00		.029107	212.718	.90495	.592034	.445965	2708.1075
240.00		.029100	212.738	.90489	.591859	.446001	2711.2791
250.00		.029093	212.759	.90483	.591684	.446037	2714.4429
260.00		.029086	212.779	.90478	.591511	.446073	2717.5988
270.00		.029079	212.800	.90472	.591339	.446109	2720.7470
280.00		.029072	212.820	.90466	.591168	.446145	2723.8875
290.00		.029065	212.841	.90460	.590999	.446181	2727.0203
300.00		.029058	212.862	.90455	.590830	.446217	2730.1455
310.00		.029051	212.883	.90449	.590662	.446253	2733.2631
320.00		.029044	212.904	.90443	.590495	.446289	2736.3732
330.00		.029037	212.925	.90438	.590330	.446324	2739.4758
340.00		.029030	212.946	.90432	.590165	.446360	2742.5709
350.00		.029023	212.967	.90426	.590002	.446396	2745.6587
360.00		.029017	212.988	.90421	.589839	.446432	2748.7391
370.00		.029010	213.009	.90415	.589678	.446467	2751.8123
380.00		.029003	213.030	.90410	.589517	.446503	2754.8781
390.00		.028996	213.052	.90404	.589358	.446539	2757.9368
400.00		.028989	213.073	.90398	.589199	.446574	2760.9883
410.00		.028983	213.095	.90393	.589042	.446610	2764.0327
420.00		.028976	213.116	.90387	.588885	.446645	2767.0700
430.00		.028969	213.138	.90382	.588730	.446681	2770.1003
440.00		.028963	213.159	.90376	.588575	.446716	2773.1236
450.00		.028956	213.181	.90371	.588421	.446752	2776.1399
460.00		.028949	213.203	.90365	.588269	.446787	2779.1493
470.00		.028943	213.224	.90360	.588117	.446823	2782.1518
480.00		.028936	213.246	.90354	.587966	.446858	2785.1475
490.00		.028930	213.268	.90349	.587816	.446893	2788.1364
500.00		.028923	213.290	.90343	.587666	.446929	2791.1186

Table II-8 (Continued)

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 140. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	10.920767	371.719	1.24314	.442268	.406204	737.0841
20.00		5.378629	370.692	1.21823	.446725	.408000	727.8956
30.00		3.529890	369.638	1.20312	.451488	.409838	718.4034
40.00		2.604410	368.554	1.19198	.456603	.411723	708.5785
50.00		2.048153	367.438	1.18301	.462125	.413657	698.3875
60.00		1.676426	366.286	1.17538	.468119	.415646	687.7910
70.00		1.410064	365.094	1.16865	.474672	.417696	676.7426
80.00		1.209472	363.858	1.16257	.481892	.419813	665.1864
90.00		1.052636	362.573	1.15694	.489918	.422007	653.0546
91.90	SAT. VAPOR	1.026599	362.323	1.15592	.491549	.422433	650.6781
91.90	SAT. LIQUID	.029892	224.511	.92623	.611312	.453684	2447.6557
100.00	COMPRESSED LIQUID	.029885	224.523	.92618	.611094	.453711	2450.6679
110.00		.029876	224.538	.92611	.610828	.453743	2454.3758
120.00		.029866	224.553	.92604	.610564	.453776	2458.0718
130.00		.029857	224.568	.92598	.610302	.453809	2461.7563
140.00		.029848	224.583	.92591	.610042	.453841	2465.4291
150.00		.029839	224.599	.92584	.609784	.453874	2469.0904
160.00		.029830	224.614	.92578	.609528	.453906	2472.7403
170.00		.029821	224.630	.92571	.609274	.453939	2476.3789
180.00		.029812	224.646	.92565	.609022	.453971	2480.0062
190.00		.029803	224.661	.92558	.608773	.454004	2483.6225
200.00		.029794	224.677	.92551	.608525	.454036	2487.2276
210.00		.029785	224.693	.92545	.608279	.454069	2490.8219
220.00		.029776	224.709	.92538	.608035	.454101	2494.4052
230.00		.029767	224.726	.92532	.607793	.454134	2497.9778
240.00		.029758	224.742	.92525	.607553	.454166	2501.5396
250.00		.029750	224.758	.92519	.607314	.454198	2505.0909
260.00		.029741	224.775	.92513	.607078	.454231	2508.6316
270.00		.029732	224.791	.92506	.606843	.454263	2512.1618
280.00		.029724	224.808	.92500	.606610	.454296	2515.6817
290.00		.029715	224.825	.92493	.606379	.454328	2519.1913
300.00		.029706	224.842	.92487	.606149	.454360	2522.6906
310.00		.029698	224.859	.92481	.605921	.454393	2526.1799
320.00		.029689	224.876	.92474	.605695	.454425	2529.6590
330.00		.029681	224.893	.92468	.605471	.454457	2533.1282
340.00		.029672	224.910	.92462	.605248	.454490	2536.5874
350.00		.029664	224.927	.92455	.605027	.454522	2540.0368
360.00		.029655	224.944	.92449	.604807	.454556	2543.4764
370.00		.029647	224.962	.92443	.604589	.454588	2546.9064
380.00		.029639	224.979	.92437	.604373	.454619	2550.3267
390.00		.029630	224.997	.92431	.604158	.454651	2553.7374
400.00		.029622	225.015	.92424	.603945	.454683	2557.1387
410.00		.029614	225.033	.92418	.603733	.454715	2560.5305
420.00		.029606	225.050	.92412	.603523	.454747	2563.9130
430.00		.029598	225.068	.92406	.603314	.454779	2567.2862
440.00		.029589	225.086	.92400	.603107	.454812	2570.6502
450.00		.029581	225.105	.92394	.602901	.454844	2574.0050
460.00		.029573	225.123	.92388	.602697	.454876	2577.3507
470.00		.029565	225.141	.92382	.602494	.454908	2580.6875
480.00		.029557	225.159	.92375	.602293	.454940	2584.0152
490.00		.029549	225.178	.92369	.602093	.454972	2587.3340
500.00		.029541	225.196	.92363	.601894	.455004	2590.6440

Table II-8 (Continued)

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 160. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	11.302315	380.687	1.25785	.453783	.417650	749.6632
20.00		5.575865	379.744	1.23307	.457693	.419223	741.3066
30.00		3.665959	378.779	1.21811	.461838	.420828	732.7100
40.00		2.710129	377.790	1.20713	.466248	.422466	723.8538
50.00		2.135872	376.775	1.19832	.470958	.424141	714.7157
60.00		1.752349	375.733	1.19087	.476010	.425856	705.2700
70.00		1.477764	374.661	1.18434	.481457	.427615	695.4871
80.00		1.271213	373.556	1.17847	.487360	.429420	685.3324
90.00		1.109961	372.414	1.17308	.493800	.431278	674.7653
100.00		.980361	371.232	1.16806	.500875	.433193	663.7376
110.00		.873716	370.004	1.16332	.508713	.435173	652.1909
119.44	SAT. VAPOR	.788817	368.798	1.15904	.516967	.437110	640.7460
119.44	SAT. LIQUID	.030642	236.968	.94641	.631097	.462456	2239.4040
120.00	COMPRESSED LIQUID	.030642	236.969	.94640	.631076	.462458	2239.6397
130.00		.030630	236.978	.94633	.630696	.462486	2243.8703
140.00		.030618	236.987	.94625	.630320	.462514	2248.0841
150.00		.030607	236.996	.94617	.629947	.462542	2252.2816
160.00		.030595	237.005	.94610	.629578	.462570	2256.4627
170.00		.030583	237.015	.94602	.629213	.462597	2260.6277
180.00		.030572	237.024	.94594	.628851	.462625	2264.7768
190.00		.030560	237.034	.94587	.628493	.462653	2268.9101
200.00		.030549	237.044	.94579	.628138	.462681	2273.0277
210.00		.030538	237.054	.94572	.627787	.462709	2277.1298
220.00		.030526	237.065	.94564	.627439	.462737	2281.2166
230.00		.030515	237.075	.94557	.627095	.462765	2285.2882
240.00		.030504	237.086	.94550	.626753	.462793	2289.3448
250.00		.030493	237.096	.94542	.626415	.462821	2293.3865
260.00		.030482	237.107	.94535	.626080	.462850	2297.4134
270.00		.030471	237.118	.94528	.625748	.462878	2301.4257
280.00		.030460	237.129	.94520	.625419	.462906	2305.4235
290.00		.030449	237.141	.94513	.625093	.462934	2309.4070
300.00		.030438	237.152	.94506	.624770	.462962	2313.3763
310.00		.030427	237.163	.94499	.624450	.462990	2317.3315
320.00		.030416	237.175	.94491	.624133	.463018	2321.2728
330.00		.030406	237.187	.94484	.623819	.463046	2325.2003
340.00		.030395	237.199	.94477	.623508	.463074	2329.1141
350.00		.030384	237.211	.94470	.623199	.463102	2333.0143
360.00		.030374	237.223	.94463	.622893	.463131	2336.9010
370.00		.030363	237.235	.94456	.622590	.463159	2340.7745
380.00		.030353	237.248	.94449	.622289	.463187	2344.6347
390.00		.030343	237.260	.94442	.621991	.463215	2348.4819
400.00		.030332	237.273	.94435	.621696	.463243	2352.3161
410.00		.030322	237.286	.94428	.621403	.463271	2356.1374
420.00		.030312	237.299	.94421	.621112	.463300	2359.9460
430.00		.030301	237.312	.94414	.620824	.463328	2363.7419
440.00		.030291	237.325	.94407	.620539	.463356	2367.5254
450.00		.030281	237.338	.94400	.620256	.463384	2371.2964
460.00		.030271	237.352	.94393	.619975	.463412	2375.0551
470.00		.030261	237.365	.94386	.619696	.463440	2378.8016
480.00		.030251	237.379	.94379	.619420	.463469	2382.5360
490.00		.030241	237.392	.94372	.619146	.463497	2386.2584
500.00		.030231	237.406	.94366	.618875	.463525	2389.9688

Table II-8 (Continued)

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 180. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
	SUPERHEATED						
10.00	VAPOR	11.682535	389.879	1.27243	.465307	.429145	761.8990
20.00		5.771694	389.010	1.24778	.468757	.430529	754.2722
30.00		3.8005535	388.122	1.23293	.472389	.431936	746.4545
40.00		2.814254	387.215	1.22209	.476225	.433370	738.4522
50.00		2.221885	386.288	1.21342	.480286	.434830	730.1901
60.00		1.826437	385.340	1.20612	.484600	.436320	721.7112
70.00		1.543479	384.368	1.19975	.489201	.437841	712.9762
80.00		1.330793	383.370	1.19405	.494126	.439396	703.9630
90.00		1.164920	382.345	1.18884	.499422	.440988	694.6464
100.00		1.031780	381.290	1.18403	.505145	.442619	684.9971
110.00		.922407	380.202	1.17951	.511366	.444295	674.9812
120.00		.830818	379.078	1.17522	.518172	.446018	664.5585
130.00		.752863	377.913	1.17111	.525672	.447795	653.6815
140.00		.685572	376.703	1.16714	.534009	.449631	642.2927
150.00		.626754	375.442	1.16328	.543368	.451535	630.3218
152.75	SAT. VAPOR	.611829	375.085	1.16223	.546154	.452072	626.9153
152.75	SAT. LIQUID	.031501	249.842	.96653	.655533	.471699	2028.9505
160.00	COMPRESSED	.031490	249.842	.96647	.655123	.471715	2032.5011
170.00	LIQUID	.031475	249.843	.96638	.654564	.471736	2037.3781
180.00		.031459	249.844	.96629	.654011	.471758	2042.2309
190.00		.031444	249.844	.96620	.653466	.471780	2047.0599
200.00		.031429	249.846	.96611	.652927	.471802	2051.8654
210.00		.031414	249.847	.96602	.652395	.471824	2056.6477
220.00		.031399	249.849	.96593	.651870	.471846	2061.4071
230.00		.031384	249.851	.96584	.651350	.471868	2066.1438
240.00		.031370	249.853	.96576	.650838	.471890	2070.8582
250.00		.031355	249.855	.96567	.650331	.471912	2075.5505
260.00		.031340	249.858	.96558	.649830	.471934	2080.2209
270.00		.031326	249.861	.96550	.649335	.471956	2084.8699
280.00		.031312	249.864	.96541	.648846	.471979	2089.4975
290.00		.031297	249.867	.96533	.648363	.472001	2094.1042
300.00		.031283	249.871	.96524	.647885	.472023	2098.6900
310.00		.031269	249.875	.96516	.647413	.472046	2103.2553
320.00		.031255	249.879	.96507	.646946	.472068	2107.8003
330.00		.031241	249.883	.96499	.646484	.472091	2112.3253
340.00		.031227	249.887	.96491	.646028	.472114	2116.8305
350.00		.031214	249.892	.96482	.645576	.472136	2121.3160
360.00		.031200	249.896	.96474	.645130	.472159	2125.7822
370.00		.031186	249.901	.96466	.644688	.472182	2130.2292
380.00		.031173	249.907	.96457	.644251	.472205	2134.6573
390.00		.031159	249.912	.96449	.643819	.472228	2139.0666
400.00		.031146	249.918	.96441	.643392	.472251	2143.4575
410.00		.031133	249.923	.96433	.642969	.472274	2147.8300
420.00		.031119	249.929	.96425	.642550	.472297	2152.1844
430.00		.031106	249.935	.96417	.642136	.472320	2156.5208
440.00		.031093	249.942	.96409	.641727	.472343	2160.8396
450.00		.031080	249.948	.96401	.641321	.472366	2165.1408
460.00		.031067	249.955	.96393	.640920	.472389	2169.4246
470.00		.031054	249.962	.96385	.640523	.472412	2173.6913
480.00		.031041	249.969	.96377	.640130	.472436	2177.9410
490.00		.031029	249.976	.96369	.639741	.472459	2182.1739
500.00		.031016	249.983	.96362	.639356	.472482	2186.3901

Table II-8 (Continued)

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 220. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	12.439715	408.943	1.30128	.488227	.452201	785.4020
20.00		6.159929	408.196	1.27681	.490954	.453285	778.9913
30.00		4.066084	407.436	1.26216	.493796	.454383	772.4572
40.00		3.018702	406.665	1.25152	.496760	.455497	765.7933
50.00		2.389886	405.880	1.24307	.499859	.456625	758.9921
60.00		1.970336	405.081	1.23600	.503104	.457770	752.0459
70.00		1.670350	404.267	1.22986	.506510	.458932	744.9458
80.00		1.445076	403.438	1.22442	.510093	.460113	737.6824
90.00		1.269594	402.592	1.21949	.513871	.461315	730.2451
100.00		1.128951	401.728	1.21496	.517865	.462533	722.6221
110.00		1.013630	400.845	1.21075	.522100	.463775	714.8004
120.00		.917285	399.942	1.20680	.526604	.465040	706.7653
130.00		.835520	399.017	1.20306	.531412	.466331	698.5004
140.00		.765194	398.068	1.19949	.536562	.467648	689.9871
150.00		.704000	397.094	1.19606	.542105	.468994	681.2042
160.00		.650206	396.093	1.19274	.548096	.470372	672.1273
170.00		.602486	395.061	1.18952	.554608	.471783	662.7283
180.00		.559803	393.995	1.18637	.561727	.473233	652.9745
190.00		.521336	392.893	1.18328	.569564	.474723	642.8272
200.00		.486424	391.750	1.18023	.578259	.476259	632.2406
210.00		.454524	390.561	1.17720	.587993	.477847	621.1591
220.00		.425187	389.320	1.17418	.599007	.479492	609.5149
230.00		.398031	388.019	1.17115	.611628	.481203	597.2235
239.80	SAT. VAPOR	.373209	386.676	1.16814	.626001	.482954	584.4415
239.80	SAT. LIQUID	.033736	277.251	1.00722	.729556	.491715	1590.3143
240.00	COMPRESSED LIQUID	.033736	277.250	1.00722	.729525	.491715	1590.4538
250.00		.033705	277.217	1.00708	.727960	.491712	1597.5241
260.00		.033675	277.185	1.00694	.726433	.491709	1604.5300
270.00		.033645	277.153	1.00680	.724941	.491707	1611.4730
280.00		.033615	277.122	1.00667	.723484	.491706	1618.3545
290.00		.033586	277.092	1.00653	.722060	.491705	1625.1760
300.00		.033557	277.063	1.00640	.720668	.491704	1631.9389
310.00		.033528	277.035	1.00626	.719307	.491704	1638.6445
320.00		.033500	277.007	1.00613	.717975	.491704	1645.2941
330.00		.033472	276.980	1.00600	.716672	.491705	1651.8889
340.00		.033445	276.954	1.00587	.715397	.491706	1658.4302
350.00		.033417	276.928	1.00574	.714148	.491707	1664.9191
360.00		.033390	276.903	1.00561	.712925	.491709	1671.3567
370.00		.033364	276.879	1.00549	.711727	.491711	1677.7440
380.00		.033337	276.855	1.00536	.710553	.491714	1684.0821
390.00		.033311	276.832	1.00524	.709402	.491717	1690.3721
400.00		.033285	276.810	1.00511	.708274	.491720	1696.6148
410.00		.033260	276.788	1.00499	.707167	.491724	1702.8112
420.00		.033234	276.767	1.00487	.706082	.491728	1708.9622
430.00		.033209	276.747	1.00475	.705017	.491732	1715.0688
440.00		.033185	276.727	1.00463	.703972	.491736	1721.1317
450.00		.033160	276.707	1.00451	.702946	.491741	1727.1517
460.00		.033136	276.688	1.00439	.701938	.491746	1733.1297
470.00		.033112	276.670	1.00427	.700949	.491752	1739.0665
480.00		.033088	276.652	1.00416	.699977	.491758	1744.9628
490.00		.033064	276.635	1.00404	.699023	.491764	1750.8193
500.00		.033041	276.618	1.00393	.698084	.491770	1756.6367

Table II-8 (Continued)

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 200. F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/ F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/ F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/ F)	SONIC VELOCITY (FT/SEC)
	SUPERHEATED						
10.00	VAPOR	12.061616	399.298	1.28691	.476796	.440669	773.8035
20.00		5.966325	398.493	1.26235	.479856	.441892	766.8210
30.00		3.933848	397.673	1.24761	.483059	.443132	759.6856
40.00		2.917044	396.839	1.23688	.486420	.444392	752.3876
50.00		2.306481	395.987	1.22833	.489954	.445673	744.9167
60.00		1.899015	395.119	1.22115	.493679	.446975	737.2613
70.00		1.607580	394.232	1.21491	.497616	.448301	729.4085
80.00		1.388642	393.325	1.20935	.501789	.449651	721.3440
90.00		1.218011	392.397	1.20430	.506229	.451027	713.0516
100.00		1.081172	391.446	1.19964	.510967	.452432	704.5130
110.00		.968886	390.471	1.19529	.516046	.453868	695.7075
120.00		.874988	389.468	1.19119	.521513	.455336	686.6113
130.00		.795209	388.437	1.18729	.527427	.456841	677.1970
140.00		.726494	387.373	1.18354	.533861	.458384	667.4328
150.00		.666600	386.274	1.17993	.540906	.459971	657.2814
160.00		.613838	385.136	1.17641	.548675	.461606	646.6983
170.00		.566910	383.954	1.17296	.557314	.463293	635.6305
180.00		.524799	382.723	1.16957	.567017	.465041	624.0131
190.00		.486692	381.436	1.16620	.578040	.466857	611.7659
192.59	SAT. VAPOR	.477404	381.092	1.16533	.581148	.467339	608.4837
192.59	SAT. LIQUID	.032510	263.225	.98674	.686836	.481433	1813.6816
200.00	COMPRESSED	.032494	263.215	.98666	.686171	.481442	1817.9772
210.00	LIQUID	.032473	263.203	.98655	.685287	.481454	1823.7385
220.00		.032452	263.191	.98644	.684418	.481467	1829.4622
230.00		.032432	263.180	.98633	.683564	.481480	1835.1492
240.00		.032411	263.169	.98623	.682723	.481492	1840.7998
250.00		.032391	263.158	.98612	.681896	.481506	1846.4151
260.00		.032371	263.148	.98601	.681082	.481519	1851.9952
270.00		.032351	263.138	.98591	.680281	.481532	1857.5410
280.00		.032331	263.129	.98580	.679493	.481546	1863.0528
290.00		.032311	263.120	.98570	.678716	.481560	1868.5314
300.00		.032292	263.111	.98560	.677952	.481574	1873.9771
310.00		.032273	263.103	.98549	.677200	.481588	1879.3906
320.00		.032253	263.095	.98539	.676459	.481602	1884.7723
330.00		.032234	263.088	.98529	.675728	.481617	1890.1227
340.00		.032216	263.081	.98519	.675009	.481632	1895.4425
350.00		.032197	263.074	.98509	.674300	.481646	1900.7315
360.00		.032178	263.068	.98499	.673602	.481661	1905.9909
370.00		.032160	263.062	.98489	.672914	.481676	1911.2209
380.00		.032142	263.056	.98479	.672235	.481691	1916.4218
390.00		.032124	263.051	.98469	.671566	.481707	1921.5942
400.00		.032106	263.045	.98459	.670906	.481722	1926.7383
410.00		.032088	263.041	.98450	.670256	.481738	1931.8548
420.00		.032070	263.036	.98440	.669614	.481754	1936.9438
430.00		.032052	263.032	.98430	.668981	.481769	1942.0059
440.00		.032035	263.028	.98421	.668357	.481785	1947.0413
450.00		.032018	263.025	.98411	.667741	.481801	1952.0506
460.00		.032000	263.022	.98402	.667133	.481818	1957.0339
470.00		.031983	263.019	.98392	.666533	.481834	1961.9917
480.00		.031966	263.016	.98383	.665941	.481850	1966.9243
490.00		.031949	263.014	.98374	.665357	.481867	1971.8321
500.00		.031933	263.012	.98364	.664780	.481884	1976.7153

Table II-8 (Continued)

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 240. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	12.816962	418.815	1.31556	.499592	.463718	796.7283
20.00		6.352646	418.120	1.29117	.502033	.464683	790.8271
30.00		4.197395	417.414	1.27659	.504566	.465660	784.8260
40.00		3.119395	416.698	1.26603	.507197	.466647	778.7205
50.00		2.472281	415.972	1.25767	.509933	.467646	772.5055
60.00		2.040598	415.234	1.25068	.512783	.468658	766.1756
70.00		1.732007	414.483	1.24464	.515757	.469683	759.7246
80.00		1.506337	413.721	1.23929	.518865	.470721	753.1464
90.00		1.319938	412.945	1.23446	.522120	.471774	746.4337
100.00		1.175417	412.155	1.23004	.525535	.472842	739.5790
110.00		1.056981	411.350	1.22595	.529125	.473925	732.5738
120.00		.958096	410.529	1.22211	.532909	.475026	725.4088
130.00		.874241	409.692	1.21850	.536906	.476144	718.0739
140.00		.802184	408.837	1.21506	.541141	.477281	710.5578
150.00		.739554	407.963	1.21178	.545640	.478438	702.8478
160.00		.684572	407.068	1.20862	.550436	.479616	694.9299
170.00		.635876	406.152	1.20556	.555566	.480818	686.7881
180.00		.592405	405.212	1.20260	.561075	.482044	678.4047
190.00		.553319	404.246	1.19971	.567016	.483296	669.7593
200.00		.517946	403.252	1.19687	.573455	.484578	660.8285
210.00		.485737	402.228	1.19408	.580470	.485891	651.5854
220.00		.456242	401.171	1.19133	.588161	.487238	641.9987
230.00		.429086	400.076	1.18859	.596650	.488623	632.0315
240.00		.403953	398.940	1.18587	.606094	.490050	621.6401
250.00		.380571	397.758	1.18314	.616699	.491524	610.7717
260.00		.358705	396.524	1.18040	.628737	.493051	599.3618
270.00		.338148	395.228	1.17763	.642576	.494638	587.3304
280.00		.318712	393.863	1.17481	.658734	.496295	574.5755
290.00		.300219	392.414	1.17192	.677964	.498034	560.9646
295.38	SAT. VAPOR	.290593	391.594	1.17033	.689966	.499010	553.2230
295.38		.035309	292.148	1.02827	.794440	.502687	1354.1389
300.00	SAT. LIQUID	.035286	292.115	1.02818	.792944	.502672	1358.3465
310.00	COMPRESSED LIQUID	.035237	292.045	1.02798	.789791	.502640	1367.3675
320.00		.035189	291.977	1.02779	.786754	.502611	1376.2649
330.00		.035142	291.911	1.02761	.783826	.502582	1385.0434
340.00		.035096	291.847	1.02742	.781000	.502555	1393.7071
350.00		.035051	291.785	1.02724	.778271	.502529	1402.2601
360.00		.035006	291.724	1.02706	.775634	.502504	1410.7061
370.00		.034963	291.665	1.02688	.773082	.502480	1419.0486
380.00		.034920	291.607	1.02671	.770612	.502457	1427.2910
390.00		.034877	291.551	1.02654	.768220	.502436	1435.4366
400.00		.034836	291.496	1.02636	.765901	.502415	1443.4883
410.00		.034795	291.443	1.02620	.763652	.502396	1451.4490
420.00		.034755	291.391	1.02603	.761470	.502377	1459.3214
430.00		.034715	291.340	1.02587	.759351	.502359	1467.1082
440.00		.034676	291.291	1.02570	.757292	.502342	1474.8118
450.00		.034638	291.243	1.02554	.755290	.502326	1482.4346
460.00		.034600	291.196	1.02539	.753344	.502310	1489.9788
470.00		.034563	291.150	1.02523	.751450	.502296	1497.4466
480.00		.034526	291.105	1.02507	.749606	.502282	1504.8400
490.00		.034490	291.062	1.02492	.747810	.502269	1512.1610
500.00		.034455	291.019	1.02477	.746060	.502257	1519.4114

Table II-8 (Continued)

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 260. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	13.193467	428.915	1.32975	.510889	.475198	807.8195
20.00		6.544594	428.265	1.30542	.513084	.476060	802.3739
30.00		4.327909	427.608	1.29091	.515352	.476931	796.8474
40.00		3.219258	426.942	1.28042	.517699	.477811	791.2366
50.00		2.553812	426.267	1.27213	.520129	.478700	785.5379
60.00		2.109959	425.582	1.26522	.522650	.479598	779.7476
70.00		1.792722	424.888	1.25926	.525267	.480506	773.8616
80.00		1.554614	424.183	1.25399	.527988	.481424	767.8754
90.00		1.369249	423.468	1.24925	.530821	.482353	761.7844
100.00		1.220799	422.742	1.24492	.533775	.483293	755.5835
110.00		1.099189	422.003	1.24092	.536860	.484245	749.2671
120.00		.997701	421.253	1.23718	.540087	.485209	742.8294
130.00		.911685	420.489	1.23367	.543470	.486186	736.2638
140.00		.837819	419.711	1.23034	.547023	.487176	729.5632
150.00		.773666	418.919	1.22717	.550762	.488181	722.7201
160.00		.717397	418.112	1.22414	.554706	.489201	715.7258
170.00		.667613	417.288	1.22121	.558876	.490237	708.5710
180.00		.623225	416.446	1.21839	.563297	.491289	701.2456
190.00		.583373	415.586	1.21564	.567998	.492359	693.7380
200.00		.547368	414.706	1.21297	.573012	.493449	686.0357
210.00		.514651	413.805	1.21035	.578379	.494559	678.1242
220.00		.484763	412.880	1.20778	.584145	.495690	669.9878
230.00		.457324	411.931	1.20525	.590366	.496845	661.6082
240.00		.432016	410.954	1.20276	.597109	.498026	652.9648
250.00		.408571	409.948	1.20028	.604456	.499234	644.0341
260.00		.386757	408.910	1.19781	.612507	.500472	634.7885
270.00		.366378	407.836	1.19535	.621389	.501745	625.1963
280.00		.347262	406.722	1.19289	.631261	.503051	615.2198
290.00		.329254	405.563	1.19041	.642329	.504399	604.8142
300.00		.312220	404.354	1.18791	.654863	.505792	593.9252
310.00		.296034	403.088	1.18537	.669227	.507237	582.4863
320.00		.280579	401.756	1.18278	.685925	.508741	570.4141
330.00		.265744	400.345	1.18012	.705674	.510314	557.6021
340.00		.251414	398.842	1.17736	.729543	.511969	543.9098
350.00		.237466	397.224	1.17449	.759205	.513723	529.1460
360.00		.223760	395.461	1.17145	.797455	.515600	513.0379
360.51	SAT. VAPOR	.223069	395.367	1.17129	.799699	.515699	512.1793
360.51	SAT. LIQUID	.037516	308.373	1.05046	.914261	.514699	1097.2784
370.00	COMPRESSED LIQUID	.037426	308.227	1.05017	.905880	.514604	1109.3577
380.00		.037335	308.079	1.04987	.897637	.514509	1121.7789
390.00		.037247	307.937	1.04957	.889931	.514418	1133.9094
400.00		.037162	307.801	1.04929	.882706	.514333	1145.7671
410.00		.037079	307.669	1.04901	.875915	.514251	1157.3686
420.00		.037000	307.543	1.04874	.869516	.514173	1168.7283
430.00		.036922	307.421	1.04847	.863474	.514098	1179.8599
440.00		.036847	307.303	1.04822	.857756	.514027	1190.7754
450.00		.036774	307.189	1.04796	.852335	.513960	1201.4861
460.00		.036703	307.078	1.04771	.847186	.513895	1212.0022
470.00		.036634	306.972	1.04747	.842288	.513832	1222.3330
480.00		.036566	306.868	1.04723	.837621	.513773	1232.4873
490.00		.036501	306.768	1.04700	.833167	.513716	1242.4731
500.00		.036437	306.671	1.04677	.828911	.513661	1252.2978

Table II-8 (Continued)

THERMODYNAMIC DATA FOR N-BUTANE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 280. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
10.00	SUPERHEATED VAPOR	13.569323	439.241	1.34385	.522119	.486618	818.7111
20.00		6.735872	438.633	1.31958	.524100	.487391	813.6747
30.00		4.457728	438.019	1.30514	.526140	.488171	808.5724
40.00		3.318403	437.397	1.29471	.528244	.488957	803.4019
50.00		2.634598	436.768	1.28648	.530415	.489750	798.1607
60.00		2.178547	436.131	1.27963	.532657	.490551	792.8461
70.00		1.852635	435.486	1.27374	.534976	.491359	787.4554
80.00		1.608055	434.833	1.26854	.537377	.492175	781.9854
90.00		1.417690	434.171	1.26387	.539864	.492999	776.4332
100.00		1.265272	433.499	1.25962	.542444	.493831	770.7951
110.00		1.140446	432.818	1.25569	.545125	.494672	765.0677
120.00		1.036311	432.128	1.25204	.547912	.495523	759.2469
130.00		.948085	431.427	1.24861	.550816	.496382	753.3288
140.00		.872356	430.715	1.24538	.553844	.497252	747.3086
150.00		.806620	429.991	1.24230	.557008	.498131	741.1818
160.00		.748998	429.256	1.23936	.560318	.499022	734.9429
170.00		.698053	428.508	1.23654	.563788	.499924	728.5865
180.00		.652668	427.747	1.23383	.567432	.500837	722.1063
190.00		.611960	426.972	1.23120	.571266	.501763	715.4958
200.00		.575221	426.182	1.22865	.575310	.502702	708.7477
210.00		.541880	425.376	1.22616	.579584	.503655	701.8541
220.00		.511467	424.554	1.22374	.584114	.504622	694.8063
230.00		.483594	423.713	1.22136	.588926	.505605	687.5947
240.00		.457937	422.854	1.21902	.594055	.506604	680.2088
250.00		.434223	421.975	1.21671	.599538	.507620	672.6368
260.00		.412221	421.074	1.21444	.605420	.508655	664.8657
270.00		.391732	420.150	1.21218	.611754	.509710	656.8807
280.00		.372585	419.200	1.20995	.618605	.510786	648.6654
290.00		.354632	418.223	1.20772	.626049	.511885	640.2010
300.00		.337742	417.215	1.20549	.634180	.513009	631.4661
310.00		.321801	416.175	1.20326	.643113	.514160	622.4361
320.00		.306705	415.098	1.20102	.652991	.515341	613.0826
330.00		.292363	413.980	1.19876	.663999	.516555	603.3722
340.00		.278690	412.818	1.19647	.676369	.517805	593.2653
350.00		.265607	411.604	1.19415	.690412	.519096	582.7147
360.00		.253040	410.332	1.19178	.706542	.520432	571.6628
370.00		.240916	408.993	1.18936	.725328	.521821	560.0383
380.00		.229161	407.575	1.18685	.747585	.523271	547.7511
390.00		.217699	406.062	1.18425	.774514	.524792	534.6847
400.00		.206442	404.434	1.18155	.807980	.526400	520.8826
410.00		.195284	402.661	1.17862	.851068	.528115	505.5267
420.00		.184085	400.698	1.17549	.909328	.529967	488.8950
430.00		.172637	398.469	1.17204	.994018	.532007	470.2725
436.67	SAT. VAPOR	.164686	396.771	1.16946	1.077392	.533516	456.3066
436.67	SAT. LIQUID	.041298	327.241	1.07550	1.259833	.528876	803.4318
440.00	COMPRESSED	.041203	327.089	1.07526	1.242405	.528755	810.7430
450.00	LIQUID	.040936	326.663	1.07458	1.196531	.528418	831.8076
460.00		.040693	326.274	1.07395	1.158369	.528114	851.6695
470.00		.040470	325.916	1.07337	1.126006	.527838	870.5072
480.00		.040264	325.585	1.07282	1.098128	.527585	888.4589
490.00		.040073	325.277	1.07230	1.073802	.527352	905.6338
500.00		.039894	324.989	1.07181	1.052345	.527136	922.1205

Table II-9 Superheated Vapor and Compressed Liquid Tables of Ethylene

THERMODYNAMIC DATA FOR ETHYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -50. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
170.00	SUPERHEATED VAPOR	.754776	136.253	1.38816	.430042	.254330	890.6145
178.21	SAT. VAPOR	.710561	135.250	1.38299	.440319	.256332	883.4194
178.21	SAT. LIQUID	.033369	-23.715	.99528	.630431	.238779	3465.2246
180.00	COMPRESSED LIQUID	.033367	-23.714	.99525	.630317	.238789	3466.0024
190.00		.033356	-23.709	.99511	.629680	.238840	3470.3361
200.00		.033345	-23.703	.99498	.629050	.238892	3474.6547
210.00		.033333	-23.698	.99484	.628425	.238944	3478.9583
220.00		.033322	-23.692	.99470	.627805	.238996	3483.2470
230.00		.033311	-23.687	.99456	.627191	.239048	3487.5210
240.00		.033300	-23.681	.99443	.626581	.239100	3491.7804
250.00		.033289	-23.675	.99429	.625977	.239151	3496.0253
260.00		.033278	-23.669	.99416	.625379	.239203	3500.2558
270.00		.033267	-23.663	.99402	.624785	.239255	3504.4720
280.00		.033256	-23.656	.99389	.624196	.239307	3508.6742
290.00		.033245	-23.650	.99375	.623612	.239359	3512.8623
300.00		.033234	-23.643	.99362	.623033	.239411	3517.0365
310.00		.033224	-23.636	.99349	.622458	.239463	3521.1969
320.00		.033213	-23.629	.99335	.621889	.239515	3525.3437
330.00		.033202	-23.622	.99322	.621324	.239567	3529.4769
340.00		.033192	-23.615	.99309	.620763	.239619	3533.5966
350.00		.033181	-23.607	.99296	.620207	.239671	3537.7030
360.00		.033171	-23.600	.99283	.619656	.239723	3541.7961
370.00		.033160	-23.592	.99269	.619109	.239775	3545.8762
380.00		.033150	-23.584	.99256	.618568	.239827	3549.9431
390.00		.033139	-23.576	.99243	.618028	.239878	3553.9972
400.00		.033129	-23.568	.99230	.617494	.239930	3558.0384
410.00		.033119	-23.560	.99217	.616964	.239983	3562.0669
420.00		.033108	-23.552	.99205	.616438	.240035	3566.0827
430.00		.033098	-23.543	.99192	.615916	.240087	3570.0860
440.00		.033088	-23.535	.99179	.615399	.240139	3574.0769
450.00		.033078	-23.526	.99166	.614885	.240191	3578.0555
460.00		.033068	-23.517	.99153	.614375	.240243	3582.0217
470.00		.033057	-23.508	.99140	.613870	.240295	3585.9759
480.00		.033047	-23.499	.99128	.613368	.240347	3589.9179
490.00		.033037	-23.490	.99115	.612870	.240399	3593.8480
500.00		.033027	-23.481	.99102	.612375	.240451	3597.7662
510.00		.033017	-23.471	.99090	.611885	.240503	3601.6726
520.00		.033008	-23.462	.99077	.611398	.240555	3605.5673
530.00		.032998	-23.452	.99065	.610914	.240607	3609.4504
540.00		.032988	-23.442	.99052	.610435	.240659	3613.3219
550.00		.032978	-23.433	.99040	.609959	.240711	3617.1820
560.00		.032968	-23.423	.99027	.609486	.240763	3621.0307
570.00		.032959	-23.412	.99015	.609017	.240815	3624.8681
580.00		.032949	-23.402	.99002	.608551	.240867	3628.6943
590.00		.032939	-23.392	.98990	.608089	.240919	3632.5093
600.00		.032930	-23.381	.98978	.607629	.240971	3636.3133
610.00		.032920	-23.371	.98966	.607174	.241023	3640.1064
620.00		.032911	-23.360	.98953	.606721	.241075	3643.8885
630.00		.032901	-23.349	.98941	.606272	.241127	3647.6599
640.00		.032892	-23.338	.98929	.605826	.241179	3651.4204
650.00		.032882	-23.327	.98917	.605383	.241231	3655.1704
660.00		.032873	-23.316	.98905	.604944	.241283	3658.9097

Table II-9 (Continued)

THERMODYNAMIC DATA FOR ETHYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -40. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
170.00	SUPERHEATED VAPOR	.788344	140.338	1.39800	.419750	.257728	905.5177
180.00		.734152	139.226	1.39200	.430053	.259867	897.7235
190.00		.685396	138.081	1.38615	.441215	.262056	889.6874
200.00		.641236	136.902	1.38042	.453374	.264300	881.3860
210.00		.600990	135.683	1.37478	.466704	.266602	872.7918
211.15	SAT. VAPOR	.596605	135.540	1.37414	.468315	.266870	871.7877
211.15	SAT. LIQUID	.034118	-17.463	1.00984	.651880	.245695	3211.3805
220.00	COMPRESSED LIQUID	.034106	-17.465	1.00971	.651128	.245733	3215.6840
230.00		.034092	-17.466	1.00955	.650287	.245777	3220.5252
240.00		.034078	-17.468	1.00940	.649456	.245820	3225.3466
250.00		.034065	-17.469	1.00925	.648632	.245863	3230.1484
260.00		.034051	-17.470	1.00909	.647817	.245906	3234.9308
270.00		.034038	-17.470	1.00894	.647010	.245950	3239.6941
280.00		.034024	-17.471	1.00879	.646211	.245993	3244.4384
290.00		.034011	-17.471	1.00864	.645420	.246037	3249.1640
300.00		.033997	-17.471	1.00849	.644637	.246080	3253.8709
310.00		.033984	-17.471	1.00834	.643862	.246124	3258.5594
320.00		.033971	-17.471	1.00819	.643094	.246168	3263.2296
330.00		.033958	-17.470	1.00805	.642334	.246211	3267.8818
340.00		.033945	-17.469	1.00790	.641581	.246255	3272.5161
350.00		.033932	-17.468	1.00775	.640835	.246299	3277.1327
360.00		.033919	-17.467	1.00760	.640096	.246343	3281.7317
370.00		.033906	-17.466	1.00746	.639365	.246387	3286.3134
380.00		.033893	-17.464	1.00731	.638640	.246431	3290.8778
390.00		.033881	-17.463	1.00717	.637922	.246475	3295.4252
400.00		.033868	-17.461	1.00702	.637211	.246519	3299.9556
410.00		.033856	-17.459	1.00688	.636506	.246564	3304.4693
420.00		.033843	-17.456	1.00673	.635808	.246608	3308.9665
430.00		.033831	-17.454	1.00659	.635118	.246652	3313.4471
440.00		.033818	-17.451	1.00645	.634431	.246697	3317.9115
450.00		.033806	-17.449	1.00630	.633752	.246741	3322.3598
460.00		.033793	-17.446	1.00616	.633079	.246785	3326.7920
470.00		.033781	-17.442	1.00602	.632412	.246830	3331.2084
480.00		.033769	-17.439	1.00588	.631751	.246875	3335.6091
490.00		.033757	-17.436	1.00574	.631095	.246919	3339.9942
500.00		.033745	-17.432	1.00560	.630446	.246964	3344.3639
510.00		.033733	-17.428	1.00546	.629802	.247009	3348.7183
520.00		.033721	-17.424	1.00532	.629164	.247053	3353.0575
530.00		.033709	-17.420	1.00518	.628532	.247098	3357.3816
540.00		.033697	-17.416	1.00504	.627905	.247143	3361.6908
550.00		.033685	-17.411	1.00491	.627283	.247188	3365.9853
560.00		.033673	-17.407	1.00477	.626667	.247233	3370.2651
570.00		.033662	-17.402	1.00463	.626056	.247278	3374.5304
580.00		.033650	-17.397	1.00449	.625450	.247322	3378.7812
590.00		.033638	-17.392	1.00436	.624849	.247367	3383.0178
600.00		.033627	-17.387	1.00422	.624253	.247413	3387.2402
610.00		.033615	-17.381	1.00409	.623662	.247458	3391.4485
620.00		.033604	-17.376	1.00395	.623077	.247503	3395.6429
630.00		.033593	-17.370	1.00382	.622496	.247548	3399.8235
640.00		.033581	-17.364	1.00368	.621919	.247593	3403.9904
650.00		.033570	-17.358	1.00355	.621348	.247638	3408.1437
660.00		.033559	-17.352	1.00342	.620781	.247683	3412.2834

Table II-9 (Continued)

THERMODYNAMIC DATA FOR ETHYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -30. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
170.00	SUPERHEATED VAPOR	.820629	144.354	1.40745	.412343	.261435	919.4067
180.00		.765498	143.336	1.40167	.420952	.263324	912.4222
190.00		.715964	142.293	1.39606	.430164	.265250	905.2555
200.00		.671170	141.222	1.39058	.440061	.267214	897.8920
210.00		.630422	140.123	1.38523	.450741	.269221	890.3148
220.00		.593150	138.991	1.37996	.462325	.271274	882.5047
230.00		.558880	137.824	1.37477	.474961	.273376	874.4396
240.00		.527213	136.618	1.36963	.488821	.275533	866.0933
248.30	SAT. VAPOR	.502669	135.586	1.36539	.501443	.277369	858.9324
248.30	SAT. LIQUID	.034950	-10.978	1.02454	.679584	.252749	2964.5152
250.00	COMPRESSED LIQUID	.034947	-10.980	1.02451	.679385	.252754	2965.4511
260.00		.034930	-10.990	1.02434	.678223	.252786	2970.9342
270.00		.034913	-11.001	1.02417	.677077	.252818	2976.3903
280.00		.034896	-11.011	1.02399	.675944	.252850	2981.8199
290.00		.034879	-11.020	1.02382	.674825	.252883	2987.2232
300.00		.034862	-11.030	1.02365	.673720	.252915	2992.6005
310.00		.034845	-11.039	1.02348	.672628	.252948	2997.9522
320.00		.034829	-11.047	1.02331	.671550	.252981	3003.2786
330.00		.034812	-11.056	1.02314	.670484	.253014	3008.5799
340.00		.034796	-11.064	1.02297	.669431	.253047	3013.8566
350.00		.034779	-11.072	1.02280	.668390	.253080	3019.1088
360.00		.034763	-11.079	1.02263	.667361	.253114	3024.3369
370.00		.034747	-11.087	1.02247	.666344	.253147	3029.5410
380.00		.034731	-11.094	1.02230	.665339	.253181	3034.7216
390.00		.034715	-11.100	1.02213	.664346	.253215	3039.8789
400.00		.034699	-11.107	1.02197	.663363	.253249	3045.0131
410.00		.034684	-11.113	1.02181	.662392	.253283	3050.1246
420.00		.034668	-11.119	1.02164	.661432	.253317	3055.2134
430.00		.034652	-11.125	1.02148	.660482	.253352	3060.2800
440.00		.034637	-11.130	1.02132	.659542	.253386	3065.3246
450.00		.034622	-11.135	1.02116	.658613	.253421	3070.3473
460.00		.034606	-11.140	1.02100	.657694	.253456	3075.3485
470.00		.034591	-11.145	1.02084	.656785	.253491	3080.3283
480.00		.034576	-11.149	1.02068	.655886	.253526	3085.2870
490.00		.034561	-11.154	1.02052	.654996	.253561	3090.2249
500.00		.034546	-11.157	1.02036	.654116	.253596	3095.1420
510.00		.034531	-11.161	1.02021	.653245	.253632	3100.0388
520.00		.034516	-11.165	1.02005	.652383	.253667	3104.9153
530.00		.034502	-11.168	1.01989	.651530	.253703	3109.7718
540.00		.034487	-11.171	1.01974	.650686	.253739	3114.6085
550.00		.034473	-11.174	1.01958	.649850	.253775	3119.4255
560.00		.034458	-11.176	1.01943	.649023	.253810	3124.2232
570.00		.034444	-11.178	1.01927	.648205	.253847	3129.0016
580.00		.034429	-11.181	1.01912	.647394	.253883	3133.7611
590.00		.034415	-11.182	1.01897	.646592	.253919	3138.5016
600.00		.034401	-11.184	1.01882	.645798	.253955	3143.2236
610.00		.034387	-11.186	1.01867	.645011	.253992	3147.9271
620.00		.034373	-11.187	1.01851	.644233	.254028	3152.6123
630.00		.034359	-11.188	1.01836	.643461	.254065	3157.2794
640.00		.034345	-11.189	1.01821	.642698	.254102	3161.9286
650.00		.034331	-11.189	1.01807	.641941	.254138	3166.5600
660.00		.034318	-11.190	1.01792	.641192	.254175	3171.1738

Table II-9 (Continued)

THERMODYNAMIC DATA FOR ETHYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -20. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
170.00	SUPERHEATED VAPOR	.851862	148.323	1.41658	.407074	.265375	932.5142
180.00		.795722	147.385	1.41098	.414400	.267056	926.2000
190.00		.745326	146.426	1.40556	.422165	.268764	919.7456
200.00		.699804	145.446	1.40030	.430420	.270501	913.1415
210.00		.658448	144.443	1.39516	.439225	.272268	906.3771
220.00		.620677	143.416	1.39014	.448649	.274069	899.4404
230.00		.586011	142.362	1.38520	.458777	.275904	892.3177
240.00		.554048	141.280	1.38035	.469709	.277778	884.9938
250.00		.524447	140.166	1.37555	.481567	.279693	877.4510
260.00		.496918	139.018	1.37079	.494501	.281653	869.6689
270.00		.471212	137.832	1.36606	.508695	.283662	861.6239
280.00		.447111	136.604	1.36134	.524385	.285726	853.2880
290.00	SAT. VAPOR	.424414	135.329	1.35661	.541878	.287851	844.6246
290.00	SAT. LIQUID	.035888	-4.205	1.03949	.715867	.260020	2722.1340
300.00	COMPRESSED LIQUID	.035866	-4.228	1.03928	.714206	.260037	2728.4002
310.00		.035844	-4.250	1.03908	.712571	.260054	2734.6309
320.00		.035823	-4.272	1.03888	.710961	.260071	2740.8245
330.00		.035801	-4.294	1.03868	.709376	.260089	2746.9813
340.00		.035780	-4.315	1.03848	.707815	.260107	2753.1021
350.00		.035758	-4.335	1.03829	.706277	.260125	2759.1872
360.00		.035737	-4.355	1.03809	.704761	.260144	2765.2373
370.00		.035717	-4.375	1.03789	.703268	.260163	2771.2529
380.00		.035696	-4.394	1.03770	.701797	.260182	2777.2344
390.00		.035675	-4.413	1.03751	.700347	.260202	2783.1823
400.00		.035655	-4.431	1.03732	.698918	.260222	2789.0973
410.00		.035634	-4.449	1.03713	.697508	.260242	2794.9796
420.00		.035614	-4.466	1.03694	.696119	.260263	2800.8298
430.00		.035594	-4.484	1.03675	.694749	.260284	2806.6483
440.00		.035575	-4.500	1.03656	.693398	.260305	2812.4355
450.00		.035555	-4.517	1.03637	.692065	.260326	2818.1920
460.00		.035535	-4.532	1.03619	.690750	.260348	2823.9180
470.00		.035516	-4.548	1.03600	.689453	.260370	2829.6140
480.00		.035497	-4.563	1.03582	.688174	.260392	2835.2805
490.00		.035477	-4.578	1.03564	.686911	.260414	2840.9177
500.00		.035458	-4.592	1.03545	.685664	.260437	2846.5262
510.00		.035440	-4.606	1.03527	.684434	.260460	2852.1062
520.00		.035421	-4.620	1.03509	.683220	.260483	2857.6581
530.00		.035402	-4.633	1.03491	.682021	.260507	2863.1823
540.00		.035384	-4.646	1.03474	.680838	.260530	2868.6792
550.00		.035365	-4.659	1.03456	.679669	.260554	2874.1490
560.00		.035347	-4.671	1.03438	.678515	.260578	2879.5921
570.00		.035329	-4.683	1.03420	.677375	.260603	2885.0089
580.00		.035311	-4.695	1.03403	.676249	.260627	2890.3997
590.00		.035293	-4.706	1.03386	.675137	.260652	2895.7648
600.00		.035275	-4.717	1.03368	.674038	.260677	2901.1044
610.00		.035258	-4.728	1.03351	.672953	.260702	2906.4190
620.00		.035240	-4.738	1.03334	.671880	.260727	2911.7088
630.00		.035223	-4.749	1.03317	.670820	.260753	2916.9741
640.00		.035205	-4.758	1.03300	.669773	.260778	2922.2152
650.00		.035188	-4.768	1.03283	.668738	.260804	2927.4323
660.00		.035171	-4.777	1.03266	.667714	.260830	2932.6258

Table II-9 (Continued)

THERMODYNAMIC DATA FOR ETHYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= -10. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
170.00	SUPERHEATED VAPOR	.882219	152.264	1.42543	.403440	.269493	945.0077
180.00		.825016	151.394	1.41999	.409766	.270998	939.2578
190.00		.773702	150.507	1.41473	.416420	.272523	933.3984
200.00		.727388	149.603	1.40964	.423437	.274070	927.4230
210.00		.685350	148.681	1.40468	.430853	.275640	921.3246
220.00		.646998	147.740	1.39985	.438712	.277234	915.0956
230.00		.611842	146.778	1.39513	.447065	.278853	908.7273
240.00		.579474	145.794	1.39049	.455971	.280500	902.2105
250.00		.549549	144.786	1.38593	.465499	.282176	895.5337
260.00		.521774	143.753	1.38143	.475732	.283884	888.6856
270.00		.495899	142.692	1.37698	.486767	.285625	881.6524
280.00		.471708	141.601	1.37257	.498725	.287403	874.4185
290.00		.449011	140.478	1.36818	.511746	.289221	866.9662
300.00		.427643	139.318	1.36380	.526019	.291082	859.2747
310.00		.407456	138.119	1.35942	.541759	.292991	851.3198
320.00		.388320	136.875	1.35502	.559256	.294952	843.0732
330.00		.370114	135.581	1.35058	.578879	.296972	834.5005
336.62	SAT. VAPOR	.358517	134.695	1.34762	.593273	.298345	828.6253
336.62	SAT. LIQUID	.036968	2.927	1.05481	.764675	.267611	2481.7094
340.00	COMPRESSED LIQUID	.036958	2.914	1.05472	.763825	.267609	2484.1738
350.00		.036929	2.874	1.05448	.761343	.267605	2491.4295
360.00		.036900	2.834	1.05424	.758910	.267601	2498.6300
370.00		.036872	2.796	1.05401	.756526	.267597	2505.7764
380.00		.036843	2.758	1.05377	.754187	.267595	2512.8696
390.00		.036816	2.721	1.05354	.751894	.267593	2519.9108
400.00		.036788	2.685	1.05331	.749644	.267591	2526.9008
410.00		.036760	2.649	1.05308	.747437	.267591	2533.8408
420.00		.036733	2.614	1.05285	.745270	.267591	2540.7316
430.00		.036706	2.580	1.05262	.743143	.267591	2547.5741
440.00		.036680	2.547	1.05239	.741055	.267592	2554.3692
450.00		.036654	2.514	1.05217	.739003	.267594	2561.1177
460.00		.036627	2.482	1.05195	.736989	.267596	2567.8205
470.00		.036602	2.450	1.05173	.735009	.267599	2574.4783
480.00		.036576	2.419	1.05151	.733064	.267603	2581.0920
490.00		.036551	2.389	1.05129	.731151	.267606	2587.6623
500.00		.036525	2.359	1.05107	.729272	.267611	2594.1899
510.00		.036500	2.330	1.05086	.727423	.267616	2600.6756
520.00		.036476	2.301	1.05065	.725606	.267621	2607.1201
530.00		.036451	2.273	1.05043	.723818	.267627	2613.5239
540.00		.036427	2.246	1.05022	.722059	.267633	2619.8878
550.00		.036403	2.219	1.05001	.720328	.267640	2626.2125
560.00		.036379	2.193	1.04981	.718625	.267648	2632.4985
570.00		.036355	2.167	1.04960	.716948	.267655	2638.7465
580.00		.036332	2.142	1.04939	.715298	.267663	2644.9570
590.00		.036309	2.117	1.04919	.713673	.267672	2651.1306
600.00		.036285	2.093	1.04898	.712072	.267681	2657.2679
610.00		.036263	2.069	1.04878	.710496	.267690	2663.3695
620.00		.036240	2.046	1.04858	.708944	.267700	2669.4358
630.00		.036217	2.023	1.04838	.707414	.267710	2675.4675
640.00		.036195	2.000	1.04818	.705907	.267721	2681.4649
650.00		.036173	1.979	1.04799	.704422	.267732	2687.4286
660.00		.036151	1.957	1.04779	.702959	.267743	2693.3592

Table II-9 (Continued)

THERMODYNAMIC DATA FOR ETHYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 0. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
	SUPERHEATED						
170.00	VAPOR	.911832	156.190	1.43406	.401087	.273745	957.0105
180.00		.853528	155.378	1.42875	.406614	.275099	951.7424
190.00		.801255	154.553	1.42362	.412393	.276470	946.3875
200.00		.754102	153.715	1.41867	.418447	.277856	940.9416
210.00		.711332	152.861	1.41387	.424799	.279260	935.3999
220.00		.672342	151.992	1.40920	.431479	.280682	929.7573
230.00		.636633	151.107	1.40464	.438519	.282123	924.0083
240.00		.603788	150.204	1.40019	.445954	.283584	918.1466
250.00		.573458	149.283	1.39582	.453828	.285066	912.1658
260.00		.545346	148.343	1.39152	.462188	.286571	906.0578
270.00		.519197	147.381	1.38729	.471091	.288100	899.8150
280.00		.494793	146.397	1.38311	.480604	.289655	893.4280
290.00		.471944	145.388	1.37897	.490804	.291237	886.8866
300.00		.450487	144.353	1.37487	.501784	.292848	880.1792
310.00		.430275	143.290	1.37079	.513655	.294490	873.2926
320.00		.411180	142.197	1.36672	.526552	.296167	866.2120
330.00		.393088	141.069	1.36265	.540640	.297881	858.9203
340.00		.375895	139.905	1.35857	.556123	.299636	851.3975
350.00		.359508	138.699	1.35447	.573258	.301435	843.6203
360.00		.343840	137.448	1.35033	.592376	.303283	835.5613
370.00		.328809	136.145	1.34615	.613902	.305187	827.1874
380.00		.314339	134.784	1.34190	.638407	.307152	818.4585
388.54	SAT. VAPOR	.302364	133.568	1.33819	.662276	.308886	810.6840
388.54	SAT. LIQUID	.038243	10.523	1.07070	.833261	.275668	2240.4816
390.00	COMPRESSED	.038237	10.513	1.07066	.832664	.275662	2241.7457
400.00	LIQUID	.038197	10.447	1.07036	.828630	.275624	2250.3649
410.00		.038157	10.382	1.07007	.824705	.275588	2258.8973
420.00		.038118	10.318	1.06978	.820884	.275553	2267.3450
430.00		.038079	10.256	1.06949	.817163	.275519	2275.7104
440.00		.038041	10.195	1.06920	.813537	.275487	2283.9956
450.00		.038003	10.135	1.06892	.810003	.275456	2292.2025
460.00		.037966	10.077	1.06864	.806557	.275427	2300.3331
470.00		.037929	10.019	1.06836	.803194	.275398	2308.3892
480.00		.037893	9.963	1.06809	.799913	.275371	2316.3728
490.00		.037857	9.908	1.06781	.796709	.275345	2324.2853
500.00		.037821	9.854	1.06754	.793580	.275320	2332.1286
510.00		.037786	9.801	1.06728	.790523	.275296	2339.9042
520.00		.037752	9.749	1.06701	.787535	.275273	2347.6136
530.00		.037718	9.698	1.06675	.784614	.275252	2355.2584
540.00		.037684	9.648	1.06649	.781756	.275231	2362.8398
550.00		.037651	9.599	1.06623	.778961	.275211	2370.3593
560.00		.037618	9.551	1.06598	.776226	.275192	2377.8183
570.00		.037585	9.504	1.06572	.773548	.275174	2385.2179
580.00		.037553	9.458	1.06547	.770925	.275157	2392.5595
590.00		.037521	9.413	1.06522	.768357	.275141	2399.8441
600.00		.037490	9.369	1.06497	.765841	.275126	2407.0731
610.00		.037459	9.325	1.06473	.763374	.275111	2414.2473
620.00		.037428	9.283	1.06449	.760957	.275098	2421.3681
630.00		.037397	9.241	1.06424	.758587	.275085	2428.4362
640.00		.037367	9.200	1.06400	.756262	.275073	2435.4529
650.00		.037337	9.159	1.06377	.753981	.275061	2442.4191
660.00		.037308	9.120	1.06353	.751743	.275050	2449.3356

Table II-9 (Continued)

THERMODYNAMIC DATA FOR ETHYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 10. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
	SUPERHEATED						
170.00	VAPOR	.940808	160.109	1.44249	.399756	.278100	968.6144
180.00		.881376	159.349	1.43729	.404633	.279325	963.7625
190.00		.828111	158.579	1.43228	.409708	.280561	958.8413
200.00		.780085	157.797	1.42745	.414994	.281811	953.8477
210.00		.736546	157.003	1.42278	.420510	.283073	948.7787
220.00		.696877	156.196	1.41824	.426275	.284350	943.6306
230.00		.660570	155.376	1.41382	.432308	.285641	938.3999
240.00		.627200	154.542	1.40951	.438634	.286946	933.0825
250.00		.596410	153.693	1.40530	.445280	.288268	927.6740
260.00		.567899	152.829	1.40117	.452276	.289606	922.1697
270.00		.541407	151.948	1.39711	.459657	.290962	916.5645
280.00		.516713	151.050	1.39312	.467461	.292336	910.8532
290.00		.493626	150.133	1.38918	.475734	.293730	905.0280
300.00		.471979	149.196	1.38529	.484529	.295144	899.0838
310.00		.451626	148.239	1.38143	.493906	.296580	893.0124
320.00		.432439	147.259	1.37760	.503937	.298039	886.8054
330.00		.414304	146.254	1.37380	.514705	.299525	880.4535
340.00		.397121	145.224	1.37001	.526310	.301034	873.9462
350.00		.380798	144.164	1.36622	.538871	.302573	867.2716
360.00		.365254	143.074	1.36244	.552535	.304144	860.4161
370.00		.350414	141.951	1.35864	.567478	.305748	853.3643
380.00		.336210	140.790	1.35481	.583920	.307389	846.0982
390.00		.322578	139.587	1.35096	.602138	.309070	838.5969
400.00		.309458	138.339	1.34706	.622486	.310795	830.8360
410.00		.296791	137.040	1.34310	.645422	.312570	822.7858
420.00		.284523	135.682	1.33907	.671558	.314400	814.4107
430.00		.272595	134.256	1.33494	.701724	.316294	805.6668
440.00		.260949	132.753	1.33069	.737089	.318260	796.4986
446.21	SAT. VAPOR	.253828	131.773	1.32797	.762392	.319523	790.5591
446.21	SAT. LIQUID	.039805	18.744	1.08749	.936501	.284416	1995.1419
450.00	COMPRESSED	.039782	18.703	1.08734	.933692	.284380	1999.1684
460.00	LIQUID	.039723	18.594	1.08695	.926481	.284288	2009.4857
470.00		.039664	18.489	1.08657	.919547	.284199	2020.0692
480.00		.039607	18.386	1.08620	.912875	.284113	2030.3032
490.00		.039551	18.285	1.08583	.906448	.284031	2040.4000
500.00		.039496	18.187	1.08546	.900252	.283951	2050.3645
510.00		.039442	18.092	1.08510	.894274	.283874	2060.2012
520.00		.039389	17.998	1.08475	.888500	.283799	2069.9146
530.00		.039337	17.907	1.08440	.882920	.283727	2079.5087
540.00		.039285	17.818	1.08406	.877523	.283657	2088.9875
550.00		.039235	17.731	1.08372	.872299	.283590	2098.3545
560.00		.039186	17.646	1.08338	.867240	.283525	2107.6133
570.00		.039137	17.562	1.08305	.862337	.283462	2116.7671
580.00		.039089	17.481	1.08272	.857583	.283401	2125.8192
590.00		.039042	17.401	1.08240	.852969	.283343	2134.7725
600.00		.038996	17.323	1.08208	.848489	.283286	2143.6299
610.00		.038950	17.247	1.08176	.844137	.283231	2152.3941
620.00		.038905	17.172	1.08145	.839907	.283178	2161.0676
630.00		.038861	17.099	1.08114	.835794	.283126	2169.6530
640.00		.038817	17.028	1.08084	.831792	.283076	2178.1526
650.00		.038774	16.957	1.08053	.827896	.283028	2186.5687
660.00		.038732	16.889	1.08024	.824102	.282982	2194.9033

Table II-9 (Continued)

THERMODYNAMIC DATA FOR ETHYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 20. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
	SUPERHEATED						
170.00	VAPOR	.969233	164.031	1.45075	.399256	.282534	979.8891
180.00		.908650	163.317	1.44564	.403596	.283645	975.4003
190.00		.854370	162.595	1.44074	.408093	.284766	970.8558
200.00		.805447	161.862	1.43601	.412756	.285897	966.2534
210.00		.761110	161.120	1.43145	.417599	.287038	961.5909
220.00		.720733	160.367	1.42702	.422635	.288190	956.8660
230.00		.683795	159.603	1.42272	.427876	.289353	952.0761
240.00		.649864	158.828	1.41854	.433340	.290527	947.2186
250.00		.618575	158.040	1.41445	.439044	.291713	942.2908
260.00		.589622	157.241	1.41046	.445008	.292911	937.2890
270.00		.562740	156.428	1.40654	.451254	.294123	932.2106
280.00		.537705	155.601	1.40270	.457807	.295348	927.0518
290.00		.514321	154.760	1.39892	.464693	.296587	921.8086
300.00		.492420	153.903	1.39519	.471946	.297841	916.4770
310.00		.471854	153.030	1.39152	.479600	.299111	911.0525
320.00		.452493	152.140	1.38788	.487696	.300397	905.5300
330.00		.434224	151.232	1.38428	.496282	.301701	899.9042
340.00		.416944	150.304	1.38071	.505411	.303022	894.1691
350.00		.400565	149.355	1.37715	.515146	.304364	888.3184
360.00		.385004	148.384	1.37362	.525560	.305725	882.3446
370.00		.370189	147.390	1.37009	.536739	.307109	876.2398
380.00		.356055	146.369	1.36656	.548785	.308517	869.9951
390.00		.342541	145.321	1.36303	.561820	.309949	863.6004
400.00		.329592	144.242	1.35949	.575992	.311408	857.0444
410.00		.317157	143.131	1.35593	.591479	.312897	850.3140
420.00		.305188	141.983	1.35233	.608503	.314418	843.3944
430.00		.293641	140.795	1.34871	.627341	.315973	836.2686
440.00		.282473	139.563	1.34503	.648342	.317567	828.9163
450.00		.271641	138.280	1.34129	.671962	.319203	821.3139
460.00		.261104	136.942	1.33747	.698795	.320886	813.4329
470.00		.250819	135.539	1.33356	.729645	.322622	805.2386
480.00		.240740	134.062	1.32954	.765623	.324419	796.6881
490.00		.230817	132.498	1.32537	.808353	.326286	787.7669
500.00		.220994	130.829	1.32102	.860118	.328238	778.2839
510.00		.211198	129.031	1.31644	.924734	.330286	768.2629
510.15	SAT. VAPOR	.211054	129.003	1.31637	.925799	.330517	768.1117
510.15	SAT. LIQUID	.041829	27.878	1.10570	1.110410	.294255	1741.2111
520.00	COMPRESSED	.041731	27.692	1.10515	1.094859	.294059	1754.6674
530.00	LIQUID	.041635	27.511	1.10461	1.080047	.293869	1768.0264
540.00		.041542	27.335	1.10409	1.066117	.293687	1781.1039
550.00		.041452	27.165	1.10357	1.052985	.293512	1793.9158
560.00		.041364	27.001	1.10307	1.040578	.293345	1806.4766
570.00		.041279	26.842	1.10258	1.028833	.293184	1818.7995
580.00		.041196	26.687	1.10210	1.017693	.293030	1830.8965
590.00		.041116	26.538	1.10163	1.007109	.292881	1842.7788
600.00		.041038	26.393	1.10117	.997036	.292738	1854.4566
610.00		.040961	26.252	1.10072	.987435	.292600	1865.9391
620.00		.040887	26.115	1.10027	.978270	.292467	1877.2353
630.00		.040814	25.982	1.09984	.969510	.292339	1888.3532
640.00		.040743	25.852	1.09941	.961126	.292215	1899.3002
650.00		.040674	25.726	1.09899	.953091	.292096	1910.0834
660.00		.040606	25.603	1.09858	.945384	.291980	1920.7093

Table II-9 (Continued)

THERMODYNAMIC DATA FOR ETHYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 30. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
170.00	SUPERHEATED VAPOR	.997176	167.962	1.45885	.399440	.287027	990.8875
180.00		.935426	167.289	1.45383	.403330	.288039	986.7185
190.00		.880113	166.609	1.44901	.407345	.289059	982.5044
200.00		.830272	165.920	1.44438	.411495	.290087	978.2436
210.00		.785117	165.223	1.43991	.415786	.291123	973.9348
220.00		.744008	164.518	1.43558	.420230	.292167	969.5762
230.00		.706415	163.803	1.43138	.424835	.293219	965.1662
240.00		.671897	163.079	1.42730	.429612	.294280	960.7029
250.00		.640082	162.345	1.42333	.434574	.295350	956.1845
260.00		.610655	161.601	1.41945	.439734	.296430	951.6090
270.00		.583350	160.846	1.41565	.445106	.297520	946.9742
280.00		.557937	160.079	1.41194	.450707	.298619	942.2778
290.00		.534217	159.302	1.40829	.456554	.299729	937.5175
300.00		.512018	158.512	1.40470	.462668	.300850	932.6905
310.00		.491190	157.709	1.40116	.469070	.301983	927.7941
320.00		.471603	156.892	1.39768	.475786	.303127	922.8253
330.00		.453140	156.062	1.39424	.482843	.304284	917.7809
340.00		.435698	155.216	1.39084	.490273	.305454	912.6575
350.00		.419188	154.355	1.38746	.498111	.306638	907.4514
360.00		.403527	153.477	1.38412	.506399	.307835	902.1584
370.00		.388644	152.581	1.38079	.515182	.309048	896.7742
380.00		.374472	151.666	1.37749	.524514	.310277	891.2940
390.00		.360952	150.732	1.37419	.534457	.311522	885.7126
400.00		.348031	149.776	1.37090	.545081	.312785	880.0242
410.00		.335660	148.797	1.36761	.556471	.314067	874.2226
420.00		.323794	147.793	1.36432	.568725	.315368	868.3007
430.00		.312391	146.763	1.36101	.581960	.316691	862.2507
440.00		.301413	145.704	1.35769	.596316	.318037	856.0640
450.00		.290824	144.613	1.35435	.611963	.319407	849.7308
460.00		.280590	143.489	1.35097	.629107	.320804	843.2400
470.00		.270677	142.326	1.34756	.648005	.322229	836.5790
480.00		.261056	141.123	1.34410	.668976	.323685	829.7333
490.00		.251695	139.873	1.34058	.692428	.325175	822.6859
500.00		.242562	138.571	1.33699	.718889	.326703	815.4171
510.00		.233627	137.210	1.33332	.749054	.328273	807.9034
520.00		.224856	135.783	1.32954	.783863	.329891	800.1162
530.00		.216211	134.277	1.32563	.824622	.331561	792.0207
540.00		.207653	132.680	1.32157	.873207	.333294	783.5726
550.00		.199130	130.973	1.31732	.932426	.335099	774.7154
560.00		.190581	129.130	1.31282	1.006707	.336990	765.3728
570.00		.181920	127.115	1.30801	1.103526	.338989	755.4384
580.00		.173023	124.871	1.30276	1.236743	.341126	744.7536
580.97	SAT. VAPOR	.172144	124.639	1.30222	1.252406	.341342	743.6734
580.97	SAT. LIQUID	.044715	38.528	1.12648	1.469777	.306016	1471.5482
590.00	COMPRESSED LIQUID	.044535	38.193	1.12565	1.427179	.305612	1489.0179
600.00		.044347	37.843	1.12476	1.385266	.305194	1507.6194
610.00		.044170	37.514	1.12392	1.347853	.304802	1525.5275
620.00		.044003	37.202	1.12312	1.314246	.304436	1542.8114
630.00		.043844	36.906	1.12235	1.283832	.304090	1559.5294
640.00		.043693	36.624	1.12161	1.256142	.303764	1575.7313
650.00		.043549	36.356	1.12090	1.230797	.303455	1591.4597
660.00		.043411	36.099	1.12021	1.207488	.303162	1606.7518

Table II-9 (Continued)

THERMODYNAMIC DATA FOR ETHYLENE GIVEN BY STARLINGS EQUATION OF STATE

TEMPERATURE= 40. °F

PRESSURE (PSIA)		SPECIFIC VOLUME (FT^3/LBM)	ENTHALPY (BTU/LBM)	ENTROPY (BTU/LBM/°F)	CONSTANT PRESSURE SPECIFIC HEAT (BTU/LBM/°F)	CONSTANT VOLUME SPECIFIC HEAT (BTU/LBM/°F)	SONIC VELOCITY (FT/SEC)
170.00	SUPERHEATED VAPOR	1.024697	171.906	1.46682	.400193	.291564	1001.6506
180.00		.961765	171.271	1.46187	.403701	.292490	997.7653
190.00		.905405	170.629	1.45714	.407311	.293421	993.8433
200.00		.854631	169.979	1.45258	.411030	.294358	989.8837
210.00		.808641	169.323	1.44819	.414864	.295301	985.8854
220.00		.766784	168.659	1.44395	.418819	.296251	981.8473
230.00		.728518	167.988	1.43984	.422902	.297208	977.7682
240.00		.693392	167.309	1.43585	.427121	.298171	973.6470
250.00		.661029	166.621	1.43197	.431485	.299141	969.4824
260.00		.631107	165.925	1.42819	.436003	.300119	965.2730
270.00		.603354	165.220	1.42449	.440685	.301104	961.0175
280.00		.577536	164.506	1.42088	.445542	.302097	956.7144
290.00		.553451	163.783	1.41734	.450585	.303097	952.3622
300.00		.530923	163.049	1.41386	.455828	.304106	947.9591
310.00		.509801	162.305	1.41045	.461285	.305123	943.5035
320.00		.489950	161.551	1.40709	.466972	.306149	938.9936
330.00		.471253	160.785	1.40378	.472907	.307184	934.4275
340.00		.453606	160.007	1.40051	.479109	.308229	929.8030
350.00		.436917	159.217	1.39729	.485600	.309283	925.1180
360.00		.421104	158.414	1.39409	.492403	.310348	920.3701
370.00		.406092	157.598	1.39093	.499546	.311423	915.5570
380.00		.391818	156.767	1.38779	.507059	.312509	910.6760
390.00		.378220	155.921	1.38467	.514976	.313607	905.7242
400.00		.365248	155.059	1.38157	.523336	.314717	900.6986
410.00		.352846	154.180	1.37849	.532182	.315839	895.5960
420.00		.340977	153.283	1.37541	.541565	.316975	890.4128
430.00		.329598	152.368	1.37234	.551543	.318124	885.1453
440.00		.318672	151.432	1.36927	.562180	.319288	879.7893
450.00		.308165	150.475	1.36619	.573555	.320467	874.3405
460.00		.298044	149.495	1.36311	.585757	.321663	868.7939
470.00		.288281	148.490	1.36001	.598891	.322876	863.1443
480.00		.278847	147.458	1.35690	.613082	.324109	857.3858
490.00		.269717	146.398	1.35377	.628480	.325357	851.5120
500.00		.260866	145.306	1.35060	.645264	.326628	845.5168
510.00		.252271	144.180	1.34740	.663652	.327926	839.3892
520.00		.243907	143.017	1.34415	.683912	.329239	833.1234
530.00		.235752	141.812	1.34086	.706380	.330583	826.7084
540.00		.227785	140.561	1.33750	.731478	.331954	820.1328
550.00		.219981	139.260	1.33407	.759749	.333357	813.3636
560.00		.212317	137.900	1.33055	.791900	.334793	806.4457
570.00		.204768	136.475	1.32692	.828879	.336267	799.3017
580.00		.197305	134.975	1.32318	.871980	.337782	791.9305
590.00		.189896	133.385	1.31928	.923032	.339345	784.3072
600.00		.182504	131.691	1.31521	.984706	.340963	776.4009
610.00		.175080	129.869	1.31090	1.061092	.342645	768.1729
620.00		.167562	127.888	1.30630	1.158813	.344402	759.5729
630.00		.159860	125.700	1.30132	1.289454	.346252	750.5328
640.00		.151836	123.231	1.29581	1.475550	.348222	740.9550
650.00		.143251	120.347	1.28949	1.768553	.350355	730.6864
659.45	SAT. VAPOR	.134165	116.983	1.28228	2.279828	.352599	720.0942
659.45	SAT. LIQUID	.049797	52.477	1.15327	2.661361	.322049	1171.2767
660.00	COMPRESSED LIQUID	.049759	52.416	1.15315	2.641858	.321969	1173.5215

III. PRESENTATION AND DISCUSSION OF THE COMPUTER CODE

III-1 INTRODUCTION

The computer code for calculation of thermodynamic properties of propane and its mixtures, TAPPAM, is a group of Univac 1100, FORTRAN V subroutines, functions, main programs and block data subroutines written specifically for the accurate generation of data to be used in two-phase flow calculations. The thermodynamic equation of state developed by Starling et.al. (ref. 2) is used, with mixtures of up to, and including, three components allowed. Mixtures are treated as single component pseudo-fluids, to allow simple estimation of mixture two-phase flow rates. The code is in a modular form, to avoid unnecessary calculations and for simplification of additional programming.

The code has three major main programs which perform the following calculations:

VLEQUIL calculates vapor-liquid equilibrium conditions,

ISENTROP calculates thermodynamic data along isentropic lines to aid in calculation of isentropic flow rates,

COMPLIQ calculates thermodynamic properties in compressed liquid and superheated vapor regions of fluid behavior.

In addition, there is a minor main program, COEFFICTS, which performs curve fitting of thermodynamic reference data necessary to calculate enthalpy, entropy and specific heats.

There are four subroutines in TAPPAM. SECANT calculates solutions to an implicit form of the equation of state. The other three subroutines, ORTHLS, FITY and FITD, are used in the curve fitting and evaluation of thermodynamic reference data. ORTHLS is called by COEFFICTS to calculate coefficients for an orthogonal polynomial expansion of the reference data. FITY is called by some function routines to evaluate the expansion calculated by ORTHLS. FITD evaluates the derivative of the polynomial expansion. These three subroutines are exactly as described by Ries (ref.3), except for modification to allow double precision calculations.

There are seven double precision functions, each of which evaluates a single thermodynamic property; these functions are (the calculated property is given in parenthesis): FP (pressure), FF (mixture fugacity), FH (enthalpy), FS (entropy), FCP (constant pressure specific heat), FCV (constant volume specific heat) and FAS (sonic velocity squared). Density and temperature are the independent variables in all of these functions.

To complete the code, there is a collection of block data subroutines which give equation of state coefficients and reference data coefficients for propane, propylene, n-butane, a 65-25-10 percent by weight mixture of these three compounds, and ethylene. The proper data blocks are selected when a program is run to give thermodynamic properties of the desired fluid.

The purpose of the remainder of this chapter is to fully document the components of TAPPAM and to demonstrate the use of the code for thermodynamic calculations.

III-2 MAIN PROGRAMS

A. The program "VLEQUIL"

1. Description

This program calculates vapor-liquid equilibrium conditions for a mixture of up to three components. The user selects a periodic set of temperatures at which equilibrium information is desired. The program then solves for equilibrium at these temperatures by equating vapor pressures and fugacities to liquid pressures and fugacities. The procedure is as follows:

a.) Select an approximation to the equilibrium pressure.

b.) Calculate (by search and successive bisection) the liquid and gas densities predicted by the equation of state at the given temperature and pressure approximation.

c.) Using these densities, calculate the fugacity of the liquid and the vapor phases.

d.) Using ratio of liquid and vapor fugacities, calculate a new pressure approximation.

e.) Repeat steps "b" through "d" until change in predicted pressure is small or until a specified number of iterations have been performed.

2. List of Variables

Variable Name	Units	Meaning
HLD1, HLD2, HLD3		Temporary Storage.
ALPHAH, BETAH, CH, JH, KH		Enthalpy reference data information; located in common block HREF.
ALPHAS, BETAS, CS, JS, KS		Entropy reference data information; located in common block SREF.
ALPHAC, BETAC,CC, JC, KC		Constant pressure specific heat reference data information; located in common block CPREF.
AO	$\frac{lbf - ft^6}{lb\ mole^2\ in^2}$	Equation of state coefficient.
BO	$\frac{ft^3}{lb\ mole}$	Equation of state coefficient.
CO	$\frac{lbf - R^o - ft^6}{lb\ mole^2\ in^2}$	Equation of state coefficient.
DO	$\frac{lbf - R^{o^2} - ft^6}{lb\ mole^2\ in^2}$	Equation of state coefficient.
EO	$\frac{lbf - R^{o^3} - ft^6}{lb\ mole^2\ in^2}$	Equation of state coefficient.
A	$\frac{lbf - ft^9}{lb\ mole^3\ in^2}$	Equation of state coefficient.
B	$\frac{ft^6}{lb\ mole^2}$	Equation of state coefficient.
C	$\frac{lbf - R^{o^2} - ft^9}{lb\ mole^3\ in^2}$	Equation of state coefficient.
D	$\frac{lbf - R^o - ft^9}{lb\ mole^3\ in^2}$	Equation of state coefficient.
ALPHA	$\frac{ft^9}{lb\ mole^3}$	Equation of state coefficient.
GAMMA	$\frac{ft^6}{lb\ mole^2}$	Equation of state coefficient.

R	$\frac{\text{lbf - ft}^3}{\text{lb mole - R}^0 \text{ - in}^2}$	Universal gas constant.
XM	$\frac{\text{lb mass}}{\text{lb mole}}$	Molecular weight.
X1, X2, X3		Mole fractions of components in mixture.
A2, B2, C2, D2, ALPHA2, CGAMMA, ONETR, T2, T3, T4, T5, ADT, RT, CONVER		Combinations of equation of state coefficients, temperatures and constants used throughout program; located in common blocks PARA and TEMP.
NCOMP		Number of components in mixture.
NDATA		Number of data points to be generated.
T	^{0}R	Temperature.
DELT	R^0	Temperature increment.
PN	$\frac{\text{lbf}}{\text{in}^2}$	Equilibrium pressure approximation.
NUMBIT		Maximum number of iterations to find equilibrium conditions.
EPS1		Error bound on pressure (relative change per iteration).
EPS2		Error bound on density (relative change per iteration).
KNSRCH, NITER		Iteration parameters in solution of equation of state for density. Usually set to 1000.
XINT, XFIN	$\frac{\text{lb mole}}{\text{ft}^3}$	Density limits for search routine to solve equation of state. Usually set to 1.2 and .0001, respectively.
XLIQ, XGAS	$\frac{\text{lb mole}}{\text{ft}^3}$	Density of liquid and gas phases respectively.

FL, FG	$\frac{lbf}{in^2}$	Fugacities of liquid and gas phases, respectively.
PNN	$\frac{lbf}{in^2}$	New equilibrium pressure approximation.
P	$\frac{lbf}{in^2}$	Final, calculated equilibrium pressure.
HLIQ, HGAS	$\frac{BTU}{lb\ mass}$	Enthalpy of liquid and gas phases, respectively.
SLIQ, SGAS	$\frac{BTU}{lb\ mass - R^o}$	Entropy of liquid and gas phases, respectively.
CPLIQ, CPGAS	$\frac{BTU}{lb\ mass - R^o}$	Constant pressure specific heat of liquid and gas phases, respectively.
CVLIQ, CVGAS	$\frac{BTU}{lb\ mass - R^o}$	Constant volume specific heat of liquid and gas phases, respectively.
ASLIQ, ASGAS	$\frac{ft}{sec}$	Sonic velocity of liquid and gas phases, respectively.
RAT		Ratio of specific heats (C_p/C_v).
TF	^oF	Temperature.

3. Input, Output and Format

a. Input and Format

Card Number	Data	Format
1	Number of Components.	I1
2	Number of Equilibrium Points Desired.	I3
3	Initial Temperature (^oR), Temperature Increment (R^o).	2D12.6
4	Initial Equilibrium Pressure Approximation (psia).	D12.6
5	Pressure Error Bound, Density Error Bound, KNSRCH, NITER, NUMBIT, XINT (lb mole/ft^3), XFIN (lb mole/ft^3).	2D12.6,3I5,2D12.6

b. Output and Format

The program outputs to three devices. Unit number six is a line printer. Units ten and eleven are user defined data files.

i. Output and Format to Unit Six

Line Number	Data	Format
odd	Pressure (psia), Temperature (^{o}F), Liquid and Vapor Phase Specific Volume (ft^3/lb mass), Liquid and Vapor Phase Enthalpy (BTU/lb mass), Liquid and Vapor Phase Entropy (BTU/lb mass/R^{o}).	2X,8(D12.6,2X)
even	Liquid and Vapor Phase Constant Pressure Specific Heats (BTU/lb mass/R^{o}), Liquid and Vapor Phase Constant Volume Specific Heats (BTU/lb mass/R^{o}), Liquid and Vapor Phase Sonic Velocities (ft/sec).	2X,6(D12.6,2X)

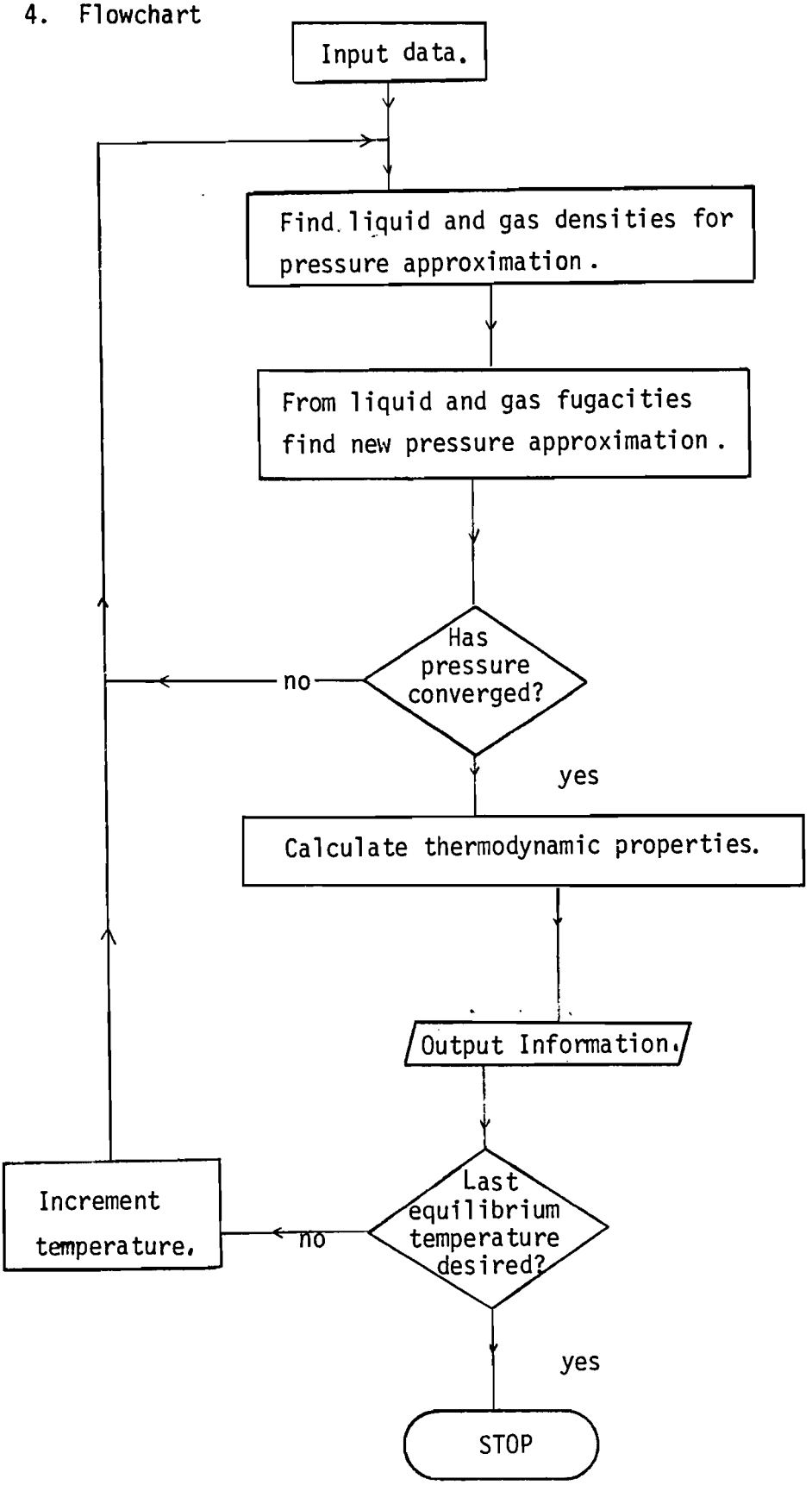
ii. Output and Format to Unit Ten

Line Number	Data	Format
odd	Pressure (psia), Temperature (^{o}F), Liquid and Vapor Phase Specific Volume (ft^3/lb mass).	4(D18.12,2X)
even	Liquid and Vapor Phase Enthalpy (BTU/lb mass), Liquid and Vapor Phase Entropy (BTU/lb mass/R^{o}).	4(D18.12,2X)

iii. Output and Format to Unit Eleven

Line Number	Data	Format
odd	Pressure (psia), Temperature (^{o}F), Liquid and Vapor Constant Pressure Specific Heat (BTU/lb mass/R^{o}).	4(D18.12,2X)
even	Liquid and Vapor Phase Constant Volume Specific Heat (BTU/lb mass/R^{o}), Liquid and Vapor Phase Sonic Velocity (ft/sec).	4(D18.12,2X)

4. Flowchart


Input data.
Find liquid and gas densities for pressure approximation.
From liquid and gas fugacities find new pressure approximation.
Has pressure converged?
no
yes
Calculate thermodynamic properties.
Output Information.
Last equilibrium temperature desired?
no
Increment temperature.
yes
STOP

B. The Program "ISENTROP"

1. Description

This program calculates thermodynamic properties along isentropic lines in single phase regions of fluid behavior, from a given thermodynamic state specified by pressure and temperature. The user selects initial pressure and temperature, from which the program calculates the remaining thermodynamic properties. The user then inputs temperatures, and, using these temperatures and the entropy of the initial state, the thermodynamic properties are found. The equations of state (pressure - temperature - density and entropy - temperature - density) are solved for densities using a search technique followed by successive bisections. Thermodynamic properties are then calculated directly from the equation of state.

2. List of Variables

Variable Name	Units	Meaning
ALPHAE, BETAE, CE, JE, KE		Coefficients for entropy calculation; located in common block SREF.
ALPHAH, BETAH, CH, JH, KH		Coefficients for enthalpy calculation; located in common block HREF.
AO, BO, CO, DO, EO, A, B, C, D, ALPHA, GAMMA, R, XM, XINT, XFIN, KNSRCH, NITER, T2, T3, T4, T5, ADT, RT		See section II A 2.
PO	$\frac{lbf}{in^2}$	Initial pressure.
TO	^oR	Initial temperature.
EPS		Relative maximum error in calculating densities.
XO	$\frac{lb\ mole}{ft^3}$	Initial density.
XOO	$\frac{lb\ mass}{ft^3}$	Initial density.

HO	$\frac{BTU}{lb\ mass}$	Initial enthalpy.
SO	$\frac{lbf - ft^3}{in^2 - lb\ mole - R^o}$	Initial entropy.
SOO	$\frac{BTU}{lb\ mass - R^o}$	Initial entropy.
TOT	^oF	Initial temperature.
T	^oR	Desired temperature.
X	$\frac{lb\ mole}{ft^3}\left(\frac{lb\ mass}{ft^3}\right)$	Density at desired temperature and initial entropy.
P	$\frac{lbf}{in^2}$	Pressure at desired temperature and initial entropy.
HOO	$\frac{BTU}{lb\ mass}$	Enthalpy at desired temperature and initial entropy.

3. Input, Output and Format

a. Input and Format

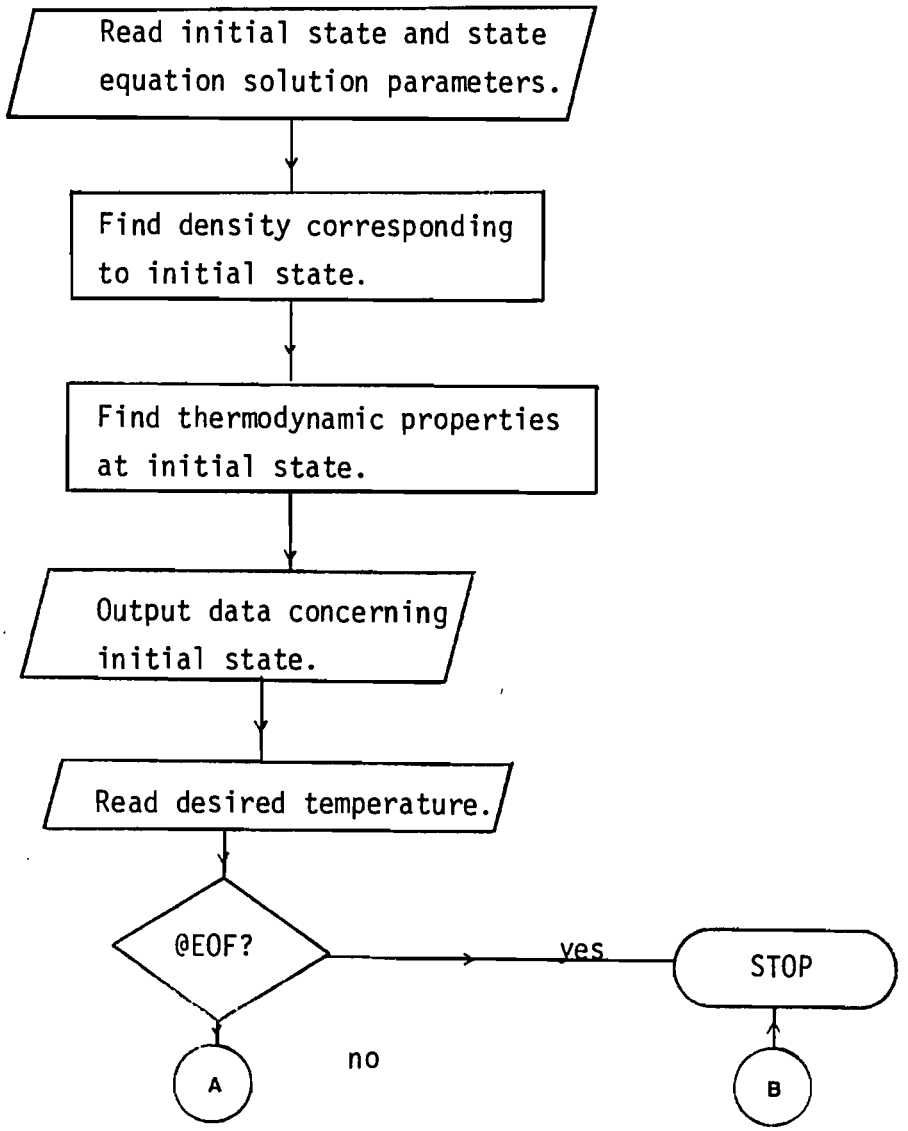
Card Number	Data	Format
1	Initial pressure and temperature.	Open
2	EPS, KNSRCH, NITER, XINT, XFIN.	Open
3	Desired temperature.	Open
4	Desired temperature.	Open
n	Last desired temperature.	Open
n+1	@EOF	@ in column number one.

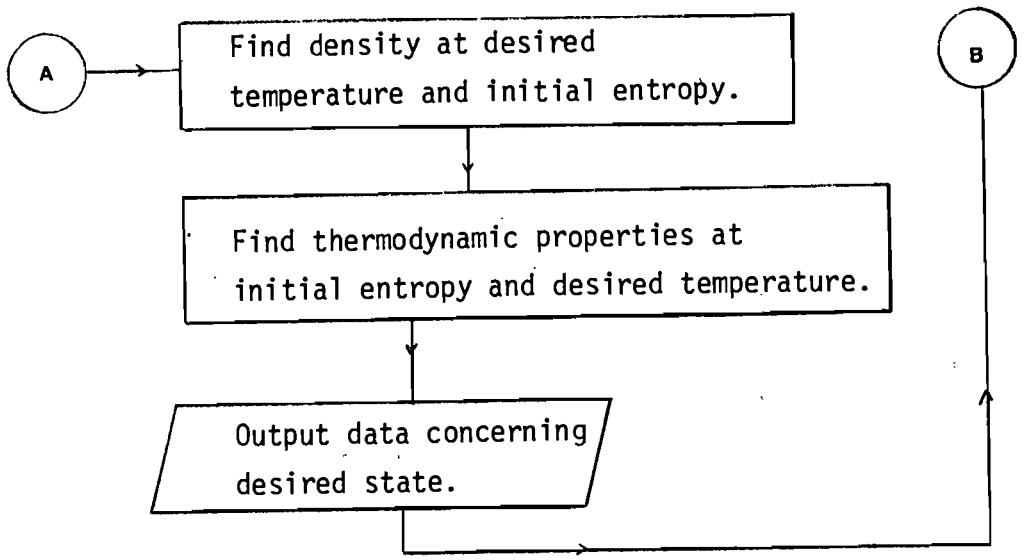
b. Output and Format

All output is printed on unit number six, a line printer.

Line Number		
1	Initial pressure (psia), temperature (^{O}F), density (lb mass/ft^3), enthalpy (BTU/lb mass), and entropy (BTU/lb mass - R^{O}).	1X,5(D14.8,1X)
2	Desired pressure, temperature, density, enthalpy and entropy in same units as line number 1.	1X,5(D14.8,1X)
n-1	Same as line 2 for last desired temperature.	1X,5(D14.8,1X)

4. Flowchart





C. The program "COMPLIQ"

1. Description

This program finds thermodynamic properties in the compressed liquid and superheated vapor regions at states specified by pressure and temperature. The pressure and temperature are input by the user and, using a search method followed by successive bisection, the pressure - temperature - density equation of state is solved for density. Thermodynamic properties are then calculated directly. If the desired state is compressed liquid then XINT greater than XFIN is input. For superheated vapor regions XINT should be less than XFIN.

2. List of Variables

Variable Name	Units	Meaning
AO, BO, CO, DO, EO, A, B, C, D, ALPHA, GAMMA, R, XM, HLD1, HLD2, T2, T3, T4, T5, ADT, RT, CONVER	See section II A 2.	See section II A 2.
X	$\frac{\text{lb mole}}{\text{ft}^3}\left(\frac{\text{lb mass}}{\text{ft}^3}\right)$	Density.
H	$\frac{\text{BTU}}{\text{lb mass}}$	Enthalpy.

S	$\frac{\text{BTU}}{\text{lb mass} - R^{o}}$	Entropy.
P	$\frac{\text{lbf}}{\text{in}^2}$	Pressure.
T	^{o}R	Temperature.
CP	$\frac{\text{BTU}}{\text{lb mass} - R^{o}}$	Constant pressure specific heat.
CV	$\frac{\text{BTU}}{\text{lb mass} - R^{o}}$	Constant volume specific heat.
AS	$\frac{\text{ft}}{\text{sec}}$	Sonic velocity.

3. Input, Output and Format

a. Input and Format

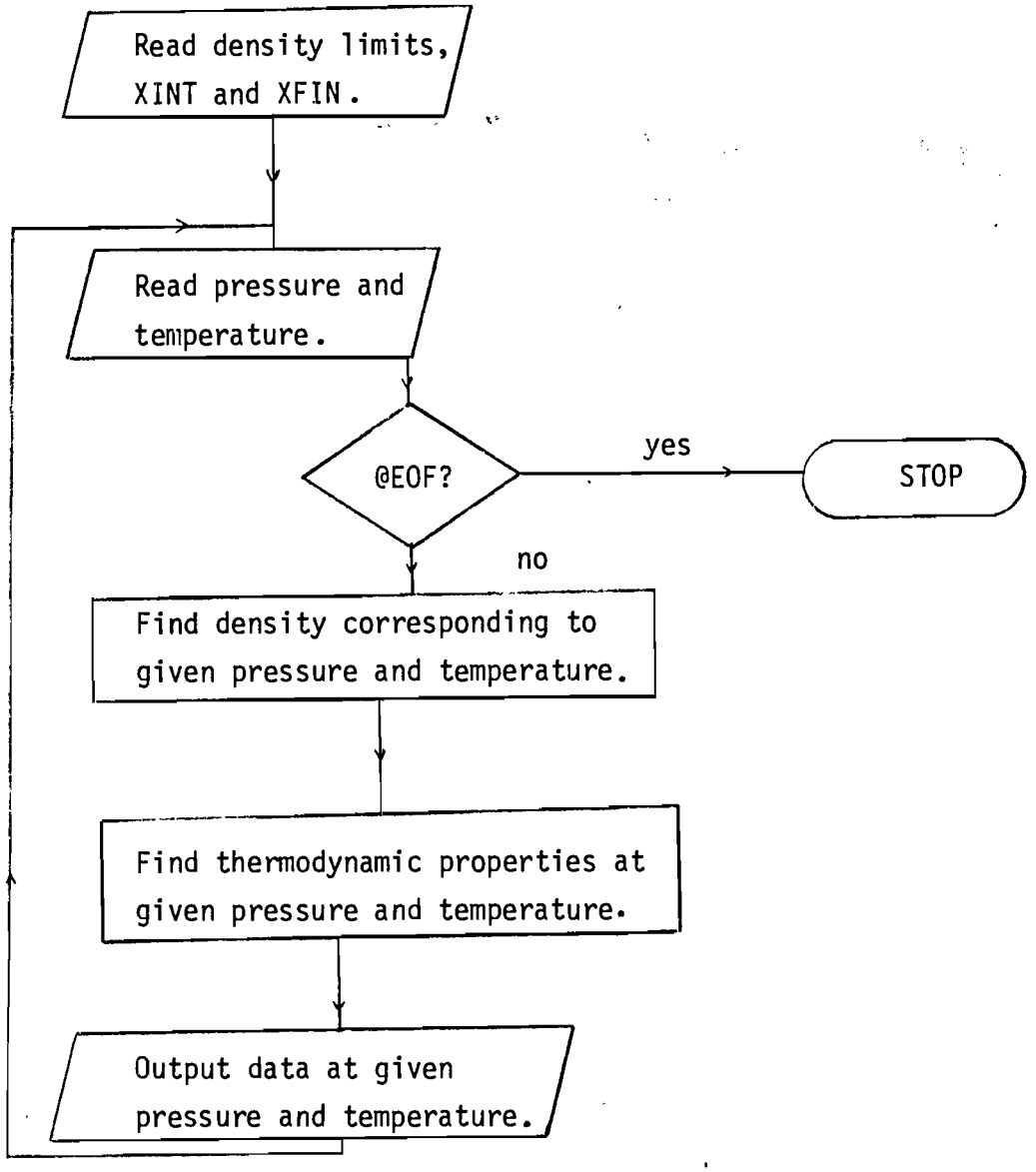
Card Number	Data	Format
1	XINT, XFIN	Open
2	Desired pressure $\left(\frac{\text{lbf}}{\text{in}^2}\right)$ and temperature (^{o}R).	Open
n	Last desired pressure $\left(\frac{\text{lbf}}{\text{in}^2}\right)$ and temperature.	Open
n+1	@EOF	@ in column number one.

b. Output and Format

All output is to unit number six, a line printer.

Line Number	Data	Format
1	Pressure $\left(\frac{lbf}{in^2}\right)$, temperature ($^oR$), density (lb mass/$ft^3$), enthalpy BTU/lb mass), entropy (BTU/lb mass - R^o), constant pressure and volume specific heats (BTU/ lb mass - R^o) and sonic velocity (ft/sec).	4(D14.8,1X),/, 4(D14.8,1X)
n-1	Same as line 1 for last desired state.	Same as line 1.

4. Flowchart



D. The program "COEFFICTS"

1. Description

This program determines a least square orthogonal polynomial approximation to the reference values of enthalpy, entropy and specific heat of a mixture, given a series of reference value versus temperature points and mole fraction of each component. The program then outputs the statements necessary to create a block data subroutine containing the polynomial coefficients and absolute reference point.

The user inputs the number of components and mole fraction of each component, followed by the name of the common block to be used in creating the block data subroutine. In creating the block data subroutines for TAPPAM, HREF, SREF and CPREF were used for enthalpy, entropy and constant pressure specific heat reference value common block names. The reference value versus temperature points are then read for the major component, followed by the information for the minor components. A mole weighted average of the reference values is then calculated and the orthogonal polynomial curve fit is applied. It is not necessary that the input data for each component be at the same temperatures, since the program automatically calculates interpolating polynomials which are evaluated to arrive at a series of reference values for each component at the temperatures supplied with the major component. When absolute reference values are needed (such as for enthaply) these are also calculated.

2. List of Variables

Variable Name	Units	Meaning
XM		Mole fractions.
T	^{o}R	Temperature of major component.
P	(BTU, lb mole, R°)	Reference value for major component.
T2	^{o}R	Temperature of minor component.
P2	(BTU, lb mole, R°)	Reference value for minor component.

Z1, Z2, Z3, W		Temporary storage.
NAME		Common block name of output.
ALPHAE, BETAE, CE		Calculated coefficients for orthogonal polynomial expansion.
NUMB		Number of components in mixture.
N1		Number of reference value points for major components.
K1		Order of polynomial curve fit for final output. (usually set to nine)
J1		Number of low order coefficients in polynomial to be set to zero. (usually set to zero)
POO1	(BTU, lb mole, R°)	Absolute reference value of major component. If none is needed, set to zero.
N,POO		Corresponding to N1 and POO1 for minor components.
J,K		Corresponding to J1, K1 for interpolating polynomial for minor component.

3. Input, Output and Format

a. Input and Format

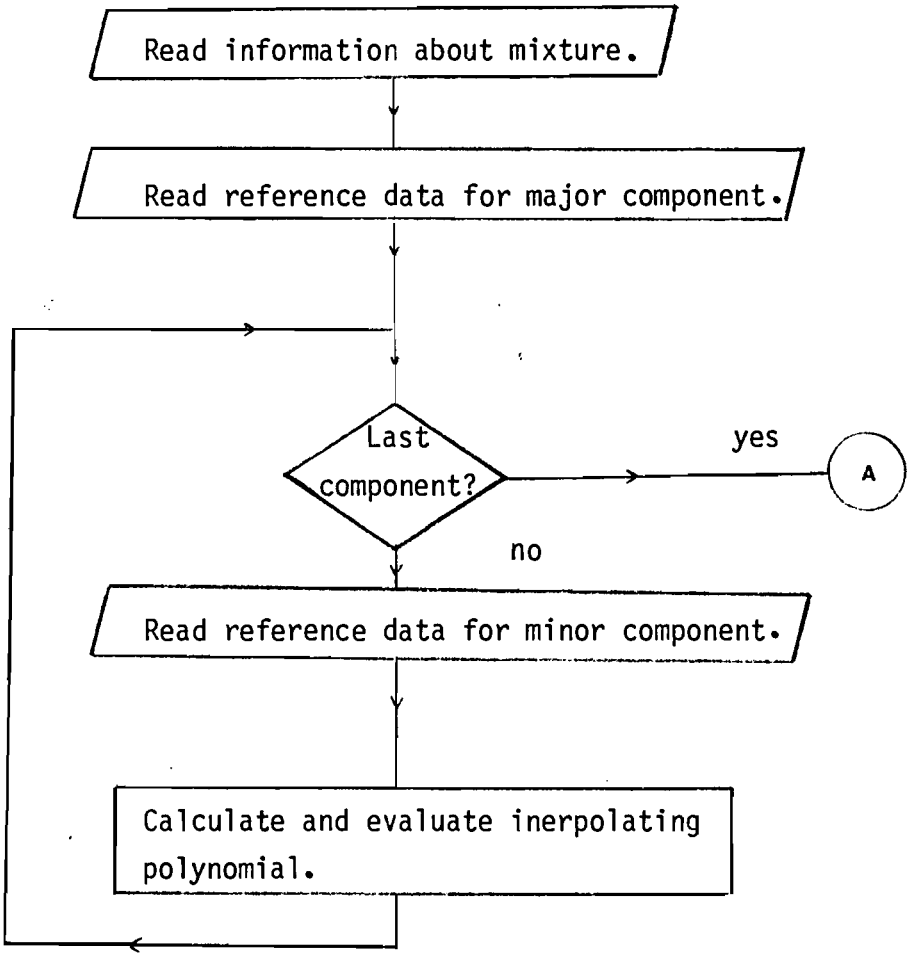
Card Number	Data	Format
1	Number of components.(NUMB)	I2
2	Mole fraction of major component.	F10.8
3	Mole fraction of minor component.	F10.8
NUMB+1	Mole fraction of last component.	F10.8
NUMB+2	Name of output common block.	A6
NUMB+3	N1, K1 and J1	I2, 2I1
NUMB+4	T(1) (^{o}R) and P(1), (per lb mole)	2F20.10

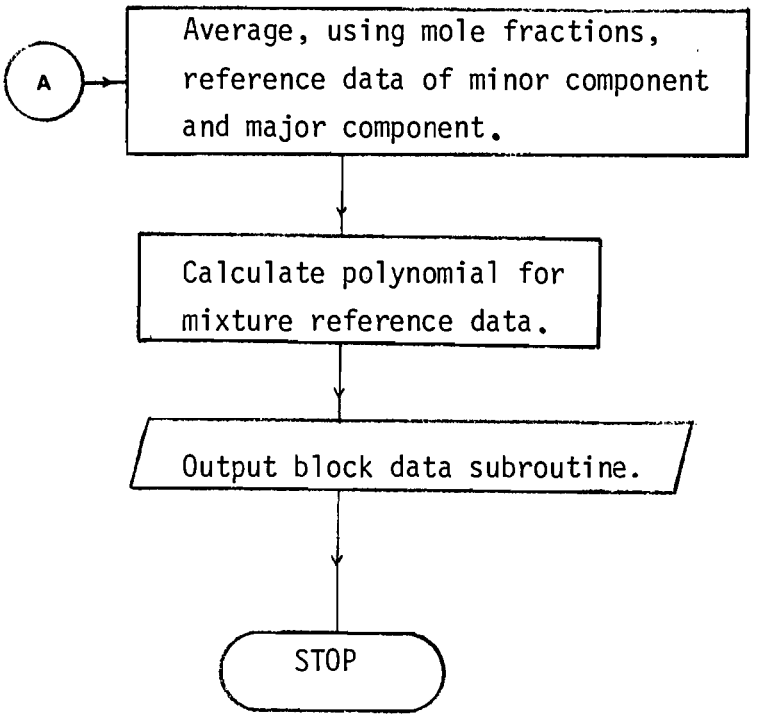
NUMB+N1+3	T(N1) and P(N1)	2F20.10
NUMB+N1+4	POO1 (per lb mole)	F20.10
NUMB+N1+5	N, K and J for next component.	I2, 2I1
	etc.	

b. Output and Format

This program actually creates as its output another program; a block data subroutine. For an example of output and format see section VI D.

4. Flowchart





III-3 SUBROUTINES

A. The Subroutines "ORTHLS," "FITY," and "FITD."

The three subroutines ORTHLS, FITY and FITD, compute and evaluate a least square orthogonal polynomial fit to a series of data points. Knowledge of these subroutines for the usage of TAPPAM is not necessary. For a complete description of their use see Ries (ref. 3). For a description of their use for this application, see Wu (ref. 4).

B. The Subroutine "SECANT"

1. Description

This subroutine solves for the zero of a function of three variables, with two variables fixed. Given are the values XINT and XFIN, as values of the free variable, and the values T and P of the fixed variables;

the subroutine first divides the interval (XINT, XFIN) into KN equally spaced subintervals. The function is then evaluated at the endpoints of each subinterval (starting with $\left(\text{XINT}, \text{XINT} + \frac{\text{XFIN} - \text{XINT}}{\text{KN}}\right)$ until the function values at each endpoint are of different sign. This guaranties a root of the function (assuming continuity) in the subinterval. This algorithum is the classical search method of rooting functions. The subinterval is then bisected a maximum of NITER times, each time determining a new subinterval containing the root of the function. If the size of the interval relative to the interval center is equal to or less than EPS, the routine is considered to have converged, and the center value of the interval returned to the calling program as the root.

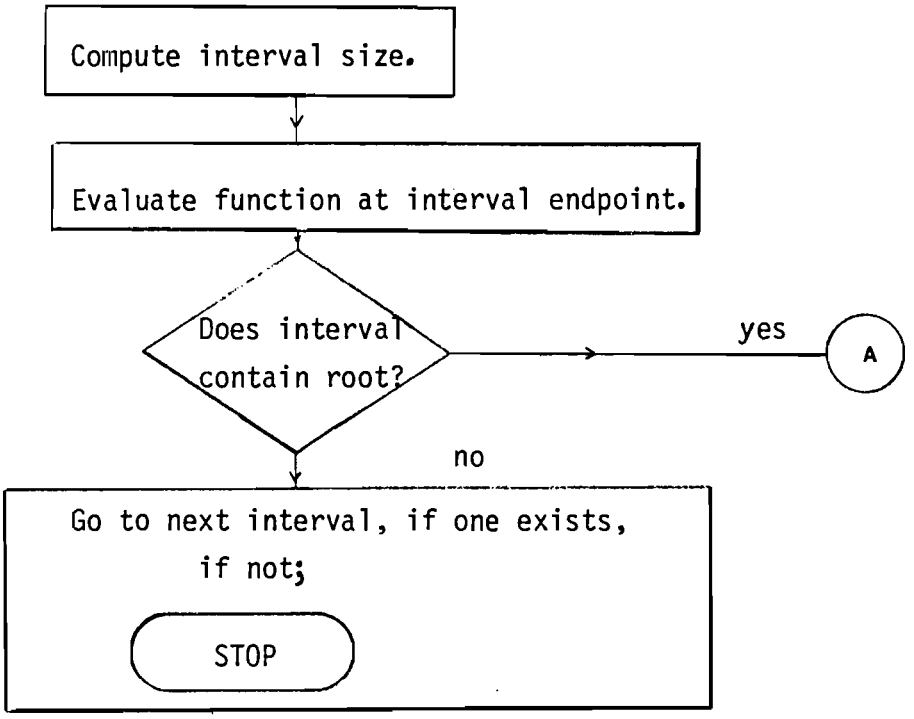
In using this subroutine with the functions in TAPPAM, density is the free variable and temperature and a dependent thermodynamic variable are fixed. To find a liquid solution, XINT must be greater than XFIN. For solutions in the superheated vapor region, the opposite must be true.

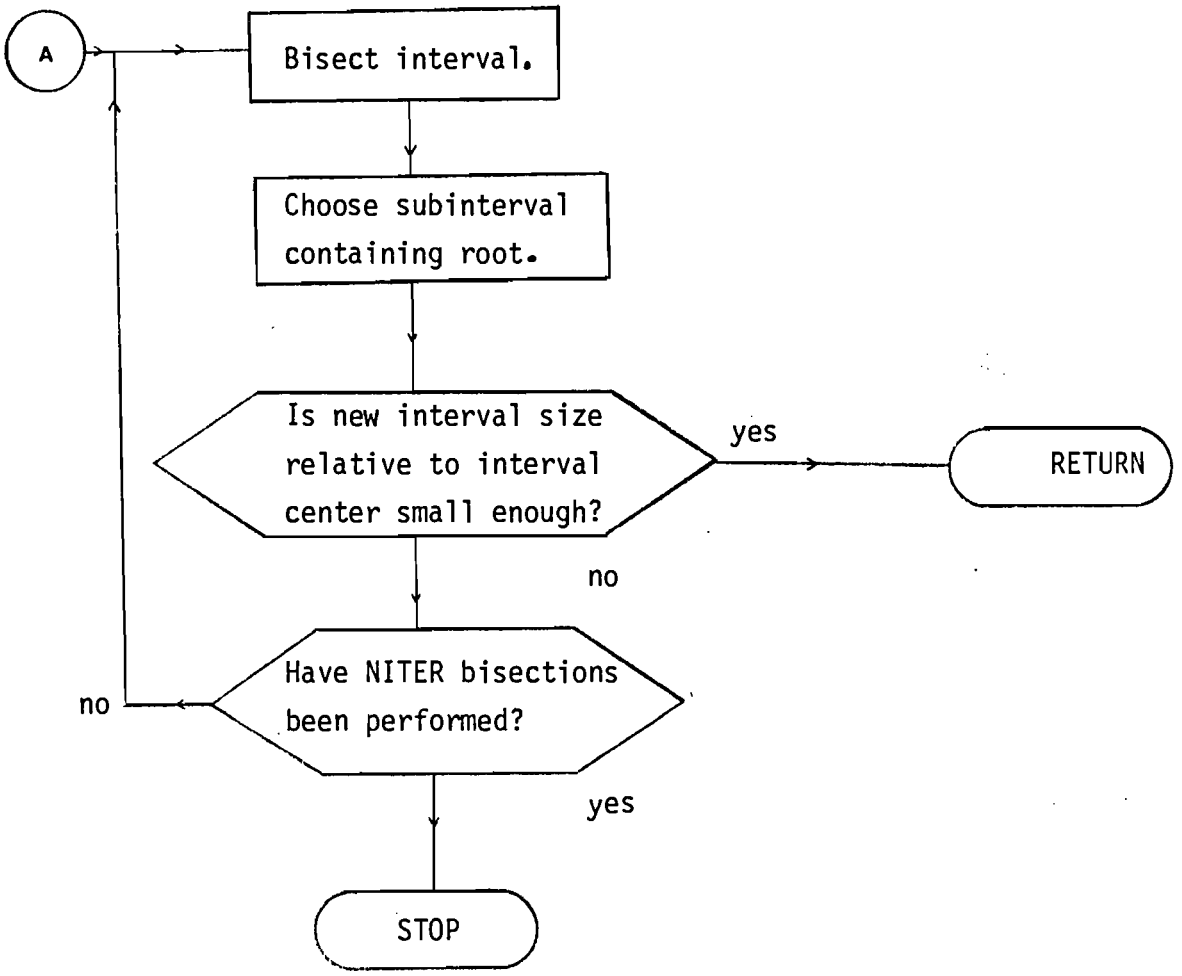
2. List of Variables

Variable Name	Units	Meaning
XINT	$\frac{\text{lb mole}}{\text{ft}^3}$	Initial value of search routine.
XFIN	$\frac{\text{lb mole}}{\text{ft}^3}$	Final value of search routine.
FS		Name of function to be rooted.
KN		Number of search intervals.
SO		Fixed value of dependent thermodynamic variable.
T	^{o}R	Fixed temperature.
X	$\frac{\text{lb mole}}{\text{ft}^3}$	Final root of function.
NITER		Maximum number of allowed bisections.
EPS		Desired relative error of density.
ERROR		Error parameter giving approximate value of function at calculated density.

DX	$\frac{\text{lb mole}}{\text{ft}^3}$	Size of search intervals.
X1	$\frac{\text{lb mole}}{\text{ft}^3}$	Initial value of density in sub-interval.
X2	$\frac{\text{lb mole}}{\text{ft}^3}$	Final value of density in sub-interval.
F1		Value of function at X1.
F2		Value of function at X2.
XM	$\frac{\text{lb mole}}{\text{ft}^3}$	Midpoint of interval.
FM		Value of function at XM.

3. Flowchart





III-4 FUNCTIONS

A. The Function "FP"

The function used for evaluation of pressure is:(see Starling, et al. (ref. 1))

$$FP = \rho RT + \left(B_0 RT - A_0 - \frac{C_0}{T^2} + \frac{D_0}{T^3} - \frac{E_0}{T^4}\right)\rho^2 + \left(bRT - a - \frac{d}{T}\right)\rho^3 + \alpha\left(a + \frac{d}{T}\right)\rho^6 + \frac{c\rho^3}{T^2}\left(1 + \gamma\rho^2\right) \exp\left(-\gamma\rho^2\right) - P$$

The variables, their units and their meanings are:

Variable Name	Units	Meaning
X	$\frac{\text{lb mole}}{\text{ft}^3}$	Density.
T	^{o}R	Temperature.
P	$\frac{\text{lbf}}{\text{in}^2}$	Pressure.
AO, BO, CO, DO, EO, A, B, C, D, ALPHA, GAMMA, R, T2, T3, T4, T5, ADT, RT		See section II A 2.
X2	$\frac{\text{lb mole}^2}{\text{ft}^6}$	Density squared.
X3	$\frac{\text{lb mole}^3}{\text{ft}^9}$	Density cubed.
X6	$\frac{\text{lb mole}^6}{\text{ft}^{18}}$	Density to the sixth power.

B. The Function "FF"

The function used to evaluate the fugacity of a mixture is:(see Wu ref. 4)

$$FF = \exp\left(\sum_{i=1}^{n} X_i \, \ell n \frac{\bar{f}_i}{x_i}\right)$$

where

$$RT \ln \bar{f}_i = RT \ln (\rho RTX_i) + \rho(B_0 + B_{0i})RT + 2\rho \sum_{j=1}^{n} X_i \left[-(A_{0j}A_{0i})^{1/2} - \frac{(C_{0j}C_{0i})^{1/2}}{T^2} + \frac{(D_{0j}D_{0i})^{1/2}}{T^3} - \frac{(E_{0j}E_{0i})^{1/2}}{T^4} \right]$$

$$+ \frac{\rho^2}{2} \left[3(b^2b_i)^{1/3}RT - 3(a^2a_i)^{1/3} - \frac{3(d^2d_i)^{1/3}}{T} \right]$$

$$+ \frac{\alpha\rho^5}{5} \left[3(a^2a_i)^{1/3} + \frac{3(d^2d_i)^{1/3}}{T} \right] + \frac{3\rho^5}{5} \left(a + \frac{d}{T} \right) (\alpha^2\alpha_i)^{1/3}$$

$$+ \frac{3(c^2c_i)^{1/3}\rho^2}{T^2} \left[\frac{1 - \exp(-\gamma\rho^2)}{\gamma\rho^2} - \frac{\exp(-\gamma\rho^2)}{2} \right]$$

$$- \frac{2C}{\gamma T^2} \left(\frac{\gamma i}{\gamma} \right)^{1/2} \{1 - \exp(-\gamma\rho^2)[1 + \gamma\rho^2 + \frac{1}{2}\gamma^2\rho^4]\}$$

The variables, their units and their meanings are:

Variable Name		
X, T, X2		see section IV A.
NCOMP		Number of components in mixture.
AOO, BOO, COO, DOO, EOO, AA, BB, CC, DD, ALPALP, GAMGAM		Equation of state coefficients.
XX		Mole fractions of mixture components.
AO, BO, CO, DO, EO, A, B, C, D, ALPHA, GAMMA, R, XM, A2, B2, C2, D2, ALPHA2, CGAMMA, ONETR, T2		See section II A 2.
T3, T4, T5, ADT, RT		
X4	$\frac{\text{lb mole}^4}{\text{ft}^{12}}$	Density to fourth power.

X5	$\frac{\text{lb mole}^5}{\text{ft}^{15}}$	Density to fifth power.
XRT		Product of density and RT.
GX2	$\frac{\text{lbf}}{\text{in}^2}$	Product of Gamma and X2.
GX22		GX2 squared.
EXPP, EXP1, EXP2, FFF, ADCOMB, SUM		Temporary storage.
FF	$\frac{\text{lbf}}{\text{in}^2}$	Fugacity of mixture.

C. The function "FH".

The function used to evaluate enthalpy is: (see Wu ref. 4)

$$FH = \left[B_0RT - 2A_0 - \frac{4C_0}{T^2} + \frac{5D_0}{T^3} - \frac{6E_0}{T^4}\right]\rho$$

$$+ \frac{1}{2}\left(2bRT - 3a - \frac{4d}{T}\right)\rho^2 + \frac{1}{5}\alpha\left(6a + \frac{7d}{T}\right)\rho^5$$

$$+ \frac{C}{T^2}\left[3 - \left(3 + \frac{1}{2}\gamma\rho^2 - \gamma^2\rho^4\right)\exp\left(-\gamma\rho^2\right)\right]$$

$$(H^0 - H_0^0) + H_0^0 - H$$

The variable used, their units and their meanings are:

Variable Name	Units	Meaning
X, T, X2		See section IV A.
AO, BO, CO, DO, EO, A, B, C, D, ALPHA, GAMMA, R, XM, T2, T3, T4, T5, ADT, RT		See section II A 2.
H	$\frac{\text{lbf - ft}^3}{\text{in}^2\text{ -lb mole}}$	Enthalpy.

ALPHAE, BETAE, CE, JE, KE		Reference value coefficients for enthalpy; located in common block HREF.
HOO	$\frac{BTU}{lb\ mole}$	Absolute enthalpy reference value.
X5		See section IV B.
Z1, Z2, Z3, Z4, Z5, T1, TT2, TT, DEL		Temporary storage.

D. The Function "FS"

The function used to evaluate entropy is: (see Wu ref. 4)

$$FS = -R\ \ell n\ \rho RT - \left[B_0 R + \frac{2C_0}{T^3} - \frac{3D_0}{T^4} + \frac{4E_0}{T^5} \right]\rho - \frac{1}{2}\left[bR + \frac{d}{T^2}\right]\rho^2$$

$$+ \frac{\alpha\rho^5 d}{5T^2} + \frac{2C}{\gamma T^3}\left[1 - \left[1 + \frac{1}{2}\gamma\rho^2\right]\exp\left(-\gamma\rho^2\right)\right]$$

$$(S_0 - S_0^0) + S_0^0 - S$$

The variables, their units and their meanings are:

Variable Name	Units	Meaning
X, T, X2		See section IV A.
S	$\frac{lbf - ft^3}{in^2 - lb\ mole - R^o}$	Entropy.
ALPHAE, BETAE, CE, JE, KE		Entropy reference coefficients; located in common block SREF.
AO, BO, CO, DO, EO, A, B, C, D, ALPHA, GAMMA, R, XM, T2, T3, T4, T5, ADT, RT		See section II A 2.
TT, T1, TT2, Z1, Z2, Z3, Z4, Z5, Z6, DEL		Temporary storage.

E. The Function "FCP"

The function for evaluation of constant pressure specific heat is: (see Wu ref. 4. The equation should read as follows.)

$$FCP = -R + \left(\frac{6C_0}{T^3} - \frac{12D_0}{T^4} + \frac{20E_0}{T^5} \right) \rho + \frac{d}{T^2} \rho^2$$

$$-\frac{2}{5} \frac{\alpha d}{T^2} \rho^5 + \frac{6C}{\gamma T^3} \left(e^{-\gamma\rho^2} - 1 \right) + \frac{3C}{T^3} \rho^2 e^{-\gamma\rho^2} + (\bar{P}) + C_p^* - C_p$$

where $(\bar{P})$ is

$$\frac{T R + \rho\left(B_0 R + \frac{2C_0}{T^3} - \frac{3D_0}{T^4} + \frac{4E_0}{T^5}\right) + \rho^2\left(bR + \frac{d}{T^2}\right) - \frac{\alpha d \rho^5}{T^2} - \frac{2c\rho^2}{T^3}(1 + \gamma\rho^2)\exp(-\gamma\rho^2)}{\text{denominator}}^2$$

where the denominator is

$$\{RT + 2\left(B_0 RT - A_0 - \frac{C_0}{T^2} + \frac{D_0}{T^3} - \frac{E_0}{T^4}\right)\rho + 3\rho^2\left(bRT - a - \frac{d}{T}\right)$$

$$+ 6\alpha\rho^5\left(a + \frac{d}{T}\right) + \frac{C\rho^2}{T^2} (3 + 3\gamma\rho^2 - 2\gamma^2\rho^4) \exp(-\gamma\rho^2)\}$$

The variables, their units and their meanings are:

Variable Name	Units	Meaning
CP	$\frac{\text{lbf - ft}^3}{\text{in}^2 \text{ - lb mole - R}^\circ}$	Constant pressure specific heat.
X, T, X2		see section IV A.
X5		see section IV B.

ALPHAE, BETAE, CE, JE, KE	Reference value coefficients for constant pressure specific heat; located in common block CPREF.
TT1, TT2, TR, DEL, Z1, Z2, Z3, Z4, Z5, Z6, DEX, CPP, ADD1, DIVI	Temporary storage.
AO, BO, CO, DO, EO, A, B, C, D, ALPHA, GAMMA, R, T2, T3, T4, T5, ADT, RT, XM	see section II A 2.

F. The Function "FCV"

The function used for evaluation of constant volume specific heat is:

$$FCV = -R + \left(6\frac{C_0}{T^3} - 12\frac{D_0}{T^4} + 20\frac{E_0}{T^5}\right)\rho + \frac{d}{T^2}\left(\rho^2 - \frac{2}{5}\alpha\rho^5\right) +$$

$$\frac{3C}{\gamma T^3}\left[-2 + \{2 + \gamma\rho^2\}\exp(-\gamma\rho^2)\right] - C_v + \left(\frac{\partial H_0}{\partial T}\right)$$

The variables, their units and their meanings are:

Variable Name	Units	Meaning
X, T, X2, X3		see section IV A.
ALPHAE, BETAE, CE, JE, KE		Reference value coefficients for enthalpy; located in common block HREF.
CV	$\frac{\text{lbf - ft}^3}{\text{in}^2 \text{ - lb mole - R}^{\circ}}$	Constant volume specific heat.
TT1, TT2, TR, DEL, GAMXX, Z1, Z2, Z3		Temporary storage.

G. The Function "FAS"

The function used to evaluate the sonic velocity squared is:

$$FAS = C_p/C_v \{RT + 2(B_0RT - A_0 - C_0/T^2 + D_0/T^3 - E_0/T^4)\rho + 3(bRT - a - d/T)\rho^2 + 6\alpha(a + d/T)\rho^5 + \frac{c\rho^2}{T^2}(2\gamma\rho^2 + (3 - 2\gamma\rho^2)(1 + \gamma\rho^2)) \exp(-\gamma\rho^2)\} - a_s^2$$

The variables, their units and their meanings are:

Variable Name	Units	Meaning
X, T, X2		see section IV A.
X5		see section IV C.
AS	$\frac{lbf - ft^3}{lb\ mole - in^2}$	Sonic velocity squared.
GAMMXX, Z1, Z2, Z3, Z4		Temporary storage.
RAT		Ratio of constant pressure to constant volume specific heats.
AO, BO, CO, DO, EO, A, B, C, D, ALPHA, GAMMA, R		see section II A 2.

III-5 BLOCK DATA SUBROUTINES

There are seven common blocks used in TAPPAM which contain information about the fluid whose properties are desired. The first of these is COEFF, which contains the coefficients of the equation of state, the molecular weight of the fluid, the universal gas constant and the mole fractions of the constituents of a mixture. If a mixture is used, the common blocks COEFF1, COEFF2 and COEFF3 must contain the equation of state coefficients of the mixture components.

The common blocks HREF, SREF and CPREF contain the information generated by COEFFICTS for evaluating reference values of enthalpy, entropy and constant pressure specific heat, respectively.

In order to initialize the values in the common blocks when a program is run, block data subroutines have been used. Twenty four block data subroutines are given here, containing information about propane, propylene, n-butane, a 65-25-10 percent by mole weight mixture of these three compounds and ethylene.

A list of the subroutine names, the common block which they initialize and the fluid they describe is:

Subroutine Name	Common Block	Fluid
PROPCOEFF	COEFF	Propane
PROPLCOEFF	COEFF	Propylene
NBUTCOEFF	COEFF	N-butane
MIXCOEFF	COEFF	Mixture
MIXCOEFF1	COEFF1	Propane
MIXCOEFF2	COEFF2	Propylene
MIXCOEFF3	COEFF3	N-butane
PROPHREF	HREF	Propane
PROPLHREF	HREF	Propylene
NBUTHREF	HREF	N-butane
MIXHREF	HREF	Mixture
PROPSREF	SREF	Propane
PROPLSREF	SREF	Propylene
NBUTSREF	SREF	N-butane
MIXSREF	SREF	Mixture
PROPCPREF	CPREF	Propane
PROPLCPREF	CPREF	Propylene
NBUTCPREF	CPREF	N-butane
MIXCPREF	CPREF	Mixture
LINHOPKECOEFF	COEFF	Propane
ETHLCOEFF	COEFF	Ethylene
ETHLHREF	HREF	Ethylene
ETHLSREF	SREF	Ethylene
ETHLCPREF	CPREF	Ethylene

III-6 EXAMPLES

A. Use of the Program "VLEQUIL"

Consider the following problem; it is desired to know vapor-liquid equilibrium conditions for a pseudo-fluid composed of 65 percent propane, 25 percent propylene and 10 percent n-butane by mole weight. These conditions are to be determined at temperatures of 450, 460, 470, 480 and 490 degrees Rankin.

Since vapor-liquid equilibrium is desired, the main program VLEQUIL must be used. With VLEQUIL, it is also necessary to use all seven functions and the three subroutines SECANT, FITY and FITD. Since a mixture is desired, block data subroutines must be chosen to initialize the common block COEFF, COEFF1, COEFF2, COEFF3, HREF, SREF and CPREF. (If a single component substance were being used, COEFF1 through COEFF3 would not be needed). Therefore the block data subroutines MIXCOEFF, MIXCOEFF1, MIXCOEFF2, MIXCOEFF3, MIXHREF, MIXSREF and MIXCPREF are needed to describe the mixture.

Now that the necessary components of TAPPAM are determined, the proper input to VLEQUIL must be constructed. Card one contains the number of components of the mixture, three. We have five equi-spaced temperatures, therefore card two, the desired number of data points, contains a five. Card three contains the first temperature and the temperature increment. The temperature is 450 degrees Rankin and the increment is 10 degrees Rankin. Card four contains an estimate of the equilibrium pressure at the first temperature. Arbitrarily, select 25 psia for this value. The fifth, and last, card contains the data needed to solve the equation of state for vapor-liquid equilibrium. The first value is the error bound on pressure. A value of 10^{-5} has been found sufficient for this parameter. The next value is the density error bound. The equation of state for pressure is very density sensitive in regions of liquid behavior, so a small value is required. A value of 10^{-10} has been used previously with good results. The next three values are the iteration parameters. Each has been given a value of 1000. The last two values are the bounds on density. The first is the maximum density which will be considered.

For proper selection of this value, known thermodynamic data should be consulted whenever possible. A value of 1.2 lbmole/ft^3 is selected here. If a value used does not give convergence, the value should be increased until a solution is found. The last parameter is the minimum density to be expected. A value of zero would suffice, but in order to avoid computational problems, a small positive value is suggested. Here the value is .0001 lbmole/ft^3.

The basic data necessary to the program is now complete, and the proper subroutines and functions have been selected. The program must now be run on a computer. The following runstream was used on the UNIVAC 1108 at the University of Maryland to implement the program with the desired data:

```
@HDG,X                                          SAMPLE RUN OF VLEQUIL.
@COPY,S T.VLEQUIL,VLEQUIL                         . COPY VLEQUIL INTO WORKSPACE
@COPY,S T.SECANT,SECANT                           . COPY SECANT INTO WORKSPACE
@COPY,S T.FITY,FITY                               . COPY FITY INTO WORKSPACE
@COPY,S T.FITD,FITD                               . COPY FITD INTO WORKSPACE
@COPY,S T.FP,FP                                   . COPY FP INTO WORKSPACE
@COPY,S T.FF,FF                                   . COPY FF INTO WORKSPACE
@COPY,S T.FH,FH                                   . COPY FH INTO WORKSPACE
@COPY,S T.FS,FS                                   . COPY FS INTO WORKSPACE
@COPY,S T.FCP,FCP                                 . COPY FCP INTO WORKSPACE
@COPY,S T.FCV,FCV                                 . COPY FCV INTO WORKSPACE
@COPY,S T.FAS,FAS                                 . COPY FAS INTO WORKSPACE
@COPY,S T.MIXCOEFF,MIXCOEFF                       . COPY MIXCOEFF INTO WORKSPACE
@COPY,S T.MIXCOEFF1,MIXCOEFF1                     . COPY MIXCOEFF1 INTO WORKSPACE
@COPY,S T.MIXCOEFF2,MIXCOEFF2                     . COPY MIXCOEFF2 INTO WORKSPACE
@COPY,S T.MIXCOEFF3,MIXCOEFF3                     . COPY MIXCOEFF3 INTO WORKSPACE
@COPY,S T.MIXHREF,MIXHREF                         . COPY MIXHREF INTO WORKSPACE
@COPY,S T.MIXSREF,MIXSREF                         . COPY MIXSREF INTO WORKSPACE
@COPY,S T.MIXCPREF,MIXCPREF                       . COPY MIXCPREF INTO WORKSPACE
@ASG,T TEMP.                                      . DEFINE FILE TEMP
@ASG,T TEMPP.                                     . DEFINE FILE TEMPP
@USE 10.,TEMP.                                    . DEFINE UNIT FOR TEMP
@USE 11.,TEMPP.                                   . DEFINE UNIT FOR TEMPP
@COMPILE                                          . COMPILE FORTRAN PROGRAMS
@MAP VLEQUIL                                      . CREATE ABSOLUTE ELEMENT
IN VLEQUIL
IN SECANT
IN FITY
IN FITD
IN FP
IN FF
IN FH
IN FS
IN FCP
IN FCV
IN FAS
IN MIXCOEFF
IN MIXCOEFF1
IN MIXCOEFF2
IN MIXCOEFF3
IN MIXHREF
IN MIXSREF
IN MIXCPREF
END
@XQT VLEQUIL                                      . EXECUTE PROGRAM, DATA FOLLOWS
3
  5
     450.0D0       10.0D0
      25.0D0
    1.0D-05     1.0D-10 1000 1000 1000      1.2D0      .0001D0
@ED 10.                                           . OUTPUT CONTENTS OF FILE 10
0,*
@ED 11.                                           . OUTPUT CONTENTS OF FILE 11
0,*
E
```

The output generated by this runstream is:

```
@HDG,X                                  SAMPLE RUN OF VLEQUIL.

@COPY,S T.VLEQUIL,VLEQUIL                       . COPY VLEQUIL INTO WORKSPACE
FURPUR R26V  01/18-11:37
 1 SYM

@COPY,S T.SECANT,SECANT                         . COPY SECANT INTO WORKSPACE
 1 SYM

@COPY,S T.FITY,FITY                             . COPY FITY INTO WORKSPACE
 1 SYM

@COPY,S T.FITD,FITD                             . COPY FITD INTO WORKSPACE
 1 SYM

@COPY,S T.FP,FP                                 . COPY FP INTO WORKSPACE
 1 SYM

@COPY,S T.FF,FF                                 . COPY FF INTO WORKSPACE
 1 SYM

@COPY,S T.FH,FH                                 . COPY FH INTO WORKSPACE
 1 SYM

@COPY,S T.FS,FS                                 . COPY FS INTO WORKSPACE
 1 SYM

@COPY,S T.FCP,FCP                               . COPY FCP INTO WORKSPACE
 1 SYM

@COPY,S T.FCV,FCV                               . COPY FCV INTO WORKSPACE
 1 SYM

@COPY,S T.FAS,FAS                               . COPY FAS INTO WORKSPACE
 1 SYM

@COPY,S T.MIXCOEFF,MIXCOEFF                     . COPY MIXCOEFF INTO WORKSPACE
 1 SYM

@COPY,S T.MIXCOEFF1,MIXCOEFF1                   . COPY MIXCOEFF1 INTO WORKSPACE
 1 SYM

@COPY,S T.MIXCOEFF2,MIXCOEFF2                   . COPY MIXCOEFF2 INTO WORKSPACE
 1 SYM

@COPY,S T.MIXCOEFF3,MIXCOEFF3                   . COPY MIXCOEFF3 INTO WORKSPACE
 1 SYM

@COPY,S T.MIXHREF,MIXHREF                       . COPY MIXHREF INTO WORKSPACE
 1 SYM

@COPY,S T.MIXSREF,MIXSREF                       . COPY MIXSREF INTO WORKSPACE
 1 SYM

@COPY,S T.MIXCPREF,MIXCPREF                     . COPY MIXCPREF INTO WORKSPACE
 1 SYM

@ASG,T TEMP.                                    . DEFINE FILE TEMP
FACILITY WARNING  100000000000

@ASG,T TEMPP.                                   . DEFINE FILE TEMPP
FACILITY WARNING  100000000000
```

SAMPLE RUN OF VLEQUIL

```
@USE 10.,TEMP.                          . DEFINE UNIT FOR TEMP
READY

@USE 11.,TEMPP.                         . DEFINE UNIT FOR TEMPP
READY

@COMPILE                                . COMPILE FORTRAN PROGRAMS
18 PROGRAMS FOUND, 18 PROCESSED.

@RALPH VLEQUIL/,.VLEQUIL/
RALPH  107.09  01/18-11:40-VLEQUIL(0)
THE SYMBOL 'J' OCCURS ONLY ONCE IN THE PROGRAM.
COMPILATION SUCCESSFUL.

@RALPH SECANT/,.SECANT/
RALPH  107.09S 01/18-11:40-SECANT(0)
COMPILATION SUCCESSFUL.

@RALPH FITY/,.FITY/
RALPH  107.09S 01/18-11:40-FITY(0)
COMPILATION SUCCESSFUL.

@RALPH FITD/,.FITD/
RALPH  107.09S 01/18-11:40-FITD(0)
COMPILATION SUCCESSFUL.

@RALPH FP/,.FP/
RALPH  107.09S 01/18-11:40-FP(0)
COMPILATION SUCCESSFUL.

@RALPH FF/,.FF/
RALPH  107.09S 01/18-11:41-FF(0)
COMPILATION SUCCESSFUL.

@RALPH FH/,.FH/
RALPH  107.09S 01/18-11:41-FH(0)
COMPILATION SUCCESSFUL.

@RALPH FS/,.FS/
RALPH  107.09S 01/18-11:41-FS(0)
COMPILATION SUCCESSFUL.

@RALPH FCP/,.FCP/
RALPH  107.09S 01/18-11:41-FCP(0)
COMPILATION SUCCESSFUL.

@RALPH FCV/,.FCV/
RALPH  107.09S 01/18-11:42-FCV(0)
COMPILATION SUCCESSFUL.

@RALPH FAS/,.FAS/
RALPH  107.09S 01/18-11:42-FAS(0)
COMPILATION SUCCESSFUL.

@RALPH MIXCOEFF/,.MIXCOEFF/
RALPH  107.09S 01/18-11:42-MIXCOEFF(0)
COMPILATION SUCCESSFUL.

@RALPH MIXCOEFF1/,.MIXCOEFF1/
RALPH  107.09S 01/18-11:42-MIXCOEFF1(0)
COMPILATION SUCCESSFUL.

@RALPH MIXCOEFF2/,.MIXCOEFF2/
RALPH  107.09S 01/18-11:42-MIXCOEFF2(0)
COMPILATION SUCCESSFUL.

@RALPH MIXCOEFF3/,.MIXCOEFF3/
RALPH  107.09S 01/18-11:43-MIXCOEFF3(0)
COMPILATION SUCCESSFUL.
```

SAMPLE RUN OF VLEQUIL

```
@RALPH MIXHREF/,,MIXHREF/
RALPH  107.09S 01/18-11:43-MIXHREF(0)
COMPILATION SUCCESSFUL.

@RALPH MIXSREF/,,MIXSREF/
RALPH  107.09S 01/18-11:43-MIXSREF(0)
COMPILATION SUCCESSFUL.

@RALPH MIXCPREF/,,MIXCPREF/
RALPH  107.09S 01/18-11:43-MIXCPREF(0)
COMPILATION SUCCESSFUL.

@MAP VLEQUIL                              . CREATE ABSOLUTE ELEMENT
MAP48R2H 01/18-11:42 VLEQUIL
START=014150, PROG SIZE(I/D)=7788*/3381

@XQT VLEQUIL                              . EXECUTE PROGRAM, DATA FOLLOWS
   .369244+002  -.100000+002   .289533-001   .265558+001  -.459774+003  -.295084+003
   .851880+000   .121786+001
   .566200+000   .377505+000   .346907+000   .308563+000   .349343+004   .709947+003
   .450549+002   .000000       .293271-001   .219474+001  -.454071+003  -.292698+003
   .864457+000   .121527+001
   .571785+000   .389690+000   .353853+000   .316778+000   .331189+004   .709215+003
   .544707+002   .100000+002   .297190-001   .182744+001  -.448304+003  -.290362+003
   .876873+000   .121292+001
   .578189+000   .402682+000   .360559+000   .325151+000   .313751+004   .707593+003
   .652956+002   .200000+002   .301318-001   .153179+001  -.442464+003  -.288083+003
   .889153+000   .121078+001
   .585542+000   .416605+000   .367081+000   .333681+000   .296905+004   .705041+003
   .776579+002   .300000+002   .305689-001   .129159+001  -.436543+003  -.285870+003
   .901319+000   .120882+001
   .593999+000   .431614+000   .373470+000   .342365+000   .280539+004   .701505+003


NORMAL EXIT.  EXECUTION TIME:          3054 MILLISECONDS.

@ED 10.                                   . OJTPUT CONTENTS OF FILE 10
ED 29B 01/18/78 11:47 (0):F
EDIT.
 .3692442734 75+002  -.1000000000 00+002   .2895332422 00-001   .2655578947 18+001
-.4597743355 13+003  -.2950836878 89+003   .8518797193 30+000   .1217859045 25+001
 .4505487939 25+002   .0000000000 00       .2932712815 50-001   .2194738032 75+001
-.4540711460 70+003  -.2926982717 03+003   .8644565162 07+000   .1215267232 48+001
 .5447069794 59+002   .1000000000 00+002   .2971902407 05-001   .1827435442 42+001
-.4463038601 85+003  -.2903623685 74+003   .8768732535 09+000   .1212919197 56+001
 .6529563188 11+002   .2000000000 00+002   .3013181724 29-001   .1531786576 59+001
-.4424642681 66+003  -.2880833724 22+003   .8891527950 38+000   .1210780343 53+001
 .7765788045 60+002   .3000000000 00+002   .3056888692 96-001   .1291590171 74+001
-.4365431485 56+003  -.2858698959 77+003   .9013185328 99+000   .1208815073 35+001
EOF AT LINE 10
END EDIT 10 LINES OUTPUT

@ED 11.                                   . OUTPUT CONTENTS OF FILE 11
ED 29B 01/18/78 11:47 (0):F
EDIT
 .3692442734 75+002  -.1000000300 00+002   .5662004003 27+000   .3775048684 79+000
 .3469071209 86+000   .3085634908 04+000   .3493426467 65+004   .7099473748 75+003
 .4505487939 25+002   .0000000300 00       .5717845436 79+000   .3896903090 06+000
 .3538531521 73+000   .3167775945 53+000   .3311886898 07+004   .7092151687 80+003
 .5447069794 59+002   .1000000300 00+002   .5731892483 88+000   .4026822495 38+000
 .3605591962 39+000   .3251513573 70+000   .3137513574 58+004   .7075932077 34+003
 .6529563188 11+002   .2000000000 00+002   .5855418774 95+000   .4166047659 95+000
 .3670814942 95+000   .3336811011 41+000   .2969054706 23+004   .7050407672 99+003
 .7765788045 60+002   .3000000000 00+002   .5939990075 20+000   .4316142581 91+000
 .3734695500 15+000   .3423646934 37+000   .2805390455 39+004   .7015049903 73+003
EOF AT LINE 10
END EDIT 10 LINES OUTPUT
```

B. Use of the Program "ISENTROP"

The problem to be solved is the construction of thermodynamic data for propane along an isentropic line from 50 psia and 600 degrees Rankin. Since we must use ISENTROP, the following subroutines and functions must be used; FITY, SECANT, FP, FH, and FS. The common blocks needed are to be filled with propane data so PROPCOEFF, PROPHREF and PROPSREF are also necessary.

The input data must now be choosen. Card number one must contain the initial state, 50 psia and 600 degrees Rankin. Card number two contains the data for solution to the equation of state. Choosing 10^{-10} for EPS, and 1000 for both KNSRCH and NUMBIT, leaves open the choice of XINT and XFIN. From a vapor-liquid equilibrium table for propane, we see that the saturation pressure for 600 degrees Rankin is 308 psia. Therefore the initial state is superheated vapor and XINT should be less than XFIN. Choose XINT as .0001 and XFIN as 1.2.

The desired temperatures along the isentropic line must now be input. For this example use 599,598,597, 596 and 595 degrees Rankin.

Using the above values, the following runstream was created and run on the University of Maryland UNIVAC 1108 Computer:

```
@HDG,X                          SAMPLE RUN OF ISENTROP
@COPY,S T.ISENTROP,ISENTROP      . COPY ISENTROP INTO WORKSPACE
@COPY,S T.SECANT,SECANT          . COPY SECANT INTO WORKSPACE
@COPY,S T.FITY,FITY              . COPY FITY INTO WORKSPACE
@COPY,S T.FP,FP                  . COPY FP INTO WORKSPACE
@COPY,S T.FH,FH                  . COPY FH INTO WORKSPACE
@COPY,S T.FS,FS                  . COPY FS INTO WORKSPACE
@COPY,S T.PROPCOEFF,PROPCOEFF    . COPY PROPCOEFF INTO WORKSPACE
@COPY,S T.PROPHREF,PROPHREF      . COPY PROPHREF INTO WORKSPACE
@COPY,S T.PROPSREF,PROPSREF      . COPY PROPSREF INTO WORKSPACE
@COMPILE                         . COMPILE FORTRAN PROGRAMS
@MAP ISENTROP                    . CREATE ABSOLUTE ELEMENT
IN ISENTROP
IN SECANT
IN FITY
IN FP
IN FH
IN FS
IN PROPCOEFF
IN PROPHREF
IN PROPSREF
END
@XQT ISENTROP                    . EXECUTE PROGRAM, DATA FOLLOWS
50.0D0,600.0D0,
1.0D-10,1000,1000,0.0001D0,1.20D0,
599.0D0,
598.0D0,
597.0D0,
596.0D0,
595.0D0,
@EOF                             . END OF DATA
```

The following is the output created by this runstream:

```
@HDG,X                          SAMPLE RUN OF ISENTROP

@COPY,S T.ISENTROP,ISENTROP          . COPY ISENTROP INTO WORKSPACE
FURPUR R25V  01/18-16:03
 1 SYM

@COPY,S T.SECANT,SECANT              . COPY SECANT INTO WORKSPACE
 1 SYM

@COPY,S T.FITY,FITY                  . COPY FITY INTO WORKSPACE
 1 SYM

@COPY,S T.FP,FP                      . COPY FP INTO WORKSPACE
 1 SYM

@COPY,S T.FH,FH                      . COPY FH INTO WORKSPACE
 1 SYM

@COPY,S T.FS,FS                      . COPY FS INTO WORKSPACE
 1 SYM

@COPY,S T.PROPCOEFF,PROPCOEFF        . COPY PROPCOEFF INTO WORKSPACE
 1 SYM

@COPY,S T.PROPHREF,PROPHREF          . COPY PROPHREF INTO WORKSPACE
 1 SYM

@COPY,S T.PROPSREF,PROPSREF          . COPY PROPSREF INTO WORKSPACE
 1 SYM

@COMPILE                             . COMPILE FORTRAN PROGRAMS
9 PROGRAMS FOUND, 9 PROCESSED.

@RALPH ISENTROP/,.ISENTROP/
RALPH  107.09  01/18-16:03-ISENTROP(0)
COMPILATION SUCCESSFUL.

@RALPH SECANT/,.SECANT/
RALPH  107.09S 01/18-16:03-SECANT(0)
COMPILATION SUCCESSFUL.

@RALPH FITY/,.FITY/
RALPH  107.09S 01/18-16:03-FITY(0)
COMPILATION SUCCESSFUL.

@RALPH FP/,.FP/
RALPH  107.09S 01/18-16:03-FP(0)
COMPILATION SUCCESSFUL.

@RALPH FH/,.FH/
RALPH  107.09S 01/18-16:03-FH(0)
COMPILATION SUCCESSFUL.

@RALPH FS/,.FS/
RALPH  107.09S 01/18-16:03-FS(0)
COMPILATION SUCCESSFUL.

@RALPH PROPCOEFF/,.PROPCOEFF/
RALPH  107.09S 01/18-16:03-PROPCOEFF(0)
COMPILATION SUCCESSFUL.

@RALPH PROPHREF/,.PROPHREF/
RALPH  107.09S 01/18-16:03-PROPHREF(0)
COMPILATION SUCCESSFUL.
```

```
                    SAMPLE RUN OF ISENTROP

@RALPH PROPSREF/.,PROPSREF/
RALPH  107.09S 01/18-16:04-PROPSREF(0)
COMPILATION SUCCESSFUL.

@MAP ISENTROP                          . CREATE ABSOLUTE ELEMENT
MAP28R2H 01/18-16:04 ISENTROP
START=013765, PROG SIZE(I/D)=6495*/2696

@XQT ISENTROP                          . EXECUTE PROGRAM, DATA FOLLOWS
  .5000000+002  .1400000+003  .3565432+000 -.6293569+003  .1329554+001
  .4924122+002  .1390000+003  .3515719+000 -.6297512+003  .1329554+001
  .4849330+002  .1380000+003  .3466678+000 -.6301454+003  .1329554+001
  .4775612+002  .1370000+003  .3418299+000 -.6305394+003  .1329554+001
  .4702952+002  .1360000+003  .3370575+000 -.6309333+003  .1329554+001
  .4631337+002  .1350000+003  .3323496+000 -.6313270+003  .1329554+001

NORMAL EXIT.  EXECUTION TIME:        193 MILLISECONDS.    STOP: 01030
```

C. Use of the Program "COMPLIQ"

Consider the following problem; it is desired to know the thermodynamic properties of propane at the pressures 300 and 400 psia at 460 degrees Rankin.

Since these conditions are compressed liquid (determined from a vapor-liquid equilibrium chart of propane), the program COMPLIQ must be used. With COMPLIQ, it is also necessary to use FITY, FITD, SECANT, and all functions excluding FF. Also, since propane is the desired fluid, PROPCOEFF, PROPHREF, PROPSREF and PROPCPREF must be used.

The proper input to COMPLIQ must now be determined. Since the points of interest are compressed liquid, XFIN must be less than XINT. Therefore choose XINT as 1.2 and XFIN as .0001. The next cards are the desired pressures and temperatures.

The following runstream was used on the University of Maryland Univac 1108 :

```
@HDG,X                          SAMPLE RUN OF COMPLIQ
@COPY,S T.COMPLIQ,COMPLIQ        . COPY COMPLIQ INTO WORKSPACE
@COPY,S T.SECANT,SECANT          . COPY SECANT INTO WORKSPACE
@COPY,S T.FITY,FITY              . COPY FITY INTO WORKSPACE
@COPY,S T.FITD,FITD              . COPY FITD INTO WORKSPACE
@COPY,S T.FP,FP                  . COPY FP INTO WORKSPACE
@COPY,S T.FH,FH                  . COPY FH INTO WORKSPACE
@COPY,S T.FS,FS                  . COPY FS INTO WORKSPACE
@COPY,S T.FCP,FCP                . COPY FCP INTO WORKSPACE
@COPY,S T.FCV,FCV                . COPY FCV INTO WORKSPACE
@COPY,S T.FAS,FAS                . COPY FAS INTO WORKSPACE
@COPY,S T.PROPCOEFF,PROPCOEFF    . COPY PROPCOEFF INTO WORKSPACE
@COPY,S T.PROPHREF,PROPHREF      . COPY PROPHREF INTO WORKSPACE
@COPY,S T.PROPCPREF,PROPCPREF    . COPY PROPCPREF INTO WORKSPACE
@COMPILE                         . COMPILE FORTRAN PROGRAMS
@MAP COMPLIQ                     . CREATE ABSOLUTE ELEMENT
```

```
 IN COMPLIQ
 IN SECANT
 IN FITY
 IN FITD
 IN FP
 IN FH
 IN FS
 IN FCP
 IN FCV
 IN FAS
 IN PROPCOEFF
 IN PROPHREF
 IN PROPSREF
 IN PROPCPREF
 END
 @XQT COMPLIQ                          . EXECUTE PROGRAM, DATA FOLLOWS
 1.2D0,0.0001D0
 300.0D0,460.0D0
 400.0D0,460.0D0
 @EOF                                  . END OF DATA
```

The following are the results of the computer run:

```
@HDG,X                        SAMPLE RUN OF COMPLIQ

@COPY,S T.COMPLIQ,COMPLIQ             . COPY COMPLIQ INTO WORKSPACE
FURPUR R26V  01/18-16:25
 1 SYM

@COPY,S T.SECANT,SECANT               . COPY SECANT INTO WORKSPACE
 1 SYM

@COPY,S T.FITY,FITY                   . COPY FITY INTO WORKSPACE
 1 SYM

@COPY,S T.FITD,FITD                   . COPY FITD INTO WORKSPACE
 1 SYM

@COPY,S T.FP,FP                       . COPY FP INTO WORKSPACE
 1 SYM

@COPY,S T.FH,FH                       . COPY FH INTO WORKSPACE
 1 SYM

@COPY,S T.FS,FS                       . COPY FS INTO WORKSPACE
 1 SYM

@COPY,S T.FCP,FCP                     . COPY FCP INTO WORKSPACE
 1 SYM

@COPY,S T.FCV,FCV                     . COPY FCV INTO WORKSPACE
 1 SYM

@COPY,S T.FAS,FAS                     . COPY FAS INTO WORKSPACE
 1 SYM

@COPY,S T.PROPCOEFF,PROPCOEFF         . COPY PROPCOEFF INTO WORKSPACE
 1 SYM

@COPY,S T.PROPHREF,PROPHREF           . COPY PROPHREF INTO WORKSPACE
 1 SYM

@COPY,S T.PROPCPREF,PROPCPREF         . COPY PROPCPREF INTO WORKSPACE
 1 SYM

@COMPILE                              . COMPILE FORTRAN PROGRAMS
15 PROGRAMS FOUND, 6 PROCESSED.

@RALPH COMPLIQ/,,COMPLIQ/
RALPH  107.09  01/18-16:26-COMPLIQ(0)
THE SYMBOL 'ERR' OCCURS ONLY ONCE IN THE PROGRAM.
COMPILATION SUCCESSFUL.
```

SAMPLE RUN OF COMPLIQ

```
@RALPH FITD/,.FITD/
RALPH  107.09S 01/18-16:27-FITD(0)
COMPILATION SUCCESSFUL.

@RALPH FCP/,.FCP/
RALPH  107.09S 01/18-16:27-FCP(0)
COMPILATION SUCCESSFUL.

@RALPH FCV/,.FCV/
RALPH  107.09S 01/18-16:27-FCV(0)
COMPILATION SUCCESSFUL.

@RALPH FAS/,.FAS/
RALPH  107.09S 01/18-16:27-FAS(0)
COMPILATION SUCCESSFUL.

@RALPH PROPCPREF/,.PROPCPREF/
RALPH  107.09S 01/18-16:27-PROPCPREF(0)
COMPILATION SUCCESSFUL.

@MAP COMPLIQ                          . CREATE ABSOLUTE ELEMENT
MAP28R2H 01/18-16:27 COMPLIQ
START=014036, PROG SIZE(I/D)=7127*/3049

@XQT COMPLIQ                          . EXECUTE PROGRAM, DATA FOLLOWS
 .30000000+003  .46000000+003  .34107314+002 -.85620197+003
 .86037983+000  .55079948+000  .38201729+000  .33671766+004
 .40000000+003  .46000000+003  .34165721+002 -.85593035+003
 .85979160+000  .54970452+000  .38248539+000  .33937876+004

NORMAL EXIT.  EXECUTION TIME:          220 MILLISECONDS.    STOP: 02000
```

D. Use of the Program "COEFFICTS"

Assume a block data subroutine for the reference enthalpy of propane is to be created. Then the program COEFFICTS must be used. Along with COEFFICTS, FITY and ORTHLS are necessary.

Since propane is desired, only one component is necessary. Therefore NUMB is one, and the mole fraction of the major component is also one. The name for the final common block should be HREF, in accordance with the format of the other programs in TAPPAM. From API project 44 (ref. 5), twenty seven reference points for enthalpy were found. Therefore, set N1 to twenty seven, K1 to nine (standard) and J1 to zero (standard). The enthalpy reference values follow. The absolute reference value for propane enthalpy is -35042.07 BTU/lbmole.

With the above data, the following runstream was used on the UNIVAC 1108 at the University of Maryland:

```
@HDG,X                          SAMPLE RUN OF COEFFICTS
@COPY,S  T.COEFFICTS,COEFFICTS          . COPY COEFFICTS INTO WORKSPACE
@COPY,S  T.ORTHLS,ORTHLS                . COPY ORTHLS INTO WORKSPACE
@COPY,S  T.FITY,FITY                    . COPY FITY INTO WORKSPACE
@ASG,T TEMP.                            . DEFINE FILE TEMP
@USE 10.,TEMP.                          . DEFINE UNIT 10 AS TEMP
@COMPILE                                . COMPILE FORTRAN PROGRAMS
@MAP COEFFICTS                          . CREATE ABSOLUTE ELEMENT
IN COEFFICTS
IN ORTHLS
IN FITY
END
@XQT COEFFICTS                          . EXECUTE COEFFICTS, DATA FOLLOWS
 1
1.0000000
HREF
2790
0.                      0.
210.                    1821.52
260.                    2368.77
310.                    2996.66
360.                    3601.63
410.                    4294.72
460.                    5044.22
492.                    5554.896
510.                    5853.196
520.                    6022.39
528.                    6159.43
537.                    6313.20
560.                    6727.83
610.                    7672.52
660.                    8681.98
710.                    9755.33
760.                    10900.94
810.                    12112.64
860.                    13386.04
960.                    16095.85
1060.                   19025.97
1160.                   22167.59
1260.                   25494.27
1360.                   28997.20
1460.                   32658.75
1560.                   36465.71
1660.                   40404.85
-35042.068
@ED 10.                                 . EDIT FILE 10
0 *
E
```

The following is the output resulting from the runstream:

```
@HDG,X                          SAMPLE RUN OF COEFFICTS

@COPY,S T.COEFFICTS,COEFFICTS           . COPY COEFFICTS INTO WORKSPACE
FURPUR R26V  01/20-11:31
 1 SYM

@COPY,S T.ORTHLS,ORTHLS                 . COPY ORTHLS INTO WORKSPACE
 1 SYM

@COPY,S T.FITY,FITY                     . COPY FITY INTO WORKSPACE
 1 SYM

@ASG,T TEMP.                            . DEFINE FILE TEMP
READY

@USE 10.,TEMP.                          . DEFINE UNIT 10 AS TEMP
READY

@COMPILE                                . COMPILE FORTRAN PROGRAMS
3 PROGRAMS FOUND, 3 PROCESSED.
```

SAMPLE RUN OF COEFFICTS

```
@RALPH COEFFICTS/,.COEFFICTS/
RALPH  107.09  01/20-11:32-COEFFICTS(0)
COMPILATION SUCCESSFUL.

@RALPH ORTHLS/,.ORTHLS/
RALPH  107.09S 01/20-11:32-ORTHLS(0)
COMPILATION SUCCESSFUL.

@RALPH FITY/,.FITY/
RALPH  107.09S 01/20-11:32-FITY(0)
COMPILATION SUCCESSFUL.

@MAP COEFFICTS                          . CREATE ABSOLUTE ELEMENT
MAP28R2H 01/20-11:32 COEFFICTS
START=013506, PROG SIZE(I/D)=6183*/2892

@XQT COEFFICTS                          . EXECUTE COEFFICTS, DATA FOLLOWS




NORMAL EXIT.  EXECUTION TIME:          162 MILLISECONDS.    STOP: 0050

@ED 10.                                 . EDIT FILE 10
ED 29B 01/20/78 11:35 (0):F
EDIT
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /HREF  /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .74248148148148148O+003/
      DATA BETAE( 1)/ .18221447187928669 3+006/
      DATA CE( 1)/ .12614003777777777+005/
      DATA ALPHAE( 2)/ .99527819522864658 7+003/
      DATA BETAE( 2)/ .20282156695436411 2+006/
      DATA CE( 2)/ .25442089673115425 4+002/
      DATA ALPHAE( 3)/ .72709640709470603 3+003/
      DATA BETAE( 3)/ .22327916328573405 0+006/
      DATA CE( 3)/ .11169365713677478 2-001/
      DATA ALPHAE( 4)/ .81842263723360908 6+003/
      DATA BETAE( 4)/ .18934983424658301 8+006/
      DATA CE( 4)/-.98172493177610183 9-006/
      DATA ALPHAE( 5)/ .83035342016203996 3+003/
      DATA BETAE( 5)/ .17204025884322448 5+006/
      DATA CE( 5)/-.19441159944591399 2-008/
      DATA ALPHAE( 6)/ .86584417495431583 8+003/
      DATA BETAE( 6)/ .14801728460979535 2+006/
      DATA CE( 6)/ .15314198991668610 4-011/
      DATA ALPHAE( 7)/ .93258280245022862 8+003/
      DATA BETAE( 7)/ .11838167642154082 5+006/
      DATA CE( 7)/ .13825476953804862 0-015/
      DATA ALPHAE( 8)/ .91781691901494748 9+003/
      DATA BETAE( 8)/ .13984056210690986 9+006/
      DATA CE( 8)/-.30548552374657625 6-017/
      DATA ALPHAE( 9)/ .85886097163947111 4+003/
      DATA BETAE( 9)/ .11849333073185837 8+006/
      DATA CE( 9)/ .62858668767314084 5-020/
      DATA ALPHAE(10)/ .00000000000000000    /
      DATA BETAE(10)/ .00000000000000000    /
      DATA CE(10)/-.60436034633793654 3-023/
      DATA CE(11)/ .00000000000000000    /
      DATA POO/   -35042.06800000007/
      END
EOF AT LINE 38
END EDIT 38 LINES OUTPUT
```

III-7 Listing of Entire Program

```
                                    TAPPAM:VLEQUIL
C*********************************************************************
C     THIS PROGRAM FINDS VAPOR-LIQUID EQUILIBRIUM FOR A MIXTURE
C    OF UP TO THREE COMPONENTS USING STARLINGS EQUATION OF STATE.
C*********************************************************************
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION HLD1(13),HLD2(13),HLD3(13)
      DIMENSION ALPHAH(10),ALPHAS(10),ALPHAC(10)
      DIMENSION BETAH(10),BETAS(10),BETAC(10)
      DIMENSION CH(11),CS(11),CC(11)
      EXTERNAL FP
      COMMON/COEFF/AO,BO,CO,DO,EO,A,B,C,D,ALPHA,GAMMA,R,X*,X1,X2,X3
      COMMON/COEFF1/HLD1
      COMMON/COEFF2/HLD2
      COMMON/COEFF3/HLD3
      COMMON/HREF/KH,JH,ALPHAH,BETAH,CH,HOO
      COMMON/SREF/KS,JS,ALPHAS,BETAS,CS
      COMMON/CPREF/KC,JC,ALPHAC,BETAC,CC
      COMMON/PARA/A2,B2,C2,D2,ALPHA2,CGAMMA,ONETR
      COMMON/TEMP/T2,T3,T4,T5,ADT,RT
C*********************************************************************
C     DEFINE COMMON PARAMETERS WHICH APPEAR THROUGHT SUBROUTINES.
C*********************************************************************
      A2=A*A
      B2=B*B
      C2=C*C
      D2=D*D
      ALPHA2=ALPHA*ALPHA
      CGAMMA=C/GAMMA
      ONETR=1.0D0/3.0D0
      CONVER=144.0D0/778.0D0
C*********************************************************************
C     INPUT NUMBER OF COMPONENTS IN MIXTURE AND NUMBER OF DATA POINTS.
C*********************************************************************
      READ(5,1)NCOMP
      READ(5,2)NDATA
      IF(NCOMP.NE.1)GO TO 888
C*********************************************************************
C     DEFINE COEFFICIENTS OF COMPONENTS FOR A PURE SUBSTANCE.
C*********************************************************************
      HLD1(1)=AO
      HLD1(2)=BO
      HLD1(3)=CO
      HLD1(4)=DO
      HLD1(5)=EO
      HLD1(6)=A
      HLD1(7)=B
      HLD1(8)=C
      HLD1(9)=D
      HLD1(10)=ALPHA
      HLD1(11)=GAMMA
888   CONTINUE
C*********************************************************************
C     INPUT LOWEST TEMPERATURE(DEG R), AND TEMPERATURE INCREMENT.
C*********************************************************************
      READ(5,6)T,DELT
C*********************************************************************
C     INPUT FIRST PRESSURE APPROXIMATION AND EQUATION SOLUTION
C    INFORMATION.
C*********************************************************************
      READ(5,3)PN
      READ(5,4)EPS1,EPS2,KNSRCH,NITER,NUMBIT,XINT,XFIN
C*********************************************************************
C     START VAPOR-LIQUID CALCULATIONS.
C*********************************************************************
      DO 101 I=1,NDATA
      DO 102 J=1,NUMBIT
C*********************************************************************
C     GENERATE DENSITIES CORRESPONDING TO GIVEN TEMPERATURE AND
C     PRESSURE GUESS.
C*********************************************************************
      T2=T*T
      T3=T2*T
      T4=T3*T
      T5=T4*T
      ADT=A+D/T
      RT=R*T
      CALL SECANT(XINT,XFIN,FP,KNSRCH,PN,T,XLIQ,NITER,EPS2,ERROR)
      CALL SECANT(XFIN,XINT,FP,KNSRCH,PN,T,XGAS,NITER,EPS2,ERROR)
C*********************************************************************
C     CALCULATE FUGACITIES AND NEW PRESSURE APPROXIMATION.
C*********************************************************************
      FL=FF(XLIQ,T,NCOMP)
      FG=FF(XGAS,T,NCOMP)
      PNN=PN*FL/FG
C*********************************************************************
C     CHECK ERROR BOUNDS ON PRESSURE.
C*********************************************************************
```

```
      IF(DABS((PNN-PN)/PN).LE.EPS1)GO TO 103
102   PN=PNN
C*****************************************************************************
C     IF PROGRAM REACHES THIS POINT, NUMBIT ITERATIONS HAVE BEEN MADE.
C    PRINT PRESANT INFORMATION AND STOP PROGRAM.
C*****************************************************************************
      WRITE(6,5)FL,FG,XLIQ,XGAS,I,T,PN,PNN
      STOP 00001
103   P=PNN
C*****************************************************************************
C     GENERATE THERMODYNAMIC PROPERTIES.
C*****************************************************************************
      HLIQ=FH(XLIQ,T,0.0)
      HGAS=FH(XGAS,T,0.0)
      SLIQ=FS(XLIQ,T,0.0)
      SGAS=FS(XGAS,T,0.0)
      CPLIQ=FCP(XLIQ,T,0.0)
      CPGAS=FCP(XGAS,T,0.0)
      CVLIQ=FCV(XLIQ,T,0.0)
      CVGAS=FCV(XGAS,T,0.0)
      RAT=CPLIQ/CVLIQ
      ASLIQ=FAS(XLIQ,T,0.0,RAT)
      RAT=CPGAS/CVGAS
      ASGAS=FAS(XGAS,T,0.0,RAT)
C*****************************************************************************
C     CHANGE TO ENGLISH UNITS AND OBTAIN SPECIFIC VOLUMES.
C*****************************************************************************
      XLIQ=1.0D0/XLIQ/XM
      XGAS=1.0D0/XGAS/XM
      HLIQ=HLIQ/XM*CONVER
      HGAS=HGAS/XM*CONVER
      SLIQ=SLIQ/XM*CONVER
      SGAS=SGAS/XM*CONVER
      CPLIQ=CPLIQ/XM*CONVER
      CPGAS=CPGAS/XM*CONVER
      CVLIQ=CVLIQ/XM*CONVER
      CVGAS=CVGAS/XM*CONVER
      ASLIQ=DSQRT(ASLIQ/XM*4636.8D0)
      ASGAS=DSQRT(ASGAS/XM*4636.8D0)
      TF=T-460.0D0
C*****************************************************************************
C     OUTPUT INFORMATION INTO FILES #10,#11 AND LINE PRINTER.
C*****************************************************************************
      WRITE(6,7)P,TF,XLIQ,XGAS,HLIQ,HGAS,SLIQ,SGAS
      WRITE(6,7)CPLIQ,CPGAS,CVLIQ,CVGAS,ASLIQ,ASGAS
      WRITE(10,8)P,TF,XLIQ,XGAS,HLIQ,HGAS,SLIQ,SGAS
      WRITE(11,8)P,TF,CPLIQ,CPGAS,CVLIQ,CVGAS,ASLIQ,ASGAS
C*****************************************************************************
C     INCREMENT TEMPERATURE.
C*****************************************************************************
      T=T+DELT
C*****************************************************************************
C     IF TEMPERATURE IS ABOVE CRITICAL POINT STOP PROGRAM.
C*****************************************************************************
      IF(XLIQ.EQ.XGAS)STOP 00002
101   CONTINUE
1     FORMAT(I1)
2     FORMAT(I3)
3     FORMAT(D12.6)
4     FORMAT(2D12.6,3I5,2D12.6)
5     FORMAT(4(D12.5,2X),I3,2X,3(D12.6,2X))
6     FORMAT(2D12.6)
7     FORMAT(2X,8(D12.6,2X))
8     FORMAT(4(D13.12,2X),/,4(D13.12,2X))
      STOP
      END


                                    TAPPAM:ISENTROP
C*****************************************************************************
C     THIS PROGRAM COMPUTES THE THERMODYNAMIC PROPERTIES OF THE SUBSTANCE
C    DESCRIBED BY THE STARLINGS AND REFERENCE VALUE COEFFICIENTS FOUND IN
C    THE COMMON BLOCKS, ALONG AN ISENTROPIC LINE.
C*****************************************************************************
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      EXTERNAL FP,FS
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      DIMENSION ALPHAH(10),BETAH(10),CH(11)
      COMMON/HREF/KH,JH,ALPHAH,BETAH,CH,HH
      COMMON/SREF/KE,JE,ALPHAE,BETAE,CE
      COMMON/TEMP/T2,T3,T4,T5,ADT,RT
      COMMON/COEFF/A0,B0,C0,D0,E0,A,B,C,D,ALPHA,GAMMA,R,XM
C*****************************************************************************
C        READ INITIAL THERMODYNAMIC STATE.
C*****************************************************************************
      READ(5,1)P0,T0
1     FORMAT( )
```

```
C*****************************************************************
C         READ EQUATION SOLUTION INFORMATION.
C*****************************************************************
      READ(5,1)EPS,KNSRCH,NITER,XINT,XFIN
C*****************************************************************
C         DEFINE COMMON BLOCK PARAMETERS.
C*****************************************************************
      T2=TO*TO
      T3=T2*TO
      T4=T3*TO
      T5=T4*TO
      ADT=A+D/TO
      RT=R*TO
C*****************************************************************
C         FIND DENSITY CORRESPONDING TO INITIAL THERMODYNAMIC STATE.
C*****************************************************************
      CALL SECANT(XINT,XFIN,FP,KNSRCH,PO,TO,XO,NITER,EPS,ERROP)
C*****************************************************************
C         CALCULATE THERMODYNAMIC PROPERTIES IN ENGLISH UNITS.
C*****************************************************************
      PO=FP(XO,TO,0.0D0)
      SO=FS(XO,TO,0.0D0)
      HO=FH(XO,TO,0.0D0)/XM/778.0D0*144.0D0
      XOO=XO*XM
      SOO=SO*144.0D0/778.0D0/XM
      TOT=TO-460.0D0
C*****************************************************************
C         OUTPUT INITIAL THERMODYNAMIC STATE.
C*****************************************************************
      WRITE(6,2)PO,TOT,XOO,HO,SOO
2     FORMAT(1X,5(D13.7,1X))
C*****************************************************************
C         READ TEMPERATURE AT DESIRED POINT ALONG ISENTROPIC LINE FROM
C       INITIAL STATE.
C*****************************************************************
998   READ(5,1,END=999)T
C*****************************************************************
C         DEFINE COMMON BLOCK PARAMETERS.
C*****************************************************************
      RT=R*T
      ADT=A+D/T
      T2=T*T
      T3=T2*T
      T4=T3*T
      T5=T4*T
C*****************************************************************
C         FIND DENSITY CORRESPONDING TO NEW TEMPERATURE AND INITIAL
C       ENTROPY.
C*****************************************************************
      CALL SECANT(XINT,XFIN,FS,KNSRCH,SO,T,X,NITER,EPS,ERROR)
C*****************************************************************
C         CALCULATE THERMODYNAMIC PROPERTIES IN ENGLISH UNITS.
C*****************************************************************
      P=FP(X,T,0.0D0)
      SOO=FS(X,T,0.0D0)*144.0D0/778.0D0/XM
      HO=FH(X,T,0.0D0)/XM/778.0D0*144.0D0
      XOO=X*XM
      TOT=T-460.0D0
C*****************************************************************
C         OUTPUT NEW THERMODYNAMIC STATE.
C*****************************************************************
      WRITE(6,2)P,TOT,XOO,HO,SOO
      GO TO 998
999   STOP 01000
      END

                              TAPPAM:COMPLIQ
C*****************************************************************
C         THIS PROGRAM CALCULATES THE THERMODYNAMIC PROPERTIES OF THE
C       SUBSTANCE DESCRIBED IN THE COMMON BLOCKS AT A GIVEN PRESSURE AND
C       TEMPERATURE.
C*****************************************************************
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION HLD1(23),HLD2(23),HLD3(23)
      COMMON/COEFF/AO,BO,CO,DO,EO,A,B,C,D,ALPHA,GAMMA,R,XM
      COMMON/HREF/HLD1
      COMMON/SREF/HLD2
      COMMON/CPREF/HLD3
      COMMON/TEMP/T2,T3,T4,T5,ADT,RT
      EXTERNAL FP
      CONVER=144.0D0/778.0D0
C*****************************************************************
C         READ DENSITY LIMITS. XINT>XFIN FOR LIQUID, XINT<XFIN FOR GAS.
C*****************************************************************
      READ(5,1)XINT,XFIN
C*****************************************************************
C         READ PRESSURE AND TEMPERATURE.
C*****************************************************************
```

```
20      READ(5,1,END=999)P,T
C*********************************************************************
C          CALCULATE COMMON BLOCK PARAMETERS.
C*********************************************************************
        T2=T*T
        T3=T2*T
        T4=T3*T
        T5=T4*T
        ADT=A+D/T
        RT=R*T
C*********************************************************************
C          FIND DENSITY CORRESPONDING TO GIVEN PRESSURE AND TEMPERATURE.
C*********************************************************************
        CALL SECANT(XINT,XFIN,FP,1500,P,T,X,1500,1.0D-10,ERR)
C*********************************************************************
C          CALCULATE THERMODYNAMIC PROPERTIES IN ENGLISH UNITS.
C*********************************************************************
        H=FH(X,T,0.0D0)*CONVER/XM
        S=FS(X,T,0.0D0)*CONVER/XM
        CP=FCP(X,T,0.0D0)*CONVER/XM
        CV=FCV(X,T,0.0D0)*CONVER/XM
        RAT=CP/CV
        AS=FAS(X,T,0.0D0,RAT)
        AS=DSQRT(AS*4636.3D0/XM)
        X=X*XM
C*********************************************************************
C          OUTPUT THERMODYNAMIC INFORMATION.
C*********************************************************************
        WRITE(6,2)P,T,X,H,S,CP,CV,AS
2       FORMAT(4(D14.3,1X),/,4(D14.3,1X))
1       FORMAT( )
        GO TO 20
999     STOP 02000
        END
```

TAPPAM:COEFFICTS

```
C*********************************************************************
C     THIS PROGRAM CREATES A BLOCK DATA SUBROUTINE CONTAINING THE
C    INFORMATION NECESSARY TO CALCULATE CURVE FITTING INFORMATION
C    FOR MIXTURES
C*********************************************************************
        IMPLICIT DOUBLE PRECISION (A-H,O-Z)
        DIMENSION XM(10),T(30),P(30),T2(30),P2(30),Z1(30),Z2(30),Z3(30)
       1,ALPHAE(10),BETAE(10),CE(11),W(30),NAME(2)
C*********************************************************************
C    READ NUMBER OF COMPONENTS IN MIXTURE
C*********************************************************************
        READ(5,1)NUMB
1       FORMAT(I2,I1,I1)
C*********************************************************************
C     READ MOLE FRACTIONS OF COMPONENTS
C*********************************************************************
        DO 10 J=1,NUMB
10      READ(5,2)XM(J)
2       FORMAT(F10.5)
C*********************************************************************
C     READ ALPHANUMERIC NAME OF FINAL COMMON BLOCK
C*********************************************************************
        READ(5,4)NAME
4       FORMAT(2A3)
C*********************************************************************
C     READ CURVE FITTING INFORMATION FOR MAJOR COMPONENT
C*********************************************************************
        READ(5,1)N1,K1,J1
C*********************************************************************
C     READ DATA POINTS FOR CURVE
C*********************************************************************
        DO 11 J=1,N1
        READ(5,3)T(J),P(J)
11      P(J)=P(J)*XM(1)
3       FORMAT(2F20.10)
C*********************************************************************
C     READ ABSOLUTE REFERENCE POINT
C*********************************************************************
        READ(5,3)P001
        P001=P001*XM(1)
        IF(NUMB.EQ.1)GO TO 500
        DO 501 KK=2,NUMB
C*********************************************************************
C    READ CURVE FITTING INFORMATION FOR I'TH COMPONENT
C*********************************************************************
        READ(5,1)N,K,J
C*********************************************************************
C     READ DATA FOR I'TH COMPONENT
C*********************************************************************
```

```
      DO 12 I=1,N
      READ(5,3)T2(I),P2(I)
12    P2(I)=P2(I)*XM(KK)
C*****************************************************************
C     CALCULATE CURVE FOR I'TH COMPONENT
C*****************************************************************
      CALL ORTHLS(T2,P2,W,N,0,J,CE,ALPHAE,BETAE,K,Z1,Z2,Z3,IND)
      IF(IND.EQ.-1)GO TO 999
C*****************************************************************
C     CALCULATE CURVE VALUES CORRESPONDING TO MAJOR COMPONENTS DATA
C*****************************************************************
      CALL FITY(T,N1,J,CE,ALPHAE,BETAE,K,P2,Z1,Z2,IND)
      IF(IND.EQ.-3)GO TO 999
      DO 13 I=1,N1
13    P(I)=P(I)+P2(I)
C*****************************************************************
C     READ ABSOLUTE REFERENCE VALUE
C*****************************************************************
      READ(5,3)P00
      P00=P00*XM(KK)
      P001=P001+P00
501   CONTINUE
500   CONTINUE
      IF(NUMB.EQ.1.AND.XM(1).NE.1.0D0)GO TO 999
C*****************************************************************
C     CALCULATE REFERENCE CURVE INFORMATION FOR MIXTURE
C*****************************************************************
      CALL ORTHLS(T,P,W,N1,0,J1,CE,ALPHAE,BETAE,K1,Z1,Z2,Z3,IND)
      IF(IND.EQ.-1)GO TO 999
C*****************************************************************
C     CREATE BLOCK DATA SUBROUTINE FOR INFORMATION
C*****************************************************************
      WRITE(10,600)
600   FORMAT(6X,'BLOCK DATA',/,6X,'IMPLICIT DOUBLE PRECISION(A-H,O-Z)'
     1,/,6X,'DIMENSION ALPHAE(10),BETAE(10),CE(11)')
      WRITE(10,601)NAME
601   FORMAT(6X,'COMMON /',2A3,'/KE,JE,ALPHAE,BETAE,CE,P00')
      WRITE(10,611)K1,J1
611   FORMAT(6X,'DATA KE/',I1,'/,JE/',I1,'/')
      DO 550 I=1,10
      WRITE(10,602)I,ALPHAE(I)
602   FORMAT(6X,'DATA ALPHAE(',I2,')/',D24.18,'/')
      WRITE(10,603)I,BETAE(I)
603   FORMAT(6X,'DATA BETAE(',I2,')/',D24.18,'/')
      WRITE(10,604)I,CE(I)
604   FORMAT(6X,'DATA CE(',I2,')/',D24.18,'/')
550   CONTINUE
      I=11
      WRITE(10,604)I,CE(I)
      WRITE(10,610)P001
610   FORMAT(6X,'DATA P00/',F20.10,'/',/,6X,'END')
999   STOP 0050
      END
                                    TAPPAM:SECANT
C*****************************************************************
C          THIS SUBROUTINE SOLVES FOR A ROOT OF A FUNCTION ,FS, OF
C       THREE PARAMETERS,(X,S AND T), WHEN TWO,(S AND T), ARE GIVEN.
C          THE SUBROUTIN FIRST PERFORMS A SEARCH FORM XINT TO XFIN IN
C       KN INTERVALS TO DETERMINE THE LOCATION OF THE ROOT.
C          A MAXIMUN OF NITER SUCCESSIVE BISECTIONS ARE THEN PERFORMED
C       UNTIL THE RELATIVE CHANGE IN X IS LESS THAN EPS.
C          UPON RETURN X IS THE APPROXIMATE VALUE OF THE ROOT AND ERROR
C       IS THE VALUE OF THE FUNCTION AT THE COMPUTED ROOT.
C*****************************************************************
      SUBROUTINE SECANT(XINT,XFIN,FS,KN,S0,T,X,NITER,EPS,ERROR)
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
C*****************************************************************
C          SET UP SEARCH FOR FUNCTION ROOT
C*****************************************************************
      DX=(XFIN-XINT)/DFLOAT(KN)
      KNSRCH=KN+1
      X1=XINT
      X2=XINT+DX
      F1=FS(X1,T,S0)
      DO 10 I=1,KNSRCH
      F2=FS(X2,T,S0)
C*****************************************************************
C          STOP SEARCH IF INTERVAL CONTAINING ROOT IS FOUND
C*****************************************************************
      IF(F1*F2)999,999,998
998   X1=X2
      X2=X2+DX
      F1=F2
10    CONTINUE
      WRITE(6,100)
100   FORMAT(1X,30(1H*),'NO ROOT FOUND IN INTERVAL',30(1H*))
      STOP 0020
```

```
999   CONTINUE
C*************************************************************************
C          START SUCCESSIVE BISECTION OF INTERVAL
C*************************************************************************
      DO 20 I=1,NITER
      XM=(X1+X2)/2.0D0
      FM=FS(XM,T,SO)
C*************************************************************************
C          FIND HALF INTERVAL WHICH ROOT IS LOCATED
C*************************************************************************
      IF(FM*F1)1,1,3
3     IF(FM*F2)4,4,5
5     WRITE(6,6)
6     FORMAT(1X,30(1H*),'BISECTION YEILDS NO ROOT!!!!!',30(1H*))
      STOP 0021
1     F2=FM
      X2=XM
      IF(DABS((X1-X2)/(X1+X2)*2.).LE.EPS)GO TO 30
      GO TO 20
4     X1=XM
      F1=FM
      IF(DABS((X1-X2)/(X1+X2)*2.).LE.EPS)GO TO 30
20    CONTINUE
      WRITE(6,7)
7     FORMAT(1X,30(1H*),'MAX # OF BISECTIONS PERFORMED',30(1H*))
      STOP 0022
30    ERROR=DABS(F1-F2)/2.
      X=(X1+X2)/2.0D0
      RETURN
      END

                                    TAPPAM:ORTHLS
      SUBROUTINE ORTHLS (X,Y,W,N,L,J,C,ALPHA,BETA,K,T1,T2,T3,IND1)
C*************************************************************************
C     THIS SUBROUTINE COMPUTES THE COEFFICIENTS OF THE POLYNOMIAL
C     EQUATION OF DEGREE K AND THE ALPHA AND BETA PARAMETERS.
C*************************************************************************
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      PARAMETER KKKK=10,KKKN=30
      DIMENSION X(N),Y(N),W(N),C(KKKK),ALPHA(K),BETA(K),T1(N),T2(N),T3(K
     1KKN)
C*************************************************************************
C     PROGRAM INITIALIZATION.
C*************************************************************************
      KJ1=K-J+1
      IF (KJ1.LE.0) GO TO 16
      SUM=0.0D0
      IF (L.EQ.1) GO TO 3
      DO 2 I=1,N
    2 W(I)=1.0D0
    3 DO 6 I=1,N
      T3(I)=X(I)
      IF (J.GT.0) GO TO 4
      SUM=SUM+W(I)
      GO TO 6
    4 SUM=SUM+W(I)*X(I)**(2*J)
    6 CONTINUE
      B=0.0D0
      RO=SUM
      DO 9 I=1,N
      IF (J.GT.0) GO TO 8
      T2(I)=1.0D0
      GO TO 9
    8 T2(I)=T3(I)**J
    9 T1(I)=0.0D0
C*************************************************************************
C     BEGIN COMPUTATION.
C*************************************************************************
      II=1
   10 S=0.0D0
      DO 11 I=1,N
   11 S=S+Y(I)*W(I)*T2(I)
C*************************************************************************
C     COMPUTATION OF A COEFFICIENT IN THE POLYNOMIAL EQUATION.
C*************************************************************************
      C(II)=S/RO
      IF (II.GE.KJ1) GO TO 15
C*************************************************************************
C      COMPUTATION OF AN ALPHA FOR THE POLYNOMIAL EQUATION.
C*************************************************************************
      SUMXPS=0.0D0
      DO 12 I=1,N
   12 SUMXPS=SUMXPS+X(I)*T2(I)*T2(I)*W(I)
      ALPHA(II)=SUMXPS/RO
C*************************************************************************
C     COMPUTATION OF A NEW POLYNOMIAL.
C*************************************************************************
```

```
      DO 13 I=1,N
      TEMP=T2(I)
      T2(I)=(T2(I)-ALPHA(II))*T2(I)-B*T1(I)
   13 T1(I)=TEMP
C*****************************************************************
C     COMPUTATION OF A BETA FOR THE POLYNOMIAL EQUATION.
C*****************************************************************
      R=0.0D0
      DO 14 I=1,N
   14 R=R+W(I)*T2(I)*T2(I)
      BETA(II)=R/RO
      RO=R
      B=BETA(II)
      II=II+1
      GO TO 10
C*****************************************************************
C     SUCCESSFUL RETURN.
C*****************************************************************
   15 IND1=+1
      RETURN
C*****************************************************************
C     ERROR RETURN.  SET ALL C COEFFICIENTS, ALPHA AND BETA TO ZERO.
C*****************************************************************
   16 DO 17 II=1,K
      C(II)=0.0D0
      ALPHA (II)=0.0D0
   17 BETA(II)=0.0D0
      C(K+1)=0.0D0
      IND1=-1
      RETURN
      END

                                    TAPP.M:FITY
      SUBROUTINE FITY (XF,M,J,C,ALPHA,BETA,KF,YF,T1,T2,IND3)
C*****************************************************************
C     THIS SUBROUTINE COMPUTES THE FITTED VALUES FOR A GIVEN SET OF
C     ARGUMENTS WITH A POLYNOMIAL OF DEGREE KF WHERE KF IS LESS THAN
C     OR EQUAL TO K.
C*****************************************************************
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION XF(M),C(11),ALPHA(10),BETA(10),YF(M),T1(M),T2(M)
C*****************************************************************
C     PROGRAM INITIALIZATION.
C*****************************************************************
      KFJ1=KF-J+1
      IF (KFJ1.LE.0) GO TO 7
      B=0.0D0
      DO 2 I=1,M
      YF(I)=0.0D0
      IF (J.GT.0) GO TO 1
      T2(I)=1.0D0
      GO TO 2
    1 T2(I)=XF(I)**J
    2 T1(I)=0.0D0
C*****************************************************************
C     BEGIN COMPUTATION.
C*****************************************************************
      II=1
    3 DO 4 I=1,M
    4 YF(I)=YF(I)+C(II)*T2(I)
      IF (II.GE.KFJ1) GO TO 6
C*****************************************************************
C     COMPUTATION OF A NEW POLYNOMIAL.
C*****************************************************************
      DO 5 I=1,M
      TEMP=T2(I)
      T2(I)=(XF(I)-ALPHA(II))*T2(I)-B*T1(I)
    5 T1(I)=TEMP
      B=BETA(II)
      II=II+1
      GO TO 3
C*****************************************************************
C     SUCCESSFUL RETURN.
C*****************************************************************
    6 IND3=+3
      RETURN
C*****************************************************************
C     ERROR RETURN.  SET ALL THE FITTED VALUES EQUAL TO ZERO.
C*****************************************************************
    7 DO 8 I=1,M
    8 YF(I)=0.0D0
      IND3=-3
      RETURN
      END
```

TAPPAM:FITD

```
      SUBROUTINE FITD(XD,J,C,ALPHA,BETA,KD,DERIV,ND,T1,T2,IND4)
C*****************************************************************
C     THIS SUBROUTINE COMPUTES THE FITTED VALUE AND THE ND DERIVATIVES
C     FOR GIVEN ARGUMENT WITH A POLYNOMIAL OF DEGREE KD WHERE KD IS LESS
C     THAN OR EQUAL TO K.
C*****************************************************************
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION C(11),ALPHA(10),BETA(10),DERIV(ND),T1(10),T2(10)
C*****************************************************************
C       PROGRAM INITIALIZATION
C*****************************************************************
      KD1=KD+1
      KDJ1=KD1-J
      IF(KDJ1.LE.0)GO TO 11
      IF(ND.GT.KD)GO TO 11
      J1=J+1
      ND1=ND+1
      DO 1 II=1,KD1
      T1(II)=0.0D0
      T2(II)=0.0D0
1     CONTINUE
      IF(J.LE.0)GO TO 4
      T2(J1)=1.0D0
      DO 2 II=1,J
2     T2(J1)=T2(J1)*DFLOAT(II)
      DO 3 II=J,1,-1
3     T2(II)=XD*T2(II+1)/DFLOAT(J+1-II)
      TEMP=XD**J
      GO TO 5
4     TEMP=1.0D0
5     NN=1
      GO TO 7
C*****************************************************************
C       BEGIN COMPUTATION
C*****************************************************************
6     TEMP=T2(NN)
7     TEMPO=0.0D0
      DERIV(NN)=0.0D0
      B=0.0D0
      II=1
C*****************************************************************
C    COMPUTATION OF THE FITTED VALUE AND THE DERIVATAVE
C*****************************************************************
8     DERIV(NN)=DERIV(NN)+C(II)*TEMP
      IF(II.GE.KDJ1)GO TO 9
C*****************************************************************
C       COMPUTATION OF A NEW POLYNOMIAL
C*****************************************************************
      SAVE=TEMP
      TEMP=(XD-ALPHA(II))*TEMP+DFLOAT(NN-1)*T1(II)-B*TEMPO
      TEMPO=SAVE
      T1(II)=TEMPO
      B=BETA(II)
      II=II+1
      GO TO 8
C*****************************************************************
C             COMPUTATION OF THE NEXT ERIVATIVE
C*****************************************************************
9     IF(NN.GE.ND1)GO TO 10
      NN=NN+1
      GO TO 6
C*****************************************************************
C             SUCCESSUFUL RETURN
C*****************************************************************
10    IND4=+4
      RETURN
C*****************************************************************
C     ERROR RETURN,,,SET ALL VALJE TO ZERO
C*****************************************************************
11    DO 12 NN=1,ND1
12    DERIV(NN)=0.0D0
      IND4=-4
      RETURN
      END
```

TAPPAM:FP

```
C*****************************************************************
C     THIS FUNCTION EVALUATES STARLINGS EQUATION OF STATE IN THE FORM;
C           FP(DENSITY,TEMPERATJRE,PRESSURE)=P(D,T)-P=0
C*****************************************************************
      DOUBLE PRECISION FUNCTION FP(X,T,P)
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      COMMON/COEFF/A0,B0,C0,D0,E0,A,B,C,D,ALPHA,GAMMA,R
      COMMON/TEMP/T2,T3,T4,T5,ADT,RT
      X2=X*X
      X3=X2*X
      X6=X3*X3
```

```
GX2=GAMMA*X2
FP=X*RT
FP=FP+X2*(B0*RT-A0-C0/T2+D0/T3-E0/T4)
FP=FP+(B*RT-ADT)*X3
FP=FP+ALPHA*ADT*X5
FP=FP+C*X3/T2*(1.0D0+GX2)*DEXP(-GX2)
FP=FP-P
RETURN
END
```

TAPPAM:FF

```
C*************************************************************************
C      THIS FUNCTION CALCULATES THE FUGACITY OF AN NCOMP MIXTURE USING
C    STARLINGS EQUATION OF STATE.
C              X=DENSITY
C              T=TEMPERATURE
C*************************************************************************
      DOUBLE PRECISION FUNCTION FF(X,T,NCOMP)
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION A00(3),B00(3),C00(3),D00(3),E00(3),AA(3),BB(3)
      DIMENSION CC(3),DD(3),ALPALP(3),GAMGAM(3),XX(3)
      COMMON/COEFF/A0,B0,C0,D0,E0,A,B,C,D,ALPHA,GAMMA,R,XM,XX
      COMMON/COEFF1/A001,B001,C001,D001,E001,AA1,BB1
     1,CC1,DD1,ALPAL1,GAMGA1
      COMMON/COEFF2/A002,B002,C002,D002,E002,AA2,BB2
     2,CC2,DD2,ALPAL2,GAMGA2
      COMMON/COEFF3/A003,B003,C003,D003,E003,AA3,BB3
     3,CC3,DD3,ALPAL3,GAMGA3
      COMMON/PARA/A2,B2,C2,D2,ALPHA2,CGAMMA,ONETR
      COMMON/TEMP/T2,T3,T4,T5,ADT,RT
      A00(1)=A001
      A00(2)=A002
      A00(3)=A003
      B00(1)=B001
      B00(2)=B002
      B00(3)=B003
      C00(1)=C001
      C00(2)=C002
      C00(3)=C003
      D00(1)=D001
      D00(2)=D002
      D00(3)=D003
      E00(1)=E001
      E00(2)=E002
      E00(3)=E003
      AA(1)=AA1
      AA(2)=AA2
      AA(3)=AA3
      BB(1)=BB1
      BB(2)=BB2
      BB(3)=BB3
      CC(1)=CC1
      CC(2)=CC2
      CC(3)=CC3
      DD(1)=DD1
      DD(2)=DD2
      DD(3)=DD3
      ALPALP(1)=ALPAL1
      ALPALP(2)=ALPAL2
      ALPALP(3)=ALPAL3
      GAMGAM(1)=GAMGA1
      GAMGAM(2)=GAMGA2
      GAMGAM(3)=GAMGA3
      X2=X*X
      X4=X2*X2
      X5=X4*X
      XRT=X*RT
      GX2=X2*GAMMA
      GX22=GX2*GX2
      EXPP=DEXP(-GX2)
      EXP1=3.0D0*X2/T2*((1.0D0-EXPP)/GX2-EXPP*.5D0)
      EXP2=2.0D0*CGAMMA/T2*(1.0D0-EXPP*(1.0D0+GX2+.5D0*GX22))
      FFF=0.0D0
      DO 990 I=1,NCOMP
      FF=RT*DLOG(XRT*XX(I))
      FF=FF+XRT*(B0+B00(I))
      ADCOMB=(A2*AA(I))**ONETR+(D2*DD(I))**ONETR/T
      FF=FF+1.5D0*X2*((B2*BB(I))**ONETR*RT-ADCOMB)
      FF=FF+.6D0*X5*(ALPHA*ADCOMB+ADT*(ALPHA2*ALPALP(I))**ONETR)
      FF=FF+(C2*CC(I))**ONETR*EXP1
      FF=FF-DSQRT(GAMGAM(I)/GAMMA)*EXP2
      DO 900 J=1,NCOMP
      SUM=-DSQRT(A00(J)*A00(I))
      SUM=SUM-DSQRT(C00(J)*C00(I))/T2
      SUM=SUM+DSQRT(D00(J)*D00(I))/T3
      SUM=SUM-DSQRT(E00(J)*E00(I))/T4
```

```
      FF=FF+2.0D0*X*SUM*XX(J)
900   CONTINUE
      FFX=DEXP(FF/RT)/XX(I)
      FFF=FFF+XX(I)*DLOG(FFX)
999   CONTINUE
      FF=DEXP(FFF)
      RETURN
      END

                                    TAPPAM:FH
C*********************************************************************
C       THIS FUNCTION EVALUATES STARLINGS EQUATION OF STATE IN THE FORM;
C              FH(DENSITY,TEMPERATURE,ENTHALPY)=H(D,T)-H=0
C*********************************************************************
      DOUBLE PRECISION FUNCTION FH(X,T,H)
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11),T1(1),TT2(1),TT(1),DEL(1)
      COMMON/HREF/KE,JE,ALPHAE,BETAE,CE,H00
      COMMON/COEFF/A0,B0,C0,D0,E0,A,B,C,D,ALPHA,GAMMA,R,XM
      COMMON/TEMP/T2,T3,T4,T5,ADT,RT
      X2=X*X
      X5=X2*X2*X
      Z1=B0*RT-2.0D0*A0-4.0D0*C0/T2+5.0D0*D0/T3-6.0D0*E0/T4
      Z2=.5D0*(2.0D0*B*RT-3.0D0*A-4.0D0*D/T)
      Z3=1.0D0/5.0D0*ALPHA*(5.0D0*A+7.0D0*D/T)
      Z4=C/GAMMA/T2
      Z5=((3.0D0+.5D0*GAMMA*X2)-(GAMMA*X2)**2)*DEXP(-GAMMA*X2)
      FH=Z1*X+Z2*X2+Z3*X5+Z4*(3.0D0-Z5)-H
      TT(1)=T
      CALL FITY(TT,1,JE,CE,ALPHAE,BETAE,KE,DEL,T1,TT2,IND)
      IF(IND.LE.0)WRITE(6,1)IND
      IF(IND.LE.0)STOP 3010
1     FORMAT(1X,30(1H*),'ERROR IN FH,IND=',I2,30(1H*))
      FH=FH+(DEL(1)+H00)*778.0D0/144.0D0
      RETURN
      END

                                    TAPPAM:FS
C*********************************************************************
C       THIS FUNCTION EVALUATES STARLINGS EQUATION OF STATE IN THE FORM
C              FS(DENSITY,TEMPERATURE,ENTROPY)=S(D,T)-S=0
C*********************************************************************
      DOUBLE PRECISION FUNCTION FS(X,T,S)
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION TT(1),T1(1),TT2(1),CE(11),ALPHAE(10),BETAE(10),DEL(1)
      COMMON/SREF/KE,JE,ALPHAE,BETAE,CE
      COMMON /COEFF/A0,B0,C0,D0,E0,A,B,C,D,ALPHA,GAMMA,R,XM
      COMMON/TEMP/T2,T3,T4,T5,ADT,RT
      X2=X*X
      Z1=R*DLOG(X*RT)
      Z2=B0*R+2.0D0*C0/T3-3.0D0*D0/T4+4.0D0*E0/T5
      Z3=.5D0*(B*R+D/T2)
      Z4=ALPHA*D/5.0D0/T2
      Z5=2.0D0*C/GAMMA/T3
      Z6=1.0D0-(1.0D0+.5D0*GAMMA*X2)*DEXP(-GAMMA*X2)
      FS=-Z1-Z2*X-Z3*X2+Z4*X2*X2*X+Z5*Z6
      TT(1)=T
      CALL FITY(TT,1,JE,CE,ALPHAE,BETAE,KE,DEL,T1,TT2,IND)
      IF(IND.LT.0)WRITE(6,1)IND
      IF(IND.LT.0)STOP 3011
1     FORMAT(1X,30(1H*),'ERROR IN FS,IND=',I2,30(1H*))
      FS=FS+DEL(1)*778.0D0/144.0D0-S
      RETURN
      END
                                    TAPPAM:FCP
C*********************************************************************
C       THIS FUNCTION EVALUATES STARLINGS EQUATION OF STATE IN THE FORM
C              FCP(DENSITY,TEMPERATURE,SPECIFIC HEAT)=CP(D,T)-CP=0
C*********************************************************************
      DOUBLE PRECISION FUNCTION FCP(X,T,CP)
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11),TT1(1),TT2(1),TR(1)
      DIMENSION DEL(1)
      COMMON/CPREF/KE,JE,ALPHAE,BETAE,CE
      COMMON/TEMP/T2,T3,T4,T5,ADT,RT
      COMMON/COEFF/A0,B0,C0,D0,E0,A,B,C,D,ALPHA,GAMMA,R
      X2=X*X
      X5=X2*X2*X
      Z1=C0/T3
      Z2=D0/T4
      Z4=D/T2
      Z3=E0/T5
      DEX=DEXP(-GAMMA*X2)
      Z5=C/T3
      Z6=B*R
      Z7=B0*R
```

```
      CPP=-R+(6.0D0*Z1-12.0D0*Z2+20.0D0*Z3)*X
      CPP=CPP+Z4*X2-.40D0*Z4*ALPHA*X5
      CPP=CPP+6.0D0*Z5/GAMMA*(DEX-1.0)
      CPP=CPP+3.0D0*Z5*DEX*X2
      ADD1=R+X*(Z7+2.0D0*Z1-3.0D0*Z2+4.0D0*Z3)
      ADD1=ADD1+X2*(Z6+Z4)-Z4*ALPHA*X5
      ADD1=ADD1-2.0D0*Z5*X2*DEX*(1.0+GAMMA*X2)
      ADD1=ADD1*ADD1*T
      DIVI=RT+2.0D0*(Z7*T-A0-C0/T2+D0/T3-E0/T4)*X
      DIVI=DIVI+3.0D0*X2*(Z6*T-ADT)
      DIVI=DIVI+6.0D0*ALPHA*X5*(ADT)
      DIVI=DIVI+X2*C/T2*(3.0D0+3.0D0*GAMMA*X2-2.0D0*(GAMMA*X2)**2)*DEX
      FCP=CPP+ADD1/DIVI-CP
      TR(1)=T
      CALL FITY(TR,1,JE,CE,ALPHAE,BETAE,KE,DEL,TT1,TT2,IND)
      IF(IND.LE.0)WRITE(6,1)IND
      IF(IND.LE.0)STOP 0012
1     FORMAT(1X,30(1H*),'ERROR IN FCP;IND=',I2,30(1H*))
      FCP=FCP+DEL(1)*778.0D0/144.0D0
      RETURN
      END

                                    TAPPAM:FCV
C*********************************************************************
C       THIS FUNCTION EVALUATES STARLINGS EQUATION OF STATE IN THE FORM;
C          FCV(DENSITY,TEMPERATURE,SPECIFIC HEAT)=CV(D,T)-CV=0
C*********************************************************************
      DOUBLE PRECISION FUNCTION FCV(X,T,CV)
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11),TT1(10),TT2(10),TR(1)
      DIMENSION DEL(2)
      COMMON/HREF/KE,JE,ALPHAE,BETAE,CE
      COMMON/COEFF/A0,B0,C0,D0,E0,A,B,C,D,ALPHA,GAMMA,R
      COMMON/TEMP/T2,T3,T4,T5
      X2=X*X
      X3=X2*X
      GAMXX=GAMMA*X2
      Z1=6.0D0*C0/T3-12.0D0*D0/T4+20.0D0*E0/T5
      Z2=D/T2*(1.0D0-0.4D0*ALPHA*X3)
      Z3=3.0D0*C/GAMMA/T3*(-2.0D0+(2.0D0+GAMXX)*DEXP(-GAMXX))
      FCV=-R+Z1*X+Z2*X2+Z3
      TR(1)=T
      CALL FITD(TR,JE,CE,ALPHAE,BETAE,KE,DEL,2,TT1,TT2,IND4)
      IF(IND4.LE.0)WRITE(6,1)IND4
      IF(IND4.LE.0)STOP 0013
1     FORMAT(1X,30(1H*),'ERROR IN FCV;IND=',I2,30(1H*))
      FCV=FCV+DEL(2)*778.0D0/144.0D0-CV
      RETURN
      END

                                    TAPPAM:FAS
C*********************************************************************
C         THIS FUNCTION EVALUATES STARLINGS EQUATION OF STATE IN THE FORM
C              FAS(D,T,C2,G)=C2(D,T,G)-C2=0
C      WHERE  D=DENSITY
C             T=TEMPERATURE
C             C2=SONIC VELOCITY SQUARED
C             G=RATIO OF SPECIFIC HEATS
C*********************************************************************
      DOUBLE PRECISION FUNCTION FAS(X,T,AS,RAT)
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      COMMON/COEFF/A0,B0,C0,D0,E0,A,B,C,D,ALPHA,GAMMA,R
      COMMON/TEMP/T2,T3,T4,T5,ADT,RT
      X2=X*X
      X5=X2*X2*X
      GAMXX=GAMMA*X2
      Z1=2.0D0*(B0*RT-A0-C0/T2+D0/T3-E0/T4)
      Z2=3.0D0*(B*RT-ADT)
      Z3=6.0D0*ALPHA*(ADT)
      Z4=(5.0D0-2.0D0*GAMXX)*(1.0D0+GAMXX)+2.0D0*GAMXX
      Z4=DEXP(-GAMXX)*Z4*C*X2/T2
      FAS=RAT*(RT+Z1*X+Z2*X2+Z3*X5+Z4)-AS
      RETURN
      END

                                    TAPPAM:PROPCOEFF
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK COEFF WITH THE
C   STARLINGS EQUATION OF STATE COEFFICIENTS OF PURE PROPANE.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      COMMON/COEFF /A0,B0,C0,D0,E0,A,B,C,D,ALPHA,GAMMA,R,XM,X1,X2,X3
      DATA A0/ .15c3470000000005/,B0/ .964762000000D000/
      DATA C0/ .796173000000D010/,D0/ .453708000000D012/
      DATA E0/ .256053000000DD14/,A/ .400664000000D005/
```

```
      DATA B/ .5462480000000D001/,C/ .2744610000000D011/
      DATA D/ .1505200000000D008/,ALPHA/ .2014020000000D001/
      DATA GAMMA/ .4561820000000D001/,R/ .1073350000000D002/
      DATA XM/ .4406200000000D002/,X1/ .1000000000000D001/
      DATA X2/ .0000000000000     /,X3/ .0000000000000     /
      END
```

TAPPAM:LINHOPKECOEF

```
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK COEFF WITH THE
C    STARLINGS EQUATION OF STATE COEFFICIENTS FOR PURE PROPANE AS GIVEN
C    BY LIN-HOPKE(1974).
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      COMMON/COEFF/AO,BO,CO,DO,EO,A,B,C,D,ALPHA,GAMMA,R,XM,X1,X2,X3
      DATA AO/22032.5          D0/
      DATA BO/1.15091/,CO/75.3232D08/,DO/75.6999D10/
      DATA EO/437.431D11/,A/55835.6/,B/6.3661/,C/23.3092D9/
      DATA D/10.744D5/,ALPHA/2.17606/,GAMMA/5.50137/
      DATA R/10.7335/,X1/1.0D0/,X2/0.0D0/,X3/0.0D0/
      DATA XM/44.062D0/
      END
```

TAPPAM:PROPHREF

```
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK HREF WITH THE
C    INFORMATION NECESSARY TO CALCULATE THE REFERENCE ENTHALPY
C    OF PURE PROPANE IN BTU/LBMOLE.
C     A 9'TH ORDER CURVE FIT IS USED.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /HREF   /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .7424814814814814800D003/
      DATA BETAE( 1)/ .1322144713792866693D006/
      DATA CE( 1)/ .1261400389151851040D005/
      DATA ALPHAE( 2)/ .9952781952286465867D003/
      DATA BETAE( 2)/ .2022215669543641120D006/
      DATA CE( 2)/ .2544209934073327430D002/
      DATA ALPHAE( 3)/ .7270964070947060330D003/
      DATA BETAE( 3)/ .2232791632857340500D006/
      DATA CE( 3)/ .1116936643979214760D-01/
      DATA ALPHAE( 4)/ .8184226372336090860D003/
      DATA BETAE( 4)/ .1893498342465830160D006/
      DATA CE( 4)/-.9817251247593332400D-06/
      DATA ALPHAE( 5)/ .8303534201620399630D003/
      DATA BETAE( 5)/ .1720402588432244850D006/
      DATA CE( 5)/-.1944119209140062300D-08/
      DATA ALPHAE( 6)/ .8659441749543158380D003/
      DATA BETAE( 6)/ .1480172846097953520D006/
      DATA CE( 6)/ .1531432612595427330D-11/
      DATA ALPHAE( 7)/ .9325628024502286280D003/
      DATA BETAE( 7)/ .1183516764215408250D006/
      DATA CE( 7)/ .1382201563699987270D-15/
      DATA ALPHAE( 8)/ .9178169190149474890D003/
      DATA BETAE( 8)/ .1398405621069096690D006/
      DATA CE( 8)/-.3054751357779509660D-17/
      DATA ALPHAE( 9)/ .8588609716394711140D003/
      DATA BETAE( 9)/ .1184933307318583780D006/
      DATA CE( 9)/ .6285588598163042050D-20/
      DATA ALPHAE(10)/ .0000000000000000000     /
      DATA BETAE(10)/ .0000000000000000000     /
      DATA CE(10)/-.6042956301083146000D-23/
      DATA CE(11)/ .0000000000000000000     /
      DATA POO/-35042.06798D0/
      END
```

TAPPAM:PROPSREF

```
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK SREF WITH THE
C    INFORMATION NECESSARY TO CALCULATE THE REFERENCE ENTROPY OF
C    PURE PROPANE IN BTU/LBMOLE/DEG R.
C     A 9'TH ORDER CURVE FIT IS USED.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /SREF   /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .1214865000000000000D004/
      DATA BETAE( 1)/ .6137575962749999996D006/
      DATA CE( 1)/ .8256999999999999995D002/
```

```
      DATA ALPHAE( 2)/ .157575186470294677D004/
      DATA BETAE( 2)/ .405377305164337800D 006/
      DATA CE( 2)/ .266135841725391261D-01/
      DATA ALPHAE( 3)/ .146640593519431499D004/
      DATA BETAE( 3)/ .477650840709131936D 006/
      DATA CE( 3)/-.395796189448508511D-05/
      DATA ALPHAE( 4)/ .139993086663649636D004/
      DATA BETAE( 4)/ .431356410957249111D 006/
      DATA CE( 4)/ .798110527066703616D-09/
      DATA ALPHAE( 5)/ .146520971795695696D004/
      DATA BETAE( 5)/ .399730327736652410 006/
      DATA CE( 5)/-.688562267346186562D-12/
      DATA ALPHAE( 6)/ .143264451941527293D004/
      DATA BETAE( 6)/ .399682917427980402D 006/
      DATA CE( 6)/ .907515953571158278D-15/
      DATA ALPHAE( 7)/ .142047526795371199D004/
      DATA BETAE( 7)/ .374740444250862921D 006/
      DATA CE( 7)/-.956080611945857768D-18/
      DATA ALPHAE( 8)/ .139214986725302064D004/
      DATA BETAE( 8)/ .377641634317166049D 006/
      DATA CE( 8)/ .968897516982019007D-21/
      DATA ALPHAE( 9)/ .134990212476282099D004/
      DATA BETAE( 9)/ .358736353360230100D 006/
      DATA CE( 9)/-.137432907222613405D-23/
      DATA ALPHAE(10)/ .000000000000000000D 000/
      DATA BETAE(10)/ .000000000000000000D 000/
      DATA CE(10)/ .686591484809780395D-27/
      DATA CE(11)/ .000000000000000000D 000/
      DATA P00/ .000000000D 000/
      END
```

TAPPAM:PROPCPREF

```
C*****************************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK CPREF WITH THE
C   INFORMATION NECESSARY TO CALCULATE THE REFERENCE CP OF PURE
C   PROPANE IN BTU/LBMOLE/DEG R.
C     A 9TH ORDER CURVE FIT IS USED.
C*****************************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /CPREF/KE,JE,ALPHAE,BETAE,CE,P00
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .121171500000000000D004/
      DATA BETAE( 1)/ .619896773274999996D 006/
      DATA CE( 1)/ .294184999999999998D002/
      DATA ALPHAE( 2)/ .156393932387567827D004/
      DATA BETAE( 2)/ .417344093380328081D 006/
      DATA CE( 2)/ .168993352207404400D-01/
      DATA ALPHAE( 3)/ .144300986829011196D004/
      DATA BETAE( 3)/ .491624431021428779D 006/
      DATA CE( 3)/-.583778927464902162D-05/
      DATA ALPHAE( 4)/ .139317577301958131D004/
      DATA BETAE( 4)/ .427343890146563601D 006/
      DATA CE( 4)/ .958637032131550867D-09/
      DATA ALPHAE( 5)/ .143108914194281491D004/
      DATA BETAE( 5)/ .364685019474164916D 006/
      DATA CE( 5)/ .792131317605515871D-12/
      DATA ALPHAE( 6)/ .146525609336496645D004/
      DATA BETAE( 6)/ .374955579138252209D 006/
      DATA CE( 6)/ .745544270459602296D-15/
      DATA ALPHAE( 7)/ .146426799121021170D004/
      DATA BETAE( 7)/ .346493535355158274D 006/
      DATA CE( 7)/ .367953233356412274D-18/
      DATA ALPHAE( 8)/ .143666445275133521D004/
      DATA BETAE( 8)/ .355265885086322294D 006/
      DATA CE( 8)/ .200994242614620675D-23/
      DATA ALPHAE( 9)/ .136105733034574021D004/
      DATA BETAE( 9)/ .345189959099553532D 006/
      DATA CE( 9)/-.555179524347923505D-23/
      DATA ALPHAE(10)/ .000000000000000000D 000/
      DATA BETAE(10)/ .000000000000000000D 000/
      DATA CE(10)/ .234126033181944867D-26/
      DATA CE(11)/ .000000000000000000D 000/
      DATA P00/ .000000000D 000/
      END
```

TAPPAM:PROPLCOEFF

```
C*****************************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK COEFF WITH THE
C   STARLINGS EQUATION OF STATE CONSTANTS FOR PURE PROPYLENE.
C*****************************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      COMMON/COEFF /AO,BO,CO,DO,EO,A,B,C,D,ALPHA,GAMMA,R,XM,X1,X2,X3
      DATA AO/ .605136000000D004/,BO/ .114457000000D000/
      DATA CO/ .974762000000D010/,DO/ .705921000000D012/
      DATA EO/ .341250000000D014/,A/ .818804000000D005/
```

```
      DATA B/ .764114000000D001/,C/ .294141000000D011/
      DATA D/ .541935000000D007/,ALPHA/ .136532000000D001/
      DATA GAMMA/ .407919000000D001/,R/ .107335000000D002/
      DATA XM/ .420460000000D002/,X1/ .100000000000D001/
      DATA X2/ .000000000000     /,X3/ .000000000000     /
      END

                                    TAPPAM:PROPLHREF
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK HREF WITH THE
C    INFORMATION NECESSARY TO CALCULATE THE REFERENCE ENTHALPY OF
C    PURE PROPYLENE IN BTU/LBMOLE.
C     A 9'TH ORDER CURVE FIT IS USED.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /HREF  /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .111045237968079523D004/
      DATA BETAE( 1)/ .269146135504782061D006/
      DATA CE( 1)/ .201157556704566475D005/
      DATA ALPHAE( 2)/ .107023634244055358D004/
      DATA BETAE( 2)/ .303593655594440669D006/
      DATA CE( 2)/ .249178060153134797D002/
      DATA ALPHAE( 3)/ .836734429395579602D003/
      DATA BETAE( 3)/ .359719906439352241D006/
      DATA CE( 3)/ .793373123411321402D-02/
      DATA ALPHAE( 4)/ .963958853537313310D003/
      DATA BETAE( 4)/ .198487765513804764D006/
      DATA CE( 4)/-.112252896960660321D-05/
      DATA ALPHAE( 5)/ .119605120652015176D004/
      DATA BETAE( 5)/ .138702585634561755D006/
      DATA CE( 5)/-.572134005193056220D-09/
      DATA ALPHAE( 6)/ .123523622845844896D004/
      DATA BETAE( 6)/ .127279693740157215D006/
      DATA CE( 6)/ .705903272454502861D-12/
      DATA ALPHAE( 7)/ .122910114799091537D004/
      DATA BETAE( 7)/ .129276290233184694D006/
      DATA CE( 7)/-.472345691675338930D-15/
      DATA ALPHAE( 8)/ .123840922181670955D004/
      DATA BETAE( 8)/ .147957814195644539D006/
      DATA CE( 8)/ .390746140224083606D-18/
      DATA ALPHAE( 9)/ .126348199348513107D004/
      DATA BETAE( 9)/ .174325424376671641D006/
      DATA CE( 9)/ .150828380815555319D-20/
      DATA ALPHAE(10)/ .000000000000000000     /
      DATA BETAE(10)/ .000000000000000000     /
      DATA CE(10)/ .848699864953226637D-23/
      DATA CE(11)/ .000000000000000000     /
      DATA POO/    14534.4612800000D0/
      END

                                    TAPPAM:PROPLSREF
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK SREF WITH THE
C    INFORMATION NECESSARY TO CALCULATE THE REFERENCE ENTROPY OF
C    PURE PROPYLENE IN BTU/LBMOLE/DEG R.
C     A 9'TH ORDER CURVE FIT IS USED.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /SREF  /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .553347713461536460D009/
      DATA BETAE( 1)/ .368094501245029421D019/
      DATA CE( 1)/ .883538461538461536D002/
      DATA ALPHAE( 2)/ .664615397653764220D010/
      DATA BETAE( 2)/ .543757512199555471D007/
      DATA CE( 2)/-.292708189477505248D-08/
      DATA ALPHAE( 3)/ .161423147521686729D004/
      DATA BETAE( 3)/ .386499419225220524D006/
      DATA CE( 3)/-.281725147400146372D-11/
      DATA ALPHAE( 4)/ .162766912336107860D004/
      DATA BETAE( 4)/ .553679411340747834D012/
      DATA CE( 4)/ .420366090976977715D-15/
      DATA ALPHAE( 5)/ .719999522831641136D010/
      DATA BETAE( 5)/ .338024126544766226D014/
      DATA CE( 5)/ .923330124309325087D-20/
      DATA ALPHAE( 6)/ .631473364392324408D004/
      DATA BETAE( 6)/ .286971601806562986D006/
      DATA CE( 6)/ .918526012475939171D-29/
      DATA ALPHAE( 7)/ .170709680248701536D004/
      DATA BETAE( 7)/ .241240598014839643D006/
      DATA CE( 7)/ .483637271218272619D-33/
      DATA ALPHAE( 8)/ .124270164340594990D009/
```

```
      DATA BETAE( 8)/ .3792897935233646 67D018/
      DATA CE( 8)/ .797306956990965536D-33/
      DATA ALPHAE( 9)/ .707573157625325599D010/
      DATA BETAE( 9)/ .120207105186474376D008/
      DATA CE( 9)/ .638050169456324538D-41/
      DATA ALPHAE(10)/ .000000000000000000     /
      DATA BETAE(10)/ .000000000000000000     /
      DATA CE(10)/ .375373525493767650D-48/
      DATA CE(11)/ .000000000000000000     /
      DATA POO/          .0000000000/
      END
```

TAPPAM:PROPLCPREF

```
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK CPREF WITH THE
C    INFORMATION NECESSARY TO CALCULATE THE REFERENCE CP OF PURE
C    PROPYLENE IN BTU/LBMOLE/DEG R.
C     A 9'TH ORDER CURVE FIT IS USED
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /CPREF /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .111890476190476190D004/
      DATA BETAE( 1)/ .278946181405895689D006/
      DATA CE( 1)/ .247374285714285712D002/
      DATA ALPHAE( 2)/ .127428305278766368D004/
      DATA BETAE( 2)/ .169462158799479485D006/
      DATA CE( 2)/ .149128702680561907D-01/
      DATA ALPHAE( 3)/ .132273649815952849D004/
      DATA BETAE( 3)/ .155950524167302468D006/
      DATA CE( 3)/-.515569210550908599D-05/
      DATA ALPHAE( 4)/ .130752856488927007D004/
      DATA BETAE( 4)/ .161217407338265743D006/
      DATA CE( 4)/ .621289442485802330D-09/
      DATA ALPHAE( 5)/ .126867265352080071D004/
      DATA BETAE( 5)/ .171708625503714906D006/
      DATA CE( 5)/ .111130562037257316D-11/
      DATA ALPHAE( 6)/ .123145100631775677D004/
      DATA BETAE( 6)/ .174439209498983436D006/
      DATA CE( 6)/-.171640456257800365D-14/
      DATA ALPHAE( 7)/ .122428880142419081D004/
      DATA BETAE( 7)/ .162501007150362954D006/
      DATA CE( 7)/ .857104317984903552D-18/
      DATA ALPHAE( 8)/ .124021816239004757D004/
      DATA BETAE( 8)/ .146873882125917742D006/
      DATA CE( 8)/ .137562067205918160D-20/
      DATA ALPHAE( 9)/ .124873573342409265D004/
      DATA BETAE( 9)/ .136435643094896122D006/
      DATA CE( 9)/-.258502116823253209D-23/
      DATA ALPHAE(10)/ .000000000000000000     /
      DATA BETAE(10)/ .000000000000000000     /
      DATA CE(10)/ .181970505310315542D-26/
      DATA CE(11)/ .000000000000000000     /
      DATA POO/          .0000000000/
      END
```

TAPPAM:NBUTCOEFF

```
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK COEFF WITH THE
C    STARLINGS EQUATION OF STATE CONSTANTS FOR PURE N-BUTANE.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      COMMON/COEFF/AO,BO,CO,DO,EO,A,B,C,D,ALPHA,GAMMA,R,XM,X1,X2,X3
      DATA AO/ .325447000000D005/,BO/ .155588000000D001/
      DATA CO/ .137463000000D011/,DO/ .333159000000D012/
      DATA EO/ .230902000000D013/,A/ .711818000000D005/
      DATA B/ .914066000000D001/,C/ .700044000000D011/
      DATA D/ .364238000000D008/,ALPHA/ .400985000000D001/
      DATA GAMMA/ .754122000000D001/,R/ .107335000000D002/
      DATA XM/ .581210000000D002/,X1/ .100000000000D001/
      DATA X2/ .000000000000     /,X3/ .000000000000     /
      END
```

TAPPAM:NBUTHREF

```
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK HREF WITH THE
C    INFORMATION NECESSARY TO CALCULATE THE REFERENCE ENTHALPY OF PURE
C    N-BUTANE IN BTU/LBMOLE.
C     A 9'TH ORDER CURVE FIT IS USED.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /HREF  /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
```

```
      DATA ALPHAE( 1)/ .5[illegible]279166666666666D003/
      DATA BETAE( 1)/ .1704708159722224221D006/
      DATA CE( 1)/ .1526643541666666D005/
      DATA ALPHAE( 2)/ .1005144650123463710004/
      DATA BETAE( 2)/ .2140130748405247709300 6/
      DATA CE( 2)/ .34386991605358952D002/
      DATA ALPHAE( 3)/ .6492442423753226573D003/
      DATA BETAE( 3)/ .2540[illegible]49677474946700 6/
      DATA CE( 3)/ .1427989010306367666D-01/
      DATA ALPHAE( 4)/ .5393604510846269083D003/
      DATA BETAE( 4)/ .1470548605476444260D006/
      DATA CE( 4)/-.1511173762842065730-05/
      DATA ALPHAE( 5)/ .9717191934161255083D003/
      DATA BETAE( 5)/ .1179977249757449260006/
      DATA CE( 5)/-.1926519433691417650-08/
      DATA ALPHAE( 6)/ .9810704327266370830003/
      DATA BETAE( 6)/ .1273410543299079520006/
      DATA CE( 6)/ .1940025292435438070-11/
      DATA ALPHAE( 7)/ .9556517794677447940003/
      DATA BETAE( 7)/ .1036647540541362630006/
      DATA CE( 7)/-.6219553399613601190-15/
      DATA ALPHAE( 8)/ .1017269673006539200004/
      DATA BETAE( 8)/ .8836[illegible]0e75407c27460005/
      DATA CE( 8)/-.1115914625857440870-17/
      DATA ALPHAE( 9)/ .9804902533430[illegible]1373D003/
      DATA BETAE( 9)/ .9463898373731940641D005/
      DATA CE( 9)/ .2022[illegible]319923099D-23/
      DATA ALPHAE(10)/ .0000000000000000000     /
      DATA BETAE(10)/ .0000000000000000000     /
      DATA CE(10)/ .1274225[illegible]37000369D-22/
      DATA CE(11)/ .0000000000000000000     /
      DATA P00/     11768.34003D07
      END
```

TAPPAM:NBUTSREF

```
C*****************************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK SREF WITH THE
C   INFORMATION NECESSARY TO CALCULATE THE REFERENCE ENTROPY OF
C   PURE N-BUTANE IN BTU/LBMOLE/DEG R.
C    A 9TH ORDER CURVE FIT IS USED.
C*****************************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /SREF  /KE,JE,ALPHAE,BETAE,CE,P00
      DATA KE/7/,JE/0/
      DATA ALPHAE( 1)/ .1458[illegible]0000000000000D004/
      DATA BETAE( 1)/ .5639760000000[illegible]0000D006/
      DATA CE( 1)/ .1065666666666666D003/
      DATA ALPHAE( 2)/ .1535753351200[illegible]431D004/
      DATA BETAE( 2)/ .4007[illegible]794392254666D006/
      DATA CE( 2)/ .33471637[illegible]9940033990-01/
      DATA ALPHAE( 3)/ .1568913827525[illegible]748D004/
      DATA BETAE( 3)/ .3544[illegible]4261154300[illegible]41D006/
      DATA CE( 3)/-.4308666637358666[illegible]11D-05/
      DATA ALPHAE( 4)/ .1565394397069[illegible]453D004/
      DATA BETAE( 4)/ .3577431450217256[illegible]D006/
      DATA CE( 4)/ .5720[illegible]1470566678720[illegible]-09/
      DATA ALPHAE( 5)/ .1533564578005768[illegible]D004/
      DATA BETAE( 5)/ .3588[illegible]76024962[illegible]167D006/
      DATA CE( 5)/-.1600642646424826[illegible]-12/
      DATA ALPHAE( 6)/ .1499222653524137[illegible]D004/
      DATA BETAE( 6)/ .3500[illegible]122841157[illegible]05D006/
      DATA CE( 6)/ .2217752[illegible]9840001[illegible]-15/
      DATA ALPHAE( 7)/ .1465601[illegible]5398666[illegible]D004/
      DATA BETAE( 7)/ .3245[illegible]0144357295500006/
      DATA CE( 7)/-.4394[illegible]0970[illegible]2359776D-18/
      DATA ALPHAE( 8)/ .1483652703153[illegible]663D004/
      DATA BETAE( 8)/ .2921[illegible]892[illegible]82156[illegible]44D006/
      DATA CE( 8)/ .5031794534484584[illegible]-21/
      DATA ALPHAE( 9)/ .1403244239403[illegible]180D004/
      DATA BETAE( 9)/ .2663[illegible]028731494760D006/
      DATA CE( 9)/-.4024[illegible]4744657360[illegible]-24/
      DATA ALPHAE(10)/ .0000000000000000000     /
      DATA BETAE(10)/ .0000000000000000000     /
      DATA CE(10)/-.2337099[illegible]6434177440-27/
      DATA CE(11)/ .0000000000000000000     /
      DATA P00/              .0000000000/
      END
```

TAPPAM:NBUTCPREF

```
C*****************************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK CPREF WITH THE
C   INFORMATION NECESSARY TO CALCULATE THE REFERENCE CP OF PURE
C   N-BUTANE IN BTU/LBMOLE/DEG R.
C    A 9TH ORDER CURVE FIT IS USED.
C*****************************************************************************
```

```
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /CPREF /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .7327647058823529 40D003/
      DATA BETAE( 1)/ .5584512110726643 57D005/
      DATA CE( 1)/ .2950635294117647 04D002/
      DATA ALPHAE( 2)/ .9281227396670453 99D003/
      DATA BETAE( 2)/ .4573795533369296 06D005/
      DATA CE( 2)/ .3061823471855036 76D-01/
      DATA ALPHAE( 3)/ .6835265598095277 78D003/
      DATA BETAE( 3)/ .3934828336059931 85D005/
      DATA CE( 3)/-.8953718409223301 97D-05/
      DATA ALPHAE( 4)/ .6771129122430527 63D003/
      DATA BETAE( 4)/ .4679881794736313 97D005/
      DATA CE( 4)/-.7999201686554366 12D-08/
      DATA ALPHAE( 5)/ .8216262155589369 93D003/
      DATA BETAE( 5)/ .4075909427739913 19D005/
      DATA CE( 5)/ .2134686598871380 96D-10/
      DATA ALPHAE( 6)/ .8381465644954393 29D003/
      DATA BETAE( 6)/ .3612147494249619 51D005/
      DATA CE( 6)/-.2987970548743195 77D-13/
      DATA ALPHAE( 7)/ .6252705705323395 44D003/
      DATA BETAE( 7)/ .2671151092961587 95D005/
      DATA CE( 7)/ .8786061202155355 40D-16/
      DATA ALPHAE( 8)/ .8070061764324150 61D003/
      DATA BETAE( 8)/ .2657222450493340 13D005/
      DATA CE( 8)/-.2147338348326996 02D-18/
      DATA ALPHAE( 9)/ .7635804990844942 89D003/
      DATA BETAE( 9)/ .1764794055728231 53D005/
      DATA CE( 9)/-.6564097521514897 69D-21/
      DATA ALPHAE(10)/ .0000000000000000 00     /
      DATA BETAE(10)/ .0000000000000000 00     /
      DATA CE(10)/ .1299200253080598 31D-22/
      DATA CE(11)/ .0000000000000000 00     /
      DATA POO/          .000L000000/
      END
```

TAPPAM:ETHLCOEFF

```
      BLOCK DATA
C*********************************************************************
C        THIS SUBROUTINE INITIALIZES THE COMMON BLOCK COEFF
C      WITH THE STARLINGS EQUATION OF STATE COEFFICIENTS
C      FOR PURE ETHYLENE.
C*********************************************************************
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      COMMON /COEFF/AO,BO,CO,DO,EO,A,B,C,D,ALPHA,GAMMA,R,XM,X1
      DATA AO/12133.9D0/,BO/0.747945D0/,CO/163203.D4/
      DATA DO/517563.D5/,EO/161706.D5/,A/15938.1D0/
      DATA B/2.62914D0/,C/409725.D4/,D/903550.D0/
      DATA ALPHA/0.589153D0/,GAMMA/2.27971D0/,R/10.7335D0/
      DATA XM/28.054D0/
      DATA X1/1.0D0/
      END
```

TAPPAM:ETHLHREF

```
C*********************************************************************
C        THIS SUBROUTINE INITIALIZES THE COMMON BLOCK HREF WITH THE
C      INFORMATION NECESSARY TO CALCULATE THE REFERENCE ENTHALPY OF
C      PURE ETHYLENE. A 9'TH ORDER CURVE FIT IS USED.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /HREF  /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .1405814814814814 81D004/
      DATA BETAE( 1)/ .5115520027434642 21D006/
      DATA CE( 1)/ .2014443057037037 02D005/
      DATA ALPHAE( 2)/ .1548806337925998 60D004/
      DATA BETAE( 2)/ .3315946726945862 44D006/
      DATA CE( 2)/ .1966194805375577 05D002/
      DATA ALPHAE( 3)/ .1616684719610961 08D004/
      DATA BETAE( 3)/ .2992562960520101 04D006/
      DATA CE( 3)/ .3743830279116139 00D-02/
      DATA ALPHAE( 4)/ .1619663133785775 92D004/
      DATA BETAE( 4)/ .2930715963825782 51D006/
      DATA CE( 4)/-.9263400654283694 64D-06/
      DATA ALPHAE( 5)/ .1595658015740767 41D004/
      DATA BETAE( 5)/ .3079118082693872 42D006/
      DATA CE( 5)/ .1937294187655611 15D-09/
      DATA ALPHAE( 6)/ .1560048100001596 40D004/
      DATA BETAE( 6)/ .3199704452307345 74D006/
      DATA CE( 6)/-.3946774432667848 53D-13/
      DATA ALPHAE( 7)/ .1529848579511559 20D004/
      DATA BETAE( 7)/ .3223170323078665 34D006/
```

```
      DATA CE( 7)/ .104173511014538633D-16/
      DATA ALPHAE( 8)/ .152327764073086976D004/
      DATA BETAE( 8)/ .309445206349595717D006/
      DATA CE( 8)/ .952431431790771355D-19/
      DATA ALPHAE( 9)/ .153594436827102799D004/
      DATA BETAE( 9)/ .290534587941206714D006/
      DATA CE( 9)/ .406251120991203662D-22/
      DATA ALPHAE(10)/ .000000000000000000    /
      DATA BETAE(10)/ .000000000000000000    /
      DATA CE(10)/-.147953505631336394D-24/
      DATA CE(11)/ .000000000000000000    /
      DATA POO/       931.7200000000/
      END
```

TAPPAM:ETHLSREF

```
C*********************************************************************
C       THIS SUBROUTINE INITIALIZES THE COMMON BLOCK SREF WITH THE
C     INFORMATION NECESSARY TO CALCULATE THE REFERENCE ENTROPY OF
C     PURE ETHYLENE. A 9'TH ORDER CURVE FIT IS USED.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /SREF  /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .480666666666666665D003/
      DATA BETAE( 1)/ .196622222222222223D004/
      DATA CE( 1)/ .513557457412599996D002/
      DATA ALPHAE( 2)/ .484396624472573839D003/
      DATA BETAE( 2)/ .175284409549751643D004/
      DATA CE( 2)/ .195763504458431353D-01/
      DATA ALPHAE( 3)/ .488573072497123131D003/
      DATA BETAE( 3)/ .173482880755608027D004/
      DATA CE( 3)/-.282615643130146023D-05/
      DATA ALPHAE( 4)/ .487003797653956943D003/
      DATA BETAE( 4)/ .150373123234725733D004/
      DATA CE( 4)/-.713239154076052361D-08/
      DATA ALPHAE( 5)/ .482082111436950147D003/
      DATA BETAE( 5)/ .123099173553719006D004/
      DATA CE( 5)/ .324253582606758476D-10/
      DATA ALPHAE( 6)/ .479090909090909091D003/
      DATA BETAE( 6)/ .114676957406230134D004/
      DATA CE( 6)/-.857725455487454414D-13/
      DATA ALPHAE( 7)/ .478146893851201184D003/
      DATA BETAE( 7)/ .105248378073887879D004/
      DATA CE( 7)/ .176346917604657891D-15/
      DATA ALPHAE( 8)/ .478075798185444338D003/
      DATA BETAE( 8)/ .963189143074208863D003/
      DATA CE( 8)/-.329738199747037925D-18/
      DATA ALPHAE( 9)/ .478267850977387423D003/
      DATA BETAE( 9)/ .865537950972280696D003/
      DATA CE( 9)/ .608547061610327335D-21/
      DATA ALPHAE(10)/ .000000000000000000    /
      DATA BETAE(10)/ .000000000000000000    /
      DATA CE(10)/-.113561590474644769D-23/
      DATA CE(11)/ .000000000000000000    /
      DATA POO/          .0000000000/
      END
```

TAPPAM:ETHLCPREF

```
C*********************************************************************
C       THIS SUBROUTINE INITIALIZES THE COMMON BLOCK CPREF WITH
C     THE INFORMATION NECESSARY TO CALCULATE CP* FOR PURE
C     ETHYLENE. A 9'TH ORDER CURVE FIT IS USED.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /CPREF /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .140581481481481481D004/
      DATA BETAE( 1)/ .511552002743484221D006/
      DATA CE( 1)/ .184225444444444443D002/
      DATA ALPHAE( 2)/ .154880638792599860D004/
      DATA BETAE( 2)/ .331594678594586244D006/
      DATA CE( 2)/ .794126851258017062D-02/
      DATA ALPHAE( 3)/ .161668471961096103D004/
      DATA BETAE( 3)/ .299252298052010104D006/
      DATA CE( 3)/-.280355420292946130D-05/
      DATA ALPHAE( 4)/ .161966313373577592D004/
      DATA BETAE( 4)/ .298071596382578251D006/
      DATA CE( 4)/ .677074188247761563D-09/
      DATA ALPHAE( 5)/ .159565801574076741D004/
      DATA BETAE( 5)/ .307911508269387242D006/
      DATA CE( 5)/-.122370492655345525D-13/
      DATA ALPHAE( 6)/ .156004810000159640D004/
```

```
      DATA BETAE( 6)/ .31997044523073457 4D006/
      DATA CE( 6)/-.29622937895300262 9D-15/
      DATA ALPHAE( 7)/ .15296485795115592 0D004/
      DATA BETAE( 7)/ .32231703230786653 4D006/
      DATA CE( 7)/ .38697027480195818 2D-18/
      DATA ALPHAE( 8)/ .15232776407308697 6D004/
      DATA BETAE( 8)/ .30944520634959571 7D006/
      DATA CE( 8)/-.25080439614114273 2D-21/
      DATA ALPHAE( 9)/ .15359443582710279 9D004/
      DATA BETAE( 9)/ .29058458794120671 4D006/
      DATA CE( 9)/-.12918750377376823 3D-24/
      DATA ALPHAE(10)/ .00000000000000000     /
      DATA BETAE(10)/ .00000000000000000     /
      DATA CE(10)/ .49993266278909218 8D-27/
      DATA CE(11)/ .00000000000000000     /
      DATA POO/          .00000000000/
      END
```

TAPPAM:MIXCOEFF

```
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK COEFF WITH THE
C    STARLINGS EQUATION OF STATE COEFFICIENTS FOR A 65-25-10
C    MIXTURE OF PROPANE-PROPYLENE-N-BUTANE.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      COMMON/COEFF /AO,BO,CO,DO,EO,A,B,C,D,ALPHA,GAMMA,R,XM,X1,X2,X3
      DATA AO/ .15931136190 3D005/,BO/ .81229755000 0D000/
      DATA CO/ .89124352771 7D010/,DO/ .49786249312 2D012/
      DATA EO/ .24024496064 8D014/,A/ .51654451520 7D005/
      DATA B/ .62931350614 0D001/,C/ .31093502077 7D011/
      DATA D/ .13404903215 2D008/,ALPHA/ .19864616841 4D001/
      DATA GAMMA/ .46995089208 2D001/,R/ .10733500000 0D002/
      DATA XM/ .44963900000 0D002/,X1/ .65000000000 0D000/
      DATA X2/ .25000000000 0D000/,X3/ .10000000000 0D000/
      END
```

TAPPAM:MIXCOEFF1

```
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK COEFF1 WITH THE
C    STARLINGS EQUATION OF STATE COEFFICIENTS OF PURE PROPANE.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      COMMON/COEFF1 /AO,BO,CO,DO,EO,A,B,C,D,ALPHA,GAMMA,R,XM,X1,X2,X3
      DATA AO/ .15634700000 0D005/,BO/ .96476200000 0D000/
      DATA CO/ .79617800000 0D010/,DO/ .45370800000 0D012/
      DATA EO/ .25605300000 0D014/,A/ .40066400000 0D005/
      DATA B/ .54624800000 0D001/,C/ .27446100000 0D011/
      DATA D/ .15052000000 0D008/,ALPHA/ .20140200000 0D001/
      DATA GAMMA/ .45615200000 0D001/,R/ .10733500000 0D002/
      DATA XM/ .44062000000 0D002/,X1/ .10000000000 0D001/
      DATA X2/ .00000000000     /,X3/ .00000000000     /
      END
```

TAPPAM:MIXCOEFF2

```
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK COEFF2 WITH THE
C    STARLINGS EQUATION OF STATE CONSTANTS FOR PURE PROPYLENE.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      COMMON/COEFF2 /AO,BO,CO,DO,EO,A,B,C,D,ALPHA,GAMMA,R,XM,X1,X2,X3
      DATA AO/ .60513600000 0D004/,BO/ .11445700000 0D000/
      DATA CO/ .97476200000 0D010/,DO/ .70592100000 0D012/
      DATA EO/ .34125000000 0D014/,A/ .81280400000 0D005/
      DATA B/ .76411400000 0D001/,C/ .29414100000 0D011/
      DATA D/ .54193500000 0D007/,ALPHA/ .13653200000 0D001/
      DATA GAMMA/ .40791900000 0D001/,R/ .10733500000 0D002/
      DATA XM/ .42046000000 0D002/,X1/ .10000000000 0D001/
      DATA X2/ .00000000000     /,X3/ .00000000000     /
      END
```

TAPPAM:MIXCOEFF3

```
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK COEFF3 WITH THE
C    STARLINGS EQUATION OF STATE CONSTANTS FOR PURE N-BUTANE.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      COMMON/COEFF3/AO,BO,CO,DO,EO,A,B,C,D,ALPHA,GAMMA,R,XM,X1,X2,X3
      DATA AO/ .32544700000 0D005/,BO/ .15658800000 0D001/
      DATA CO/ .13746300000 0D011/,DO/ .33315900000 0D012/
      DATA EO/ .23090200000 0D013/,A/ .71181800000 0D005/
      DATA B/ .91406600000 0D001/,C/ .70004400000 0D011/
      DATA D/ .36423500000 0D008/,ALPHA/ .40098500000 0D001/
      DATA GAMMA/ .75412200000 0D001/,R/ .10733500000 0D002/
      DATA XM/ .58121000000 0D002/,X1/ .10000000000 0D001/
      DATA X2/ .00000000000     /,X3/ .00000000000     /
      END
```

TAPPAM:MIXHREF

```
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK HREF WITH THE
C    INFORMATION NECESSARY TO CALCULATE THE REFERENCE ENTHALPY OF
C    A 65-25-10 MIXTURE OF PROPANE-PROPYLENE-N-BUTANE IN BTU/LBMOLE.
C     A 9'TH ORDER CURVE FIT IS USED IN ALL CALCULATIONS.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /HREF  /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .742481481481481480D003/
      DATA BETAE( 1)/ .182214471379286693D006/
      DATA CE( 1)/ .126421793575956102D005/
      DATA ALPHAE( 2)/ .995273195228646587D003/
      DATA BETAE( 2)/ .202821566954364112D006/
      DATA CE( 2)/ .251952197918272494D002/
      DATA ALPHAE( 3)/ .727096407094706033D003/
      DATA BETAE( 3)/ .223279163285734050D006/
      DATA CE( 3)/ .109626687315935255D-01/
      DATA ALPHAE( 4)/ .818422637233609065D003/
      DATA BETAE( 4)/ .189349834246563018D006/
      DATA CE( 4)/-.915621665309813463D-06/
      DATA ALPHAE( 5)/ .830353420162039963D003/
      DATA BETAE( 5)/ .172040258843224485D006/
      DATA CE( 5)/-.234702892276990365D-08/
      DATA ALPHAE( 6)/ .865844174954315838D003/
      DATA BETAE( 6)/ .148017284609795352D006/
      DATA CE( 6)/ .291376828784044613D-11/
      DATA ALPHAE( 7)/ .932582802450228628D003/
      DATA BETAE( 7)/ .118531676421540825D006/
      DATA CE( 7)/-.263241455052364743D-14/
      DATA ALPHAE( 8)/ .917816919014947489D003/
      DATA BETAE( 8)/ .139840562106909869D006/
      DATA CE( 8)/ .237959728526119145D-17/
      DATA ALPHAE( 9)/ .858860971639471114D003/
      DATA BETAE( 9)/ .118493330731858578D006/
      DATA CE( 9)/-.119879367192101153D-20/
      DATA ALPHAE(10)/ .000000000000000000    /
      DATA BETAE(10)/ .000000000000000000    /
      DATA CE(10)/-.531943129620719964D-24/
      DATA CE(11)/ .000000000000000000    /
      DATA POO/   -17965.894859000000/
      END
```

TAPPAM:MIXSREF

```
C*********************************************************************
C     THIS SUBROUTINE INITIALIZES THE COMMON BLOCK SREF WITH THE
C    INFORMATION NECESSARY TO CALCULATE THE REFERENCE ENTROPY OF A
C    65-25-10 MIXTURE OF PROPANE-PROPYLENE-N-BUTANE IN BTU/LBMOLE/DEG R.
C     A 9'TH ORDER CURVE FIT IS USED IN ALL CALCULATIONS.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /SREF  /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .121486500000000000D004/
      DATA BETAE( 1)/ .613757596274999996D006/
      DATA CE( 1)/ .831555626202508686D002/
      DATA ALPHAE( 2)/ .187575185470294677D004/
      DATA BETAE( 2)/ .405377805164337800D006/
      DATA CE( 2)/ .263042466201609175D-01/
      DATA ALPHAE( 3)/ .146640593519431499D004/
      DATA BETAE( 3)/ .477683840709131936D006/
      DATA CE( 3)/-.399037267596539432D-05/
      DATA ALPHAE( 4)/ .139993086663649635D004/
      DATA BETAE( 4)/ .431356410957249111D006/
      DATA CE( 4)/ .824338603566564940D-09/
      DATA ALPHAE( 5)/ .146520971795695696D004/
      DATA BETAE( 5)/ .399730302773665241D006/
      DATA CE( 5)/-.631330451989953051D-12/
      DATA ALPHAE( 6)/ .143264451941527293D004/
      DATA BETAE( 6)/ .399682917427980402D006/
      DATA CE( 6)/ .782334731781138757D-15/
      DATA ALPHAE( 7)/ .142047526795371199D004/
      DATA BETAE( 7)/ .374740442508829210D006/
      DATA CE( 7)/-.746258546941534444D-18/
      DATA ALPHAE( 8)/ .179214986725302064D004/
      DATA BETAE( 8)/ .377041634317186049D006/
      DATA CE( 8)/ .691989980081203363D-21/
      DATA ALPHAE( 9)/ .134990212476282099D004/
      DATA BETAE( 9)/ .338738553360230100D006/
      DATA CE( 9)/-.912730534214355274D-24/
      DATA ALPHAE(10)/ .000000000000000000    /
      DATA BETAE(10)/ .000000000000000000    /
      DATA CE(10)/ .422913468158143033D-27/
      DATA CE(11)/ .000000000000000000    /
      DATA POO/          .000000000/
      END
```

```
                                    TAPPAM:MIXCPREF
C*********************************************************************
C      THIS SUBROUTINE INITIALIZES THE COMMON BLOCK CPREF WITH THE
C     INFORMATION NECESSARY TO CALCULATE THE REFERENCE CP OF A
C     65-25-10 MIXTURE OF PROPANE-PROPYLENE-N-BUTANE IN BTU/LBMOLE/DEG R.
C      A 9'TH ORDER CURVE FIT IS USED IN ALL CALCULATIONS.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION(A-H,O-Z)
      DIMENSION ALPHAE(10),BETAE(10),CE(11)
      COMMON /CPREF /KE,JE,ALPHAE,BETAE,CE,POO
      DATA KE/9/,JE/0/
      DATA ALPHAE( 1)/ .12117150000000000000D004/
      DATA BETAE( 1)/ .61989677327499999 6D006/
      DATA CE( 1)/ .25178249429318502 6D005/
      DATA ALPHAE( 2)/ .15639393238756782 7D004/
      DATA BETAE( 2)/ .41734409338032888 1D006/
      DATA CE( 2)/ .56512976553683538 94D002/
      DATA ALPHAE( 3)/ .14430098682901119 6D004/
      DATA BETAE( 3)/ .49162243102142877 9D006/
      DATA CE( 3)/ .82712237067278157 2D-01/
      DATA ALPHAE( 4)/ .13931757730195813 1D004/
      DATA BETAE( 4)/ .42734389014656380 1D006/
      DATA CE( 4)/ .90017628292805755 6D-04/
      DATA ALPHAE( 5)/ .14810891419428149 1D004/
      DATA BETAE( 5)/ .38488501947416491 8D006/
      DATA CE( 5)/ .86545313226222373 3D-07/
      DATA ALPHAE( 6)/ .14652560938649664 5D004/
      DATA BETAE( 6)/ .37495557913825220 9D006/
      DATA CE( 6)/ .67890881619297757 4D-10/
      DATA ALPHAE( 7)/ .14642679912102117 0D004/
      DATA BETAE( 7)/ .34649353535515827 4D006/
      DATA CE( 7)/ .42791735305431821 4D-13/
      DATA ALPHAE( 8)/ .14368644527513352 1D004/
      DATA BETAE( 8)/ .35526588508632229 4D006/
      DATA CE( 8)/ .20647032817293208 7D-16/
      DATA ALPHAE( 9)/ .13610573808437402 1D004/
      DATA BETAE( 9)/ .34518995909955333 2D006/
      DATA CE( 9)/ .68726606410972723 7D-20/
      DATA ALPHAE(10)/ .00000000000000000     /
      DATA BETAE(10)/ .00000000000000000     /
      DATA CE(10)/ .13007220722963756 3D-23/
      DATA CE(11)/ .00000000000000000     /
      DATA POO/          .0000000000/
      END
```

```
                                    TAPPAM:BWRCOEFF
C*********************************************************************
C        THIS SUBROUTINE INITIALIZES THE COMMON BLOCK COEFF WITH
C     THE BWR EQUATION OF STATE COEFFICIENTS FOR PURE PROPANE.
C*********************************************************************
      BLOCK DATA
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      COMMON /COEFF/AO,BO,CO,DO,EO,A,B,C,D,ALPHA,GAMMA,R,XM,X1,X2,X3
      DATA AO/25915.4D0/,BO/1.55884D0/,CO/6209.93D6/
      DATA DO/0.0D0/,EO/0.0D0/,A/57248.0D0/,B/5.77355D0/
      DATA C/25247.8D6/,D/0.0D0/,ALPHA/2495.77D-3/,GAMMA/564.525D-2/
      DATA R/10.7535D0/,XM/44.062D0/,X1/1.0D0/,X2/0.0D0/,X3/.0D0/
      END
```

VI. References

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2. Starling, K. E., Fluid Thermodynamic Properties for Light Petroleum Systems, Gulf Publishing Co., Houston, 1973.

3. Ries, D.,UNIVAC 1108 EXEC 8 Math-Pak Users Guide, University of Maryland Computer Science Center note CN 5.1, 1970.

4. Wu, K. F., Ph.D. dissertation, Department of Mechanical Engineering, University of Maryland, College Park, MD, 1977.

5. API Research Project No. 44, Washington, D. C., NBS (1944).